SCHEDULE OF ACTIVITIES

11:30 am – 1:00 pm……..	Set Up Posters *Biotech Place Atrium*
12:00 pm – 1:00 pm…….	Research Lecture and Lunch Gary H. Gibbons, MD “A Bold Vision to Advance Scientific Discovery for Public Health Impact” *Biotech Place Auditorium*
1:00 pm – 3:00 pm…….	Presentation and Judging of Posters *Biotech Place Atrium*
3:00 pm – 5:30 pm……..	Reception and Awards *Biotech Place Atirum*

KEYNOTE SPEAKER

Gary H. Gibbons, MD

Director of the National Heart, Lung, and Blood Institute at the National Institutes of Health

Gary H. Gibbons, M.D., is Director of the National Heart, Lung, and Blood Institute (NHLBI) at the National Institutes of Health (NIH), where he oversees the third largest institute at the NIH, with an annual budget of approximately $3 billion and a staff of nearly 2,100 federal employees, contractors, and volunteers. NHLBI provides global leadership for research, training, and education programs to promote the prevention and treatment of heart, lung, and blood diseases and enhance the health of all individuals so that they can live longer and more fulfilling lives.

Dr. Gibbons provides leadership to advance several NIH initiatives including the NIH Community Engagement Alliance (CEAL) Against COVID-19 Disparities and Researching COVID to Enhance Recovery (RECOVER) initiative. Additionally, Dr. Gibbons provides strategic guidance and leadership to the Implementing a Maternal health and PRegnancy Outcomes Vision for Everyone (IMPROVE) initiative and the new NIH Climate Change and Health Initiative, an urgent, cross-cutting NIH effort to reduce health threats from climate change across the lifespan and build health resilience in individuals, communities, and nations around the world, especially among those at highest risk.

Dr. Gibbons has made many scientific contributions in the fields of vascular biology, genomic medicine, and the pathogenesis of vascular diseases. His research focuses on investigating the relationships between clinical phenotypes, behavior, molecular interactions, and social determinants on gene expression and their contribution to cardiovascular disease. Dr. Gibbons has received several patents for innovations derived from his research in the fields of vascular biology and the pathogenesis of vascular diseases.

SURGICAL SCIENCES

DEPARTMENT CHAIRMEN:

Edward H. (Ted) Kincaid M.D. .....Department of Cardiothoracic Surgery

J. Wayne Meredith, M.D. .....Department of General Surgery

Charles L. Branch, Jr., M.D. .....Department of Neurosurgery

Craig M. Greven, M.D. .....Department of Ophthalmology

Cynthia Emory, M.D. .....Department of Orthopaedic Surgery and Rehabilitation

J. Dale Browne, M.D. .....Department of Otolaryngology

Lisa David, M.D. .....Department of Plastic and Reconstructive Surgery

Anthony Atala, M.D. .....Department of Urology

Matthew Edwards, M.D. .....Department of Vascular and Endovascular Surgery

RESEARCH DAY 2023
PLANNING COMMITTEE

HOST DEPARTMENT: SURGERY-HYPERTENSION

Hossam A. Shaltout, Ph.D.....Chair, Department of Surgery-Hypertension
John D. Jackson, Ph.D.....Co-Chairperson, Wake Forest Institute for Regenerative Medicine

Committee Members

Lydia Durr.....Hypertension & Vascular Research

Shanna J. Ellison.....Hypertension & Vascular Research

Shea Gilliam-Davis, Ph.D.....Hypertension & Vascular Research

Kenya Little.....Hypertension & Vascular Research

Jasmine L. Malachi, M.A.....Hypertension & Vascular Research

PAST KEYNOTE SPEAKERS

2018	Todd E. Rasmussen, MD, FACS Uniformed Services University School of Medicine
2019	Andreas K. Lauer, MD Oregon Health & Science Universtiy
2020	Ana H. Kim, MD Columbia University Medical Center
2021	Rebecca Sippel MD, FACS University of Wisconsin-Madison
2022	Prasad S.Adusumilli, MD, FACS Memorial Sloan Kettering Cancer Center

PREVIOUS AWARD RECIPIENTS

CLINICAL RESEARCH

	Gold Medal	Silver Medal
2018	Robert C. Siska, MD Plastic and Reconstructive Surgery Resident	Konstantinos Chouliaras, MD General Surgery-Oncology Resident
	David Harriman, MD General Surgery-Transplant Fellow	Ioannis Kontopidis, MD Cardiothoracic Surgery Fellow
	Mike C. Lin, BS Cardiothoracic Surgery Student	Tracey Pu, BS Cardiothoracic Surgery Student
2019	Christine Velazquez, MD Plastic and Reconstructive Surgery Resident	Suman Medda, MD Orthopaedic Surgery Resident
	Adam Campman Nelson, MD General Surgery Fellow	David Hobson, MD Cardiothoracic Surgery Fellow
	R. Andrew Hesse, BS Surgery-Ophthalmology Student	Harper Wilson, BS/BA Otolaryngology Student
2020	Mija Khan, MD Plastic and Reconstructive Surgery Resident	Jungwon Park, MD, PhD Plastic and Reconstructive Surgery Resident
	Christine Velazquez, MD General Surgery Fellow	Shiny Rajan, PhD Institute for Regenerative Medicine Fellow
	Vanessa Lukas, BA General Surgery-Urology Student	Ishetta Madeka, BA General Surgery-Oncology Student
2021	Jacob Maus, MD Plastic and Reconstructive Surgery Resident	Sydney Thomas, MD Surgery-Otolaryngology (Dentistry) Resident
	Griffin Bins, MD Plastic and Reconstructive Surgery Fellow	Berjesh Sharda, MD General Surgery – Transplantation Fellow
	Rohin Gawdi, BS General Surgery- Oncology Student	Symonne Martin General Surgery- Trauma Student

	Gold Medal	Silver Medal
2022	Maria Masciello, MD, MS Surgery-Otolaryngology (Dentistry) Resident	Donald Browne, MD Plastic and Reconstructive Surgery Resident
	Griffin Bins, MD Plastic and Reconstructive Surgery Fellow	Mary Duet, BS Plastic and Reconstructive Surgery Fellow
	Ahmad Shamulzai, BS Neurosurgery Student	Greg Aiello, BS Ophthalmology Student

BASIC RESEARCH

	Gold Medal	Silver Medal
2018	Lily Velet, MD Urology Resident	Edward J. Doyle, III, MD Otolaryngology Resident
	Nima Pourhabibi Zarandi, MD Institute for Regenerative Medicine Fellow	Manuel U. Ramirez, PhD Hypertension and Vascular Research Fellow
	Omeed Rahimi, MS Hypertension and Vascular Research Student	Elizabeth R. Stirling, MS Hypertension and Vascular Research Student
2019	Amy P. Trammell, MD Orthopaedic Surgery Resident	Robert Siska, MD Plastic and Reconstructive Surgery Resident
	Tomohisa Yamashita, MD, PhD General Surgery Fellow	Omar A. Abdelaal, MD Institute for Regenerative Medicine Fellow
	Jordan Forte, BS Plastic and Reconstructive Surgery Student	Adam Jorgensen Institute for Regenerative Medicine Student
2020	Aaron Bradshaw, MD General Surgery-Urology Resident	Tyler Overholt, MD General Surgery-Urology Resident
	Brittany Liebenow, BA Neurosurgery Student	Ishetta Madeka, BA General Surgery-Oncology Student
2021	Robert Siska, MD Plastic and Reconstructive Surgery Resident	Richard A. Erali, MD General Surgery-Oncology Resident
	Nadeem Wajih, PhD General Surgery-Oncology Fellow	Anastasiya Gorkun, PhD Institute for Regenerative Medicine Fellow
	Ethan Shelkey, BS Institute for Regenerative Medicine Student	Yismeilin Feliz-Mosquea, BS General Surgery- Hypertension Student

	Gold Medal	Silver Medal
2022	Gloria Sanin, MD Vascular and Endovascular Surgery Resident	Tameka Dean, DO Orthopedics Resident
	Li Tan, PhD Plastic and Reconstructive Surgery Fellow	Cecilia Schaaf, DVM, PhD Institute for Regenerative Medicine Fellow
	Yu-Ting Tsai, MS Cancer Biology Student	Nicholas Edenhoffer, BS Physiology and Pharmacology Student

EDUCATIONAL RESEARCH

	Gold Medal	Silver Medal
2018	Lindsay Jones Allred, MD Plastic and Reconstructive Surgery Resident	
2019	Thomas N. Steele, MD Plastic and Reconstructive Surgery Resident	
2021	Michael Boyajian, MD Plastic and Reconstructive Surgery Resident	Thomas N. Steele, MD Plastic and Reconstructive Surgery Resident
2022	Michael Boyajian, MD Plastic and Reconstructive Surgery Resident	Gabriel Cambronero, MD General Surgery Resident

Abstracts

1. Coronary Malperfusion after Freestyle Aortic Root Replacement - Fact or Fiction?
Yusuf Aboutabl, BS....19

2. Development of Frontal Asymmetry and Diagnostic Indices for the Quantitative Evaluation of Unicoronal Craniosynostosis
Elsa Katarina Acosta....19

3. Stimulation of Exosome Secretion by Urine-derived Stem Cells with Controlled Release of Hepatic Growth Factor
Abdelrahman Alwan, MD....20

4. Photodynamic Bone Augmentation for Complex Geriatric Femur Fractures
Nicholas Andring, MD....20

5. Technical Trick: Dual Plate Technique for Geriatric Distal Femur Fractures
Nicholas Andring, MD....21

6. Anti-cancer endocrine-targeting therapies and diet interactions shift the gut microbiome to impact ER+ breast carcinogenesis and outcomes
Alana Arnone....22

7. The Renin-Angiotensin-Aldosterone Axis in a Hemorrhagic Shock Porcine Model
Elizabeth Azar, BA....22

8. Posterior Vault Distraction Osteogenesis in Pediatric Refractory Idiopathic Intracranial Hypertension: Efficacy and Cranial Suture Fusion Analysis
Mario Blondin, MD....23

9. Engineering Adiponectin-Loaded Microparticles to Stimulate Stem Cells to Secrete Exosomes & Subsequent Characterization for Treatment of Metabolic Disease
Joshua Bowlby, PhD....23

10. Innovating Tendon Repair Training
Michael Boyajian, MD....24

11. Are There Racial Differences in Frailty and Complications in Breast Cancer Surgery Patients?
Andrea Boyd Tressler, MD, PhD....24

12. In-Vitro Effects of Amniotic Fluid Derived Stem Cell Conditioned Media in End-Stage OA
Marcel Brown, MD....25

13. Characterizing the Venous Congestion Curve Utilizing Near Infrared Spectroscopy
Donald Browne, MD....25

14. Role of frailty in axilla management for elderly breast cancer patients
Ashley Cairns....26

15. Induction of Neurogenesis and Angiogenesis at the Site of Injury in Acute Traumatic Spinal Cord Injury
Rebecca Calafiore, MD....26

16. Mini-Thoracotomy Mitral Valve Surgery is Safe and Associated with Shorter Hospitalization Compared to Open Sternotomy
Gabriel Cambronero, MD....27

17. Novel Breast Biopsy Scaffold and Deployment System
Darnell Campbell....28

18. Long term outcomes of pediatric free flap reconstruction
Sydney Cannon, MD....28

19. Quality Improvement for the Development and Implementation of a Fourth Year Medical Student Ophthalmology Curriculum
Samuel Carpentier, MD, PhD....29
20. Emergency Room Pediatric Burn Care Before and After Pediatric Burn Center Establishment: Assessment of Five State Geographical Catch Area in the Southeast
Brandon Casas, MD....29
21. Biosensor Integrated Multi-Organ-On-A-Chip Platform for Real-Time Monitoring of Organoid Function
Joshua Cheng....30
22. Assessment of Food Insecurity and Other Social Determinants of Health in Orthopaedic Trauma Patients
Morgan Childress, BS....30
23. Epistaxis in COVID Positive ICU Patients, Implications, and Future Interventions
Sarah Clark, MD....31
24. Supplementation of bacterial species Akkermansia muciniphila enhances anti-PD-L1 immune checkpoint blockade response in triple-negative breast cancer
Kenysha Clear, BS....31
25. The impact of bioink formulation on cell phenotype in DLP printed hydrogels
Zachary Congress, PhD....32
26. Influence of L-Carnitine on Increasing Efficacy of Therapeutic Treatments and Preventing ER+ Breast Cancer-Related Osteoporosis
Zipporah Cornelius, PhD....33
27. Presentation of Kidney Stones in Renal Transplant Recipients
Claudia Costa, MS....33
28. Placental Derived Stem Cell Therapy Induces the Formation of Myelin in Injured Central Nervous System Tissue
Joseph Criscitiello, MSII....34
29. Abbe Flap for Secondary Cleft Lip Deformity: A Systematic Review
Caitrin Curtis, MD....35
30. Ultrasonography of the Palmar Cutaneous and Recurrent Motor Branches in Carpal Tunnel Syndrome
Amelia Davidson, BS....35
31. Biomanufacturing of Vascularized Liver Constructs for Spaceflight Testing
Timothy Dobroski....35
32. Biomimetic Vascular Scaffold with Sustained Angiogenic Factor Delivery Enhances Vascularization and Renal Tissue Formation in Vivo
Timothy Dobroski....36
33. Predictive Factors of Postoperative Outcomes in Facial Trauma Patients Undergoing Complicated Mandible Fracture Repair
Mary Dover, BS....37
34. Mastectomy Flap Temperatures Compared to Core Body Temperature and Adverse Outcomes
Cassandra Driscoll, MD....37
35. Implementation of a Fracture Liaison Service and its Effects on Secondary Fracture in Patients Undergoing Vertebral Augmentation
Blake Dunson....38

36. Assessing the Effects of BAPN and Marimastat on Collagen Remodeling in an Ex-Vivo Tumor Organoid Model
Nicholas Edenhoffer....38
37. Direct Effects of Cannabinoids on Different Cell Types of 3D Human Testis Organoid System: An In Vitro Model
Megan Escott, MD....39
38. Shear-Wave Elastography of the Testis in the Pediatric Population: Establishing Normal Ranges and Application to Patients with Klinefelter Syndrome
Megan Escott, MD....39
39. Does age really matter? Evaluating Outcomes in Pediatric and Adult Patients Following First Rib Resection and Anterior Scalenectomy for Thoracic Outlet Syndrome
Lydia Faber, MS....40
40. Multiple Simultaneous Free Flaps for Reconstruction of Head and Neck Defects - A Twenty-Year Single-Institution Retrospective Review
Kenneth Feehs, MD....41
41. Targeting inositol-requiring enzyme-1 (IRE1) affects triple-negative breast cancer chemotherapy sensitivity and prevents chemotherapy-related cardiotoxicity
Yismeilin Feliz Mosquea, BS....41
42. Over The Counter Therapies for Urinary Incontinence Before Presentation at a Specialty Clinic: Patient Perspective and Use
Maya Fisher, BS....42
43. EARLY TRIGGERS FOR PRIMARY PALLIATIVE CARE IN TRAUMA PATIENTS
Craig Follette, DO....42
44. No Seasonal Variance Found Between Peripheral Arterial Disease and Infection-Related Transmetatarsal Amputations
Madeline Fram, BA....43
45. The Microbiome Mediates Carcinogenic Alterations of the Mammary Gland in the Context of Obesity
Mohamed Gaber....43
46. A Retrospective Comparison of Different Processing Techniques in Autologous Fat Grafting Post Breast Reconstruction
Mariam Gadjiko, MD....44
47. Volume Replacement using Stromal Vascular Fraction
Amol Garg, MD....44
48. 3D human skin equivalents for viral infection with skin-tropic viruses
Catalina Gaviria, PhD....45
49. THE FOG HAS NOT LIFTED: NO REDUCTION IN COMPLICATIONS FOR PARTIAL REBOA IN THE AAST AORTA REGISTRY
Micaela Gomez, MD....45
50. DEVELOPING DIGITAL TOOLS OF SKIN REPIGMENTATION ASSESSMENT IN THE REGENERATING WOUND
Anastasiya Gorkun, PhD....46
51. Changes in hip coverage parameters and lumbar lordosis after posterior spinal fusion in Adolescent Idiopathic Scoliosis
Sofia Griff, BS....46
52. The Use of Topical Cocaine in Septoplasty and Rhinoplasty
Justin Hall, MD....47

53. Idiopathic Intracranial Hypertension in Surgical Cure of Cerebrospinal Fluid Leak
Justin Hall, MD....48
54. Cost of follow-up imaging for patients with p16/HPV-positive oropharyngeal cancer after negative post-treatment PET scan
Lauren Grace Himes, MD....48
55. A Multi-Institutional Level 1 Trauma Center Analysis of Pediatric Facial Fracture Management and Outcomes
Madison Hinson, BS....48
56. Implementation Evaluation of a Novel Emergency General Surgery Handover: A Prospective Feasibility Study
Lauren Hostettler, MS....49
57. Microfluidic Incubation of Patient Derived Tumor and Immune Cells Boosts Lymphocyte Cytotoxic Phenotype
Damian Hutchins, PhD....50
58. The multiaxial bioreactor integrated with an environmental monitoring system for a tissue-engineered skin graft
Seunggyu Jeon, PhD....50
59. Preparation of 3D printed Thick Liver constructs
Jin-Oh Jeong, PhD....51
60. 3D printing of primary adipose tissue with silk scaffold for volumetric soft tissue reconstruction
Wonwoo Jeong, PhD....51
61. Embedded printing of breast cancer spheroids to control cancer aggressiveness by basement membrane for high throughput screening
Wonwoo Jeong, PhD....52
62. Artificial Intelligence to Predict Conversion to Neovascular Age Related Macular Degeneration
Hindo Kamanda....52
63. Superior Transseptal vs. Left Atriotomy Approaches in Isolated Mitral Valve Surgery
Zohaib Khawaja, BS....53
64. Muscle Fiber Fragments for Restoration of Muscle Tissue Function
Ji Hyun Kim, PhD....53
65. Diabetic Osteomyelitis: Oral vs Intravenous Antibiotics at a Single Level 1 Academic Medical Trauma Center
Jennifer Kipp, DPM....54
66. Total Ankle Arthroplasty Results in Better Postoperative Pain Scores and Lower Reoperation Rates than Tibiotalocalcaneal Arthrodesis
Jennifer Kipp, DPM....54
67. Developing a Predictor of Arthrofibrosis after Total Knee Arthroplasty
Nicholas Kiritsis, BS....55
68. Characterizing a Previously Unrecognized Clinical Phenotype: The Coexistence of Cerebral Venous Outflow and Connective Tissue Disorders
Nicholas Kiritsis, BS....55
69. Redefining Treatment Expectations: Exploring Long-Term Outcomes of Venous Sinus Stenting in Idiopathic Intracranial Hypertension
Lucas Klever, BS....56
70. Impact of ERAS Protocol on Perioperative Outcomes of Head and Neck Surgery
Lucas Klever, BS....56

71. Influence of Closed-incision Negative Pressure Wound Therapy on Abdominal Site Complications in Autologous Breast Reconstruction
Samuel Kogan, PhD....57
72. Graduated Craniofacial Fellows: Where Are They Now and Why?
Sasha Kondrasov....57
73. PRECLINICAL DEVELOPMENT OF NOVEL SMALL MOLECULE BASED THERAPY TO TREAT ALOPECIA
Gauri Kulkarni, PhD....58
74. The Relevance of Breast Size Beyond Plastic Surgery
Elizabeth Laikhter, MD....58
75. Customized Electronic Cortical Impact in a Polytrauma Swine Model of TBI and Uncontrolled Hemorrhage
Bonnie Laingen, MS....59
76. Thromboelastography of Post-traumatic Injury Coagulation: Comparison Between Uncontrolled Intra-Abdominal Hemorrhage in Swine Models with and without TBI
Bonnie Laingen, MS....60
77. Multi-functional Pulsatile Bioreactor Module Development for Biomanufacturing Engineered Tubular Tissues
Po-Feng Lee, PhD....60
78. The Impact of Silver Nanoparticle-Induced Photothermal Therapy and Augmentation of Hyperthermia on Breast Cancer Cells Harboring Intracellular Bacteria
Sijia Liu, PhD....61
79. Fat Grafting Post Breast-Reconstruction: A Tale of Two Estimates
Kelsey Lloyd, MD....62
80. Review of Piezo1 Mechanosensitive Ion Channel Function in Macrophages and Intracerebral Hemorrhage
Renate Ma, BS....62
81. Reactive Oxygen Species Production in UVB-Exposed Skin Organoids: A Comparative Analysis
Naresh Mahajan, PhD....63
82. Is it time to redefine afferent limb syndrome in ileal pouch-anal anastomosis?
Bigyan Mainali, MD....63
83. A Paired Comparison of Outcomes in Therapeutic versus Prophylactic Breasts Following Bilateral Mastectomy with Deep Inferior Epigastric Perforator (DIEP) Flap Reconstruction
Jacob Maus, MD....64
84. Reversal of clinical botulism by the modulation of central and peripheral neurological circuits
William McClinticf, PhD....64
85. Bioprinting Smooth Muscle Cells on Electrospun Scaffolds for the Development of Tissue-Engineered Small Intestine
Bailey McCollum, MS....65
86. Development of a Sensor-Integrated Uniaxial Bioreactor for Maturation of Muscle Tissue
Adit Mehta, MS....66
87. Outcomes and Complications of Internal Jugular Vein Stenting in Symptomatic Cerebral Venous Outflow Disorders: A Case Series
Jackson Midtlien, MS....66

88. Symptom Resolution and Recurrence in Ventriculoperitoneal Shunting for Refractory Idiopathic Intracranial Hypertension: A Long-Term Outcome Analysis
Jackson Midtlien, MS....67
89. Non-White Race Is Associated With Higher Risk Of Amputation In Patients With Lower Wifi Scores
Caroline Minnick....67
90. Blood Profiling Reflects Alternative Gene Expression Following Renal Transplantation with DCD and AKI Allografts
Alexandra Monetti, BS....68
91. SMALL FIBER POLYNEUROPATHY IS COMMON IN NON-BLADDER CENTRIC INTERSTITIAL CYSTITIS/BLADDER PAIN SYNDROME
Mary Namugosa. MD....68
92. 4 axis bioprinting with metamaterials and dual-crosslink bioink for tubular tissue regeneration
Wei Nie, PhD....69
93. Development of a Combined Melanoma/Skin Organoid System to Study Tumor-Stroma Interactions
Gemma Nomdedeu-Sancho, MS....69
94. The Role of Prolonged Operative Time, Gender, and Other Risk Factors in Total Knee Arthroplasty Complications
Ayobami Ogunsola, MD....70
95. Colonic Radiographic Patterns in Children with Vesicoureteral Reflux who Underwent Surgical Intervention with Ureteroneocystotomy
Tyler Overholt, MD....70
96. Postoperative Oxygen Saturation and Surgical-Site Infection after Major Non-Cardiac Surgery: A Retrospective Analysis
Jacqueline Palermo, BS....71
97. Botulinum Toxin-A Injection Reduces Hospitalization Length in Post-Laryngectomy Pharyngocutaneous Fistulas
Kunjan Patel....71
98. The Effect of the Strengthen Opioid Misuse Prevention Act on Opiate Prescription Practices After Breast Reduction
Abby Peoples, MD....72
99. Photothermal Ablation of Intracellularly Infected Cancer Cells
Spencer Phillips....72
100. Comparative Physical Motion of Virtual Reality and Saw Bone Training for Tibial Shaft Intramedullary Nail Fixationt
Bryce Polascik, BS....73
101. DOES 4FACTOR-PCC IMPROVE OUTCOMES FOR MILD TRAUMATIC BRAIN INJURY PATIENTS ON FACTOR XA INHIBITORS?
Jessica Rauh, MD....73
102. Transcystic Laparoscopic Common Bile Duct Exploration for Pediatric Patients with Choledocholithiasis: A Multi-center study
Jessica Rauh, MD....74
103. Preeclampsia Reduces Middle Cerebral Artery Resistance Post-Pregnancy in the Setting of Sustained Hypertension in Rat
Jonathan Ray, MS....74

104. A Surgery First Approach to Acute Choledocholithiasis in Pediatric Patients in Low Resourced Weekend Hours, A Multi-Center Study
Garrett Reid, MS....75
105. Investigating the Relationship between Bleeding, Clotting, and Coagulopathy during Automated Partial REBOA Strategies in a Highly Lethal Porcine Hemorrhage Model
Antonio Renaldo, BS....75
106. Advancing Treatment with Customized Alginate-Based Bioink for 3D-Printed Human Islet Structures in Transplantation
Arunkumar Rengaraj, PhD....76
107. Mast Cells and Interstitial Cystitis/Bladder Pain Syndrome Revisited
Rory Ritts, MD....76
108. SPLENIC ARTERY EMBOLIZATION: IT IS FEASIBLE BUT IS IT SAFE?
Heidi Roeber, MD....77
109. Man Vs Machine: Provider Directed Vs Partially Automated Critical Care Management (PACC-MAN) In A Porcine Model Of Distributive Shock
Gloria Sanin, MD....77
110. Impact Of Regional Differences And Neighborhood Socioeconomic Deprivation In The Outcomes Of Patients With Lower Extremity Wounds Evaluated By A Limb-Preservation Service
Gloria Sanin, MD....78
111. THE VIRTUAL HUDDLE FOR PATIENT SAFETY: PROVIDER PERCEPTIONS OF A NOVEL PACU TO ICU HANDOFF
Juhi Saxena, BS....79
112. Patient-Derived Tumor-on-a-Chip Platform Potentiates Adaptive Immune Response Against Primary Tumor Cells
Cecilia Schaaf, DVM....79
113. Farnesol Repurposing for Biofilm Prevention and Treatment of the Superbug Acinetobacter baumannii
Li Tan, PhD....80
114. Impact of Covid-19 on Thrombotic Complications in Microsurgery
Marion Tapp, MD....81
115. Feasibility and Efficacy of Continuous Flow Local Anesthetic Pumps for Post-Operative Analgesia Following Kidney Transplantation
Parth Thakker, MD....81
116. Non-surgical Non-pharmacologic Therapy for Nasal Obstruction: A Systematic Review
Cameron Todd, MD....82
117. The Eradication of Staphylococcus aureus Biofilms on Photothermal Silicone Nanocomposites
Erica Monette Vargas, BS....82
118. Characterization of Retrobulbar Hemorrhages and Orbital Compartment Syndrome
Kevin Vo, MD....83
119. Challenging the Limits of Prolonged Cold Ischemia in Deceased Donor Kidney Transplantation
Jigish Vyas, MD....83
120. Insulin dependence in diabetic macular edema does not affect response to anti-VEGF therapy
Sean Wang, BE....84
121. Atypical Infections in Acute Hand Infections: A Cost Analysis
Isabella Waung, BA....84

122. High BMI Should Not Exclude Candidates for Deceased Donor Kidney Transplantation: A Single-Center Paired Donor Kidney Analysis
Christopher Webb, MD....85
123. 3,4-Diaminopyridine reverses off-target effects of intramuscular BoNT/A injections without compromising therapeutic benefits
Travis Wentz, PhD....85
124. Assessing Knowledge about Living Kidney Donation among Transplant Candidates and Relationship to Action
Hope Werenski, MD....86
125. Pre-Formed Skin Organoids in Bioprinted Skin Improving Long Term Functionality of Full Thickness Wounds
Kelsey Willson....87
126. Production of Vascularized Functional Liver Tissue Constructs with Long-term Survival
Kelsey Willson....87
127. A Novel Taxonomy of Intraoperative Cholangiograms in Suspected Choledocholithiasis: A Tool for Advancing Transcystic Laparoscopic Common Bile Duct Exploration Outcomes Research
Elizabeth Wood, MD....88
128. Relationship Between Limb Dominance and 1st Metatarsophalangeal Joint Arthritis
Faraji Woodson, MS....89
129. Predictors of Complications of Pediatric Facial Trauma
Avery Wright, BS....89
130. Prognostic Factors of Functional Recovery After Mechanical Thrombectomy for Acute Ischemic Stroke
Brock Yager, MS....90

1. Coronary Malperfusion after Freestyle Aortic Root Replacement - Fact or Fiction?

Yusuf Aboutabl, BS Bartlomiej Imielski, MD

Gabriel E. Cambronero, Zohaib R. Khawaja, Jeanette M. Stafford, James E. Jordan, Adrian L. Lata, Edward H. Kincaid, Neal D. Kon, Bartlomiej R. Imielski
Surgery-Cardiothoracic
Clinical Science - Student

Purpose Xenograft aortic root replacement is safe and durable, while offering low outflow gradients.1,2 Nonetheless, concern for coronary malperfusion requiring concomitant coronary revascularization has been reported as a risk during implantation. This study evaluates the incidence of this malperfusion and other outcomes following Freestyle aortic root replacement with concomitant coronary revascularization. Methods 969 consecutive patients underwent aortic root replacement with a Medtronic Freestyle xenograft at our institution from 2012 to 2023. This retrospective study analyzed 312 of these who also had concomitant coronary artery intervention. Patient demographics, medical history, surgical management, perioperative and postoperative outcomes were reviewed. Concomitant coronary intervention was defined as coronary artery bypass graft (CABG) or Cabrol performed during the index operation. The primary outcome was the incidence of coronary malperfusion post-root replacement. Coronary malperfusion was defined as hypokinetic/dysfunctional right or left ventriclar function, while weaning off bypass that was not present preoperatively, and was not a result of preoperative coronary artery disease (CAD). Secondary outcomes included mortality, stroke, renal failure, post-operative atrial fibrillation, reoperation, length of stay, and worsening aortic insufficiency. Results The incidence of coronary malperfusion requiring revascularization post-freestyle aortic root replacement was 1.3% (13/969). All 13 of these patients had CABG as the form of coronary revascularization to treat perfusion insufficiency post-root implant. In total, 95.8% of patients that underwent Freestyle root replacement with concomitant coronary revascularization (299/312) had a CABG or Cabrol procedure as a result of obstructive coronary artery disease that was planned preoperatively. Further, 3.7% (11/299) of patients had coronary revascularization as a result of coronary artery dissection that occurred from acute Type A dissection. In addition, 6.0% (18/299) of patients required a Cabrol procedure; however, this was due to ostial calcification or stenosis that made coronary button implantation difficult. When assessing the secondary outcomes for patients with coronary malperfusion post-root replacement compared with patients that had planned coronary revascularization from CAD or dissection, we saw there was no significant difference for stroke, renal failure, post-op Afib, new or worsening aortic insufficiency, or mortality. There was a significant difference in length of stay and reoperation during index hospitalization. Conclusions The incidence of coronary malperfusion and other complications following Freestyle aortic root replacement is low. Xenograft root replacement is safe and effective both in the short-term and long-term outcomes, asshown by low rates of adverse cardiac complications and valve insufficiency.

2. Development of Frontal Asymmetry and Diagnostic Indices for the Quantitative Evaluation of Unicoronal Craniosynostosis

Elsa Katarina Acosta Christopher Runyan, MD PhD

Griffin Bins, Mario Blondin, Emely Pacheco, Christopher Runyan
Surgery-Plastic & Reconstructive
Clinical Science – Student

Background: Unicoronal craniosynostosis (UC) is the premature fusion of one of the coronal sutures, occurring in 1 in 10,000 infants. 3D photography has gained popularity for evaluation of skull morphology without radiation exposure. The purpose of this study is to create quantitative diagnostic and asymmetry indices for UC patient head shape based on three-dimensional vectors calculated using three-dimensional surface imaging. Hypothesis: 3D photography can be used as an effective tool to quantitatively diagnose and monitor the head shape outcomes of UC patients. Serial 3D photographs will allow peri-operative evaluation of UC severity and progress towards normalized head shape after surgery. Methods: The Unicoronal Craniosynostosis Asymmetry Index (UCAI) and Diagnostic Index (UCDI) compare patients with UC to normal controls and those with positional plagiocephaly, respectively. These indices integrate length, width, and height vectors obtained from 3D photographs.Coordinates of a surface mesh were created using two intersecting planes for each dimension. An area under the curve (AUC) analysis was used to discern the best vector for asymmetry and diagnosis Vec

tors were calculated for patients that had received pre-operative and post-operative 3D photographs to analyze changes in head morphology over time. Results: We observed significant reduction in frontal length, height, and width ipsilateral

to the fused suture after measuring discrepancies in all points on the affected and unaffected sides. The final UCAI was calculated as a ratio of ipsilateral to contralateral three-dimensional vectors with an AUC of 0.945. UCDI coordinates were chosen from areas of greatest compensatory growth relative to patients with positional plagiocephaly, yielding an AUC of 0.989. Conclusions: Quantitative measurement of severity and asymmetry of UC with 3D surface imaging is useful for diagnosis and the objective tracking of long-term outcomes without exposure to radiation. The UCAI and UCDI have high AUC's and demonstrate the expected ipsilateral frontal restriction in length, width, and height in patients with UC. Surgery for UC generally uses a frontal approach, making the UCAI an effective guide for peri-operative evaluation. Clinically, this advantageous for the evaluation of patients with UC using less radiation than serial computerized tomography scans.

3. Stimulation of Exosome Secretion by Urine-derived Stem Cells with Controlled Release of Hepatic Growth Factor

Abdelrahman Alwan, MD Emmanuel C Opara, PHD

Fatma Khalil, Exel Valle Estrada, Yuanyuan Zhang, Emmanuel C Opara
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Fellow

Introduction The prevalence of urinary incontinence escalates with advancing age, with over 40% of the female population aged ≥70 years being affected. Concurrently, the regenerative potential of stem cells diminishes with increasing age. The therapeutic efficacy of stem cells largely hinges on paracrine factors, specifically exosomes, which are nanometer-sized membrane-bound vesicles playing a pivotal role in cell-to-cell communication. Hepatocyte growth factor (HGF) has demonstrated its capacity to stimulate cell survival, proliferation, and neuromuscular differentiation in stem cells. However, it remains to be determined whether HGF can stimulate urine-derived stem cells (USC) to secrete exosomes capable of enhancing sphincter tissue regeneration. This research aims to investigate the impact of incubating HGF-loaded microbeads with human USC on augmenting exosome secretion to improve neuromuscular regeneration for the treatment of urinary incontinence. Methods First, we assessed the encapsulation efficiency and the release kinetics of HGF from alginate microbeads over a 28-day period, using Enzyme-Linked Immunosorbent Assay (ELISA). Alginate microbeads, loaded with HGF, designated as HGF-beads, were utilized for this purpose, with empty beads serving as the control. Furthermore, a third group was introduced, involving the addition of a single equivalent dose of HGF directly to the culture media, serving as a comparison between a bolus drug administration and the sustained release from the microbeads. The culture media were harvested after 3- and 7-day incubations to isolate the secreted exosomes and quantify the HGF content released within the three groups. The exosomes within each group were subjected to characterization through Western Blot and visualization using transmission electron microscopy. The exosomes were also evaluated for the expression of CD9, CD81, and CD63 biomarkers. Additionally, the exosomes from each group were compared in terms of protein concentration using the bicinchoninic acid assay (BCA), distinctive protein identification, and quantification through mass spectrometry. Results We observed that the quantity of exosomes measured was higher in the HGF-beads group in comparison to both the empty bead group and the bolus group, with a significant difference at day 7 Significantly higher protein concentrations were also noted in the HGF-beads group. Conclusion The incubation of HGF-loaded microbeads with USC results in an augmentation of exosome production and the subsequent exosomal release of HGF. These observations hold promise for therapeutic applications in the context of addressing urinary incontinence.

4. Photodynamic Bone Augmentation for Complex Geriatric Femur Fractures

Nicholas Andring, MD Jason Halvorson, MD

Marenghi, Natalie MD; Yancey, Hunter MD; Reiser, Julia MD; Pilson, Holly MD; Babcock, Sharon MD; Carroll, Eben MD; Halvorson, Jason MD
Surgery-Orthopedics
Clinical Science – Resident

Introduction: The aging population in the United States and abroad has increased the prevalence of joint replacements as well as complex periprosthetic fractures. Alongside an increasing geriatric population, there is an increased prevalence of decreased bone density increasing fracture fixation complexity in a population that needs to mobilize as soon as possible. Locked plating has improved the construct strength but high reoperation rates with early ambulation remain. At our institution we began augmenting standard locking plate fixation in osteoporotic, geriatric femur fractures with the photodynamic bone stabilization (PBS) device known as IlluminOssTM in attempt to improve constructstrength through a percutaneous

device and allow earlier ambulation. In this case series we set out to demonstrate early results using this PBS augmentation in geriatric periarticular femur fractures to determine if it may be a viable option in these complicated cases. Methods: This was a retrospective case series from 2020-2022 involving geriatric patients sustaining periprosthetic or supracondylar femur fractures. Patients were identified by corresponding CPT code and screened to ensure they underwent treatment with standard lateral locking plate and PBS augmentation. Patients who underwent arthroplasty or revision arthroplasty and had less than 3 months follow up were excluded. Medical charts were reviewed for demographics, ASA status, fracture characteristics, hardware implementation, surgical blood loss, and post-operative outcomes such as reoperation for any reason, weight bearing status, and clinical pain scores. Results: Seventeen patients met inclusion criteria and were included for analysis. The average age was 79 +/- 9.5 years with 29 +/- 17 months follow up. Four (23%) patients deceased in the first year post-operatively for unrelated comorbidities. The average ASA score was 3.3 +/- 0.8 and BMI average was 29.3 +/- 7.7 kg/m2. There were six patients sustaining interprosthetic femur fractures, ten distal femur periprosthetic fractures, and one supracondylar femur fracture. Most of the patients had AO/OTA 33-A2 fracture morphology (n=11), were as there was 1 one 33-A1, four 33-A3 and one 33-C2. Fourteen patients received a distal femur lateral locking plate with distal medial entry retrograde PBS augmentation and three had a proximal locking periprosthetic femur plate with distal lateral entry retrograde PBS augmentation. Screw distribution was 4.1 +/- 1.1 screws above the fracture and 5.4 +/- 1.3 screws below the fracture. 53% of patients were allowed to immediately weight bear post-operatively, whereas the remaining 47% had concomitant injuries with restricted weight bearing. 47% of patients required increased ambulatory devices at final follow up and had an average VAS pain score of 1.3 +/- 1.5 on a 10-point scale. There was one reoperation overall (5.8%) of which was for superficial hematoma/seroma evacuation. All patients went on to complete union and there were no instances of hardware failure, nonunion, or malunion. Conclusion: Early results using the PBS implant as fixation augmentation with standard locked plating in geriatric fragility femur fractures shows a low reoperation rate with no evidence of hardware failure or complications. Larger more longitudinal studies will be needed to determine long term outcomes and potential risks with this newer implant, but early outcomes are optimistic as a potential augment to difficult osteopenic fractures for earlier weight bearing.

5. Technical Trick: Dual Plate Technique for Geriatric Distal Femur Fractures

Nicholas Andring, MD Eben Carrol, MD

Reiser, Julia MD; Pilson, Holly MD; Babcock, SharonMD; Halvorson, Jason MD; Carroll, Eben MD
Surgery-Orthopedics
Clinical Science - Resident

INTRODUCTION: Recent literature has focused on early stabilization for geriatric distal femur fractures. Multiple techniques have been previously described such as distal femur locking plates (DFLP) as well as dual implants. One difficulty with dual plate (DP) application is neurovascular structures limiting medial plate length. We describe a new technique with patient case series for applying a DP construct with a medial “twist” plate to avoid these structures while increasing medial column plating length. METHODS: Geriatric patients underwent DP fixation with the described medial “twist” plate from July 2022 to present for complex supracondylar femur fractures or distal femur periprosthetic fractures. After provisional reduction establishing length, alignment, and rotation a 4.5mm DFLP was applied laterally. This was followed by application of another 4.5mm DFLP medially with an approximately ninety-degree twist so the distal locking cluster would contact the medial femur and proximal plate contacting the anterior femoral shaft. Both plates were applied in a minimally invasive manner. The two plates are then compressed in the coronal plane to help facilitate reduction as well as deter distal translation. Patients were allowed to weight bear immediately and had at least six months of follow up to be included. RESULTS: Eleven patients average age 72 +/- 13 years who were 82% female and all carrying multiple medical comorbidities underwent the described procedure. Average follow up was 8 +/- 2 months and length of stay averaged 7 +/- 6 days. All patients were ambulatory prior to the injury. Five patients sustained distal femur periprosthetic fractures, four supracondylar femur fractures, one interprosthetic femur fracture, and one Vancouver C fracture. Post-operatively all patients had a normal anatomic lateral distal femur angle (aLDFA) which was unchanged at final follow up. Three patients required a reoperation (two peri-implant fractures requiring revision open treatment and one with progressive screw back out requiring single screw removal). 27% of patients required an increase in assistive devices at final follow up. There was no evidence of hardware failure or malunion. The average pain score at final follow up was 1 +/- 2 on a ten-point scale. CONCLUSION: We present a technical trick with patient series for increased medial column plate length to treat difficult geriatric distal femur fractures. The relatively high reoperation rate is similar to other published series treating complex geriatric femur fractures, however, this method provides surgeons an option for DP constructs that need more proximal extension where early weight bearing is desired.

6. Anti-cancer endocrine-targeting therapies and diet interactions shift the gut microbiome to impact ER+ breast carcinogenesis and outcomes

Alana Arnone Katherine L. Cook, PhD

Adam S. Wilson; Katherine L. Cook
Surgery-Hypertension
Basic Science – Student

Breast cancer (BC) is a heterogeneous disease with diverse clinical and pathological characteristics that significantly promote carcinogenesis. Despite significant progress in its diagnosis and treatment, there are still more than 40,000 deaths per year. Recent studies implicate the gut microbiome as a potential risk factor for BC and a factor modifying therapeutic response. However, whether orally administered endocrine-targeting therapies used post-surgery in the adjuvant setting to reduce ER+ breast cancer recurrence modifies the gut microbiome is unknown. To examine this question, we performed shotgun metagenomics on DNA isolated from female C57BL/6 mouse feces administered tamoxifen citrate (TAM) for 12 weeks to show tamoxifen significantly shifted β-diversity and increased Bacteroidetes/Firmicutes ratio. Administration of TAM increased fecal Lactobacillus johnsonii proportional abundance, suggesting drug-bug interactions modifying probiotic Lactobacillus populations within the gut. We also observed changes in gut permeability markers and fecal estrone-glucuronide concentrations indicating TAM administration impacts gut health. To elucidate the effects of TAM and probiotic bacteria on BC outcomes, 4T1.2ER+ tumor-bearing female BALB/c mice, fed either a healthy control or Western diet were treated with either TAM, Lactobacillus probiotic, or combination. Results indicate that probiotics alone and in combination with TAM reduce ER+ tumor growth in Western diet-fed animals. Using an Ex vivo colonic bioreactor, we show that endocrine-targeting therapies TAM and letrozole influence β- glucuronidase-expressing (GUS) bacteria. TAM administration significantly reduced three different GUS expressing Bacteroides species while also increasing commensal B. fragilis. Administration of letrozoleincreased four other GUS-expressing species while decreasing commensal B. fragilis. Overall, we demonstrate that endocrine-targeted therapies, such as tamoxifen, modulate the gut microbiome, suggesting a potential role for specific bacterial species to enhance therapeutic responsiveness and reduce breast cancer risk.

7. The Renin-Angiotensin-Aldosterone Axis in a Hemorrhagic Shock Porcine Model

Elizabeth Azar, BA Lucas P. Neff, MD

Elizabeth Azar, Gabriel Combranero, Bonnie Laingen, Garrett Reid, Juhi Saxena, Elizabeth Wood, Magan Lane, Lucas Neff, Timothy Williams
Surgery-General
Basic Science – Student

Background: Though the pathophysiology of hemorrhagic shock is well described, there is a limited understanding of the effects of hemorrhage and life-saving maneuvers like resuscitative endovascular balloon occlusion of the aorta (REBOA) on the primary and fast acting sympathetic adrenomedullary system (SAM), hypothalamic pituitary adrenal axis (HPA), and renin-angiotensin-aldosterone system (RAAS). Studies have demonstrated that partial and full aortic occlusion result in increases in serum angiotensin-II while serum renin does not. The interplay of adrenal physiologic mechanisms has not been defined. This study explores the intersection of three axes that mitigate the physiologic effects of stress in the context of shock and endovascular resuscitation. Hypothesis: We hypothesize that during hemorrhage and adrenal reperfusion following REBOA, there is an increase in endocrine plasma/serum renin, aldosterone, and metanephrine concentration between groups and timepoints. Methods: Seventeen Yorkshire swine underwent liver transection followed by uncontrolled hemorrhage. Once subjects reach a critical stage of hypotension, balloon inflation is triggered in zone 1 of the aorta (T0). After ten minutes of complete aortic occlusion (T10), pigs are randomized to either Intermittent REBOA (iREBOA, n=9) or Partial REBOA (pREBOA, n=8). Baseline serum renin, serum aldosterone, and plasma metanephrine (PMN) concentrations were obtained prior to liver transection. Samples were also taken at T10 and T15 during the initial stages of reperfusion to downstream tissues. Results: There was no significant difference between the median (IQR) renin concentrations across timepoints (5.7 ng/mL [3.8-9.3] vs 7.3 [5.3-9.0], p=0.84 and 5.5 ng/mL [4.4-12.5] vs 7.5 ng/mL [2.8-15.1], p=0.88) or experimental arms (p=0.92, p=0.92). There was no significant difference between the median (IQR) aldosterone concentrations between timepoints (12.7 ng/mL [10.1-16.7] vs 14.6 [11.1-24.6], p=0.16 and 15.4 ng/mL [9.7-23.03] vs 20.36 ng/mL [17.7-23.0], p=0.38) or experimental arms (p=0.73, 0.59). However, there was a significant difference between the median (IQR) PMN concentrations across timepoints (77.1 ng/mL [64.7-186.1] vs 2107 [1829.1-2922.4], p=0.008 and 126.2 ng/mL [63.7-235.6] vs 2331.2 ng/mL [1823.7-3051.8], p=0.008) but not experimental arms (p=0.79, 0.87). Conclusions: This study showsthat PMN concentrations increase significantly in a hemorrhage model while renin and aldosterone

do not, despite the method of reperfusion upon balloon deflation. This finding is consistent with the expected activity of the fast-acting SAM axis and the slower responding HPA and RAAS axes. This pilot data yields insights into the physiologic changes that occur with endovascular catheters capable of precision hemodynamic control for resuscitation of bleeding patients. However, more time points are necessary to better understand this phenomenon.

8. Posterior Vault Distraction Osteogenesis in Pediatric Refractory Idiopathic Intracranial Hypertension: Efficacy and Cranial Suture Fusion Analysis

Mario Blondin, MD Christopher M. Runyan, MD, PhD

Attila K. Dos Santos Kirsten Fernando Daniel Zaki Amelia L. Davidson Gabriela Gonera Daniel E. Couture Christopher M. Runyan
Surgery-Plastic & Reconstructive
Clinical Science – Fellow

Introduction: Idiopathic intracranial hypertension (IIH) is defined as elevated intracranial pressure (ICP) without a clear etiology. In refractory cases with imminent visual deterioration, surgical management, including cerebrospinal fluid shunting or optic nerve sheath fenestration, is offered as a last resort. This study examines our use of posterior vault distraction osteogenesis (PVDO) as a novel surgical treatment for pediatric patients with refractory IIH and evaluates the relationship between skull suture fusion and elevated ICP in this population. Methods: A retrospective review was conducted on pediatric patients diagnosed with IIH and age- and sex-matched controls who had undergone head computerized tomography (CT) scans. In addition to general demographics, data collected included clinical findings on presentation, previous non-invasive treatments for IIH, and perioperative details about PVDO. Patients were excluded if they had a history of other inherited or acquired craniofacial conditions or had undergone craniofacial or neurosurgical procedures other than PVDO. Utilizing the head CT scans, a 5- point scale developed by Madeline and Elster was employed to grade major and minor cranial suture fusion. Results: Fifteen patients with IIH and thirty-one controls were included in this study. Compared to unaffected controls, patients in the IIH group had a higher BMI (32.9 vs. 22.0, P = 0.01). Within the IIH group, patients undergoing PVDO (N = 3) were significantly younger at the time of diagnosis (6.7 vs. 13.1 years of age, P = 0.004). Three patients underwent PVDO with significant improvement in their symptoms. The average latency phase, active phase, consolidation phase, time from distractor placement to removal, and distraction distance were 1.3 days (1-2 days), 29.3 days (23-40 days), 167.5days (146-189 days), 230 days (189-287 days), and 25 mm (23-29 mm), respectively. Although one surgical patient had a fused sagittal suture, we found no clinically significant association between IIH and premature suture fusion. Conclusions: PVDO appears to be a safe and effective treatment for managing pediatric patients with refractory IIH. Although one patient had premature fusion of the sagittal suture in our study population, there was no association between craniosynostosis and IIH. Craniosynostosis may be an incidental finding or may occur secondary to shunting procedures.

9. Engineering Adiponectin-Loaded Microparticles to Stimulate Stem Cells to Secrete Exosomes & Subsequent Characterization for Treatment of Metabolic Disease

Joshua Bowlby, PhD Emmanuel Opara, PhD

Abdelrahman Alwan
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science – Student

There is significant interest in the use of exosomes for cell-free treatment of disease because of the advantages over cell therapy. The diversity and distribution of uncontrolled inflammation makes it extremely difficult to diagnose and control. Adiponectin is a well-known protein that is secreted by adipose tissue, which can regulate inflammatory responses in patients. Alginate is a highly studied biomaterial that provides a superb immobilization matrix for encapsulating cells and drugs within chemically crosslinked hydrogel microparticles. Small extracellular vehicles (ECVs) are a group of secretory vesicles that contain multiple intracellular signaling molecules, playing a role in reducing inflammation and restoring tissue homeostasis. The goal of the present study is to determine the optimal procedure utilizing air extrusion methodology to encapsulate adiponectin in alginate microbeads crosslinking in 100 mM CaCl2 solution and use it to stimulate and isolate exosomes from two cell types placental (PSC) and adipose-derived mesenchymal stem cells (Ad-MSCs). Additionally, this study characterized and compared extracellular vesicles secreted by PSCs and Ad-MSCs after prolonged exposure (3 days and 7 days) to adiponectin. It is hypothesized that due to adiponectin's interaction with cells, encapsulating the protein in alginate beads will stimulate exosome production that can contain anti-inflammatory signals to be utilized for improving

inflammatory conditions outcome. In summary, this research elucidated exosome characterization secreted by Ad-MSCs and PSCs after exposure to adiponectin released from alginate microparticles over multiple days to determine the utility of these exosomes for potential therapeutic application.

10. Innovating Tendon Repair Training

Michael Boyajian, MD Anne Argenta, MD

Amelia Davidson, Will Molair, Albert Woo, Joseph Crozier, Reena Bhatt, James Johnson, Kerry Danelson, Anne Argenta
Surgery-Plastic & Reconstructive
Educational Science – Resident

Purpose: Flexor tendon repair is a technically demanding procedure, and surgical simulation may accelerate the learning curve of junior residents. Herein, the purpose of this project was to develop a training program with a 3D printed simulator to teach flexor tendon repair. Methods: A 3D printed flexor tendon repair simulator was developed to include a surgical platform and an anatomically representative set of finger bones (Figure 1). Replaceable transparent silicone tendons are threaded through pulleys, and tension can be adjusted. We also produced an instructional video that covers core and epitendinous suturing. With this curriculum, we held 3 separate 2-hour simulation workshops for 11 residents, and participants were evaluated on their ability to perform cadaveric tendon repairs before and after the workshop. For evaluation, human cadaver fingers were disarticulated and mounted on a separate 3D printed platform, specifically designed to secure the tendons under tension. Participants were anonymously recorded and graded. Survey data was also collected to assess model realism, educational utility, and overall usefulness. Results: Early results indicate that the 2-hour simulation workshop improves resident confidence and skill in flexor tendon repair. Additionally, the simulator's realism, educational utility, and overall usefulness received grades of 4.3/5, 4.3/5, and 4.7/5, respectively. Conclusions: A 3D printed surgical simulator was developed for flexor tendon repair. Feedback has been uniformly positive, and results indicate improvement in junior resident confidence and skill. Because it can be 3D printed en masse, the device potentially has wide applicability within hand surgery training.

11. Are There Racial Differences in Frailty and Complications in Breast Cancer Surgery Patients?

Andrea Boyd Tressler, MD, PhD Marissa Howard-McNAtt, MD

Crystal Diaz, Ashley Cairns, Marissa Howard-McNatt
Surgery-General
Clinical Science - Resident

BACKGROUND: Breast cancer is a common malignancy that is curable when caught early in otherwise healthy patients. When patients are older, and have comorbidities and other risk factors, the outcomes can be significantly varied. Some physicians may be less inclined to offer treatments to older patients and older patients may be less agreeable to receiving them There has been limited analysis into the impact of frailty on breast cancer outcomes, in particular amongst Black women. We sought to determine any racial differences in frailty and outcomes of elderly breast cancer patients.
METHODS: This is a retrospective review of a prospectively managed single-center database including all breast cancer patients >65 years undergoing surgery in 2021. Frailty was determined using an electronic frailty index (eFI) derived from electronic health data. Patients were categorized as Fit (eFI ≤0.10), Pre-frail (0.10<eFI≤0.21), or Frail (eFI >0.21). Chart review was collect on data examining adjuvant therapies and complications after surgery. Descriptive statistics and logistic regression were performed. RESULTS: Among 134 patients, Black women presented at a higher stage in comparison to White women (1.50 vs 1.29) but this did not reach statistical significance (p=0.124). The average age of Black breast elderly patients was 72.6 +/- 6.2 years as compared to 74.2 +/- 7.0 years (p=0.278). The medium eFrailty index was higher in Black women in comparison to White women (69% vs. 42.5% p=0.01278). Emergency department visits within 30 days was also increased in Black women as compared to White women (6.67% vs 5.66%, p= 0.01278). CONCLUSION: We found that Black breast cancer patients are more likely to be frail and have more Emergency department visits postoperatively than Caucasian women. This analysis highlights ongoing racial disparities and the need for continued work to improve breast cancer care for all patients.

12. In-Vitro Effects of Amniotic Fluid Derived Stem Cell Conditioned Media in End-Stage OA

Marcel Brown, MD Xue Ma, MD, PhD

Matthew Gwilt, Xue Ma
Surgery-Orthopedics
Basic Science – Fellow

INTRODUCTION: Osteoarthritis (OA) of the knee is a chronic disease with limited treatment options and remains the most prevalent joint disorder in the United States1. Many of the treatment options on market remain broad in their effect without a clear mechanism of action. Amniotic membrane and fluid derivatives as a therapeutic for OA have been well documented, with primary clinical studies demonstrating that intra-articular injections may reduce OA progression2. Amniotic Fluid Stem Cell Conditioned Media (AFSC-CM) is an acellular preparation that isolates the placental-derived cytokines and growth factors released into growth medium. It is believed that the growth factors and cytokines contained within AFSC-CM exert a paracrine effect to mitigate or slow OA progression, with minimal risk of immunogenicity thus making it a strong candidate for clinical use. This study will examine the in-vitro effect of AFSC-CM on human and porcine chondrocyte cell viability and the ex-vivo effect on the extracellular matrix of both human and porcine chondrocyte explants. We hypothesize AFSC-CM will improve chondrocyte proliferation and viability in comparison to control, IL-1 and IL-1 co-cultured with treatment in bothhuman OA phenotype cells and induced OA in porcine cells. We further hypothesize that AFSC-CM will inhibit the catabolic progression that leads to extracellular matrix (ECM) degradation. METHODS: Human knee articular cartilage (n=4) were collected following total knee arthroplasty in patients with end-stage OA. Porcine cartilage (n=4) was collected through sterile dissection after collection of hind limbs from same day pig necropsies. Human and porcine chondrocytes were then cultured in 10% Fetal Bovine Serum (FBS) and treated at baseline once 20% confluent with a low dose (LD=3mg/ml) and a high dose (HD=10mg/ml) of AFSC-CM. Cells were then cultured in 5% FBS and cell counting kit 8 assay (CCK-8) analysis was performed every 48 hours for 6 days. Separate plates were used for day 0, 2, 4 and 6. Articular cartilage explants (n=4 human, n=4 porcine) were collected and treated with 1% mini ITS for 6 days, with timed collection of media for assessment of glycosaminoglycan (GAG) release every 48 hours. Two-way ANOVA (IBM SPSS Vs. 29) was performed on optical density (OD) values and GAG content at all time points. Probability level less than 0.05 was considered significant. RESULTS SECTION: Human chondrocytes showed increased proliferation in the HD treated group (10mg/ml) in comparison to control at every measured time point through day 6 (Day 2 p= <0.001, Day 4 p= <0.001, Day 6 p= 0.021). Increased proliferation was appreciated in porcine cells with both LD and HD AFSC-CM treatment in comparison to IL-1α alone by day 6 (LD p= 0.002, HD p= <0.001). GAG release was decreased in porcine cartilage when treated with AFSC-CM (3mg/ml, 10mg/ml) in comparison to IL-1α after 48 hours (LD p= 0.001, HD p= <0.001). GAG release was also decreased in human articular cartilage treated with AFSC-CM (3mg/ml, 10mg/ml) compared to IL-1b after 48 hours (LD p= 0.007, HD p= <0.001). DISCUSSION: Treatment of human end-stage OA chondrocytes with AFSC-CM showed increased cell proliferation and viability over time, findings which were replicated in a similar dose-response manner in healthy control porcine samples, where AFSC-CM treatment groups outperformed the IL-1α induced OA,group. Similar results were found in both human and pig samples in the IL-1 cocultured groups, with a dosedependent response to AFSC-CM treatment increasing cell proliferation when compared to IL-1 alone. These anabolic effects of AFSC-CM on both diseased and healthy cartilage suggest that as a therapeutic, AFSC-CM can be effective both early and late in OA disease progression. In addition to the anabolic effects noted on CCK8, mitigation of GAG release with AFSC-CM treatment in chondrocyte explants suggests its role in preventing catabolic degradation of the ECM with OA. The increased GAG release with IL-1 suggests its greater effect on the catabolic mechanisms affecting the ECM rather than on cell proliferation, thus making the effect of coculturing IL-1 with AFSC-CM on cell proliferation versus catabolism hard to infer. Regardless, the consistency of the results across species and in particular the dose response of the treatment makes AFSC-CM a promising potential therapeutic. SIGNIFICANCE/CLINICAL RELEVANCE: OA remains the most common degenerative joint disease in adults, with limited treatment options available to decelerate disease progression. AFSC-CM shows therapeutic promise torestore cartilage anabolism and prevent ECM degradation in human knee samples with end-stage OA.

13. Characterizing the Venous Congestion Curve Utilizing Near Infrared Spectroscopy

Donald Browne, MD Ramon Llull, MD, PhD

Donald Browne Sabine Abukhadra Joey Kurtzman Cassandra Driscoll Ramon Llull Prasanth Patcha
Surgery-Plastic & Reconstructive
Clinical Science – Resident

Objective/Background This study aims to use curves generated from the ViOptix T.Ox tissue oximetry device to create a

mathematical model to identify and predict venous congestion in patients undergoing free tissue transfer. Methods We obtained IRB approval for a prospective in vivo venous occlusion test (VOT) to simulate tissue venous congestion. Healthy individuals >18 years old from Atrium Health Wake Forest Baptist were selected through convenience sampling, with exclusion criteria for major cardiac disease, peripheral vascular disease, neurologic conditions, and pain syndromes. Data collection involved connecting subjects to ViOptix T.Ox terminal for baseline StO2% measurements on the volar forearm using a fiber optic sensor, along with recording baseline blood pressure. During VOT the blood pressure cuff was inflated to 20mmHg below baseline diastolic pressure and blood pressure was monitored every 5 minutes during the 20-minute VOT. Five minutes of rebound StO2% was recorded. Data analysis and modeling were performed using Microsoft Excel. Results The population demographics are visualized in Table 1. Each subject's StO2% during VOT was plotted against time. The combined trend is characterized by the equation y = 80.81e-0.019x, R2 =0.9872 (Figure 1). Baseline and rebound StO2% measurements were recorded (Figure 2). The average decline in StO2% across all subjects was 1.23% per minute. Conclusion Venous congestion of tissue can be successfully characterized with this venous occlusion model. Venous occlusion is described by the curve y = 80.81e-0.019x. Identifying specific patterns of venous congestion may lead to earlier detection of tissue compromise in a clinical setting.

14. Role of frailty in axilla management for elderly breast cancer patients

Ashley Cairns Marissa Howard-McNatt MD

Perko, Martin, Levine, Howard-McNatt
Surgery-General
Clinical Science - Resident

Background In 2016, the Society of Surgical Oncology released a Choosing Wisely guideline recommending omitting sentinel lymph node biopsy (SLNB) in females greater than or equal to 70 years old. We sought to investigate our institutional rates of SLNB in women >70, early stage IA breast cancer, ER+ and whether nodal staging impacted receipt of adjuvant therapy as well as evaluate frailty differences between this cohort. Methods In a one-year retrospective analysis at a single institution, we identified 40 patients who fit the criteria of age greater than or equal to 70, early stage IA breast cancer, and ER+. Amongst these patients, 6 underwent bilateral mastectomy, 100% of which revealed SLNB; 1 received bilateral mastectomy, 100% received SLNB on side of cancer. Of those undergoing breast conserving therapy (BCT) (33), 10 did not receive any axillary staging; 22 underwent sentinel lymph node biopsy and 1 axillary lymph node dissection. Results We investigated the differences between the group receiving BCT with SLNB and those who did not. Overall, 69.7% (23/33) of those with BCT underwent nodal staging with 3% undergoing ALND. We identified that those receiving SLNB were younger (p=0.014) and had a lower end of life care integrator (EOLCI) (p=.0067). Other metrics such as electronic metric of frailty (eFI), American Society of Anesthesiologists Physical Status (ASA), Eastern Cooperative Oncology group performance score (ECOG) trended lower but was not statistically significant in those receiving SLNB w/ BCT (p=0.105 for eFI, p=0.22 for ASA, p=0.309 for ECOG). Amongst those receiving breast conserving therapy in this cohort, receipt of adjuvant therapy amongst those with SLNB was not statistically significantly from those without (95% vs. 80%), (p=0.164). There was no statistically significant difference amongst receipt of endocrine therapy, radiation therapy or chemotherapy amongst those with SLNB compared to those without, although it trended lower amongst those without SLNB (p=0.09 endocrine, p=0.15 chemotherapy, p=0.13 radiation). Interestingly, this suggests that patients are receiving adjuvant therapy despite lack of nodal staging, although all groups trended lower in those without SLNB. With regards to not being offered therapies or declining therapies citing age/comorbidities, 13% declined/were not offered adjuvant therapies citing age/comorbidities in those who underwent SLNB as compared to 50% in those who did not undergo SLNB (p=0.03). This suggests that patient specific factors, such as age, frailty, and comorbidities, affect decision to pursue nodal staging as well as adjuvant therapies. Conclusions Overall, we noted SLNB was being performed in 69.7% of patients who meet criteria for Choosing Wisely guidelines to omit SLNB. We identified that there are differences amongst the patients that underwent SLNB as compared to those who did not, specifically age, end of life care integrator, and whether therapies were not offered/declined due to comorbidities/age. We believe that the role of frailty metrics may aid in decision making for patients 70 years or older with early stage ER+ breast cancer, both at nodal staging and with adjuvant therapy.

15. Induction of Neurogenesis and Angiogenesis at the Site of Injury in Acute Traumatic Spinal Cord Injury

Rebecca Calafiore, MD Eric Marrotte, MD, PhD

Eric J. Marrotte, Joseph A. Criscitiello, Paul Marcet, Qingqi Li, Queena Chen, Thomas L. Wilson, Anthony Atala

Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Resident

Introduction: In the United States, there are approximately 300,000 people living with spinal cord injury (SCI). The inability to overcome the inhibition caused by glial scar formation following SCI not only contributes to limited functional recovery for patients but has significantly impeded the development of effective stem cell therapy for SCI; there are currently no clinically efficacious therapies that will restore motor function after SCI. While several studies have focused on the use of stem cells to induce spinal cord repair, the majority of these studies did not include modification of the extracellular matrix (ECM). A previous study demonstrated that multimodal therapy with progenitor cells combined with a PEG synthetic extracellular matrix (sECM) that polymerize ex vivo can induce de novo formation of central nervous system tissue and improve functional recovery after hemi-transection. In order to apply this combined therapy to a compression injury model, the most common type of acute traumatic SCI, a novel hyaluronic based ECM that polymerizes in situ was developed. In this study we explored the efficacy of this combined hyaluronic acid sECM/placental derived stem therapy to induce neurogenesis in a traumatic contusion spinal cord injury compared to non-treated controls. Methods: All animal procedures were a proved Wake Forest University IACUC (A20-002). Female rabbits 2.0 to 3.0 Kg (Charles River) underwent contusion injury of the spine. After 12 weeks, the spinal cords were fixed, embedded in paraffin and sectioned for immunostaining and histologic staining. Spinal cord tissue sections were immunostained with Beta III tubulin (neuron marker) and VE cadherin (angiogenesis). Histologic outcomes were analyzed between two groups: the control group, induced spinal cord injury only verse PSC only and PSC+sECM combined therapy. Results: Through our preliminary examination, we have found that the administration PSCs combined with sECM has led to induction of neurogenesis and angiogenesis at the spinal cord injury site in acute traumatic injury. Conclusions: Our initial data indicate that a PSC therapy in combination with sECM will induce neurogenesis and angiogenesis at the site of acute traumatic spinal cord injury.

16. Mini-Thoracotomy Mitral Valve Surgery is Safe and Associated with Shorter Hospitalization Compared to Open Sternotomy

Gabriel Cambronero, MD Bartlomiej R. Imielski MD

Zohaib R. Khawaja, Elizabeth C. Wood, Yusuf M. Aboutabl, James E. Jordan, Adrian L. Lata, Edward H. Kincaid, Neal D. Kon, Bartlomiej R. Imielski
Surgery-Cardiothoracic
Clinical Science - Resident

Purpose Full open sternotomy (OS) mitral valve surgery provides greater exposure, tactile feedback and allows for a variety of concomitant procedures (Svensson et al. 2007); however, it remains unclear whether mini-thoracotomy (MT) is associated with better outcomes (Al Shamry et al. 2023). This study compares outcomes between MT and OS approaches. Methods A retrospective review of 259 consecutive adults undergoing first-time cardiac surgery for isolated mitral valve repair or replacement, at a single tertiary-care hospital, over a 10-year period was performed. Exclusion criteria included those undergoing concomitant cardiac procedures and previous pacemaker placement. Cases were reviewed for intraoperative results and post-operative outcomes within 30 days of discharge. Primary outcomes evaluated were operative times and length of stay (LOS). Secondary outcomes included post-operative major adverse cardiac events (MACE), permanent pacemaker (PPM) placement, inpatient re-operations, all-time redo mitral valve surgery, intensive care unit (ICU) LOS, readmission rates, combined morbidity, and 5-year mortality. Combined morbidity included myocardial infarction, stroke, re-operation, and post-operative PPM placement. Results A total of 259 mitral valve surgeries were performed between 2012 and 2023, 102 (39.4%) were performed via MT and 157 (60.6%) via OS. There were significant differences in the primary outcomes. The total median (IQR) operative duration for MT was quicker than OS (171 min [146-201] vs 199 min [160-233]; $p = 0.001$). Cardiopulmonary bypass time for MT was shorter than OS (100 min [87-125] vs 116 min [95-136]; $p = 0.002$). Additionally, the aortic cross-clamp time for MT was shorter than OS (66 min [58-79] vs 75 min [64-89]; $p = 0.002$). The post-operative LOS and hospital LOS were shorter for MT at 126 hours (98-190) and 138 hours (106-200), respectively, compared to OS at 148 hours (121-219) and 178 hours (129-305), respectively ($p = 0.001$ and $p < 0.0001$). Although ICU LOS ($p = 0.08$) was similar between groups, the MT group had a shorter duration of mechanical ventilation ($p = 0.0003$). There were no significant differences in secondary outcomes of MACE, PPM placement, inpatient re-operations, all-time redo mitral valve surgery, readmission rates, combined morbidity, and 5-year mortality (see Table for medians/counts, IQRs/percentages, and pvalues). Conclusions Mini-thoracotomy mitral valve surgery is associated with quicker operative times, and shorter length of stays, with similar adverse events compared to open sternotomy. These findings should encourage wider use of mini-thoracotomy mitral valve surgery in order to promote faster patient recovery and reducing healthcare costs associated with length of stay.

17. Novel Breast Biopsy Scaffold and Deployment System

Darnell Campbell Nicole Levi, PhD

Marco Benavides, Jordan Forte, Clifford Howard adn Nicole Levi
Surgery-Plastic & Reconstructive
Clinical Science - Student

During a needle breast biopsy, the physician will remove a small sample of tissue to be analyzed and place a small metallic imaging marker encapsulated by either a mesh or a sponge-like polymer which is placed for monitoring purposes and in the case that surgical excision is needed. However, not all biopsies can accomplish this task due to marker migration as a complication caused by imprecise deployment or improper encapsulation of the marker, thus increasing the risk of incomplete excision during surgery and imprecise monitoring of benign vs malicious lesions. Current commercially available deployment devices apply a force that leads to marker migration. Another reason attributed to marker migration is improper encapsulation; commercially available meshes aren't robust enough to contain the marker in place and their sponge-like counterparts require a hydration period where the material absorbs moisture to secure itself within the tissue. In order to reduce marker migration complications, our group has developed a 3D printed deployment device capable of accurately releasing the marker in a passive motion, as well as an elastomeric scaffold composed of biodegradable 1,8-Octanediol co-citrate capable of securing markers in place. Our deployment device and scaffolds were compared to commercially available counterparts in translucent breast tissue phantoms and in Sprague Dawley rats, scaffolds were further characterized to determine their crosslink density, elastic properties, degradation rate, biocompatibility, and acidity profile. Initial tensile characterization of POC scaffolds demonstrated that secondary thermal treatment directly affected the material's elastic behavior and degradation rate, with samples treated for 24 hours presenting double the Young modulus when compared to samples only treated for 6 hours. Similarly, samples treated for a longer period of time were degraded at a slower rate. For the purposes of encapsulating a breast biopsy imaging marker, samples that received a secondary thermal treatment for 2, 4 and 6 hours presented the most appropriate elastic properties and were selected for further testing with deployment devices. Scaffolds containing markers were prepared into cylinders of 5mm in diameter and 10mm in length and were tested by determining their expansion rate after being released from deployment devices. Samples that were exposed to 2 hours of secondary thermal treatment were capable of being compressed to half of their original size and expanding back to their original dimensions upon release. Next, five female retired breeder Sprague-Dawley rats were implanted with POC, Securemark and Mammomark imaging markers in six mammary fat pads using commercially available Mammomark deployment device or in-house device. Then, the animals were imaged weekly for a period of 60 days in order to determine marker migration or rejection. None of the animals presented complications or rejections related to our POC material or deployment device, and the explanted materials were then evaluated to determine the presence of the marker and radiograph images were analyzed to determine marker migration.

18. Long term outcomes of pediatric free flap reconstruction

Sydney Cannon, MD J. Dale Browne, MD

Benjamin Flyer, Daniel Kirse, J. Dale Browne
Surgery-Otolaryngology (Dentistry)
Clinical Science - Resident

Long term outcomes of pediatric free flap reconstruction. Introduction Free flap reconstruction is used to repair complex defects related to head & neck trauma and cancer. The long term cosmetic and functional outcomes of these reconstructions is variable. The majority of microvascular reconstruction is applied to the adult population. Our study illustrates the long-term outcomes of soft tissue and bony free flap reconstruction of the head and neck in the pediatric population. Methods A retrospective case review was performed from 2003-2022 for patients undergoing head and neck reconstruction with free flaps less than eighteen years old at a single tertiary academic medical center. Success rate, functional outcomes, and defect symmetry were assessed along the growth continuum of the child. Results A total of nine patients were identified. Average age at time of free flap reconstruction was nine years old (range: 14 months-16 years). Herein, we also highlight the youngest hemiglossectomy defect reconstruction reported in the medical literature in a 14-month-old patient with atypical Ewing's Sarcoma using a soft tissue parascapular free flap. Facial defect types were variable, including skull base, tongue, mandible, and large soft tissue defects. The facial defects were repaired with free flap reconstructions: two radial forearms, two iliac crests, two rectus abdominis flaps, and three parascapular flaps. All free flaps survived in the immediate and long-term post-operative period. There were no donor site complications in any case. Functionally, the cohort had no long-term articulation problems, or trouble with dysphagia. Clinical facial asymmetry was addressed in one patient five

yearsafter initial surgery. Conclusion Microvascular reconstruction of pediatric facial defects can offer afunctional outcome in the growing child.

19. Quality Improvement for the Development and Implementation of a Fourth Year Medical Student Ophthalmology Curriculum

Samuel Carpentier, MD, PhD Atalie Thompson, MD, MPH

Brianna Valenti, Gillian Treadwell, Atalie Thompson
Surgery-Ophthalmology
Educational Science - Resident

Medical school curriculums do not have extensive time devoted to the development of ophthalmology physical examination skills or clinical knowledge. One survey found ophthalmology was a required rotation in only 18% of medical schools. Another survey revealed the majority of primary care program directors believed fewer than 50% of incoming residents have sufficient ophthalmology skills upon entering internship. As there are many specialties that frequently encounter patients in need of eye care, it is in the best interest of quality patient care that ophthalmology education be continually reevaluated and enhanced. Currently at Wake Forest University School of Medicine there is no required ophthalmology rotation. Students may rotate in ophthalmology for two weeks during their General Surgery rotation or may elect for four weeks of ophthalmology during their fourth year of medical school. Students that rotate for four weeks are assigned an ophthalmology resident mentor and shadow residents in urgent clinic, resident clinic, and on consults. There is no formal teaching of residents for how to mentor their medical students. Medial students also shadow attendings in the OR and clinic. There is no final examination to evaluate medical students on their rotation. Each specialty has unique overlaps with ophthalmology that make a uniform teaching curriculum challenging to implement. Fortunately, fourth year medical students rotate through the department of Ophthalmology with high flexibility for learning skills specific to their future specialty. We have established an IRB approved (IRB00093308) quality improvement (QI) project to develop and implement a more formally structured ophthalmology rotation for fourth year medical students who elect to rotate on the ophthalmology service. Using Kern's model for curriculum design, we conducted a needs assessment and survey of key stakeholders, including medical students, ophthalmology residents, and ophthalmology attendings to collect input on potential need for ophthalmic training and improvements that could be made to the current fourth year medical student ophthalmology rotation. We developed a skills-based guide and checklist wherein residents will learn to teach medical students to perform basic physical exam skills in ophthalmology. At the end of the rotation, medical students will be evaluated on these specific ophthalmic examination skills. The physical examination portion of the curriculum will also be evaluated by a pre- and post-confidence survey of medical students. We are developing a detailed study guide to help medical students acquire high-yield knowledge that will aide them in their development asphysicians whether they pursue a career in ophthalmology or another specialty. We will administer a final written exam to evaluate their ophthalmology clinical knowledge base at the end of the rotation. The new curriculum will also be evaluated with a post-curriculum survey for medical students and residents to enable feedback and continuing improvements to the curriculum over time.

20. Emergency Room Pediatric Burn Care Before and After Pediatric Burn Center Establishment: Assessment of Five State Geographical Catch Area in the Southeast

Brandon Casas, MD James Holmes, MD

Amelia L. Davidson, Karna Mangrola, James H. Holmes, Milan Nadkarni
Surgery-Plastic & Reconstructive
Clinical Science - Resident

Introduction: Pediatric burn injuries account for 120,000 emergency department visits and about 10,000 hospital admissions annually.1-3 With few ABA-verified pediatric burn centers in the southern US, there is potential for differing approaches at EDs with a pediatric burn center and those without.1,4 Pediatric burns, in particular, may be subject to further separation due to differences in fluid resuscitation, surface area calculations, and airway compromise.5,6 Thus, the aim of this study is to comparatively assess ED efficiency in the years before and after establishment of a pediatric burn center.
Methods/Design: A retrospective review of admitted pediatric (0-18 years old) burn patients seen at Atrium Health - Wake Forest Baptist emergency department between the years 2008-2022 were included. Patients transferred for further pediatric burn care from outside hospitals were also included, whereas those directly admitted were removed from the study. Variables of interest were initial 24-hour fluid resuscitation, operative vs non-operative treatments, disposition, and length

of stay (LOS). Results: 1,116 pediatric burn patients were included in the final analysis. Demographic information had no demonstrated differences before burn center establishment (2008-2016) or after (2016-2022) (Table 1). Ambulance/EMS mode of transport did increase after burn center establishment ($p<0.0001$). Burn characteristics demonstrated several significant differences (Table 2). Severity increased after establishment of burn center, with more Level 2 trauma activations compared to Level 3 and transportation from ambulance ($p<0.0001$). Emergency departments showed improvement on fluid resuscitation methods with more conservative fluid measurement on TBSA estimations ($p=0.044$, $p=0.008$; Table 3). Conclusions: Incorporation of a pediatric burn center leads to improvement and comfortability with management of more severe cases in the emergency department. This can be derived from several factors, including fluid resuscitation accuracy (and incorporation of pediatric Parkland formulas), severity of burn treatment, and proportion of operative measurements. Additionally, ambulance/EMS transport increased due to transfer for further burn management from outside hospitals (FET, pvalue= 0.032). Data collection is ongoing, with interest in readmission rates, types of operative intervention, maintenance fluid, and other therapeutic interventions

21. Biosensor Integrated Multi-Organ-On-A-Chip Platform for Real-Time Monitoring of Organoid Function

Joshua Cheng Anthony Atala, MD

Seunggyu Jeon, Adit Mehta, Anthony Atala, Sang Jin Lee, Shay Soker, James J. Yoo
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Student

The emergence of an organ-on-a-chip system aims to replicate the complex physiological functions of the human body. To assess responses to drugs or other insults, biological analytes are typically analyzed using basic laboratory techniques such as spectrophotometry and enzyme-linked immunosorbent assay (ELISA). However, manual spot analysis is limited in capturing the dynamic cellular changes in real-time and is prone to user-dependent errors. In this study, we developed a novel integrated platform that combines a multi organ-on-a-chip system with cell-specific and environmental sensors to achieve realtime monitoring. We integrated all components into a single inline flow loop with automated control and measurement capabilities. The multi-organ-on-a-chip was fabricated using a precision organoid bioprinting technique directly onto a polydimethylsiloxane (PDMS)-based chip. The viability and functional expression of cell-specific markers in the organoids were validated. Electrochemical aptamerbased biosensors such as albumin and insulin were integrated to measure the levels of secretory proteins from the organoids. The accuracy of the measurements was compared to conventional ELISA for validation. Furthermore, the environmental sensors measuring pH, oxygen, glucose, lactate, and temperature enabled the monitoring of culture conditions. These parameters were utilized in a feedback loop for automated media exchange as a proof of concept. Our approach represents an innovative multiorgan-on-a-chip platform that allows for continuous monitoring of organoid function with automated maintenance of physiological environmental conditions.

22. Assessment of Food Insecurity and Other Social Determinants of Health in Orthopaedic Trauma Patients

Morgan Childress, BS Jason J. Halvorson, MD

Shannon M. Kaupp, Kaitlin A. Henry, Jason J. Halvorson
Surgery-Orthopedics
Clinical Science - Student

INTRODUCTION: Food insecurity, defined as ‘a lack of consistent access to enough food for an active, healthy lifestyle,’ is a persistent public health challenge in the United States. In 2021, 10.2% or 13.5 million households were considered food insecure. Food insecurity (FI) is associated with unemployment, poverty, and homelessness, all of which have been shown to be risk factors for sustaining a traumatic injury with further implications on an individual’s overall health. While there is some literature to support increased FI within general trauma patients, the purpose of this preliminary study was to better understand the incidence of FI and additional social needs in the orthopaedic trauma population. As secondary aims, we sought to monitor the status of these social factors at >6wk follow-up to gauge for possible interventions and to further develop initial demographic information in this population. METHODS: Patients underwent screening during their hospital admission with the Social Determinants of Health Questionnaires built into the electronic medical record using the Food Insecurity, Financial Resource Strain, Housing Security, and Transportation Needs modules (IRB00086671). Eligible participants included patients greater than 18 years of age who sustained a traumatic orthopaedic injury requiring admission

to Atrium Health Wake Forest Baptist Medical Center.Patients who had altered mental status or sustained a traumatic head injury/brain bleed were excluded. At >6wk post-admission, a follow-up phone call repeated the FI and employment screenings. Subgroup analysis to be performed on the data from these instruments to develop an initial understanding of demographics including age, gender, race, etc. RESULTS: Of the 108 patients we screened during admission, 33% screened positive for food insecurity, 29% screened positive for housing instability and 21% screened positive for difficulty with transportation. 57% of patients endorsed financial resource strain when paying for things such as food, housing, medical care, and heating. At >6wk follow-up, we attempted to screen 74 patients via phone and 43 patients completed the follow-up screening (4 declined, 28 no answer). Of those 43, 11 (26%) patients were FI positive. Of the 11, 7 (63%) patients were positive on admission and follow-up. DISCUSSION AND CONCLUSION: The results from this pilot study suggest that over half of patients sustaining orthopaedic trauma are potentially suffering from FI, financial resource strain, housing instability, and/or transportation difficulties. Our initial dataset highlighted a higher burden of FI in orthopaedic trauma patients (33%) compared to the general US population (10.2%). At 6wk follow-up, the overall percentage of FI positive patients did not increase despite additional financial burden of injury and hospital stay. This pilot study demonstrates that admission could be the optimal time point to support our patients facing FI by providing interventions such as pamphlets of community resources, food pantry access or social work engagement.

23. Epistaxis in COVID Positive ICU Patients, Implications, and Future Interventions

Sarah Clark, MD John Clinger, MD

Kristin Sheehan, Samantha Fabian, Timothy Immelman, Connie Liu, John Clinger, Peter Miller
Surgery-Otolaryngology (Dentistry)
Clinical Science - Resident

Objective: Epistaxis in critically ill patients may prevent use of non-invasive ventilation and impair nasal oxygen delivery. Since the onset of COVID-19, high-flow nasal oxygen device use has dramatically increased. There is a paucity of literature on the characteristics of epistaxis in critically ill, COVID-19 positive patients. Therefore, we aimed to establish the incidence of epistaxis and identify risk factors in this population. Study Design: This was a retrospective observational study. Setting: This study was conducted at a large academic medical center and several satellite hospitals. Methods: Chart review was conducted on patients with an intensive care unit hospital admission and COVID-19 diagnosis between January 2020 and May 2022. Data collected included characteristics of epistaxis events, supplemental oxygen delivery, oxygen duration, anticoagulation, and antiplatelet administration. Results: 932 patients met study criteria. The incidence of epistaxis was 7.4%. Of those with epistaxis, 78% were administered supplemental oxygen. For each additional day on nasal oxygen, patients were at a 7.1% higher risk for epistaxis ($p < .001$). Antiplatelets and therapeutic anticoagulation, excluding argatroban, were not found to increase epistaxis risk. Conclusion: Nasal oxygen was a major risk factor for epistaxis in critically ill patients with COVID-19. Therapeutic anticoagulation and antiplatelets did not have a significant impact. Nasal hygiene is a standard regimen recommended by otolaryngologists for patients with epistaxis. Creating a protocol to prompt ordering physicians to include nasal hygiene measures (nasal saline spray/gel) may be an easy, inexpensive way to prevent epistaxis in an already unstable patient population.

24. Supplementation of bacterial species Akkermansia muciniphila enhances anti-PD-L1 immune checkpoint blockade response in triple-negative breast cancer

Kenysha Clear, BS Katherine Cook, PhD

Adam Wilson, Elizabeth Stirling, Yu-Ting Tsai, Mitra Kooshki, Valerie Payne, Brian Westwood, Wenhong Chen, Linda Metheny-Barlow, David Soto-Pantoja, Katherine Cook
Surgery-Hypertension
Basic Science – Student

Introduction: Triple-negative breast cancer (TNBC) is one of the most aggressive subtypes of breast cancer, disproportionately impacting African American women and women under the age of 40. The discovery that this subtype has the highest levels of tumor infiltrating immune cells and programmed death ligand 1 (PD-L1) expression propelled the use of anti-PD-1 (programmed death protein 1) monoclonal antibody immune checkpoint blockade (ICB) therapy, in combination with chemotherapy, as standard of care to treat TNBC patients. This has advantageously impacted TNBC patient survival; however there remains a need to improve the number of patients that respond to these therapies. The gut microbiome, in particular bacterial microorganisms, have become of interest as facilitators of therapeutic response in cancer. For ex-

ample, while highly dependent on geographical location, cancer type and treatment, clinical data has shown positive associations between increased levels of bacterial species Akkermansia muciniphila in the gut and enhanced ICB therapy response in cancers outside of the breast. As ICB in the treatment regimen for TNBC patients is relatively new, current data is lacking on the relationship between this gut bacterial species and ICB therapy efficacy in TNBC, thus we have performed investigations into this relationship.
Methods: We first investigated diet-gut microbiome interactions on ICB efficacy in TNBC, as diet is the main modifier of the gut microbiome. Using the EO771 (n=8-10/group) syngeneic model of TNBC, female C57Bl/6 tumor-bearing mice consuming either a low-fat control, or high-fat Western, or Mediterranean diet, were treated with 3 doses of 200 μg of IgG or anti-PD-L1 antibodies. To assess differences on treatment efficacy by diet, primary tumor volume was monitored every 2-3 days throughout the study by caliper measurement. To assess changes in tumoral immune cell populations by diet, residual tumor tissue collected at the end of the study was used for immunohistochemistry (IHC) analysis. To assess modulation on the gut bacterial microbiome by diet and ICB, 3M read depth metagenomic sequencing was performed on DNA isolated from fecal samples at the end of the study. To investigate if direct supplementation of Akkermansia muciniphila could then enhance therapy efficacy, we used the EO771 (n=15-17) syngeneic model of TNBC, where female C57Bl/6 tumor-bearing mice consuming a low-fat control diet were treated with 3 doses of 200 μg of IgG or anti-PD-L1 antibodies and a subset of mice received ~1x107 CFUs of Akkermansia muciniphila via oral gavage (OG) supplementation until the end of the study. To assess differences on treatment efficacy by direct bacterial supplementation, primary tumor volume was monitored every 2-3 days throughout the study by caliper measurement. To assess changes in tumoral immune cell populations by direct supplementation, tumor tissue collected at the end of the study was prepared for Flow Cytometry analysis.**Results:** Results from our diet model show that mice consuming a Mediterranean diet treated with anti-PD-L1 had increases in the abundance of Akkermansia muciniphila in the gut and significantly reduced primary tumor volumes from the control as well as increased immune cell activity within the tumor microenvironment (TME). Results from our microbial supplement study show mice that received direct microbe supplementation of Akkermansia muciniphila with anti-PD-L1 therapy demonstrated enhanced response to treatment, with a significant reduction in tumor progression when compared to the control as well as significantly increased levels of immune cell populations in the TME. **Conclusion:** Preclinical (unpublished) data from our lab suggest increased levels of gut Akkermansia muciniphila as a positive therapy-response associated microbe in a murine TNBC model. In addition, increasing the abundance of this microbe potentiated ICB therapeutic efficacy in a murine TNBC model. Taken together, these data suggest ICB therapy efficacy in TNBC is potentiated by the gut microbiome.

25. The impact of bioink formulation on cell phenotype in DLP printed hydrogels

Zachary Congress, PhD Shay Soker, PhD

Basic Science - Student

Introduction: Advancements in digital light processing (DLP) have enabled biomedical researchers to bioprint hydrogels in a manner that causes little damage to cells. DLP printing is a printing modality that utilizes a vat of liquid, in our case bioink, to project a digital light source onto a build platform to polymerize the bioink in a layer by-layer manner to produce a hydrogel. This study aims to determine the cellular outcomes of 6 different cell types encapsulated within various DLP bioink formulations. By combining the studies of media compositions, various bioink materials, as well as bioreactors; our team aims to develop a bioink that is both universal in terms of printing modality as well as cell type. In this study we used 6% Polyethylene-glycol diacrylate (PEGDA) and 2% Gelatin Methacrylate (GelMA) as a universal bioink base along with the incorporation of thiolated heparin (HepSH) as well as targeted growth factors (GF). Photo-crosslinking PEGDA and GelMA creates a 3D cell niche of desired stiffness by adjusting the ratio of biomaterials, thus holding the ability to recapitulate the specific mechanical properties of native ECM. We will show the benefits that the addition of HepSH and targeted growth factors have on bioink encapsulated cells. Materials and Methods: Immortalized cell lines from liver, skin, nerve, fat, pancreas, and muscle tissues were mixed into PEGDA/GelMA bioink with or without the incorporation of HepSH and various GF and then printed into cylindrical constructs utilizing a DLP bioprinter. Cells were seeded into hydrogels at a concentration of 10 million cells per 1 mL of bioink prior to printing and were then allowed to culture for a period of 7 days. Samples were removed at days 1, 4, and 7 for cellular viability and phenotype studies. ATP assays and live/dead staining were first conducted and analyzed to test for overall biocompatibility of the system. Additionally, constructs were analyzed by immunohistochemistry (IHC), PCR, and H&E for various cell markers.ATP and live/dead were then statistically tested for significance and images were analyzed via ImageJ for changes in area, distribution, and cell size utilizing a custom-made script. Results: All cell types retained some viability throughout with some faring better than others; however, many cell types in bioinks containing HepSH and GF combined displayed statistically significant higher ATP and live/dead levels on day 7 as compared to the control group. All cells in bioinks with HepSH and appropriate GF showed significantly improved viability via live/dead studies on day 7; while PC12, ADSC, and BTC6 cells showed improved ATP production on day 7. IHC results confirmed that cells from all tissue types expressed functional proteins throughout the entire timespan. Cells were able to hold cell-specific morphology on day 7 with epithelial-like cells (BTC6, Keratinocytes) expressing

greater clustering of nuclei and ADSC cells showing improved spindle formation. Muscle cells expressed lower myogenin levels in groups containing heparin and FGF2, an indication of potential inhibition of differentiation, while nerve cells (with heparin and HBEGF) and skin cells (with heparin and FGF2) expressed increased differentiation shown by increased levels of GAP43 and involucrin; respectively. For several cell types, gene expression results from PCR indicated more natural cellular functionality and differentiation in our experimental groups as compared to control groups lacking HepSH and growth factors. These results mimic literature and provide evidence that our bioink promoted natural differentiation and functionality among cells derived from varying tissue types. Conclusion: Results indicate that our bioink formulation holds certain characteristics capable of retaining universal cell function over time. The addition of thiolated heparin to the base PEGDA/GelMA bioink served as an effective binding motif for targeted growth factors to be slowly released into the microenvironment and provide sustained release of cell promoting signals. The bioink used, 6% PEGDA and 2% GelMA, showed the potential of promoting proper cellular viability, expected cellular marker expression, and differentiation with the addition of heparin and appropriate growth factors. Future work entails validating our results with long-term tissue-specific functional studies, introducing new hydrogel biomaterial compositions, and optimizing bioprinting hydrogel compositions and processes using machine learning approaches. This work shows exciting promise the development of a universal bioink capable of supporting cells from various tissue types to help improve the 3-dimensional bioprinting of functional tissues.

26. Influence of L-Carnitine on Increasing Efficacy of Therapeutic Treatments and Preventing ER+ Breast Cancer-Related Osteoporosis

Zipporah Cornelius, PhD Dr. Katherine L Cook

Dr. Katherine L. Cook, Kenysha Clear, Adam Wilson, Valerie S. Payne
Cancer Biology
Basic Science - Student

Introduction In the United States, breast cancer is the most diagnosed cancer amidst women. Within breast cancer cases, 80% of women experience estrogen receptor-positive (ER+) breast cancer. Although ER+ breast cancer has a higher survival rate compared to other subtypes, recurrent tumors are prevalent. Unfortunately, some treatments for breast cancer have shown to cause significant bone loss (ex. Fulvestrant). Therefore, investigating the therapeutic impact of endogenous molecules on tumor regression is necessary to avoid toxic side effects. Accumulating evidence indicates that l-carnitine, an endogenous nutrient essential for fatty acid metabolism, reduces proliferation rates and induces apoptosis in tumor cells. Our study objective aims to investigate l-carnitine's impact in increasing the efficacy of Fulvestrant (ICI), a selective estrogen receptor degrader known to treat ER+ breast cancer. Methods To evaluate combination l-carnitine concentrations and ICI effects on tumor cell viability, we performed in-vitro cellular analysis in 4T1.2-ER+ cells, an advanced ER+ breast cancer cell line model. Additionally, protein expressions of AMPK and phosphorylated-AMPK were detected using western blot analysis. Results Findings suggest that l-carnitine alone and in combination with ICI began to change cell proliferation capacity in a dose-dependent manner. Moreover, western blots revealed increased expressions of both AMPK and phosphorylated-AMPK, supporting the idea of changes in tumor cell proliferation. Conclusion Overall, we demonstrate l-carnitine's influence on tumor cell viability and efficacy of Fulvestrant. In future studies, we will examine benefits of l-carnitine on other commonly used ER+ breast cancer treatments. Also, we will conduct in-vivo studies assessing efficacy of l-carnitine alone and in combination with ICI on primary tumor development, bone metastasis, and ER+ breast cancer relatedbone loss.

27. Presentation of Kidney Stones in Renal Transplant Recipients

Claudia Costa, MS Maajid Mirzazadeh, MD

Adam Bret Cohen, Anita W. Rong, Brian Robusto, Davis Marie Temple, Emily Helen Sweigard Roebuck, Rainer Rodriguez, Aaron Gordon, Wyatt Whitman, Maxwell Sandberg, Kyle Wood, Dean Assimos, Maajid Mirzazadeh
Surgery-Urology
Clinical Science - Student

Introduction Kidney stones are a prevalent urological problem, affecting approximately 7.2-7.7% of the adult population, with a recurrence rate of over 30% at ten-years. However, the studies on occurrence of kidney stones in kidney transplant recipients are sparse and lacks substantial statistical data compared to the general population. This analysis aims to evaluate the unique presentation andcharacteristics of kidney stones in kidney transplant recipients. Methods A retrospective

chart review was conducted on patients from Atrium Health Wake Forest Baptist. From the Electronic Health Record, we extracted 163 kidney transplant patients who developed kidney stones and 162 age and sex matched kidney transplant patients who did not experience kidney stones. The inclusion criteria comprised (1) kidney transplant recipient, (2) patient age > 18 years, and (3) availability of data on kidney transplant and stones only in kidney transplant recipients who developed stones. In total, 308 patient datasets were analyzed, comprising 154 patients respectively who formed stones and did not form stones. We excluded 17 patient datasets that did not meet our inclusion criteria. Results Among our population, 53.9% of kidney transplant recipients with kidney stones were females, and 46.1% were males, with an average duration of 6 years and 9 months to stone formation. The prevalence of hypertension was 96.9% in patients without stones, and 50.9% in patients forming stones. Additionally, 25% of stone patients presented with symptoms, of which 10% had a fever, 12.5% had costovertebral angle tenderness, 7.5% had groin pain, 20% had abdominal pain, 22.5% had gross hematuria, 35% had dysuria and 52.5% had microhematuria. The neutrophil-lymphocyte ration (NLR) was found to be 11.97 in stone formers and 54.01 in non-stone forming patients. Conclusion In comparison to the general population which reports an average of 29.8% to 45.7% of patients developing asymptomatic kidney stones, our study population showed a much higher proportion of 74% patients having asymptomatic kidney stones. Prior research has indicated that NLR serves as an effective biomarker for predicting stone formation, with a higher NLR being a positive predictor. Although not statistically significant, our findings suggest that patients who formed stones had a lower NLR compared to those who did not form stones. In addition, there were more hypertensive patients who did not form stones compared to those who did, which contrasts with the presentation of nephrolithiasis in the general population. These findings may have implications for the clinical prevention, diagnosis, and management of kidney stones in kidney transplant recipients.

28. Placental Derived Stem Cell Therapy Induces the Formation of Myelin in Injured Central Nervous System Tissue

Joseph Criscitiello, MSII Anthony Atala, MD

Eric J. Marrotte, Michelle M. Williams, Ellie D. Gabriel, Paul Marcet, Rebecca L. Calafiore, Qingqi Li, Thomas L. Wilson, Anthony Atala
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Student

Introduction: Demyelination, a pathological process involving the loss of myelin, disrupts the essential functions of myelin in the nervous system, leading to impaired electrical insulation, compromised saltatory conduction, and increased vulnerability of axons. This pathology significantly impairs the efficient operation of the nervous system. Destruction of myelin, in diseases such as multiple sclerosis leads to sensory loss and cripplingly loss of motor function and painful muscle spasticity. Patients with demyelination disease can lose all ability to move, eat and drink requiring tube feeding and acquire bed sores over time. The total number of patients living with a demyelinating disease in the United States is estimated to be between 1 million and 1.5 million people, with the total number of patients diagnosed with a demyelinating disease in the United States yearly is estimated to be between 15,000 and 20,000 people. The number of people living with multiple sclerosis, the most prevalent demyelinating disease is in the United States, is estimated to be 913,925 with approximately 10,000 new cases diagnosed each year. At present, there exists no therapeutic intervention to induce remyelination of affected central nervous system tissue. In this study we explored the use of placental derived stem cells (PSCs) as a possible therapy to induce the formation of myelin in injured central nervous system tissue in both in vitro and in vivo studies. Methods: Central nervous system organoids incubated in PBS under hypoxic conditions of 0.1% oxygen for 6 hours. The Central nervous system organoids were then removed from PBS and hypoxic conditions and placed under normal cell culture conditions (37 °C, 21% oxygen) with or without placental derived stem cells therapy for 7 days. The organoids were then analyzed with flow cytometry for the percent of oligodendrocytes present and with qPCR to determine the gene expression of myelin. Placental derived stem cells were then injected into injured CNS spinal cord tissue in vivo and compared to controls. The formation of myelin was analyzed with Luxol fast blue staining and presence placental derived stem cells that differentiated into oligodendrocytes was traced dual labeling HuNu and olig2. Results: Placental derived stem cells induced increased expression of myelin basic protein and increased percent of oligodendrocytes in injured CNS organoids compared non-treated injured organoids ($P<0.05$). In our in vivo study, we found PSCs that differentiated into oligodendrocytes were present 12 weeks after injury. Most importantly with Luxol fast blue staining we found a significant increase in the presence of myelin in PSC treated injured CNS tissue compared to non-treated controls ($P<0.05$). Conclusions: Our initial data reveals that placental-derived stem cells promote myelin formation in both in vivo and in vitro settings within damaged central nervous system tissue. These findings underscore the potential of placental-derived stem cells as an innovative therapeutic approach for addressing demyelinating disorders.

29. Abbe Flap for Secondary Cleft Lip Deformity: A Systematic Review

Caitrin Curtis, MD Christopher Runyan, MD, PhD

Caitrin Curtis Amelia Davidson, Nina Mehta, Donald Browne, Christopher Runyan
Surgery-Plastic & Reconstructive
Clinical Science – Resident

Background: The Abbe flap is a widely used surgical technique for reconstructing secondary cleft lip deformities. This approach utilizes a full-thickness, vermillion-pedicled flap from the lower lip to the upper lip, creating philtrum divots and ridges that can be combined with other surgical approaches. Methods: A comprehensive search was conducted on the PubMed database to identify and review different techniques, modifications, and combinations related to the Abbe Flap. In total, 88 papers were obtained, with 26 found to be applicable after appropriate filters were applied. Results: The literature review included twenty-six studies published between 2002 and 2020, encompassing a total of 585 patients. Among the surveyed patients, 90% reported satisfactory results. The complication rate requiring revision surgery was 7%, affecting 32 patients. Conclusions: The Abbe flap for secondary cleft lip reconstruction demonstrates a high rate of patient satisfaction and low incidence of complication. The technique can be modified to address various deformities.

30. Ultrasonography of the Palmar Cutaneous and Recurrent Motor Branches in Carpal Tunnel Syndrome

Amelia Davidson, BS Cassandra R. Driscoll, MPH, MD

Amelia L. Davidson; Cassandra R. Driscoll; Michael Cartwright
Surgery-Plastic & Reconstructive
Clinical Science - Student

Carpal tunnel syndrome (CTS) is the most common mononeuropathy in the United States, with productivity loss of $5,000 annually per affected limb.1 Ultrasound (US) has proven to be an accurate tool in CTS diagnosis, with 91% sensitivity and 94% specificity2,3 CTS has variable responses to treatment, with 11-15% of patients having residual symptoms after release.4 This may occur because diagnostic testing does not capture the most relevant aspects of CTS. Very few studies exist on the US characteristics of the palmar cutaneous and recurrent motor branches of the median nerve, particularly in CTS.5,6 Therefore, the aim of this study is to assess the cross-sectional area (CSA) of the median, palmar cutaneous, and recurrent motor nerves in individuals with CTS and compare these to functional status (q-DASH and Boston Carpal Tunnel (BCT) questionnaires) and the same measures in controls. Currently, 11 diseased wrists, 5 contralateral unaffected wrists, and 17 control wrists are included. Demographics were statistically similar between the two groups, aside from age and diabetes. Median nerves had significantly larger CSA in CTS patients (p=0.01), as did the recurrent motor branch (p=0.02). Palmar cutaneous branches were not different between the two groups (p=0.26). Data collection and enrollment is ongoing, with addition of 3- and 6-month q-DASH and BCT follow-up questionnaires, and assessment by intervention and long-term outcome. The results of this study will add to our understanding of the morphologic changes in those with CTS, which may ultimately help inform diagnostic and treatment algorithms.

31. Biomanufacturing of Vascularized Liver Constructs for Spaceflight Testing

Timothy Dobroski James Yoo MD, PhD

Kelsey Willson, Jin-Oh Jeong, Colin Bishop, Dawn Applegate, Stefanie Countryman, Jana Stoudemire, Sang Jin Lee, James J. Yoo, and Anthony Atala
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Student

Introduction: The United States Health Resources and Services estimates that 17 people die each day waiting for an organ transplant, and every 9 minutes, someone is added to the transplant waiting list. Tissue engineering and regenerative medicine offer innovative approaches to building tissues and organs. However, establishing adequate vascularization to engineered tissues and organs is an everlasting challenge that needs to be solved. Through NASA's Vascular Tissue Challenge, we developed thick, human vascularized liver tissue that can maintain structural and metabolic functions similar to native liver cells over a 30-day survival period. In this Space Tissue and Regeneration (Ax-2) study on the International Space Station, we aim to further evaluate the vascularization of thick tissue in microgravity and to determine the

utility of this platform technology for other tissue types. Methods: Vascularized human liver tissue constructs measuring 5 cm in each dimension were fabricated using a digital light projection (DLP) printer (Miicraft). All samples were printed using a hydrogel consisting of gelatin methacrylate, 10 kDA poly-ethylene glycol acrylate, lithium phenyl (2-4, 6 trimethyl benzoyl) phosphinate (LAP), and Lycus LTD max guard 1800, dissolved in a phenol red-free Dulbecco's Modified Eagles Media. The models were gyroid in nature, with 300 μm walls. Samples were printed with HepG2's, a human liver cell line, to model the liver. Parenchymal cells were included in the bioink at 10*106 cells/mL. Following printing, samples were seeded with human umbilical vein endothelial cells (HUVECs) through traditional wicking methods using 1.25*106 cells/construct. Samples were then attached to flow using custom flow chambers and perfusion pumps. Samples were maintained on flow to allow for endothelial development. After 5 days, samples were removed from the flow and placed in bags for a spaceflight experiment. The bags containing the bioprinted tissue constructs were transported to the International Space Station National Labs (ISSNL). Media and tissue constructs were collected from ground controls and microgravity samples for analysis. Results: Vascularized human liver tissue constructs were successfully fabricated, as evidenced by their structural integrity with inner gyroid channeled architecture. Samples were monitored for viability immediately after printing when removed from flow and 15 days postlaunch. The constructs maintained over 85% viability prior to launch and greater than 75% while on station. Hepatocytes within the bioprinted constructs produced albumin, bilirubin, and urea levels comparable to humans, indicating functionality of the liver construct by immunohistochemistry (IHC) staining. In addition, staining with Ki67 confirmed the proliferative state of the cells. Histomorphological analysis showed the endothelial cell layers covering the vascular lumen surrounded the viable hepatocyte aggregates within the vascularized tissue construct interior reminiscent of native liver tissue. Conclusion: We successfully completed the AX-2 spaceflight study of 3D bioprinted vascularized liver tissue constructs in microgravity. The unique gyroid design concept applied to generate organ constructs enables the maturation of bioprinted vascularized liver tissue. Future studies will include a perfusion system to examine cellular function in microgravity during a long-term mission (30 days) onboard the International Space Station (ISS). The unique microgravity environment may enhance the manufacturing of vascularized tissues that could serve as a building block to engineer functional organs for transplantation.

32. Biomimetic Vascular Scaffold with Sustained Angiogenic Factor Delivery Enhances Vascularization and Renal Tissue Formation in Vivo

Timothy Dobroski James Yoo MD, PhD

Juhyun Park, J. William Vaughan, Ickhee Kim, John D. Jackson, Young Min Ju, Ji Hyun Kim, Anthony Atala, James J. Yoo
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Student

Introduction: Chronic kidney disease affects approximately 10% of the world's population, leading to high blood pressure, stroke, and death. Cell-based tissue engineering approaches have become an alternative strategy to restore renal function. However, establishing rapid vascularization remains a major hurdle in creating clinically relevant tissue-engineered constructs. We developed a renal tissue construct replicating native renal vasculature that captures the three-dimensional geometry of native kidney vasculature. We previously demonstrated that the vascular construct supports vascularization and improves cell survival in vivo. The present study explores the potential of accelerating vascular integration and renal tissue formation using biomimetic renal tissue constructs by delivering and sustaining the release of angiogenic factors. Methods: The collagen-based kidney scaffold was fabricated using a vascular corrosion casting technique. Our vascular scaffold is then conjugated with vascular endothelial growth factor (VEGF), a potent angiogenic factor, and seeded with human umbilical vein endothelial cells (HUVECs). The vascular renal tissue construct was created by seeding human renal cells (hRC) or human renal cell-derived organoids. The scaffold's ability to form renal tissue and vascularization was examined in vitro and in vivo using a rat kidney tissue defect model. Results: Renal vascular morphology and VEGF conjugation of the vascular scaffold were confirmed using scanning electron microscopy (SEM) imaging and anti-VEGF immunostaining. The cell-seeded renal constructs demonstrated the formation of viable renal structures in both the hRC and renal organoid groups in vitro. The cell-seeded biomimetic vascular scaffolds showed renal cell survival, renal tissue formation, and vascularization at 1, 2, and 4 weeks post-implantation. Conclusion: The biomimetic vascular renal scaffold conjugated with angiogenic factors demonstrated the ability to improve cell survival and renal tissue structure formation in vivo. Our ongoing study investigates the effects of mixed endothelial and renal cell aggregates to enhance renal structure formation in vivo using an anatrophic nephrotomy rat model. The sustained delivery of bioactive angiogenic factors combined wit biomimetic vascular scaffolds may provide a solution to developing transplantable kidney tissue constructs to treat chronic kidney diseases.

33. Predictive Factors of Postoperative Outcomes in Facial Trauma Patients Undergoing Complicated Mandible Fracture Repair

Mary Dover, BS Allison A. Slijepcevic, MD

Sugosh M. Anur, Brianna R. Maniscalco, Alexa L. Lacy, Benjamin E. Flyer, James R. Black, Candace Waters, Brian Downs, Hafiz Patwa, Allison Slijepcevic
Surgery-Otolaryngology (Dentistry)
Clinical Science - Student

Background: Mandibular fractures account for the majority of maxillofacial injuries, and surgical management remains challenging despite improved imaging and fixation techniques. Complications range between 7-29% with correlation between fracture severity and number of sites involved. We aim to assess risk factors associated with adverse postoperative outcomes. Methods: Retrospective chart review of patients undergoing complicated mandibular fracture repair at Atrium Health Wake Forest Baptist Hospital between 2010-2020. Results: 107 patients included: male 84, female 23. History smoking: prior/current 68, none 39. Total complication rate: 27.1% (n=29). Time of surgery following fracture: 61 (57%) underwent surgery <7 days, 33 (31%) underwent surgery 7 to 14 days, 13 (12%) underwent surgery >14 days. Fracture sites: multiple (42), body (24), angle (19), condyle (14), ramus (8). Surgical repair type: maxillomandibular fixation (57), open reduction and internal fixation with maxillomandibular fixation (26), open reduction internal fixation (21), external fixation and maxillomandibular fixation (3). Smoking status ($p=0.007$) was significantly associated with revision surgery. Patients undergoing surgery >14 days showed increased rates of postoperative trismus ($p=0.030$). Method of repair using maxillomandibular and external fixation, was significantly associated with postoperative infection ($p<0.001$). Fracture site and method of repair demonstrated no association with trismus, malocclusion, or revision surgery. Conclusion: Complex mandible fractures are associated with post-operative complications. Our study demonstrated smoking is associated with increased risk of revision surgery. Counseling patients regarding smoking cessations may decrease the risk of postoperative hardware failure. Prolonged time to surgical repair >14 days was associated with the highest risk of post-operative trismus.

34. Mastectomy Flap Temperatures Compared to Core Body Temperature and Adverse Outcomes

Cassandra Driscoll, MD Adam Katz, MD

Adam Katz, Abigail Peoples, Mary Duet, Amelia Davidson
Surgery-Plastic & Reconstructive
Clinical Science - Resident

Introduction: Clinicians often note that intraoperatively and months postoperatively, mastectomy flaps are clinically cool to the touch, but mastectomy flap temperature has not been objectively studied. The importance of maintaining normothermia during surgery has been well established in anesthesia literature. There is an increasing prevalence of plastic surgery literature that has established core temperature as an independent risk factor for increased complications, citing anywhere from 5-30% ischemic complication rates, warranting further investigation. Methods: A single institution prospective non-randomized study that aims to measure mastectomy flap temperature compared to core body temperature and quantify the relationship between flap temperatures and the incidence of surgical complications was performed. A 22 gauge myocardial needle was utilized to measure the mastectomy flap temperature at the level of the subdermal plexus pre- and post-mastectomy, as well as pre-implant placement. Results: There were no significant differences in demographics of patients that experienced ischemic complications (Table 1 and 5). There were a total of 4 ischemic complications out of 12 breasts total with no significant differences in the mastectomy flap temperature. In all patients at all collected time points the mastectomy flap was significantly colder when compared to the core temperature with an average core temperature of 35.7°C and average flap temperature of 29.6°C ($p<0.05$) at all time points. Systolic blood pressure was significantly higher pre-implant than pre- or postmastectomy. Conclusion: Mastectomy flaps are significantly colder than core temperature and should prompt creative perioperative intervention in efforts to optimize reconstructive outcomes.

35. Implementation of a Fracture Liaison Service and its Effects on Secondary Fracture in Patients Undergoing Vertebral Augmentation

Blake Dunson Thomas P. Sullivan, MD

Bryce Polascik, Eric Zeng, Anne F. Lake, Moaz M. Choudhary, Michael J. Miller, Patrick A. Brown, Thomas P. Sullivan
Division of Radiologic Sciences
Clinical Science - Student

Background: Vertebral augmentation (VA) with vertebroplasty and kyphoplasty are widely used minimally invasive procedures for treatment of osteoporotic vertebral compression fractures. Nevertheless, controversy exists on whether these increase patient risk for secondary fracture(s). In 2013, our institution established an orthopedic-managed fracture liaison service (FLS) which offered patients regular medical evaluation, treatment plans, and scheduled follow-up with FLS providers with a primary goal to reduce risk of secondary fracture. The purpose of this study was to assess the effects of FLS implementation on the rate of secondary fracture in patients undergoing VA. Methods: A retrospective review of all patients treated with VA (kyphoplasty or vertebroplasty) for osteoporotic vertebral compression fracture(s) at the authors' institution from 2018 to 2023 was conducted. Patient demographics, medications, FLS follow-up, dates, and secondary fracture were analyzed. Patients with vertebral compression fractures secondary to malignancy or multiple myeloma were excluded. Results: A total of 195 patients who underwent VA for fragility fractures were included in the study with a mean age of 72 years at initial VA and a mean follow-up time of 1.26 years per patient. Among these patients, 91 were referred to FLS and attended appointments at the osteoporosis clinic. These patients attended an average of 2.9 appointments and were followed longitudinally after medical management intervention at FLS provider discretion. 78 (86%) were started on medication while 13 (14%) were not. Of the 33 patients with secondary fractures requiring VA, 13 had attended at least one clinic appointment before the secondary fracture, while 20 had not. The secondary fracture cohort had more female than male patients ($p<0.05$), but there were no differences in age ($p=0.79$) or the number of operative vertebral bodies ($p=0.11$). Patients who were followed by the FLS experienced a significant increase in the time to secondary fracture, with a mean time of 397.5 days compared to 58 days for those not referred to FLS ($p<0.05$). Conclusions: The reported incidence of secondary fracture after VA has ranged widely from 2% to 23% in kyphoplasty and 2.4% to 52% in vertebroplasty. While it is uncertain if this is due to underlying osteoporosis versus increased activity after intervention, aggressive medical management with a dedicated osteoporosis provider is associated with significantly increased time to repeat fracture.

36. Assessing the Effects of BAPN and Marimastat on Collagen Remodeling in an Ex-Vivo Tumor Organoid Model

Nicholas Edenhoffer Konstantinos Votanopoulos, MD, PhD, FACS

Nicholas Edenhoffer, Lasya Reddy, Shay Soker, Konstantinos Votanopoulos
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Student

Assessing the Effects of BAPN and Marimastat on Collagen Remodeling in an Ex-Vivo Tumor Organoid Model INTRODUCTION Fibrosis in tumors has a profound impact on the tumor microenvironment, serving as a key facilitator of cancer metastasis by altering the composition and mechanical properties of the extracellular matrix (ECM). This complex remodeling process is regulated by a balance between collagen synthesis and degradation, mediated by key enzymes such as Lysyl Oxidase (LOX) and Matrix Metalloproteinases (MMPs), whose specific contributions are still areas of active investigation. Tumor organoids serve as a robust platform for studying these enzyme-mediated interactions, mimicking in vivo tumor characteristics through their 3D organization. Our study employs tumor organoids containing a liver fibroblast cell line (LX-2) and colorectal cancer cells (HCT-116) to explore the dynamic relationship between cancer cell, stromal cells, and the surround ECM. We examine the impact of inhibiting LOX and MMPs using β-aminopropionitrile (BAPN) and marimastat, respectively, to investigate their roles in ECM remodeling. METHODOLOGY LX-2 organoids with collagen matrix were cultured with or without HCT- 116 spheroids. These were treated with BAPN and marimastat separately and collected after 1 and 6 days of culture with repeated treatments every 48 hours. Measurements of organoid contraction, stiffness, and collagen fiber properties were taken to assess key metrics of fibrosis. RESULTS Organoid contraction was primarily time-dependent but also influenced by the presence of spheroids and specific inhibitor treatments. When HCT-116 spheroids were present alongside LX-2 cells within the same organoid, there was a notable increase in both contraction and stiffness. This implies that cellular crosstalk significantly impacts fibroblast activity. BAPN effectively counteracted

the contraction that would have naturally occurred over time or through exposure to HCT-116 spheroids. In contrast, Marimastat only slightly reduced contraction in organoids lacking HCT-116 spheroids and showed no effect on organoids that included them. This suggests that Marimastat's inhibitory effects are more relevant to fibroblast-driven activities and may not interact with mechanisms influenced by HCT-116 spheroids. CONCLUSIONS These findings highlight the complexity of enzyme interactions in ECM remodeling and points toward the need for targeted therapeutic strategies that account for the heterogeneity of cellular and extracellular components within the tumor microenvironment. Initial results indicate tha targeted inhibition of these enzymes significantly impacts ECM remodeling, offering potential therapeutic avenues for modulating tumor fibrosis and metastasis. Future studies will expand the scope of inhibitors tested and use co-cultures of different cancer cell types with fibroblasts to betterunderstand the specificity and generality of these findings, ultimately paving the way for more personalized and effective cancer treatments.

37. Direct Effects of Cannabinoids on Different Cell Types of 3D Human Testis Organoid System: An In Vitro Model

Megan Escott, MD Hooman Sadri-Ardekani, MD, PhD

Evan Zelt, Janmejay Hingu, Salome Amdokze, Jerri McLemore, Bita Nickkholgh, Allyn C. Howlett, Hooman Sadri-Ardekani
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Resident

Introduction/Background Previous work has established the presence of the endocannabinoid system (ECS) in the human testis and investigated its influence on human male reproduction. Our lab previously studied the in vitro effects of selective cannabinoid receptor agonists and inverse agonists on human testicular 2D cell cultures of three adult patients. Organoids, however, are known to recapitulate native tissue environments better. Therefore, in this work, we used 3D human testis organoid (HTO) systems from the same patients' cell lines to better characterize the effects of cannabinoids on male reproductive function. Methods/Materials Testicular biopsy specimens from 3 adults with complete spermatogenesis were used to form HTOs using previously published methods. All organoids were exposed to 100 nM of cannabinoid receptor ligands for two hours. Four experimental conditions were: (1) no treatment (2) CP55940 (cannabinoid full agonist that mimics THC), (3) SR141716 (CB1 inverse agonist), and (4) SR144528 (CB2 inverse agonist). RNA was isolated using the RNeasy Kit (Qiagen). cDNA was synthesized using the high-capacity cDNA reverse transcription kit (Applied Biosystems). RT-qPCR determined relative gene expression for markers of undifferentiated spermatogonial cells (ZBTB16, UCHL1, THY1), Sertoli cells (SOX9, Clusterin), Leydig cells (STAR, TSPO),peritubular cells (ACTA2, CD34), and FAAH (anandamide degrading enzyme) using TaqMan gene expression assay with technical duplicates. Results In 2D cell culture, no significant changes in gene expression were observed in any cell type marker after exposure to cannabinoid agonists or inverse agonists. In HTOs, however, there were several significant changes observed. HTO exposure to CP55940 resulted in significant changes in ZBTB16 and CLU gene expression ($p<0.0001$ and $p = 0.003$ respectively). Additionally, HTO exposure to SR141716 resulted in significant changes in the expression of ZBTB16 ($p = 0.0008$), UCLH1 ($p<0.0001$), and ACTA2 ($p = 0.004$) when compared to the control. Finally, HTO exposure to SR144528 resulted in significant changes in gene expression of ZBTB16 ($p = 0.002$), UCLH ($p<0.0001$), THY1 ($p = 0.002$), CLU ($p = 0.0003$), ACTA2 ($p = 0.0001$), and CD34 ($p = 0.04$). Conclusion We found that cannabinoid agonists and inverse agonists resulted in significantly different gene expression for various cell-type markers in HTOs in contrast to our previous results in human testis 2D cultures of the same patient cells, highlighting the need for further investigation. Future work will include analysis of ex vivo models, various cannabinoid exposure concentrations and durations, and a validated positive control, such as brain tissue.

38. Shear-Wave Elastography of the Testis in the Pediatric Population: Establishing Normal Ranges and Application to Patients with Klinefelter Syndrome

Megan Escott, MD Hooman Sadri-Ardekani, MD, PhD

Abinav Udaiyar, Robert Russell Wilson, Janmejay Hingu, Stanley Kogan, David Childs, Marc Colaco, Marshall Schwartz, Steve Hodges, Anthony Atala, Hooman Sadri-Ardekani
Surgery-Urology
Clinical Science - Resident

Introduction/Background Shear-wave elastography (SWE) is a non-invasive technique that quantifies tissue elasticity using sonography. Previous studies aimed to characterize standard testicular elastography values in the pediatric population

and studied its application to pediatric testicular pathologies, including varicocele, hydroceles, and undescended testes. Here, we report a large cohort of pediatric patients to undergo testicular elastography to determine standard reference values in both pre-pubertal and pubertal patients. Furthermore, we investigated the utility of SWE in evaluating pediatric patients diagnosed with Klinefelter syndrome. Methods Patients from one clinic location were screened for the study. To establish a range of normal values, volunteers with no known history of testicular diseases, sex chromosome abnormalities, or testicular surgery elected to undergo both testes' routine B-mode sonography and simultaneous multi-frame shear-wave elastography. Patients diagnosed with Klinefelter syndrome underwent the same imaging as part of their initial evaluation and follow up. Elastography measurements (kPa and m/s) were acquired at each testicle's superior, center, and inferior poles. Results A total of 178 testicles of 89 volunteers (mean age: 6.49 ± 4.91, range: 2 months - 18 years) with no history of testicular pathology were measured. Patients were divided into two age groups: 2 months - 9 years (n=60) and 10 - 18 years (n = 29). Average testicular elastography measurements were significantly different between the two cohorts (4.73 kPa vs 4.02 kPa, p = 0.03 and 1.22 m/s vs 1.12 m/s, p = 0.02). There was also statistically significant difference between the elastography measurements of the mid and lower poles in patients under 10 contrasted to patients 10 and older. In addition to these studies, 42 imaging studies were completed in patients with Klinefelter syndrome. In these patients under 10 years old (n=10), there was no significant difference in testicular stiffness measurements compared to normal patients. However, elastography studies of patients with Klinefelter syndrome age 10 and older (n= 74) demonstrated statistically significant differences in testicular stiffness when compared to pubertal patients with no testicular pathology (2.99 kPa vs. 4.02 kPa, $p < 0.001$ and 0.96 m/s vs. 1.12 m/s, $p < 0.0001$) Conclusion We established statistically significant standard values of testicular stiffness in the largest cohort of pre-pubertal and pubertal pediatric patients to date. We additionally applied these values to demonstrate a statistically significant difference in the testicular stiffness in patients with Klinefelter syndrome between the ages of 10 and 18.

39. Does age really matter? Evaluating Outcomes in Pediatric and Adult Patients Following First Rib Resection and Anterior Scalenectomy for Thoracic Outlet Syndrome

Lydia Faber, MS Gabriela Velazquez MD

Rasikh Hamid, Caroline Minnick, Randolph Geary, Kevin Z Chang, Matthew P Goldman, Julie Freischlag, Gabriela Velazquez-Ramirez
Surgery-Vascular & Endovascular
Clinical Science - Student

Background: Thoracic outlet syndrome (TOS) results from compression of the brachial plexus (nTOS), subclavian vein (vTOS) or subclavian artery (aTOS). Historically, pediatric patients have been excluded from studies and few case reports describe management and outcomes for these patients. This retrospective review examines the presentation and outcomes of pediatric patients and adults over the age of 40 following first rib resection and anterior scalenectomy (FRRAS) for TOS. Methods: Electronic medical records were retrospectively reviewed for patients with TOS between 2016-2023 at a single institution. Demographics, history of symptoms and duration, operative technique and complications, and post-operative outcomes (length of stay (LOS), post-operative symptoms, and time to symptom resolution were analyzed. Outcomes were compared between patients 18 years and younger (pediatric) versus patients 40 years and older (adult). Patients aged 19-39 were excluded. Results: Of the 148 patients who underwent FRRAS, 23 were in the pediatric group and 36 patients were in the adult group. Of the 36 adult patients, there were 38 operations as 2 patients had bilateral nTOS. Of the remaining 34 patients, 19 had nTOS, 13 had vTOS, and 2 had aTOS. The average age was 48.6 years (40-66 years). Chronic repetitive motion (CRM) was reported by 87% of patients and 49% reported antecedent trauma. Average symptom duration prior to diagnosis was 43.7 months (0-252 months). 8% of patients had a boney abnormality. 34 patients underwent the transaxillary approach (2 supraclavicular, 2 infraclavicular). Six patients developed a pneumothorax intraoperatively. Average LOS was 1.13 days (1- 2 days). At the first post-operative follow-up, 14 reported neurogenic symptoms, 7 had post-operative pain and discomfort, 3 had both neurogenic and post-operative pain, and 12 reported no symptoms. At an average of 5.8 months (0.2 - 33.1 months) post-operative, 33 patients had resolved or improved symptoms. Two patients were lost to follow-up and 1 did not have symptom improvement. Mean follow-up was 11.9 months (0.2 - 65.5 months). Within the pediatric group, 14 had nTOS and 9 had vTOS. The average age was 15.9 years (13-18 years). CRM was reported in 91% of patients and antecedent trauma in 30% of patients. Average symptom duration prior to diagnosis was 8.1 months (0- 48 months). 35% of patients had boney abnormalities. 20 patients underwent transaxillary approach. (1 supraclavicular, 2 infraclavicular). Six patients developed intraoperative pneumothorax. Average LOS was 1.5 days (1-2 days). At the first post-operative visit, 7 reported neurogenic symptoms, 2 had postoperative pain, 1 had neurogenic and post-operative pain, and 12 were symptom-free. Two patients were lost to follow-up. At an average of 2.0 months (0.2 - 6.3 months) post-operative, 21 patients had resolved or improved symptoms. Mean follow-up was 15.8 months (0.7 - 66.0 months). There were no mortalities or major morbidity in either group. All patients completed physical therapy and resumed

daily activities. Conclusions: Patients over 40 are more likely to have ongoing symptoms at initial follow-up and have longer recovery time to achieve symptom improvement or resolution. Despite longer recovery, symptom resolution was still achieved in a majority of the patients regardless of age group.

40. Multiple Simultaneous Free Flaps for Reconstruction of Head and Neck Defects - A Twenty-Year Single-Institution Retrospective Review

Kenneth Feehs, MD Allison Slijepcevic, MD

Benjamin Flyer, Brianna Maniscalco, Lilian Paez, Sabine Abukhadra, Grace Yucha, Allison Slijepcevic
Surgery-Otolaryngology (Dentistry)
Clinical Science - Resident

Introduction: The resection of head and neck tumors often results in complex defects that involve multiple tissue types and functional regions. While judicious selection of a single flap type routinely accomplishes a surgeon's goals of filling defect volume and re-establishing functional and aesthetic outcomes, in rare cases a single flap is insufficient and multiple simultaneous free flaps may be used. This technique has demonstrated reasonable efficacy and safety in the otolaryngologic literature; however, it does pose theoretical disadvantages including increased operating times and potential doubling of anastomosis sites and donor sites which ostensibly increases complication risks. Objective: To review the cases of simultaneous free flap transpositions for composite reconstruction of head and neck defects at Wake Forest during the past twenty years, comparing the efficacy and outcomes to single free flap reconstructions of the head and neck at Wake Forest. Methods: This is a retrospective review that analyzed all multiple, simultaneous free flap reconstructive operations in the Department of Otolaryngology/HNS over a twenty-year period from October 2000 until December of 2021. These case parameters were then compared to that of single flap reconstructions completed during the same time. Results: Over the study period, ten patients underwent multiple, simultaneous free flap reconstruction, four with combined parascapular and latissimus dorsi reconstruction and six with combined scapular and latissimus dorsi reconstruction. Eight patients (80% involved osteocutaneous reconstruction while two (20%) involved only myocutanenous or fasciocutaneous transposition. There was no statistically significant difference in operative time, overall complication rate, anastomotic failure rate, or need to return to OR within 30 days. Compared to solitary flaps, multiple flap cases did show a statistically significant increase in postoperative admission duration, likelihood of discharge to a skilled nursing facility and decrease in overall survival. Conclusion: Multiple, simultaneous free flap reconstruction is a rare but reliable method for addressing complex defects of the head and neck. References: Tharakan T, Marfowaa G, Akakpo K, et al. Multiple simultaneous free flaps for head and neck reconstruction: A multi-institutional cohort. Oral Oncology 2023;136(1). Balasubramanian D, Thankappan K, Kuriakose MA, et al. Reconstructive indications of simultaneous double free flaps in the head and neck: a case series and literature review. Microsurgery 2012;32(6):423-30. Wei FC, Yazar S, Lin CH, Cheng MH, Tsao CK, Chiang YC. Double free flaps in head and neck reconstruction. Clin Plast Surg 2005;32(3):303-8. Mochizuki Y, Harada H, Shimamoto H, Tomioka H, Hirai H. Multiple free flap reconstructions of head and neck defects due to oral cancer. Plast Reconstr Surg Global Open 2017;5(6):e1337. Wallace CG, Tsao CK, Wei FC. Role of multiple free flaps in head and neck reconstruction. Curr Opin Otolaryngol Head Neck Surg 2014;22(2):140-6. Andrades P, Bohannon IA, Baranano CF, Wax MK, Rosenthal E. Indications and outcomes of double free flaps in head and neck reconstruction. Microsurgery 2009;29(3):171-7.

41. Targeting inositol-requiring enzyme-1 (IRE1) affects triple-negative breast cancer chemotherapy sensitivity and prevents chemotherapy-related cardiotoxicity

Yismeilin Feliz Mosquea, BS Katherine Cook, PhD

David Soto-Pantoja, Kenysha Clear, Ellie Cyrus, Adam Wilson, Brian Westwood, Katherine Cook
Surgery-Hypertension
Basic Science - Student

Triple-negative breast cancer (TNBC) is one of the most highly aggressive breast cancer types thatmpredominately affect young and minority women. TNBC patients are more likely to receive cytotoxic chemotherapy regimens since they have limited targeted options. This results in severe side effects resulting in chronic cardiac dysfunction. Another issue compounded in the risk of developing cancer and chemotherapy-related toxicities is obesity. Obesity is associated with worse overall survival in women with TNBC. Inositol-requiring enzyme-1 (IRE1) is an arm of the unfolded protein response (UPR) pathway that plays a crucial role in tumor development. It has been shown that IRE1/XBP1 protein levels are upregulated in TNBC. Preliminary data suggested that targeting IRE1 in combination with Doxorubicin (DOX) enhances chemotherapy

responsiveness in the 4T1 breast cancer model and reduces metastasis. Moreover, inhibiting IRE1 prevents long-term DOX-mediated cardiac damage by reducing fibrosis. Therefore, to determine how targeting the IRE1 arm of the Unfolded Protein Response (UPR) pathway can potentially prevent the onset of cardiac dysfunction in obese and non-obese cancer patients undergoing chemotherapeutic treatments, female BALB/c mice were placed on control (low fat) and Western (high fat) diets. Then, mice were injected into mammary gland tissue with 4T1-luciferase murine TNBC cells. Mice were treated with doxorubicin (DOX) with or without IRE1 blockade. Cardiac function was measured by ultrasound at baseline and at the end of the study. Our data demonstrate that targeting IRE1 in TNBC tumors in Western diet-fed mice reduced tumor growth and increases oxidative stress. Moreover, IRE1 blockade may prevent metastasis formation in Western diet-fed mice. Furthermore, targeting IRE1 prevents chemotherapy-mediated cardiotoxities in control and Western diet. Also, targeting IRE1 reduces cardiac injury marker in control diet and reduces fibrosis in control and Western diet. Overall results suggested that systemic suppression of IRE1 protected cardiac tissue in mice treated with doxorubicin while enhancing anthracycline-mediated tumor killing.

42. Over The Counter Therapies for Urinary Incontinence Before Presentation at a Specialty Clinic: Patient Perspective and Use

Maya Fisher, BS Katherine L. Woodburn, MD

Megan Escott, Katherine L. Woodburn
Surgery-Urology
Clinical Science - Student

Introduction and objectives: The prevalence of female urinary incontinence (UI) is estimated at 60% in the United States and there are several over the counter (OTC) treatments for bladder health and urinary incontinence on the market. The safety, efficacy, and patient use profiles for OTC treatment for medical issues like constipation and headache are well-established. However, there has been no research on OTC treatment use for UI prior to specialist presentation. The goal of this study is to characterize patient use of and attitudes towards OTC treatments for UI. Methods: For this descriptive study, we developed a patient survey capturing demographic information and characterization of OTC treatment use. New patients presenting for consultation at Female Pelvic Health Clinics within one institution with a chief complaint of UI were eligible for the study. Data analysis consisted of analyzing trends in participant responses. Results: Preliminary results include a total of 17 survey responses for analysis. The patient population had a mean age of 55 years with a standard deviation of 15 years, and all participants had the equivalent of a high school diploma or greater. All insurance types were equally represented, and the median combined household income was $50,000 - $100,000 and ranged from less than $49,999 to over $200,000. 15 patients (88%) reported experiencing UI for more than two years before their first office visit. 13 patients (76%) had severe UI as determined by the Sandvik Urinary Incontinence Severity Index. Zero survey participants tried an OTC medication for UI, with a majority (65%, n=11) reporting they did not know any options existed. 15 patients (88%) agreed that they would be more likely to try OTC treatments if recommended by their healthcare provider and 13 patients (76%) believed that healthcare providers were knowledgeable about OTC treatment options. Of patients that tried pelvic floor exercises or devices for UI (41%, n=7), a majority (75%, n=5) used internet information to inform their decisions but not social media. Conclusions: In a small sample of women with severe UI, no patients had tried OTC medications for symptoms prior to specialist presentation. Majority of respondents did not know OTC treatments existed but would be more likely to try OTC treatments if recommended by a healthcare provider. This survey highlights the lack of patient knowledge about OTC treatments for UI and the need for further provider education in this area. Financial funding: none

43. EARLY TRIGGERS FOR PRIMARY PALLIATIVE CARE IN TRAUMA PATIENTS

Craig Follette, DO Preston R. Miller III, MD

Preston R. Miller III Buddy Marterre
Surgery-Trauma
Clinical Science - Fellow

Objectives: Early palliative care (PC) in injured patients adds value by aiming to avoid value incongruent outcomes (VIO). ACS TQIP Best Practice Guidelines advise subjective triggers-prognosis of death, permanent disability, or uncertainty of both, for early primary PC discussion. Objective estimates of VIO risk are lacking. We aimed to develop objective identifiers for patients at risk for VIO. Methods: Injury characteristics, demographics, and outcomes that identified a subset with possible VIO were analyzed retrospectively in adult patients admitted to the trauma ICU. VIO was defined as death, SNF

or LTACH discharge, tracheostomy or gastrostomy. Multivariable logistic regression (MLR) examining age, anticoagulation status, comorbidities, dementia, GCS, race and sex identified independent predictors of VIO. ROC curve cut points were based on Youden's index. These were tested on a subsequent year's data. Results: From 7/1/2017 to 6/30/2020, 909 (33.5%) of 2710 ICU patients had VIO. MLR identified two patterns: In ≤50 years old, GCS predicted VIO. In >50, age, GCS and comorbidities were predictors. Area under ROC curves in ages ≤50 and >50 was 0.77 (cutoff GCS ≤ 12) and 0.71 (cutoff 37% risk of VIO per regression equation). Models were tested against 1113 patients admitted 7/1/2020 to 6/30/2021. In the ≤50 group, GCS ≤12 sensitivity (SN) and specificity (SP) for VIO were 63.5 and 75.8. Positive and negative predictive values (PPV, NPV) were 35.0 and 91.0. In those >50, at 37% risk of VIO cutoff, SN and SP were 79.9 and 48.5 with PPV and NPV of 52.6 and 77.0. Conclusion: These objective triggers identify candidates for early primary PC (those at risk for VIO) by using admission characteristics. However, theylack SP and PPV needed to identify those benefitting from the more limited resource of formal PC consult. These data provide a useful screening tool for primary PC, but further refinement is needed to identify triggers for formal PC consultation.

44. No Seasonal Variance Found Between Peripheral Arterial Disease and Infection-Related Transmetatarsal Amputations

Madeline Fram, BA Ashleigh W. Medda, DPM

Kipp, Vesely, Russell, Medda
Surgery-Orthopedics
Clinical Science - Student

Classification: Diabetic Foot

Purpose: Peripheral arterial disease, trauma, and diabetes are all causes for lower extremity amputation. It has been reported in the literature that the most common season for diabetic-related amputations is spring, whereas non-diabetic amputations in the winter. The purpose of this study was to determine if there is a trend between the pathology necessitating a transmetatarsal amputation and the season in which the amputation occurred. Methodology & Procedure: A retrospective chart review was conducted to identify patients who underwent a transmetatarsal amputation for infection, peripheral arterial disease, or infection in the setting of peripheral arterial disease between January 1, 2020, and December 31, 2021, at a single Level 1 academic medical trauma center. 86 patients with 87 operative extremities were included in this study. Results: No statistical significance was found among the three categories and the season that the transmetatarsal amputations occurred (p=0.96). However, there was a statistically significant difference in hypertension between the seasons (p=0.029). Additionally, non-cardiac CRP was found to have the highest values in the fall (p=0.0017). Analysis & Discussion: This is the first study to our knowledge that breaks down the causes of amputations between peripheral arterial disease and infection and analyses the seasonal variance between the two. We found no statistically significant difference between peripheral arterial disease and infection related transmetatarsal amputations based on seasonal variance. Non-cardiac CRP did however have statistically significantly higher values in the fall. We recommend future studies investigate the seasonal variance in non-cardiac CRP levels.

45. The Microbiome Mediates Carcinogenic Alterations of the Mammary Gland in the Context of Obesity

Mohamed Gaber Katherine L. Cook, PhD

Mohamed Gaber, Kayla Neary, Julia Holmes, Adam S. Wilson, Pierre-Alexandre Vidi and Katherine L. Cook
Surgery-Hypertension
Basic Science – Student

Obesity increases the relative risk for breast cancer incidence. Multiple molecular mechanisms linked to obesity drive breast cancer progression. However, if and how obesity contributes to breast cancer initiation is poorly understood. Obesity shifts the gut microbiome in ways that may increase breast cancer risk. Microbial-associated molecular pattern (MAMP)-proteins and metabolites could directly affect breast epithelial cell signaling. In this study, we focused on lipopolysaccharide (LPS), a structural component of the outer membranes of gram-negative bacteria and a toll-like receptor 4 (TLR4)-agonist.
Systemic LPS levels are known to increase in Obesity. We hypothesize that chronic low-grade inflammation caused by LPS contributes to breast cancer initiation. To test this hypothesis, we first quantified levels of LPS, along with a panel of adipokines/cytokines, in serum samples from women with different body mass indices (BMI). Donors with high LPS had

significantly higher BMI, leptin, and leptin:adiponectin ratio, confirming a link between systemic LPS and metabolic markers of obesity. LPS levels also correlated with pro-inflammatory cytokines such as Interleukin 8 (IL-8). Other biomarkers of breast cancer risk include DNA damage. Analyses of normal breast tissue sections from the same donors revealed higher densities of DNA double-strand breaks (estimated based on 53BP1 foci counts) in women with high serum LPS. Experiments with 3D culture of breast acini showed that LPS increases DNA break frequencies and oxidative stress levels in the mammary epithelium. Moreover, LPS increases oxidative lesions in the DNA (estimated based on 8-oxoguanine fluorescence) which might explain the increased DNA damage caused by LPS. We also found that LPS disrupts epithelial polarity, a hallmark of breast tissue homeostasis. In mammary epithelium, LPS activates the nuclear factor-kappa B (NFκB) pathway by binding to the TLR4 receptor, leading to an increased expression of inflammatory cytokines such as tumor necrosis factor-alpha (TNF-α) and IL-8. Interestingly, TLR4 blockade prevented the loss of apical polarity and DNA damage induced by LPS. Last, but not least, we show some evidence for an association between breast tissue levels of LPS and obesity. These novel findings show that LPS is a key systemic and local mediator of the microbiome perturbations that happen in obesity and breast cancer risk. The outcomes of our study underscore the importance of considering the microbiome in the prevention of breast cancer.

46. A Retrospective Comparison of Different Processing Techniques in Autologous Fat Grafting Post Breast Reconstruction

Mariam Gadjiko, MD Ivo Pestana, MD

Daniel P. Zaki, Mario S. Blondin, Blake Dunson, Ivo Pestana
Surgery-Plastic & Reconstructive
Clinical Science - Resident

A Retrospective Comparison of Different Processing Techniques in Autologous Fat Grafting Post Breast Reconstruction Introduction Autologous fat transfer has become an integral instrument in addressing volume deficits and contour irregularities for patients who have undergone breast reconstruction. Its widespread use can be attributed to its safety profile, ease, and minimally invasive nature. Since its inception, focus has been placed on creating the most efficient methods to streamline the processing of the lipoaspirate as well as the delivery of usable fat intraoperatively. However, the percent yield of usable fat as well as determinants of clinical outcomes in post-reconstruction breast revision surgery among varying fat graft techniques remain elusive. Variability in outcomes, such as graft retention and post-operative complications, underscores the need for further investigation. This study aims to elucidate any differences in the yield of usable fat between three commonly utilized fat processing techniques as well as ascertain the impact of the techniques on postoperative complications in patients undergoing breast reconstruction revision surgery with fat grafting. Methods A retrospective review was conducted on patients who underwent fat grafting by a single attending plastic surgeon at Wake Forest Baptist Medical Center from 2019 to 2022. Patient demographics, complications, and operative specifics were collected. Exclusion criteria included: patients less than 18 years of age, those with less than 3-month follow-up, and fat grafting volume less than 50 ml. Participants underwent fat graft harvest using suction-assisted lipectomy and subsequent processing via Lipografter, Revolve system, or Coleman centrifugation technique. Results Of the 50 patients (Coleman=20, LipoGrafter=9, Revolve=21), no differences were found in age, BMI, or average fat used ($p>0.05$). Complication rates were equivocal across techniques. LipoGrafter yielded a significantly higher percentage of usable fat ($p<0.05$). Secondary revision surgery due to insufficient defect correction was more common with LipoGrafter ($p<0.05$). Conclusion Our preliminary data suggests that LipoGrafter may yield a higher usable fat percentage and has an increased likelihood of requiring additional fat grafting. While the Coleman technique had a longer average operative duration, no statistically significant differences were observed. Furthermore, there were no differences in post-operative complications noted among the three techniques.

47. Volume Replacement using Stromal Vascular Fraction

Amol Garg, MD Ramon Llull, MD, PhD

Surgery-Plastic & Reconstructive
Basic Science - Student

Fillers can work passively or actively. Passive fillers are inert. They remain in place and do not interact with the resident tissue. Eventually resorption of the filler will occur, and the volume replaced will be lost. This will, therefore, require repeated injections to maintain results. Hence a more active filler is needed for a longer-lasting solution. To achieve this it would require the filler to interact with the resident tissue to prevent resorption, to promote increased cellular turnover (specifi-

cally collagen) and/or to promote inflammation. Using a filler alongside a fat graft (lipofilling) would allow for the added benefit of two volumize restorers - the fat graft and the filler. Increased cellular turnover would lead to volume replacement as it would help improve the extracellular matrix. Inflammation would lead to increased volume via two main pathways: (a) swelling and therefore edema and (b) increased blood supply. The longer lasting effect, or permanency, would be via the repair process often seen post injury. To achieve this combination of inflammation and repair, subcision with subsequent placement of the filler could be used. Often injected platelet rich plasma (PRP) will be used in conjunction as a form of growth factor to stimulate or speed up the repair process. This allows for the release of the fibrous tissue and creation of a space where placement of the filler can produce maximum integration & volume replacement. This would be done via three main pathways: (a) increased cellular turnover, (b) increasedn extracellular matrix and (c) remodeled vascular network. Using stromal vascular fraction (SVF) from\adipose tissue on a collagen sponge a more robust and lasting response can be achieved in volume replacement. Through expansion of the sponge and using combination of different treatment regimens of cannula subcision, platelet rich plasma and growth factor with fat graft, we theorize that formation of neotissue can be induced with greater integration than a gel-filler.

48. 3D human skin equivalents for viral infection with skin-tropic viruses

Catalina Gaviria, PhD Patrick McNutt, PhD

Lalitha Karchalla, Vy Vuong, and Patrick McNutt
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Fellow

Skin and subcutaneous infections are of global concern due to their significant impact on morbidity and mortality. Exposure to emerging human skin pathogens, including dengue, zika, monkeypox, and vaccinia, initiates primary infections in the subcutaneous layer which can subsequently progress to cause severe systemic disease. Although therapeutic intervention during the primary infection stage is crucial to preventing systemic disease, the development of effective countermeasures requires a better understanding of infection mechanisms and host responses. Although murine models have been extensively employed to simulate various viral infections, their suitability for modeling many skin-tropic viruses is limited, primarily due to inherent disparities in skin anatomy and innate immune responses. Alternatively, most efforts to study human responses to infection have relied on cell monolayers or stratified epithelium, neglecting the complex influences of the functional epithelial anatomy and multiple dermal phenotypes on host responses to infection. To develop an improved model of human skin infection, we have engineered a three-dimensional human skin equivalent (HSE) that includes four principal skin cell types involved in most primary skin infections: adipocytes, fibroblasts, endothelial cells, and keratinocytes. Validation of HSEs included assessments of structural integrity, protein expression, and functionality of the epidermal barrier. HSEs produce viable subepithelial layers and a multilayered epidermis expressing phenotypic markers of a fully differentiated, stratified epithelium, including basal, spinous, granular, and corneum strata. Endothelial cells spontaneously form tubular, branched structures resembling capillaries. To demonstrate the suitability of HSEs for study of viral pathogens, we established a protocol for HSE infection by members of the poxvirus and flavivirus families and conducted a preliminary analysis of protein and transcriptional responses to infection. Our findings strongly support the use of HSEs as a robust platform for study of early skin responses to viral pathogen. We are also exploring the incorporation of resident immune cells in the dermis to study multitissue responses to infection. Our preliminary data show that HSEs faithfully recapitulate human skin's structural and functional attributes and exhibit susceptibility to viral infections. By incorporating multiple skin cell types, HSEs provide a more authentic representation of host responses to infection and furnish additional targets for therapeutic development. This model exhibits strong potential as a versatile platform for investigating skin viral infections and developing effective medical countermeasures. Moreover, HSEs offer a unique opportunity to study multimodal insults, such as chemical injury followed by viral infection, in the context of a complex, three-dimensional tissue. We firmly believe that HSEs will make a substantial contribution to the fundamental understanding and treatment of viral infections.

49. THE FOG HAS NOT LIFTED: NO REDUCTION IN COMPLICATIONS FOR PARTIAL REBOA IN THE AAST AORTA REGISTRY

Micaela Gomez, MD Lucas Neff, MD

Lucas Neff, Maximillian Peter Forssten, Austin Johnson, Timothy Williams, Marcelo Ribeiro Jr, Bellal Joseph, Joseph DuBose, Shahin Mohseni
Surgery-Trauma

Clinical Science - Resident

BACKGROUND: Resuscitative Endovascular Balloon Occlusion of the aorta (REBOA) is a potentially life saving but polarizing therapy due to the associated morbidity and uncertainty of who might benefit. Techniques like partial (p)REBOA to provide hemodynamic support while reducing distal ischemia are now captured in the AAST Aortic Resuscitation in Trauma and Acute Care (AORTA) registry. We hypothesized that pREBOA would be associated with improved mortality and fewer adverse outcomes. METHODS: We queried the AAST AORTA registry for patient demographics, clinical characteristics, intervention characteristics, and outcomes between 2020-2022. Adult patients who received cREBOA or pREBOA were considered for inclusion. Patients were excluded if they had a head AIS ≥3 or an AIS of 6 in any body region. RESULTS: A total of 164 patients that met inclusion criteria were identified. Partial REBOA was used in 36% of cases. There was no significant difference in patient demographics, injury characteristics, or injury severity between pREBOA and cREBOA. There was no difference in mortality rate (44% vs 45%). After adjusting for potential confounders with Poisson regression analysis, no statistically significant difference in complications was detected between the two different REBOA approaches [adjusted IRR (95% CI): 1.11 (0.54-2.27), p = 0.777]. This association persisted during subgroup analysis of aortic Zone vs. Zone 3 deployment. Notably, metrics on duration of cREBOA or pREBOA were not collected in the AORTA registry and >40% of patient entries were missing time to definitive hemorrhage control data. CONCLUSION: Based on this registry analysis, pREBOA did not reduce morbidity or mortality compared to cREBOA. Improving granularity of important clinical metrics in the AORTA registry is essential to understanding whether patients will benefit from pREBOA, and how to best guide implementation of this controversial resuscitation adjunct.

50. DEVELOPING DIGITAL TOOLS OF SKIN REPIGMENTATION ASSESSMENT IN THE REGENERATING WOUND

Anastasiya Gorkun, PhD Shay Soker, PhD

Nicholas Edenhoffer, Ethan Potts, Kelsey Willson, Naresh Mahajan, Shay Soker, Anthony Atala
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Fellow

Introduction: Skin injuries, especially burn wounds, frequently lead to hypo- or hyperpigmentation. The severity of pigmentation disorders correlates with the level of skin damage. Thus, restoration of the patient's pigmentation after full-thickness wounds remains challenging. New cell technologies such as bioengineered skin allow to develop novel technologies for skin regeneration and assessment of pigmentation. In this study, we developed digital analysis tools to track the repigmentation of newly regenerated skin following implantation of bioengineered. Methods: Full-Thickness skin defects in mice were treated by implantation of skin bioprinted in three layers using pre-organized endothelial cell tubular structures and skin organoids containing the key skin cell types, including melanocytes. Control groups included Wound Only and Hydrogel only groups. Weekly imaging monitored skin regeneration up to day 91 after the wound excision. For histology analysis of pigmentation, we applied Fontana Masson staining that uses silver nitrate, which reacts with melanin to make a brown-to-black coloring. The study used image analysis techniques to analyze skin tone. Images were processed using FIJI and ImageJ software and analyzed using custom-built Python and R scripts. Results: The wound area was manually isolated for the surgical images using FIJI and ImageJ software. For the Fontana Masson histological images, Python and OpenCV were used to threshold the images to isolate pixels staining positive for melanin. We developed the code to analyze each pixel to identify positive pixels while removing unwanted artifacts, such as hair follicles in normal skin. Through optimization of image processing programs, the best thresholds to detect melanin in the HSV color space were Hue from 18-42 degrees, Saturation from 0.40-0.98, and Value from 0.31-0.79. However, the number of pixels was highly dependent on the specific section of the skin. Images were processed using R to identify pigmented spots on the bioprinted skin and track the pigment's spread over time. The saturation value from the HSV color space was the best indicator of pigmentation spots in the bioprinted skin. The color difference of regenerated skin compared to the average color of normal skin showed a decreasing tendency over time, indicating a restoration of normal skin pigmentation. Conclusions: Both tools showed the potential to better assess color production in bioprinted skin compared to simple image analyses such as ImageJ. However, only R analysis of saturation in surgical images allows reliable quantitative visualization of the pigment formation and spread over time. Future directions include increased data collection or sourcing to train machine learning algorithms to calculate the color content of the skin and investigate if this research could apply to melanoma detection or treatment.

51. Changes in hip coverage parameters and lumbar lordosis after posterior spinal fusion in Adolescent Idiopathic Scoliosis

Sofia Griff, BS James F. Mooney, MD

Garrett Bullock, James Mooney
Surgery-Orthopedics
Clinical Science - Student

Changes in hip coverage parameters and lumbar lordosis after posterior spinal fusion in Adolescent Idiopathic Scoliosis Background: Posterior spinal fusion (PSF) is indicated in certain patients with Adolescent Idiopathic Scoliosis (AIS). There is evidence that this surgery may impact global pelvic and hip alignment parameters, which can have implications for long-term hip function. Due to this linkage, it isimportant to generate acceptable spinal and pelvic parameters after surgery to maximize function and decrease potential morbidity in the hip. It is not clear how instrumentation level selection in PSF for patients with AIS affects these pelvic parameters. This study aims to evaluate the implications of the lowest instrumentation level on post-operative pelvic parameters and lumbar lordosis. Hypothesis: Lowest instrumented level selected during posterior spinal fusion surgery for patients with Adolescent Idiopathic Scoliosis will impact post-operate pelvic parameters and lumbar lordosis. Methods: A retrospective chart review was performed using patients with a diagnosis of AIS who underwent PSF surgery between the ages of 11 and 18. Using standing radiographs obtained as part of standard preoperative and post-operative clinical protocols, measurements were collected for right and left lateral center edge angle (LCEA), right and left Tonnis angle (TA), and lumbar lordosis (LL). These measurements were gathered for 30 patients at 3 time points: pre-operative (within six months of the surgical date), one month post-op, and one year post-op. All measurements used in the analysis were collected by a single evaluator. To assess for inter- and intra-rater reliability, 30 measurements for each variable were repeated by two evaluators at separate time points. Interclass correlation coefficients (ICC) were calculated to determine agreement. Analyses of covariance (ANCOVA) were performed to assess potential differences in post-operative angles between scoliosis patients with the lowest spinal level of thoracic and lumbar-sacral. All ANCOVA's controlled for pre-operative spinal angle. Results: Intra-rater reliability was excellent with ICCs of 0.97 for right LCEA, 0.92 for right TA, 0.95 for left LCEA, 0.94 for left TA, and 0.97 for LL. Inter-rater reliability was moderate for right LCEA, right TA, and left LCEA (ICC=0.72,0.62, 0.60, respectively), poor for left TA (ICC=0.47), and excellent for LL (ICC=0.91). When grouping patients with lowest instrumented levels in thoracic (n=7) or lumbar-sacral regions (n=23), the estimated means differences for the thoracic group relative to the lumbar-sacral group were not statistically significant at one mont post-op (right LCEA: -1.29, p = 0.276; left LCEA: -0.83, p = 0.469; right TA: 0.15, p = 0.876; left TA: -0.40, p = 0.626; LL: 3.18, p = 0.224). No differences were also observed between groups at one year post-op (right LCEA: 0.63, p = 0.596; left LCEA: 0.96, p = 0.403; right TA: -0.45, p = 0.612; left TA: -1.35, p = 0.102; LL: 4.19, p = 0.129). Conclusions: Preliminary analysis demonstrated no differences in LCEA, TA, or LL between groups with the lowest instrumented level in the thoracic region relative to the lumbar-sacral region. This may be associated with the small sample size of this preliminary investigation. Further investigation will be needed to expand the sample size and to investigate potential changes associated with individual vertebral level selection.

52. The Use of Topical Cocaine in Septoplasty and Rhinoplasty

Justin Hall, MD Brian Downs, MD FACS

Maria Masciello, MD; Claire Hoffman, BS ; Macrae Robertson, BS; Mary Duet, BS; Candace Waters, MD; Bennett Calder, MD; Brian Downs, MD
Surgery-Otolaryngology (Dentistry)
Clinical Science - Resident

Background: Various topical vasoconstrictive agents are used surgically in septoplasty and rhinoplasty (SRP). Topical cocaine has widely been used in the past, although some surgeons may be reluctant due to the stigma surrounding recreational use and concern for cardiovascular effects. Study Objectives: Determine the safety profile of topical cocaine use in septorhinoplasty when compared to other vasoconstrictive techniques. Design Type: Single institution, Retrospective Review, 2019-2020 Method: ICD 9 codes were used to identify patient that had undergone septoplasty, nasal valve repair, rhinoplasty, or septorhinoplasty. Patients under the age of 18 were excluded. Data regarding demographics, past medical history, types of intra-nasal vasoconstriction, intra-operative events, and post-operative complications were recorded. Analysis of variance models were used to assess differences in vasoconstrictor combinations and estimated blood loss and operative times. Results: 640 patients were included in the study. The average age was 46 and 51% male. When comparing groups that received topical cocaine vs those that received other vasoconstrictors, there was no significant difference in peri-operative adverse events postoperative complications. Patients in which topical cocaine was used intra-operatively had statistically significantly higher heart rate in postanesthesia care unit (p=0.038), although clinically this was not a large difference (90.2 vs 87.2 beats per minute). Otherwise, there was no difference in peri-operative vital sign measurements. Conclusion: There are many topical therapies which can be used as vasoconstrictive agents for rhinoplasty.

Our study suggests that cocaine is a safe topical agent when compared to other vasoconstrictive agents.

53. Idiopathic Intracranial Hypertension in Surgical Cure of Cerebrospinal Fluid Leak

Justin Hall, MD Michele Gandolfi, MD

Edward Doyle, MD; Nikitha Jona; Drew Plonk, MD; Michele MD, MS
Surgery-Otolaryngology (Dentistry)
Clinical Science - Resident

Objective: This study investigates the role that management of idiopathic intracranial hypertension (IIH) has in surgical cure of head and neck cerebrospinal fluid (CSF) leak. Study Design: Retrospective Chart Review Setting: Single Academic Center, 2012-2023 Methods: ICD 9 and 10 codes were used to identify patients who presented for spontaneous CSF otorrhea and/or rhinorrhea. Patients with prior intracranial, otologic, or intranasal surgery in addition to inciting trauma were excluded. The patients were separated into those who had “preoperative pressure equalization procedure (PPEP)” (via cerebral venous sinus stent (CVSS) or ventriculoperitoneal shunting (VPS) and those that did not). Wilcoxon ranksum, Chi-square testing, and logistic regression were used for statistical analysis. Results: 87 patients were included in the study. The median age was 56, 66% were female, and 87% had BMI greater than 30. 75 (86%) underwent surgical intervention and 12 were managed with CVSS or VPS alone. Need for re-intervention was associated with BMI>30 (p=0.0062) and measured opening pressure greater than 20 mm Hg (P<0.0001). Any recurrent CSF leak was associated with body mass index (BMI) greater than 30 (p=0.068) and hearing loss at presentation (p=0.0442). Although there was a lower average CSF leak at most recent follow up in the group with PPEP, (9% vs 0%) this was not statistically significant. Conclusion: IIH appears to be a key feature in the etiology of spontaneous head and neck CSF leak. Although our study showed lower average CSF leak persistence with PPEP, this was not statistically significant.

54. Cost of follow-up imaging for patients with p16/HPV-positive oropharyngeal cancer after negative post-treatment PET scan

Lauren Grace Himes, MD James Dale Browne, MD

Samantha B. Fabian; Greg Russell; J. Dale Browne
Surgery-Otolaryngology (Dentistry)
Clinical Science - Resident

Background: The role of post-treatment imaging in HPV-related oropharyngeal squamous cell carcinoma (HPV-OPSCC) continues to evolve. Despite NCCN guidelines against routine imaging in asymptomatic patients, many providers still order surveillance scans. Streamlining imaging practices may assist with the financial burden of OPSCC on the healthcare system. Objectives: To evaluate the efficacy and feasibility of surveillance imaging in patients with an initial negative post-treatment PET. Methods: This retrospective chart review evaluated adult patients with HPV-positive OPSCC with an initial negative post-treatment PET scan. Primary outcome measures included associated costs, as well as the indications for surveillance scans in recurrence versus non-recurrence groups. Results: 104 patients with HPV-16 positive OPSCC were included in the analysis. The 3-year survival rate was 93.7%, but almost all non-relapsed patients received additional scans. The total cost burden for non-relapsed patients ranged up to $40,278, and the total expense of imaging was $912,866 for our cohort. In the non-relapsed group, most scans were done for surveillance (51 CT neck, 33 CT chest, 8 PET) and follow up for an imaging finding (14 CT neck, 17 CT chest, 9 PET). Only 2 CT neck and 4 PET scans were performed due to concerning exams or symptomatic patients. Conclusion: Many patients treated for HPV-16 OPSCC with negative post-treatment PET received imaging beyond the NCCN guidelines. Routine imaging led to the detection of benign lesions and exacerbated the cost burden due to subsequent imaging and/or invasive procedures.

55. A Multi-Institutional Level 1 Trauma Center Analysis of Pediatric Facial Fracture Management and Outcomes

Madison Hinson, BS Christopher Runyan, MD, PhD

Avery Wright, Amelia Davidson, Samuel Kogan, Christopher Runyan
Surgery-Plastic & Reconstructive

Clinical Science - Student

Background: The management of pediatric facial fractures presents distinctive considerations and treatment options compared to adults. This study aims to provide a unique perspective on thecorrelations between mechanism of injury, types of facial fractures, and fracture management utilized in two North Carolina Level 1 Trauma Centers to determine the optimal management options for this patient population. Hypothesis: Pediatric patients may experience differences in facial fracture management related to the type of facial fractures sustained, the mechanism of injury, and treatment options utilized for facial trauma care; this project aims to identify correlations in management and outcomes within this patient population following facial trauma. Methods: An IRB-approved retrospective chart review was performed of pediatric facial trauma patients under 18 years old at twohigh volume Level 1 Trauma Centers between January 2020 and December 2022 at Atrium Health Wake Forest Baptist Medical Center and Atrium Health Charlotte Medical Center. Data pertaining to patient demographics, mechanism of injury, facial fractures, injury management, and outcomes were collected. Results: Of 2,977 pediatric facial trauma patients, 582 of these patients sustained at least one facial fracture at the time of injury. Adolescents were significantly less likely to be transferred from outside institutions and to be admitted for further care (p=0.002). Adolescents experienced higher levels of residual symptoms following initial discharge (p=0.001) and were less likely to have resolution of these symptoms within one year (p=<0.0001). Neonates and infants were significantly more likely to receive conservative interventions for fracture management and to sustain calvarium and skull base fractures (p=<0.0001). Conclusions: Our study identifies differences in pediatric sub-groups related to transfers, admittance, fracture type, management, and reported residual symptoms. Our data suggests neonates and infants may experience conservative interventions and lower levels of residual symptoms with higher resolution of these symptoms within a year. This contrasts with the adolescent population whom reported higher incidences of residual symptoms following discharge and lower incidences of symptom resolution within a year. This difference may be attributed to lower osteogenic potential and slower healing responses in adolescents compared to younger age groups. Further investigation in these differences may elicit optimized methods of adolescent fracture management, beginning at initial evaluation.

56. Implementation Evaluation of a Novel Emergency General Surgery Handover: A Prospective Feasibility Study

Lauren Hostettler, MS Samuel Carmichael II, MD, MS, FACS

Kline, Nightingale, Moore, Miller, Nunn, Carmichael
Surgery-General
Clinical Science - Student

Introduction. High quality health information handovers are critical to optimal patient care and trainee education. Acute Care Surgery commonly employs formalized handovers in Trauma, but Emergency General Surgery (EGS) handovers remain poorly defined. The purposes of this study were to assess the feasibility of implementing an EGS morning handover in tandem with Trauma and to explore its impact upon markers of clinical care. Methods. This is a prospective feasibility study conducted at a single academic tertiary care medical center following implementation of a novel EGS morning handover process. To ensure appropriate rigor and reproducibility, we utilized the PRISM implementation framework to inform and refine our study. We assessed organizational perspective and implementation adoption through a two-part anonymous survey delivered to the EGS service staff (n=29) followed by exit interviews with participants who agreed to discuss the topic further (n=5). Feasibility metrics (length of handover, attendance, category and number of questions asked, and change in plans) were collected daily at the morning handover meetings. Exploratory clinical metrics of quality improvement were compared between parallel five-month periods pre- and post-implementation of the handover. Data were compared by descriptive statistics. Results. One hundred and twenty-seven patients (n=127) from March 1, 2022 - July 31, 2022 and 217 patients from March 1, 2023 - July 31, 2023 were identified pre- and post-handover implementation, respectively, with no statistically significant differences being identified in length of stay and time to operating room posting between these patient samples. The average duration of the EGS morning handover was 14 minutes (95% CI: 13:53, 14:07) with an average attendance of 70% from essential personnel (defined as attendings on service and residents presenting the overnight patients). The average number of questions asked during EGS handover was 12 (95% CI: 9.98, 14.02), with an average of approximately 1 change to patient management plans per meeting (95% CI: 0.68 to 1.32). Eighty four percent (n=84%) of post-implementation survey responses indicated positive regard towards the new EGS handover with exit interviews identifying direct communication, learning opportunities and the presence of multiple attendings as most beneficial from all levels of staff. Conclusions. The implementation of an Emergency General Surgery morning handover is feasible with benefits including improved communication, multiple learning opportunities for all attendees and the presence of a multidisciplinary team for patient management decisions. Further studies are needed to define the impact of the EGS morning handover upon clinical outcomes.

57. Microfluidic Incubation of Patient Derived Tumor and Immune Cells Boosts Lymphocyte Cytotoxic Phenotype

Damian Hutchins, PhD Konstantinos Votanopoulos, MD,PhD, FACS

Cecilia R. Schaaf, Nicholas Edenhoffer, Mitra Kooshki, Steven Forsythe, Robin Greissinger, Adam R. Hall, Lance Miller, Shay Soker, Pierre Triozzi, Konstantinos Votanopoulos
Surgery-Oncology
Clinical Science - Student

Introduction Tumor infiltrating lymphocytes, (TILs) hold promise in advancing adoptive cell therapy for patients with otherwise limited treatment options. However, many tumors do not attract TILs, or the TILs themselves are exhausted which limits its treatment availability and efficacy. Consequently, there is a need for alternative sources of tumor reactive T cells. Here, we address this need through the ex vivo 3D cell culture biofabrication of immune competent patient tumor organoids (iPTOs). These constructs, composed of patient-matched cancer cells, antigen presenting cells (APCs), and stromal cells encapsulated in extracellular matrix (ECM)-like hydrogel, closely mimic the in vivo tumor microenvironment. We demonstrate that constant circulation of peripheral blood mononucleocytes (PBMCs) through a microfluidic device housing iPTOs can emulate lymph node activation of immune cells to the tumor, yielding organoid interacting lymphocytes (OILs) that possess increased markers of activation, cytotoxicity, proliferation, homing markers, and inflammatory cytokine production relative to uncirculated PBMCs. Methods Tumor tissue, APCs (from lymph nodes or spleen), and peripheral blood were collected from 8 patients with mesothelioma (3), melanoma(2), and appendiceal cancer(3). PBMCs were circulated through iPTOs for 7 days and then expanded. Populations of effector, memory, and reactive T cells were analyzed via flow cytometry, immunohistochemistry, and cell culture medium proteomic analysis, and compared with both uncirculated PBMCs and patient TILs. The microfluidic chip design as well as its success to boost T cell cytotoxic phenotype will be presented. Results Data collected from patients with appendiceal, melanoma, and mesothelioma tumors shows generation of OILS with increase in cytotoxic T lymphocytes, effector memory, and central memory phenotypes when compared uncirculated PBMCs, greater than or comparable to TILs and with similar effector cytokine and enzyme expression. OILs were also found to express less immunosuppressive signals (i.e. Tim3, PD1, and IL 10). Critically, chip-based T cell activation resulted in 10x more viable OILs than were typically observed with TILs following parallel growth period of 14 days. Conclusions This data suggests that microfluidic incubation of lymphocytes with lymph node and tumor cells can generate large amounts of viable tumor-specific T cells on-demand with characteristics similar to TILs but with increased viability, cell expansion propensity, and cytotoxic responsiveness.

58. The multiaxial bioreactor integrated with an environmental monitoring system for a tissue-engineered skin graft

Seunggyu Jeon, PhD James J. Yoo, MD, PhD

Adit Mehta, Po-Feng Lee, Naresh Mahajan, Eric Renteria, Frank Marini, Ji Hyun Kim, Tracy Criswell, Thomas Shupe, Anthony Atala, Metin N. Gurcan, Shay Soker, Joshua Hunsberger, Young Min Ju, James J. Yoo
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Fellow

Tissue-engineered skin grafts have emerged as a promising solution for the treatment of chronic wounds. To facilitate the maturation of these grafts, stretch-based bioreactor systems have been employed. However, traditional systems often have limitations, particularly in terms of their stretching capabilities, which are typically limited to uni- or bi-directional stretching, and their ability to monitor dynamic changes in the surrounding culture environment. In this study, we introduced a novel multiaxial stretch-based bioreactor system with the incorporation of continuous environmental monitoring capabilities. To achieve multiaxial cyclic stretching, we designed a unique Hoberman ring structure that transforms linear motor force into radial movement, effectively stretching the skin graft in multiple directions. Additionally, we integrated environmental sensors to monitor critical parameters such as pH levels, oxygen concentrations, glucose, and lactate levels within the bioreactor. The integrated sensor system creates a single flow loop, enabling continuous monitoring of the progress of the culture. Particularly, we also integrated a media level sensor to maintain the air-liquid interface, a crucial environmental factor for preserving the functionality of the skin. Using this novel bioreactor system, we successfully increased the surface area of the skin graft by 1.13 times through controlled cyclic stretching. Moreover, we observed that cyclic stretching in-

duced early maturation of keratinocytes within the skin graft, in conjunction with dermal fibroblasts. These findings highlight the potential of our integrated design in providing new insights for the manipulation of tissue-engineered skin tissue, thus paving the way for enhanced applications in wound healing

59. Preparation of 3D printed Thick Liver constructs

Jin-Oh Jeong, PhD Sang Jin Lee, PhD

Timothy Dobroski, Kelsey Willson, Colin Bishop, Anthony Atala, James J. Yoo, and Sang Jin Lee
Wake Forest Institute Regenerative Medicine (WFIRM)
Clinical Science - Fellow

Introduction: Establishing adequate vascularization to engineered tissues and organs is an everlasting challenge that needs to be solved. For instance, most prefabricated microchannels in the engineered tissue constructs are limited to maintaining cell survival within the entire construct, resulting in generating dead zones where oxygen and nutrients are not sufficiently delivered. Thus, it is essential to design an efficient structure that allows fluid flow to pass through the entire tissue construct evenly. This study aimed to produce technologies capable of creating a viable thick (>1 cm3) metabolic tissue that could be used to advance research on human physiology, fundamental biology, and medicine. To achieve this goal, we developed thick, human vascularized liver tissue in an in vitro environment while maintaining metabolic functionality similar to the in vivo native cells throughout the 30-day survival period. Methods: Bioengineered liver constructs with a dimension of 1×1×1cm3 were produced with a digital light projection (DLP)-based bioprinting strategy using an optimized bioink formation containing human hepatocytes. Then, the interconnected vascular channel walls in the bioprinted cell-laden constructs was covered with human endothelial cells (ECs). Finally, the liver constructs were loaded into flow chambers connected to a media reservoir for continuous perfusion until predetermined time points (10 and 20 days). Results: The Live/Dead staining of the cells in the printed liver constructs showed >85% cell viability at trial days 0, 10, and 20 days. The cell viability is maintained by the nutrient delivery through the perfusion of the tissue constructs with no other outside support during the entire duration of the 20-day. HepG2 cells settled and self-aggregated to form cell clusters. These gradually formed well-defined cell aggregates over 20 days. Immunofluorescent staining confirmed Hepatocytes using their respective cell-specific antibodies (Albumin, Bilirubin, and Ki67). Endothelial cell layers covering the vascular lumen surrounded viable hepatocyte aggregates in the construct's interior, indicating EC function. In addition, hepatocytes within the printed constructs produced albumin and bilirubin levels comparable to that of humans, indicating the functionality of the liver construct. Conclusion: We successfully developed thick, human vascularized liver tissue in an in vitro environment while maintaining metabolic functionality similar to the in vivo native cells throughout the 20-day survival period. The unique gyroid design concept applied to generate organ constructs enables the growth of de novo tissues as an in vitro physiologically relevant organ model. Our next step is to evaluate whether these results show the same results on the space station. The test model will be evaluated by maintaining the basic framework and discussing it with a professional company to further develop it to be suitable for the space environment. Such an in vitro model could be utilized as a strategic tool to examine changes in tissues including the liver under microgravity. We are excited to propose a Spaceflight Experiment to advance our tissue vascularization research strategy

60. 3D printing of primary adipose tissue with silk scaffold for volumetric soft tissue reconstruction

Wonwoo Jeong, PhD Sang Jin Lee, PhD

Dongju Kim, Hyun-Wook Kang, James J. Yoo, Anthony Atala, and Sang Jin Lee
Biomedical Engineering
Basic Science - Fellow

In clinic, artificial breast implants have been reported limitations such as secondary implantation, skin contraction and autoimmune disease. Lipoaspirates are one of the promising tissues to enhance patient compatibility as it composed by autologous adipose tissue. However, low tissue engraftment of the lipoaspirates has been reported as weak vessel infiltration and poor mechanical stress. Bioprinting is proposed as a new strategy to facilitate nutrient exchange through pores by deposition of biomaterials and cells in designed 3D structures. In this study, the porous silk hemisphere having 1 mm-thin layer was printed by digital light processing (DLP). 16 %w/v of silk-methacrylate bio-ink was applied to fabricate the silk scaffold (diameter 20 mm and porosity 80 %). In addition, porcine-derived ATs were fragmented into 282 mm to fabricate micro-patterned adipose tissue. To inhibit extracellular matrix degradation, the fragmented ATs were neutralized by apro-

tinin for 3 days. The ATs based bio-ink was prepared with 15 %w/v fibrinogen and printed having diameter 18 mm and pore size 1 mm. Then, volumetric soft tissue was prepared by assembling the silk scaffold and the AT structures. As a result, in cytocompatibility test, the AT fragments maintained viability more than 80%. The porous silk scaffolds could be fabricated by DLP printing having 0.75-to-1.5 mm in thickness but 0.5 mm. Neutralized AT fragments maintained 1.34- fold higher adipocyte area compared to native tissue for 14 days in vitro cultivation. In addition, assembled AT had good structural stability in vivo as the silk successfully maintained the hemisphere under mice subcutaneously for 4 weeks. However, the AT structure without silk scaffold was degraded in 3 days. Herein, the assembly strategy of silk scaffold and AT structure was newly developed with improved structural stability for volumetric soft tissue reconstruction.

61. Embedded printing of breast cancer spheroids to control cancer aggressiveness by basement membrane for high throughput screening

Wonwoo Jeong, PhD Sang Jin Lee, PhD

Dongju Kim, Hyun-Wook Kang, James J. Yoo, and Sang Jin Lee
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Fellow

Triple-negative breast cancer (TNBC), one type of breast cancers, is more aggressive and does distal metastasis approximately 46%. Therefore, accurate first-line treatment of chemotherapy drugs is necessary to reduce invasive and metastatic behaviors. As patient-derived breast cancer organoids (PDBO) maintained patient-inherent characteristics in chemo-sensitivity and resistance, the PDBOs has been widely studied for personalized drug screening. However, during core-needle biopsy and organoid culture, the PDBOs lost tumor-matrix interaction that effected cancer aggressiveness in the patients origin. Thus, there is a need for developing an in vitro breast cancer model with different aggressiveness for personalized drug response examination. In this study, we developed a breast cancer model using TNBC spheroids combined with the basement membrane (BM) matrix that could reproduce different levels of cancer aggressiveness. The cancer spheroids co-localized with the BM matrix were deposited into alginate-based matrix by embedding printing. As a result, the BM matrix could enhance nuclear polymorphism and extracellular matrix (ECM) accumulation of the 3D-printed breast cancer spheroids in histology. The breast cancer spheroids with 25% BM matrix demonstrated a 1.21-fold higher proliferation rate, 1.37-fold improved drug resistance, and 1.48-fold higher Ki-67 positive nuclear ratio compared to the spheroids without BM matrix. At last, patient-derived TNBC organoids was printed into 96 well plate for high throughput screening. Interestingly, among 4 types of chemotherapies, the cancer spheroids with BM matrix showed similar drug response to the patient. Herein, our 3D bioprinting platform to fabricate the in vitro cancer model can be utilized as a high-throughput screening system for various tissue-derived cancers for precision medicine.

62. Artificial Intelligence to Predict Conversion to Neovascular Age Related Macular Degeneration

Hindo Kamanda Dr. Sally Ong, MD

Dr. Sally Ong Dr. Alvin Liu Dr. Craig Jones
Surgery-Ophthalmology
Clinical Science - Student

Background: Age-related Macular Degeneration (AMD) is a significant cause of vision loss in the elderly, particularly in developed countries such as the United States. Furthermore, incidence is projected to significantly grow in the coming decades, prompting urgent efforts to expand treatment options for patients. Having recognized the revolutionary potential of artificial intelligence within this space, our team is developing a model to ultimately predict conversion from non-neovascular AMD to neovascular AMD (NVAMD) by identifying key retinal imaging biomarkers for disease progression. With the introduction of new treatment options to treat NVAMD, we aim to provide physicians with new tools to identify patients most at risk for development of NVAMD so they can be targeted for early screening and diagnosis. Hypothesis: The study's deep learning model can identify retinal imaging biomarkers to consistently predict imminent conversion from Non-neovascular AMD to Neovascular AMD. Methods: Patients who were seen at Atrium Health Wake Forest Baptist between 2013-2023 and had ICD 9/10 codes H35.30, H35.301, H35.302, H35.303, H35.309, ICD9 362.50, H35.31, H35.311, H35.312, H35.313, H35.319, ICD9 362.51, H35.32, H35.321, H35.322, H35.323, H35.329, ICD9 362.52 were identified. Patients were excluded if they did not have at least 1 Heidelberg OCT within 6 months prior to conversion to NVAMD, or if they had other significant sight limiting ocular pathology such as glaucoma or diabetic retinopathy. 38 patients with 41 eligible eyes were ultimately included in the study, and a total of 185 OCTs were downloaded as data. All OCTs were obtained prior to

conversion to NVAMD. These data will be used as validation of the AI model using Bitfount, a software designed for federated learning. Federation learning ensures that patient data remains within the institution's firewalls while enabling cross-institutional training of artificial intelligence models. Results: The model achieved an AUC of 0.75 for overall performance. It was able to conform to "sensitive" mode (sensitivity of 80%), where the specificity was 45%. Conversely, when the model was set to a "specific" mode, with a specificity of 80%, it achieved a sensitivity of 57%. Cohort analysis revealed a mean 78.4 years (SD = 4.7) at time of conversion to NVAMD. Of the 41 eyes, 26 were female and 15 were male, all identified as white or Caucasian. There were 25 right eyes and 16 left eyes in the study. 140 of the 185 OCTs were from patients whose opposite eyes had already converted to NVAMD. The OCTs represent a wide range of disease progression, with a mean time-to-conversion of 328 days (SD = 64). Accordingly, there was high variability in best corrected visual acuity (BCVA) at each OCT date, with a mean BCVA of 20/35 (mean ± SD = [20/20, 20/60]). Conclusions: The cohort analysis provides a framework for incorporatingfuture algorithm-based data, as efforts continue toward validating the model and obtaining concrete biomarkers that can guide AMD treatment. Meanwhile, the team recognizes limitations of the study, particularly the lack of non-white individuals in the AHWFBH dataset-although that is partially explained by AMD's epidemiology. However, these nuances are crucial for further iterations. This project has also highlighted the technological and administrative challenges associated with pioneering artificial intelligence research in medicine.

63. Superior Transseptal vs. Left Atriotomy Approaches in Isolated Mitral Valve Surgery

Zohaib Khawaja, BS Bartlomiej Imielski, MD

Gabriel Cambronero, Yusuf Aboutabl, Elizabeth Wood, James Jordan, Timothy Craven, Adrian Lata, Edward Kincaid, Neal Kon, Bartlomiej Imielski
Surgery-Cardiothoracic
Clinical Science - Student

Purpose In mitral valve surgery, the superior transseptal (STS) approach provides optimal exposure compared to left atriotomy (LA) (Kon et al. 1993); however, concerns remain regarding post-operative dysrhythmias and subsequent pacemaker placement (Harky et al. 2020). This study aims to provide a comparison of intra-operative and postoperative outcomes between these approaches. Methods A retrospective review of 259 consecutive adults undergoing first-time cardiac surgery for isolated mitral valve repair or replacement, at a single tertiary-care hospital, over a 10-year period was performed. Exclusion criteria included previous permanent pacemaker (PPM) placement and concomitant cardiac procedures. Cases were reviewed for pre-operative characteristics, intra-operative and post-operative outcomes within 30 days of discharge. The primary outcome evaluated was post-operative PPM placement. Secondary outcomes included post-operative major adverse cardiovascular events (MACE), re-operation during index hospitalization, new-onset atrial fibrillation (Afib), new-onset dysrhythmias, all-time redo mitral valve surgery, intensive care unit (ICU) and post-operative length of stay (LOS), readmission, 30-day combined morbidity, and 5- year mortality. Dysrhythmias were defined as atrial fibrillation and flutter, atrioventricular nodal or bundle branch block, junctional rhythms, and NSVT. Combined morbidity included myocardial infarction, stroke, re-operation, and post-operative PPM placement. Results Of 259 surgeries, 116 (44.8%) were performed via LA and 143 (55.2%) via STS. 8 (3%) patients required post-operative PPM; 2 (1.7%) in the LA cohort and 6 (4.2%) in the STS group (p = 0.30). New-onset atrial fibrillation was noted in 36 (31%) LA patients and 61 (42.7%) STS patients (p = 0.055). New-onset dysrhythmias, including Afib, were noted in 43 (37.1%) LA patients and 70 (49%) STS patients (p = 0.06). Other secondary outcomes were similar between both groups (see Table 1 for counts, percentages, and p-values) such as bleeding requiring reexploration, myocardial infarction, stroke, MACE, readmission, re-do mitral valve surgery, and 5-year mortality. Additionally, cardiopulmonary bypass (CPB) time and aortic cross-clamp time did not differ by approach. Interestingly, ICU LOS (55.1 vs 72.9 hours, p = 0.04) and post-operative LOS (6.8 vs 9.0 days, p = 0.002) were shorter following LA than STS. Conclusions The superior transseptal approach provides optimal exposure, while preserving similarly low rates of post-operative morbidity and mortality when compared to the left atriotomy approach. There is no difference in the incidence of post-operative permanent pacemaker implantation, or freedom from mitral valve reintervention.

64. Muscle Fiber Fragments for Restoration of Muscle Tissue Function

Ji Hyun Kim, PhD James Yoo, MD, PhD

In Kap Ko, Eun Sang Yoo, Sang Mi Park, Bu-Kyu Lee, James J. Yoo, Anthony Atala
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Fellow

Introduction: Treatment of muscle function loss due to traumatic injury, congenital deformity, or tumor ablation is clinically

challenging. The current treatment standard is the grafting of autologous muscle flaps; however, significant donor site morbidity and graft tissue availability remain problematic. Muscle fiber therapy has been attempted to treat muscle injury by transplanting single fibers into the defect site. However, irregularly organized long fibers resulted in low survivability due to delay in vascular and neural integration, thus limiting the therapeutic efficacy. We developed a novel method that produces uniformly sized native muscle fiber fragments (MFFs) for muscle transplantation. In this study, we applied autologous MFFs to restore injured muscle anatomy and function. Methods: We developed an MFF processing method that produces uniformly sized fragments (approximately 100 μm in width and length) with intact muscle cells on the fiber surface. To test the therapeutic effects of the MFF technology, we created several rodent muscle injury models, including 1) a muscle atrophy model using toxin treatment, 2) a volumetric muscle defect model by surgical ablation, and 3) urinary incontinence (UI) model by damaging the external sphincter of the urethra. The effectiveness of the MFF therapy was determined by the structural and functional recovery of muscle tissues in these models. Results: The processed MFFs have a dimension of approximately 100 μm and contain living muscle cells on extracellular matrices (ECM). In preclinical animal studies using muscle atrophy, volumetric defect, and urinary incontinence models, histological and functional analyses confirmed that the transplanted MFFs into the injury sites were able to effectively integrate with host muscle tissue, vascular and neural systems, which resulted in significant improvement of muscle function and mass. Discussion and Conclusion: These results indicate that the MFF technology platform is a promising therapeutic option for restoring muscle function in several muscle defect models. With the initial successful outcome of the MFF technology platform in pre-clinical studies, Phase I human clinical trials for treating damaged rotator cuff muscle and sphincter muscle incontinence with the MFF are ongoing at our institution. The ease of preparation and short processing time make this technology readily usable as a point-of-care procedure in the operating room. Preliminary data indicates positive therapeutic effects, including reduced fat infiltration and an improved muscle-to-fat ratio in damaged rotator cuff muscles following autologous MFF injections. Our study results strongly suggest that as a point-of-care treatment, the MFF technology platform can potentially restore muscle anatomy and function, enhancing overall patient functionality and quality of life.

65. Diabetic Osteomyelitis: Oral vs Intravenous Antibiotics at a Single Level 1 Academic Medical Trauma Center

Jennifer Kipp, DPM Cody D. Blazek DPM

Lindsay LeSavage Joni Evans Trevor Denmeade Cody Blazek
Surgery-Orthopedics
Clinical Science - Resident

Residual osteomyelitis is a frequent problem following surgical intervention for diabetic foot infection. The current Infectious Disease Society of America guidelines recommend 4-6 weeks of initial intravenous antibiotics for treatment of residual osteomyelitis however, recent literature suggests oral antibiotic therapy is not inferior to intravenous therapy. The primary aim of this study was to evaluate treatment success in 128 patients receiving oral versus intravenous antibiotics for residual osteomyelitis in the diabetic foot after amputation at a Level 1 academic medical trauma center. In this retrospective chart review, treatment success was defined as completion of at least 4 weeks antibiotic therapy, complete surgical wound healing, and no residual infection requiring further debridement or amputation within one year of the initial surgery. Patients with peripheral vascular disease were excluded. We found no statistically significant difference in treatment success between these two groups (p=0.2766). Median time to healing for oral antibiotic treatment was 3.17 months compared to 4.06 months for intravenous treatment (p= 0.1045). Furthermore, there was no significant difference in group demographics or comorbidities, aside from more patients in the intravenous group having coronary artery disease (p=0.0416). Type of closure and type of microbial infection was also not associated with a difference in outcomes between the two treatment arms. The results of the present study suggest oral antibiotics for treatment of residual osteomyelitis are not inferior to intravenous therapy and may be more efficacious for certain patients regarding cost and ease of administration.

66. Total Ankle Arthroplasty Results in Better Postoperative Pain Scores and Lower Reoperation Rates than Tibiotalocalcaneal Arthrodesis

Jennifer Kipp, DPM Aaron T. Scott MD

Bryanna Vesely Jennifer Kipp Lindsay LeSavage Greg Russell Ashleigh Medda Aaron Scott
Surgery-Orthopedics
Clinical Science - Resident

Ankle arthritis is a common condition treated by foot and ankle providers. If conservative treatment fails, the decision to elect between an ankle arthrodesis or total ankle arthroplasty can be challenging. We performed a retrospective review of 232 patients: 154 patients who received a tibiotalocalcaneal arthrodesis and 78 who underwent total ankle arthroplasty. We found statistically significant improved postoperative pain scores among patients in the total ankle arthroplasty group ($p<0.001$) with an average postoperative pain of 1.1 in the total ankle arthroplasty group, 3 in the tibiotalocalcaneal arthrodesis group without Charcot arthropathy, and 2.2 in the tibiotalocalcaneal arthrodesis group with Charcot. The total ankle arthroplasty patients also underwent less reoperations at only 1.3%, compared to 18.4% in those who underwent tibiotalocalcaneal arthrodesis. Overall, we concluded that patients who underwent total ankle arthroplasty had better pain outcomes and fewer reoperations. We hope these findings allow physicians to educate their patients on the expected outcomes of these two procedures.

67. Developing a Predictor of Arthrofibrosis after Total Knee Arthroplasty

Nicholas Kiritsis, BS John S. Shields, MD, FAAOS, FAOA

Lucas A. Klever, Jackson P Midtlien, Garrett S. Bullock, John S. Shields
Surgery-Orthopedics
Clinical Science - Student

Background: It is estimated that nearly 500,000 total knee replacements are performed annually in the United States1 with projections to increase 139% by 2040 and 649% by 2060.2 As medical advancements extend the average lifespan, they will continue to grow in popularity alongside the aging population. Arthrofibrosis, or the formation of scar tissue, is a significant and prevalent complication of joint surgery. Although most patients report satisfactory outcomes after surgery, there is still an estimated 20-30% of the patient population with unsatisfactory results.4 Arthrofibrosis remains a prominent cause of decreased satisfaction in total knee arthroplasty (TKA) surgery, accounting for 28% of hospital readmissions during the first three months of recovery and 10% of revisions within five years of the initial surgery. The field currently lacks a proven indicator for patient movement outside of prescribed therapy, which is a key means of preventing arthrofibrosis development. One study grouped post-TKA physical therapy patients into extensive, moderate, and minimal activity groups based on their daily movement and found that 76% of the extensive group achieved >120º of motion while only 26% of the moderate and 6% of the minimal did ($p<0.01$ in each comparison).4 A reliable indicator of patient movement would benefit providers in identifying a high risk of arthrofibrosis and decrease the need for secondary intervention. Hypothesis: We hypothesize that a greater amount of 2-octyl cyanoacrylate (Dermabond) on the incision at the six-week postoperative appointment will correlate to decreased range of motion. We believe that the increased quantity of dermabond remaining on the incision indicates that the patient has not engaged in substantial activity outside of prescribed physical therapy and thus failed to disturb the glue through the shear forces of flexion and extension exercises. Methods: Patients were approached for enrollment during the preoperative appointment, preoperative holding, or six-week follow-up visit. We recruited 115 patients in person based on undergoing a primary total knee replacement. Those with a previous arthroplasty were excluded. At the six-week follow-up, each patient was assessed according to standard protocols, which include range of motion (ROM) and a KOOS Jr survey. In addition, we took images of the femoral, patellar, and tibial portions of the incision with the knee at 90º. We used ImageJ, an image processing software from the NIH, to quantify the surface area of glue. These values were analyzed for associations with KOOS scores, as a measure of reported function, and ROM, as a measure of mobility. Results: Every one inch2 increase in glue surface area at six weeks post-operative was associated with a -2.71 (95% CI: -3.33, -2.10; $p<0.001$) degree decrease in total knee range of motion. There was no association between glue surface area and KOOS total score six weeks post-operative [0.06 (95% CI: -0.25, 0.38; $p = 0.701$]. Conclusions: From these findings, we conclude that an increased surface area of Dermabond at the six-week post-operativemvisit indicates that the patient will demonstrate a decreased ROM.

68. Characterizing a Previously Unrecognized Clinical Phenotype: The Coexistence of Cerebral Venous Outflow and Connective Tissue Disorders

Nicholas Kiritsis, BS Kyle M. Fargen, MD, MPH

Jackson P. Midtlien Brian P. Curry Emily Chang Kyle M. Fargen Jennifer B. Aldridge
Surgery-Neurosurgery
Clinical Science - Student

Introduction: There is increasing recognition of connective tissue disorders and their influence on disease in the general

population. A conserved clinical phenotype involving connective tissue disorders and idiopathic intracranial hypertension (IIH) and associated cerebral venous outflow disorders (CVD) has not been previously described. These patients are rare but have severe impairment in functional capacity and quality of life and are challenging to treat. Herein we present our series of patients to document this previously unrecognized clinical phenotype. Methods: A single-institution retrospective review of a prospectively maintained database of patients with connective tissue disorders and CVD was performed. All patients had previously underwent cerebral arteriography, venography, and LP as part of their evaluation at our center. Results: A total of 86 patients were identified. The majority of these patients carried a diagnosis of Ehlers-Danlos syndrome (55%) and most were non-obese (mean body mass index 29.7 kg/m2), Caucasian (90%) females (87%). Most prevalent presenting symptoms included pressure headache (98%), dizziness (90%), tinnitus (92%), and cognitive dysfunction (69%). Aside from CVD and IIH, the most common associated conditions were postural orthostatic tachycardia syndrome (POTS; 55.8%), cerebrospinal fluid (CSF) leaks (51.2%), dysautonomia (45.3%), cranio-cervical instability (37.2%), mast cell activation syndrome (25.6%), and tethered cord syndrome (23.3%). Allergies to medications (87.2%) and surgical tape (19.8%) were also frequent. Notably, internal jugular vein stenosis was a concern for 52.3% of patients, with a history of jugular decompression or styloidectomy procedures in 31.4% and jugular vein stenting in 7.0%. Mean opening pressure on lumbar puncture was 18.5 cm H2O and spinal CSF leaks post-LP were observed in 31.9% of patients. Areas of stenosis documented via cerebral venography were rare. Conclusions: There is a rare but conserved clinical phenotype that has not been described previously that presents with severe IIH symptoms in predominantly young, non-obese Caucasian women with a high associated incidence of dysautonomia, POTS, craniocervical instability, and CSF leaks, among others. Despite significantly lower opening pressures on lumbar puncture, headache severity and quality of life scores were reported with the same severity of classic IIH patients. These findings suggest an underlying hypersensitivity to intracranial pressures and cerebral venous congestion in these patients.

69. Redefining Treatment Expectations: Exploring Long-Term Outcomes of Venous Sinus Stenting in Idiopathic Intracranial Hypertension

Lucas Klever, BS Kyle M. Fargen, MD, MPH

Jackson P Midtlien Nicholas R Kiritsis Kyle M Fargen Jennifer B Aldridge
Surgery-Neurosurgery
Clinical Science - Student

Background: Idiopathic intracranial hypertension (IIH) is a condition characterized by various symptoms such as pulsatile tinnitus, chronic headaches, and papilledema. Venous sinus stenosis has been associated with IIH, and venous sinus stenting (VSS) has emerged as a potential treatment option. However, there is a lack of standardized outcome definitions and limited long-term data on the effectiveness of VSS in current literature. Methods: In this study, we analyzed the long-term outcomes of 178 patients with medically- refractory IIH who underwent VSS by the senior author. Demographic information, pressure gradients, symptom improvement, recurrence, and persistence were recorded. Quality of life and symptom severity scores were assessed using standardized HIT-6, WHO-BREF, and pulsatile tinnitus surveys. Follow-up duration and patient-reported outcomes were also considered. Results: Among the VSS cohort, 52.8% reported initial symptom relief followed by recurrence, and 13.5% experienced persistent symptoms without improvement. Overall failure rate of VSS was found to be 66.3%. Repeat procedures, such as lumbar puncture or additional stenting occurred in many patients. Survey data showed varying degrees of improvement in symptom severity and quality of life, and these changes were found to be statistically insignificant long- term. Conclusions: Our study challenges the prevailing notion of favorable outcomes in VSS suggests a need for reevaluation of the procedure as a long-term treatment option for severe IIH. High rates of symptom recurrence, persistence, and the need for repeat interventions indicate limitations in the efficacy of VSS. Improved understanding of the underlying factors contributing to poor outcomes and the development of alternative interventions are essential for better management of this debilitating condition.

70. Impact of ERAS Protocol on Perioperative Outcomes of Head and Neck Surgery

Lucas Klever, BS Joshua D. Waltonen, MD

Maria C Masciello Joshua D Waltonen
Surgery-Otolaryngology (Dentistry)
Clinical Science - Student

Background: Enhanced recovery after surgery (ERAS) protocols are perioperative care pathways that aim to improve

recovery after surgery. ERAS protocols, while initially applied to colorectal cancer patients, are now used across multiple specialties. They were more recently introduced to free flap reconstruction protocols following head and neck resection. In 2017, an international panel of experts made 17 recommendations to be included in ERAS protocols for free flap reconstructions for head and neck cancer. These included but were not limited to the following: pre-operative education/counseling, perioperative nutrition, VTE prophylaxis, peri-operative antibiotics, peri-operative nausea/vomiting prophylaxis, peri-operative IV fluid management, pain management, and early mobilization. The purpose of this study was to compare outcomes in patients undergoing head and neck free flap reconstruction prior to and after implementation of a free-flap specific ERAS protocol. Hypothesis: Implementation of free-flap specific ERAS protocol at Wake Forest Baptist Health will; (1) decrease length of hospital stay, (2) decrease medical/surgical complications, (3) improve 6-month all-cause mortality. Methods: Subjects were retrospectively chosen from a database of patients who had undergone free flap reconstruction before and after ERAS implementation. Patient outcomes (length of stay, wound and non-wound related complications, all-cause mortality, ED visits, and readmission rates) were then recorded. Results: 166 patient charts were reviewed (90 pre-protocol, 77 post-protocol). Length of stay for pre-protocol patients was 13.3 days compared to 11.0 days for post-protocol patients (p=.02). Wound complications were less for post-protocol patients compared to pre-protocol patients (17% and 38% respectively, p=.003). Non wound complications were less in post-protocol patients compared to pre-protocol patients (34% and 58% respectively, p=.003). 66% percent of pre-protocol patients experienced any complication (wound or non-wound related) compared to 43% of postprotocol patients (p=.005). All cause mortality within 6 months was unchanged (p=.76) Conclusions: Results show that free-flap specific ERAS protocol implementation significantly improves per-operative outcomes (decreased length of stay, wound complications, non-wound complications, and overall complications), but did not have an effect on 6-month all-cause mortality.

71. Influence of Closed-incision Negative Pressure Wound Therapy on Abdominal Site Complications in Autologous Breast Reconstruction

Samuel Kogan, PhD Ramon Llull, MD/PhD

Blake Dunson Joshua A. Grosser Amelia Davidson Ramon Llull
Surgery-Plastic & Reconstructive
Clinical Science - Resident

Background: Closed-incision negative pressure wound therapy (ciNPWT) has shown promise in reducing surgical wound complications. Among its benefits, it allows for exudate management and tension offloading from wound edges. The purpose of this systematic review and meta-analysis was to assess the efficacy of prophylactic ciNPWT versus conventional dressings on abdominal donor site complications in microsurgical breast reconstruction (MR). Methods: A systematic review was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines in January 2023. PubMed and Embase were searched to identify all relevant studies. Data collected included rates of total wound complications, wound dehiscence, infection, seroma, and length of hospital stay. Results: A total of 202 articles were screened, and eight studies (1009 patients) met the inclusion criteria. Use of ciNPWT was associated with a significantly lower rate of wound dehiscence (OR, 0.53; 95% confidence interval, 0.33-0.85; P = 0.0085, I2 = 0%). There was no significant difference in the rate of total wound complica- tions [odds ratio (OR), 0.63; 95% CI, 0.35-1.14; P = 0.12, I2 = 69%], donor site infection (OR, 0.91; 95% CI, 0.42-1.50; P = 0.47, I2 = 13%), seroma (OR, 0.74; 95% CI, 0.22- 2.49; P = 0.63, I2 = 57%), or length of hospital stay (SMD, 0.089; 95% CI, -0.13-0.35; P = 0.37, I2 = 29%). Conclusions: Although exudate management by ciNPWT fails to reduce surgical site infection, seroma formation, and overall length of stay, ciNPWT tension offloading properties seem to be associated with lower rates of wound dehiscence when compared with conventional dressings in abdominal-based autologous breast reconstruction.

72. Graduated Craniofacial Fellows: Where Are They Now and Why?

Sasha Kondrasov Christopher M. Runyan, MD, PhD

Blondin, M., Saba, B.V., Ma, R., Kogan, S., & Runyan, C.M.
Surgery-Plastic & Reconstructive
Educational Science - Student

Background In North America, there is a mismatch between the high supply of fellowship-trained craniofacial surgeons and the low demand for them, leading to challenges finding positions. A 2017 analysis found that about one-third of craniofacial fellowship-trained surgeons held an academic craniofacial position, a strong determining factor of which was an academic craniofacial surgery background during training. In this analysis, we surveyed the positions of a larger cohort of

plastic surgeons who graduated from craniofacial fellowship from 2010 to 2021, assessing potential predictive factors in these surgeons' pursuits of academic craniofacial careers. Methods The names of 329 craniofacial fellows (2010-2021) in the United States and Canada were obtained from craniofacial fellowship programs recognized by the American Society of Craniofacial Surgeons. Through institution websites, LinkedIn, social media, Google Scholar, and Semantic Scholar, we obtained data regarding their current practice, where they completed residency and medical school, whether their residency offers a craniofacial fellowship, ACGME accreditation of their fellowship, and children's hospital affiliation. Descriptive statistics and odds ratios were obtained. Results A total of 321 craniofacial fellows were included in this study. Current practice patterns for this cohort were 35.6% within an academic craniofacial practice, 33% in private practice, 16.2% in nonacademic craniofacial practice, 7.8% in academic noncraniofacial practice, 3.7% in nonacademic noncraniofacial practice, and 3.7% in private practice with a craniofacial focus. 10.3% completed residency outside North America. Listed from highest to lowest, the odds ratio of the potential predictors of practicing academic craniofacial are:
completion of residency in North America (4.66), completion of residency that offers a craniofacial fellowship program (1.55), and graduation from a craniofacial fellowship program that is ACGME accredited (1.06). By contrast, the odds ratio of these factors for those in private practice are 1.12, 0.57, and 1.24, respectively. The statistically significant factor for those in academic craniofacial practice is completion of residency in North America (OR = 4.66, 95% CI [1.60, 13.59]), while that for those in private practice is completion of residency that offers a craniofacial fellowship (OR = 0.57, 95% CI [0.34, 0.96]). Conclusions Our data suggests that completing residency in North America increases the odds of being in academic craniofacial practice, while completing a residency that has a craniofacial fellowship decreases the chances of pursuing private practice. These results indicate that a career in academic craniofacial plastic surgery may be more likely than that in private practice when the individual has had early exposure in their surgical training with adequate resources and connections. We are currently building an I-10 index database, as well as creating opinion surveys to be sent out to the graduated fellows to garner their perspectives on the issue.

73. PRECLINICAL DEVELOPMENT OF NOVEL SMALL MOLECULE BASED THERAPY TO TREAT ALOPECIA

Gauri Kulkarni, PhD Anthony Atala, MD

Rongyuan Xie, Jareer Kassis, Cara Clouse, Garett Briggs, Tan Ren, John Jackson, Alan Jacobson, and Anthony Atala
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Fellow

Hair Loss/Alopecia affects over 80 million Americans. Currently there are only three FDA approved drugs including Minoxidil (Rogaine) Finasteride Baricitinib (Olumiant). Although thinning hair/alopecia is not a life-threatening condition, it has implications for mental health and quality of life. Therefore, there is a need to develop novel therapies for hair regeneration by targeting reactivation of dormant hair follicle stem cells. Direct reprogramming of quiescent adult stem cells using small molecules is an attractive strategy to regenerate functional tissue in vivo. Through our small molecule program, we have discovered a candidate small molecule (W108 / HGPSM-Hair Growth Promoting Small Molecule?) which can reactivate resting telogen phase hair follicles to actively growing anagen phase leading new hair growth in dose dependent manner in mice when applied topically. We used a series of chemical and biochemical methods to identify its potential target and mechanism of action through which HGPSM reactivates dormant dermal papilla and hair follicle stem cells to promote hair growth. We have developed a topical formulation of HGPSM for human scalp application. We established ex-vivo human skin model to study the effect of HGPSM on human hair growth. A pilot study with histological analysis using ex-vivo human skin showed promising results of hair growth promoting ability of HGPSM using both topical and systemic application in a dose dependent manner. We will be repeating these studies to objectively determine its efficacy. Further, we used 3D human microtissues including Liver, Heart, Lung and Skin to study toxicity of HGPSM topical formulation as an alternative to animals. We are also developing a process for large scale synthesis of GLP grade HGPSM to conduct efficacy, pharmacological and toxicological studies to engage with the FDA for IND application to initiate first in human clinical trial. Our ultimate goal is to develop this molecule as a potential therapy to promote hair growth in patients with conditions such as alopecia.

74. The Relevance of Breast Size Beyond Plastic Surgery

Elizabeth Laikhter, MD Lisa David, MD, MBA, FACS

Kristyn Pocock, Mary Duet, Elizabeth Laikhter, Paige M. Estave, Lisa David, Lauren Doyle Strauss,

Sandhya Kumar, Barbara Nye, Rebecca Erwin Wells
Surgery-Plastic & Reconstructive
Clinical Science - Resident

Objective: To increase awareness and better understand headache and other neurological symptoms in women with breast hypertrophy (macromastia) undergoing breast reduction surgery (reduction mammoplasty). Background: Symptomatic macromastia is a syndrome of persistent neck and shoulder pain, painful shoulder grooving from bra straps, chronic inframammary rash, headache, backache, and neuropathies caused by heavy breasts and an increase in the volume and weight of breast tissue beyond normal proportions. Up to 69% of the 100,000 women in the United States undergoing reduction mammoplasty each year cite headache as a reason for pursuing this surgery with up to 50% of these patients reporting post-operative headache improvement. However, macromastia is not discussed or addressed in the fields of Headache Medicine or Neurology. A bibliometric analysis examining medical literature from 1980-2016 that utilized the keywords “breast reduction”, “reduction mammaplasty”, and “reduction mammoplasty” discovered 1,427, none of which were published in a Neurology journal. Research in surgical fields identifies the role macromastia plays in neurological disorders, including headache, in addition to cervicalgia, occipital neuralgia, degenerative spine disease, back pain, peripheral neuropathies, sleep disorders, as well as emotional, psychological, and sexual impairment. In light of this data it is time for nonsurgical physicians to join the conversation on macromastia. Aims: To determine if there are any publications within a Neurology, Pain, or Headache Medicine journal addressing macromastia and headache. Methods: A literature search was performed in PubMed utilizing the keywords “macromastia,” “gigantomastia,” “breast hypertrophy,” “mammary hypertrophy,” “breast reduction,” “reduction mammoplasty,” OR “reduction mammaplasty” AND “headache disorders [MeSH]” OR “headache [MeSH]” OR “migraine” or “migraine disorders [MeSH].” Inclusion criteria included English language, publication between 1975-2023, and title or abstract describing macromastia’s impact on headache. Results: Twenty-five articles were discovered published between 1990-2023. Twenty-four articles were published within Plastic and Aesthetic Surgery journals. One article was published in the Mayo Clinic Proceedings. There are no data addressing macromastia and headache published within a Neurology, Pain, or Headache Medicine journal. The majority of literature exists within the Plastic Surgery journals. Conclusion and Relevance: Headache is an important symptom in patients with macromastia undergoing reduction mammoplasty, and it has not been well characterized. Current literature is predominantly published in plastic surgery journals and uses nonspecific terms like “chronic headache” resulting in diagnostic uncertainty. This results in unanswered questions including 1) what headache types patients with macromastia experience; 2) what headache types are responsive to surgery; 3) if patients with certain headache types should be referred for non-surgical headache management prior to surgical intervention; and 4) if there is an unrecognized role for surgery for patients with intractable headache and macromastia in patients being treated in headache clinics. Addressing a women’s health topic like macromastia is important for femalepredominant diseases like migraine, which affects one in five women. To answer these questions, it is prudent for plastic surgeons to collaborate with headache and pain specialists to expand our understanding of migraine and non-migraine headache disorders in women with macromastia.

75. Customized Electronic Cortical Impact in a Polytrauma Swine Model of TBI and Uncontrolled Hemorrhage

Bonnie Laingen, MS Lucas P. Neff, MD

Sanin, Gloria; Cambronero, Gabriel; Wood, Elizabeth; Patterson, James; Saxena, Juhi; Azar, Elizabeth; Reid, Garrett; Lane, Magan; Neff, Lucas; Williams, Timothy
Surgery-General
Basic Science - Student

Introduction: Traumatic brain injury (TBI) is a leading cause of mortality worldwide, especially within polytrauma. Conflicting treatment guidelines around TBI and hemorrhage polytrauma necessitate continued research into proper resuscitation strategies. Research utilizing large animal models is common due to physiological similarities to humans, yet limited descriptions of models representing polytrauma with TBI and uncontrolled abdominal hemorrhage exist. A model that induces both injuries simultaneously requires animals to be in the supine position. Our aim was to develop a customized, reproducible TBI impact in the setting of an uncontrolled abdominal hemorrhage large animal model. Methods: A novel supine TBI model was developed utilizing an electronically controlled cortical impactor (eCCI) to facilitate concurrent liver injury via a laparotomy to induce uncontrolled hemorrhage. A custom stereotactic frame and impactor mount were built to accommodate this unique eCCI swine model positioning. An electromotive force sensor built into the custom impactor tip was used to establish the impactor set point at the dural border. Then the TBI was inflicted and the liver was transected concurrently to induce uncontrolled intra-abdominal hemorrhage. Results: Representative eCCI impactor tip electromotive force set point median (IQR) readings changed from baseline of 0.0008 mV (0.0006-0.0012) to 0.01255 mV (0.00675-0.01395),

then to 0.0033 mV (0.00305-0.0045) when advanced to the dura then withdrawn just above baseline, respectively. In 11 swine, eCCI readings of TBI impact showed a median (IQR) velocity of 3.46 m/s (3.43-3.49) and impact depth of 10.77 mm (10.75-10.79) compared to programmed 4.0 m/s and 10.99 mm respectively. Conclusions: This customized TBI impact model was effective in producing repeatable eCCI calibration and impact measurements. Our results demonstrate the feasibility of implementing concurrent injuries in a TBI polytrauma supine swine model.

76. Thromboelastography of Post-traumatic Injury Coagulation: Comparison Between Uncontrolled Intra-Abdominal Hemorrhage in Swine Models with and without TBI

Bonnie Laingen, MS Lucas P. Neff, MD

Renaldo, Antonio; Sanin, Gloria; Cambronero, Gabriel; Wood, Elizabeth; Patterson, James; Saxena, Juhi; Azar, Elizabeth; Reid, Garrett; Lane, Magan; Rahbar, Elaheh; Neff, Lucas; Williams, Timothy
Surgery-General
Basic Science - Student

Background: Traumatic injury resulting in exsanguination and hemorrhagic shock is a leading cause of death worldwide, especially within polytrauma with concurrent traumatic brain injury (TBI). Disrupted coagulation can be detected early in approximately 56% of trauma patients as evidenced by abnormal coagulation measurements, which have shown to be an indicator of injury severity during hemorrhagic shock and response to endovascular hemorrhage control strategies. Injury mechanism and severity are significant contributors to the development of acute coagulopathy. This study aimed to compare initial coagulation response to separate trauma injury mechanisms in combination with full aortic occlusion via thromboelastography (TEG) parameter evaluation in porcine models.We hypothesize that the polytrauma swine models undergoing both uncontrolled intra-abdominal hemorrhage and TBI will exhibit an increased hypercoagulable response from baseline in comparison to the swine undergoing hemorrhage without concurrent TBI. Methods: 31 Yorkshire swine underwent either uncontrolled hemorrhage via liver transection (Non-TBI, n=16) or uncontrolled hemorrhage with concurrent TBI (TBI, n=15). Post-injury, all animals received 10 minutes of complete aortic occlusion with a custom REBOA catheter (T10). Global hemostatic function was assessed by citrated kaolin with heparinase thromboelastography assays using a TEG 5000 (Haemonetics, Niles, IL). The following clotting parameters were used to evaluate coagulopathy: clotting kinetic metrics (R-time, K-time), clot strength parameters (MA, G), and fibrinolytic activity (LY30). A linear mixed model was used to evaluate differences in coagulation metrics and over time; statistical significance was set at $p=0.05$. Results: Rtime significantly decreased after injury ($p=0.01$) in both groups, with no statistically significant differences between groups ($p=0.49$). All other coagulation parameters revealed no statistically significant differences over time ($p>0.05$ for all measurements) besides LY30, which was significantly different between groups at baseline ($p<0.01$) and after full occlusion (T10, $p<0.01$). Conclusions: There were few significant differences in preliminary coagulation changes between trauma models. Baseline differences in clot degradation indicate physiologic heterogeneity between cohorts which is important to consider when distinguishing the impact of the injury mechanism. These results indicate slightly higher initial coagulopathy in the TBI versus Non-TBI cohorts.

77. Multi-functional Pulsatile Bioreactor Module Development for Biomanufacturing Engineered Tubular Tissues

Po-Feng Lee, PhD James J. Yoo, MD, PhD
Adit Mehta, Eric Renteria, Frank Marini, Ji Hyun Kim, Tracy Criswell, Thomas Shupe, Anthony Atala, Joshua Hunsberger, Metin N. Gurcan, Shay Soker, Young Min Ju, James J. Yoo
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science – Fellow

Introduction: Bioreactors have become a standard tool in biomanufacturing tissue-engineered medical products for preconditioning and maturing tissue constructs. This study aimed to develop a standardized, self-contained, and modular bioreactor platform capable of establishing scalable and automated processes for the clinical manufacturing of tubular tissue constructs. Methods: To achieve this goal, design parameters specific to tubular tissues, such as blood vessels, were considered and incorporated to develop a novel pulsatile bioreactor prototype. The constructed tubular tissue bioreactor included multiple functions and features, including a pulsatile flow mechanism controlled under specific pressure conditions and the incorporation of real-time monitoring of flow dynamics through an integrated sensor module to assess the culture environment and cellular metabolites. To achieve efficient cell seeding, a machine rotary mechanism has been integrated within the bioreactor chamber box . A novel flow equalizer has been designed to provide equal flow stimulation to multiple

vessels from one single pump. The tubular scaffolds were fabricated from 5% collagen type I/PCL mixture for validation studies of cell seeding method comparison and vessel maturation under flow stimulation. Results: The flow equalizer system that can provide uniform flow stimulation across multiple tubular organs within the bioreactor with a minimal flow rate variation of less than 4%. These capabilities represent a significant improvement over the traditional 1-to-3-way connector, which results in a flow rate difference of 16%. To validate the functionality and reliability of the bioreactor, we conducted baseline tests using endothelial cell-seeded electrospun vessel scaffolds. The results demonstrated that the bioreactor module operated effectively, with the integrated sensors providing quantitative data. Furthermore, we implemented a machine rotary mechanism within the bioreactor chamber box, which offers distinct advantages over the traditional manual seeding method. Applying the rotary mechanism for cell seeding resulted in superior endothelial cell coverage. Furthermore, endothelial cells were organized and aligned in the direction of flow after five days of flow stimulation. Conclusion: The multi-functional pulsatile bioreactor has been successfully validated and may be used as a standard tool for bioman facturing tissue-engineered tubular tissue constructs.

78. The Impact of Silver Nanoparticle-Induced Photothermal Therapy and Augmentation of Hyperthermia on Breast Cancer Cells Harboring Intracellular Bacteria

Sijia Liu, PhD Nicole Levi, PhD

Spencer Phillips Scott Northrup Nicole Levi
Surgery-Plastic & Reconstructive
Basic Science - Fellow

Background: Breast cancer is the second leading cause of cancer death in women in the United States. Previous studies have identified the presence of intracellular bacteria within breast cancer cells, which has a negative impact on therapeutic responses. Photothermal therapy (PTT) is an alternative approach for treating breast cancer, using materials that absorb light to generate heat. Silver nanoparticles (AgNPs) are clinically utilized as FDAapproved antibacterial agents. Thus, AgNPs are promising for killing breast cancer cells harboring intracellular bacteria. Our team developed triangular AgNPs with near-infrared absorption, which could generate heat upon exposure to near-infrared radiation. Hypothesis: We hypothesized that AgNPs could induce sufficient heat to kill infected breast cancer cells and intracellular bacteria upon exposure to infrared light. Methods: Triangular AgNPs containing strong absorption at 800 nm was synthesized by reducing silver ions in the presence of silver seeds. Epithelial breast cell line MCF 10A, and breast cancer cell lines MCF7 and MDA-MB-231 were infected with Pseudomonas aeruginosa 27853. To measure the acute cellular response to photothermal ablation, all noninfected and infected cell lines were incubated with different concentrations (0, 10, 25 or 50 μg/mL) of AgNPs respectively and exposed to 5 W of 800 nm laser for 36 s during a 2 h incubation. Cells were counted using a hemocytometer, and viability was normalized to cells incubated with media alone. Clonogenics assay was used to evaluate the long-term cell survivability following PTT. Following treatment infected cells were transferred into T25 flasks and allowed to expand until there was sufficient number to enumerate bacteria. Then cells were counted, lysed, serially diluted and plated onto LB agar plates. The number of visible colonies were counted. Results: Upon exposure to 5 W of 800 nm light for 36 seconds, an obvious reduction in cell viability was observed for 10 μg/mL. 25 μg/mL of AgNPs induced sufficient heat to cause nearly all cell death for both non-infected and infected breast cells. Infected breast cell lines were more resistant to AgNPs-induced photothermal treatment than their corresponding non-infected cell lines. Infected/Non-infected breast cells incubated with AgNPs alone in the absence of laser had no change in the number of surviving colonies. Upon exposure to 800 nm light, colony numbers decreased with increasing AgNPs concentration (and hence increased temperature). Infected breast cells formed more colonies than their non-infected cells with the treatment of 10 μg/mL of AgNPs and laser exposure for all three cell lines. For infected/non-infected MDA-MB-231, infected/non-infected MCF 10A and non-infected MCF7, 25 μg/mL AgNPs concentration with laser (5W, 800 nm, 36s) induced sufficient heat to cause no colony formation. A significant reduction in colony number was also observed for infected MCF7 under this condition. Exposure to laser caused significant reduction in bacterial colony-forming units per cell for two kinds of breast cancer cells. Conclusions: Triangular AgNPs have been demonstrated as an effective photothermal therapy against breast cancer cells upon exposure to infrared light. In this work, 25 μg/mL AgNPs concentration with laser (5W, 800 nm, 36s) generated sufficient heat, leading to nearly complete cell death of both non-infected and infected breast cells, though infected breast cells appeared to be more resistant to AgNPs-induced hyperthermia. No colony formation indicated that AgNPs-induced cellular damage was irreversible, indicating less potential for cell regrowth. Exposure to laser caused reductions in bacterial colony-forming units per cell, indicating that AgNPsinduced photothermal therapy could be also effect to kill intracellular bacteria. In the absence of laser, breast cells incubated with AgNPs exhibited greater reductions in cell viability than cells incubated with media alone at the same temperature, indicating the potential application of AgNPs to improve the efficiency of hyperthermia treatment. Together these data suggest the benefits of AgNPs to eliminate breast cancer and intracellular bacteria in the breast tumor microenvironment.

79. Fat Grafting Post Breast-Reconstruction: A Tale of Two Estimates

Kelsey Lloyd, MD Ivo Pestana, MD

Daniel Zaki, Ivo Pestana
Surgery-Plastic & Reconstructive
Clinical Science - Resident

Introduction Autologous fat transfer has become an integral means for addressing volume deficits and contour irregularities post-breast reconstruction. Its global adoption is attributed to its safety profile, ease, and minimally invasive nature. Since its inception, there have evolved more efficient methods to streamline the processing of lipoaspirate and delivery of usable fat intraoperatively. However, the percent yield of usable fat as well as estimating the appropriate amount of lipoaspirate required to correct a particular deficit among varying fat graft techniques remain elusive. The primary aim of this study was to compare the accuracy of fat volume estimates provided by an attending and resident plastic surgeon (MD1 and MD2) in patients undergoing breast reconstruction revision surgery with fat grafting when employing different fat grafting processing techniques. Methods The authors conducted a retrospective review of a randomized trial led by a single attending plastic surgeon at Wake Forest Baptist Medical Center. Eligible participants underwent fat graft harvest using suction-assisted lipectomy and lipoaspirate processing via one of three techniques: LipoGrafter, Revolve system, or traditional centrifugation (Coleman). Surgeon estimates for prospective fat grafting were recorded on a corresponding data sheet. Exclusions were made for women below age 18, those with less than a 3- month follow-up post-fat grafting, cases containing only one surgeon estimate, and cases where the fat grafting volume was less than 50 mL. The study utilized the following statistical tests: 1. Spearman's Correlation: To assess the strength and direction of the relationship between the estimated and actual amounts of fat used. 2. . Absolute Differences: To compare the absolute difference between the estimates and the actual amounts used for both MD1 and MD2. 3. Boxplots: To visualize the spread and central tendency of the absolute differences. All statistical analyses were performed using Python programming language, specifically utilizing libraries such as pandas for data manipulation, scikit-learn for regression modeling, and seaborn for data visualization. Relevant Equation: Results Of 50 total patients (Coleman=20, LipoGrafter=9, Revolve=21), 33 patients encompassing a total of 47 breasts were identified to contain both an attending (MD1) and resident (MD2) estimate on the corresponding data sheet. The Spearman's correlation coefficients were 0.394 for MD1 and 0.337 for MD2, indicating a moderate positive correlation between the estimates and the actual amounts of fat used. The mean absolute differences were 15.2 mL for MD1 and 18.3 mL for MD2.

80. Review of Piezo1 Mechanosensitive Ion Channel Function in Macrophages and Intracerebral Hemorrhage

Renate Ma, BS Stacey Quintero Wolfe, MD
Reto Asmis, Stacey Wolfe
Surgery-Neurosurgery
Basic Science - Student

Introduction: Intracerebral hemorrhage (ICH) accounts for 10-20% of stroke cases worldwide and continues to be the deadliest subtype of stroke. The mortality rate, at 30-40% one month post initial ictus, has not changes over the past two decades despite continued research. Both primary and secondary injury play an important role in damage after ICH and may both be influenced the critical role of the Piezo1 mechanosensitive ion channels. This mechanoreceptor senses pressure which may play a role in primary injury, and modulates pro-inflammatory macrophage polarization, a critical step in secondary injury. We examine the role of Piezo1 in the pathogenesis of post-ICH brain injury. Objective: To analyze the current literature on the role of Piezo1 in macrophage function and polarization in the context of intracerebral hemorrhage, highlighting the ion channel's potential as a therapeutic target in improving patients' outcomes. Method: Key words "Piezo1," "mechanoreceptor," "macrophage," and "ICH" were searched in PubMed and google scholar. Results: The Piezo1 ion channels play important roles in the phagocytic function of macrophages and the polarization of macrophages to a pro-inflammatory phenotype, enhancing the release of inflammatory cytokines and delaying hematoma resolution. The mechanism of both findings is mediated though the increased influx of Ca2+ via reorganization of the cytoskeleton. A timely conversion of pro-inflammatory macrophages to their inflammatory resolving prototype, while allowing the initial inflammatory response to perform critical neuron protective actions, may greatly improve patient outcomes. Conclusions: With data suggesting better results with inflammatory cytokine inhibition, enhanced angiogenesis, and phagocytic activity as a result of Piezo1 inhibition, it appears that optimally timed Piezo1 inhibition may be a promising future direction for ICH research.

81. Reactive Oxygen Species Production in UVB-Exposed Skin Organoids: A Comparative Analysis

Naresh Mahajan, PhD Shay Soker, PhD

Gorkun, Anastasiya; Soker, Shay; Atala, Anthony
Wake Forest Institute Regenerative Medicine (WFIRM)
Clinical Science - Fellow

Introduction: “Organoids,” intricately designed miniature 3D structures replicating specific organs or tissues, have ushered in a transformative era in biomedical research. These simplified models have dramatically enhanced our ability to scrutinize a myriad of physiological and pathological processes within a precisely controlled environment. Skin organoids emerge as a groundbreaking and versatile platform, holding exceptional promise. They serve as a pivotal tool/platform for delving into the effects of ultraviolet B (UVB) radiation on the production of reactive oxygen species (ROS), a central mechanism in comprehending skin damage, with the potential to redefine the landscape of dermatological research. Materials and Methods: Our study centers on the innovative application of skin organoids as a model for investigating how UVB radiation influences the production of ROS. These organoids incorporate six distinct skin cell types and are subjected to a variety of UVB regimens. Our experimental approach encompasses diverse groups, including a negative control to unequivocally verify the absence of UVB exposure, a positive control employing Menadione as a well-established inducer of ROS, and different durations of acute and chronic UVB exposure. Prior to UVB exposure, these skin organoids undergo a maturation period of seven days, simulating the natural development of skin. Our assessment involves the vigilant monitoring of ROS levels at hourly intervals using incucyte technology, complemented by the utilization of the CELLROX® Deep Red reagent. Results: The results revealed dynamic changes in ROS levels over the course of UVB exposure in different experimental groups. Notably, the chronic UVB exposure group exhibited distinct ROS patterns compared to the acute exposure groups. The control group showed minimal changes in ROS production throughout the experiment, validating the absence of UVB exposure. The Menadione group exhibited a consistent increase in ROS production, indicating the effectiveness of the ROS inducer. Acute UVB exposure groups (30 min, 60 min, and 120 min) displayed varying degrees of ROS production, with a notable peak at different time points. The chronic UVB exposure group (two doses of 4.5 minutes each) demonstrated a unique ROS profile, with a sustained increase in ROS levels compared to the acute groups. Conclusions: These findings suggest that skin organoids respond differently to acute and chronic UVB exposure, leading to distinct ROS production patterns. This study provides valuable insights into the complex relationship between UVB radiation and ROS production in skin organoids, offering potential avenues for future dermatological research and skin protection strategies.
Keywords: Skin organoids, UVB radiation, Reactive oxygen species, Cellular response, Dermatological research

82. Is it time to redefine afferent limb syndrome in ileal pouch-anal anastomosis?

Bigyan Mainali, MD Jean Ashburn, MD

Jean Ashburn Alton Sutter
Surgery-General
Clinical Science - Resident

Background: Afferent limb syndrome (ALS) has been historically described, in a limited manner, as the positioning of the most distal segment of the ileum in a position posterior to the ileal pelvic pouch (IPAA), thus causing an obstructive pattern of symptoms. We posit that this diagnosis is, in fact, quite diverse in presentation and the definitive management can be surgically complex. We aim to highlight this complexity by revealing its clinical features and management. Methods: Using our prospectively maintained database, we identified patients who underwent IPAA requiring a revision in our institution by a singlesurgeon. The demographic, clinical, endoscopic, and radiographic features together with management strategies and outcomes were studied. Results: In this case series, we studied a sub-set of patients who underwent IPAA revisions for pre-pouch pathologies. We highlight three patients who representkey sub-categories of pathologies that are all traditionally classified as ALS. These patients’ pathology included: A 23yo female with classic ALS with chronic kinking of the afferent limb posterior to the IPAA contributing additionally to a pouch body intussusception, A 30yo female with an internal herniation and pouch ischemia due to acute on chronic rotation of the small bowel mesentery with extrinsic compression of the afferent limb where the afferent limb herniated underneath the cut edge of the small bowel mesentery forming a complete obstruction, and a 27yo male with fibro-stenosis of the afferent limb likely related to his Crohn’s disease. Each patient underwent targeted surgery based on their surgical presentation: with resection of angulated bowel with pouch revision and pouchopexy, lysis of adhesions with pouch mobilization and small bowel fixation, and small bowel resection and primary anastomosis respectively. Conclusions: The presentation of pre-pouch pathologies that have historically been grouped together as ALS in patients after IPAA can be markedly varied and diverse. This subset of patient presentations highlights

not only the importance of accurate diagnosis of pouch dysfunction, but also the need to better describe the syndrome. Many patients require surgical therapy for definitive fixation, and accurate identification of the pathology is paramount for successful surgical correction.

83. A Paired Comparison of Outcomes in Therapeutic versus Prophylactic Breasts Following Bilateral Mastectomy with Deep Inferior Epigastric Perforator (DIEP) Flap Reconstruction

Jacob Maus, MD Michael Robinson, MD

Mary L Duet, Marion Tapp, Robert Gallagher, Samuel Kogan, Thomas Steele, Bennett Calder, Michael Robinson
Surgery-Plastic & Reconstructive
Clinical Science - Resident

Background: The incidence of reconstruction and the decision to undergo contralateral prophylactic mastectomy are closely related yet studies show contradictory complication rates when comparing therapeutic versus prophylactic sides and mainly focus on implant-based breast reconstruction. The purpose of our study is to compare outcomes in the therapeutic versus prophylactic breast following bilateral mastectomy and DIEP flap reconstruction. Methods: A single-institution retrospective review was conducted of women undergoing autologous breast reconstruction following bilateral mastectomy for treatment of a unilateral breast cancer between January 2019 and March 2022. Patient demographics, medical history, and postoperative complications were collected. A total of 263 patients (526 breasts) met inclusion criteria. A paired analysis was performed using repeated measures logistic regression. Results: 263 patients with unilateral breast cancer underwent a bilateral mastectomy with DIEP flap reconstruction. 33% of patients had at least one surgical complication. 12.6% of patients developed complications on the prophylactic side, 14.1% of patients on the therapeutic side, and 7.2% of the population developed a complication bilaterally. Paired analysis comparing reconstruction of the therapeutic versus prophylactic mastectomy side revealed no increased risk of overall complications (p=0.65) or isolated complications. Conclusion: This represents the largest paired analysis of surgical outcomes between therapeutic and prophylactic breasts following bilateral autologous DIEP flap reconstruction. Our analysis showed comparable rates of overall complications per side despite more aggressive oncological treatment on the therapeutic breast. Patients should be counseled on the risks associated with contralateral prophylactic mastectomy and subsequent DIEP breast reconstruction as it is not without risk.

84. Reversal of clinical botulism by the modulation of central and peripheral neurological circuits

William McClinticf, PhD Patrick Michael McNutt, PhD

Zachary D. Chandler, Sean W. O'Brien, Alan Jacobson, and Patrick M. McNutt
Wake Forest Institute Regenerative Medicine (WFIRM)
Clinical Science - Fellow

Botulinum neurotoxin (BoNT) is a highly potent microbial toxin that blocks release of acetylcholine from neuromuscular junctions (NMJs), causing muscle paralysis and death by asphyxiation at lethal doses. Although botulism is rare in humans, with approximately 150 cases per year in the United States, largescale intoxication can result from accidental or deliberate exposure to contaminated foods or aerosols. The only approved pharmacotherapy for botulism is post-exposure prophylaxis with anti-botulinum antibodies (a.k.a. antitoxin), which terminate exposure by neutralizing the toxin in the bloodstream.However, respiratory motor neurons often internalize paralytic amounts of BoNT during the latent period between exposure and symptomatic manifestation. Consequently, approximately 70% of patients who receive antitoxin after symptomatic emergence will require mechanical ventilation for survival. We recently reported that the FDA approved drug 3,4-diaminopyridine (amifampridine) is a potent reversal agent for respiratory paralysis caused by botulism. 3,4-DAP prolongs action potential duration by reversibly blocking voltage-gated potassium channels (VGKC), facilitating presynaptic Ca2+ influx and increasing acetylcholine release. We found that 3,4-DAP restores neurotransmission in intoxicated NMJs by increasing the number of sites activated to release acetylcholine during action potentials, thus directly addressing the pathophysiology caused by botulism. In rodent models of botulism, bolus administration of 3,4-DAP rapidly reverses toxic signs of botulism, while continuous infusion for two weeks had antidotal effects, allowing survival from lethal doses without symptomatic rebound after 3,4- DAP withdrawal. Although the therapeutic effects of 3,4-DAP are assumed to be caused by reversal of paralysis at the diaphragm NMJs, the resulting effects on respiration are not understood. Here, we combined unrestrained whole-body plethysmography (UWBP) with arterial blood gas measurements to study the effects of 3,4-DAP

and other aminopyridines on ventilation and respiration in mice at terminal stages of botulism. Treatment of symptomatic mice with clinically relevant doses of 3,4-DAP restored ventilation in a dose-dependent manner, producing significant improvements in tidal volume, respiratory rate, and minute volume. Concomitant with improved ventilation, 3,4-DAP treatment reversed botulism-induced respiratory acidosis, restoring CO2 and blood pH to normal physiological levels within 30 min. Having established that 3,4-DAP-mediated improvements in ventilation are correlated with improved respiration, we next used UWBP to quantitatively evaluate eight structurally related aminopyridines for therapeutic efficacy in BoNT-intoxicated mice. Multiple aminopyridines were identified with similar or improved therapeutic efficacies compared to 3,4-DAP. Notably, some aminopyridines preferentially enhanced tidal volume, while others preferentially enhanced respiratory rate. We interpret these results to indicate that aminopyridines can directly or indirectly modulate central respiratory circuits, as well as facilitate neurotransmission at the NMJ. In addition to contributing to a growing body of evidence supporting the use of aminopyridines in the treatment of clinical botulism, these findings are expected to inform the development of aminopyridine derivatives with improved pharmacological properties for the treatment of multiple neuromuscular indications.

85. Bioprinting Smooth Muscle Cells on Electrospun Scaffolds for the Development of Tissue-Engineered Small Intestine

Bailey McCollum, MS Mitchell Ladd, MD, PhD

Kaushik Katragadda, Wei Nie, Jin-Oh Jeong, Anthony Atala, Sang Jin Lee, Marshall Schwartz, and Mitchell R. Ladd
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Student

Background: Short bowel syndrome (SBS) is defined as not having enough small intestine to absorb calories and nutrients for growth. One of the main causes of SBS is surgical resection of the small bowel which can be necessary for various disease processes. Necrotizing Enterocolitis (NEC) is a disease of premature infants which results in inflammation of the intestinal wall due to bacterial invasion which ultimately causes the bowel to die. The substantial loss of surface area that occurs in intestinal resections for NEC, puts these infants at risk of developing SBS. Tissue engineering of the small intestine (TESI) has emerged as a potential solution for SBS. Tissue engineering techniques combine a 3D scaffold with cells to re-create the structure and function of tissues and organs. The overall objective of this project is to develop functional segments of TESI. For TESI constructs to be functional they must absorb nutrients and undergo peristalsis. We have developed electrospun scaffolds with circumferentially aligned fibers that encourage circumferential alignment when seeded with intestinal smooth muscle cells. The scaffolds are currently statically seeded which is inefficient and not uniform. We sought to improve the construct seeding technique. Hypothesis: The goal of this study is to develop a cell bioprinting method for seeding TESI constructs. Bioprinting uses a computer-aided process to print a 3D scaffold or cells. We hypothesize that using bioprinting to seed the electrospun scaffolds will provide better control, automation, and tissue formation in the creation of TESI compared to statically seeded scaffolds. Methods: Tubular scaffolds were made by electrospinning an 18% w/v solution of polycaprolactone and collagen 1:1 blend dissolved in hexafluoro-2-proponal onto a 6 mm mandrel Scaffolds were characterized with electron microscopy, porosity measurements, and tensile testing. The in vitro degradation rate of the scaffolds was determined incubation in a medium of bile salts and pancreatic enzymes for 6 weeks at 37°C. Changes to fiber size, porosity, and tensile strength were characterized. Intestinal smooth muscle cells (SMCs) were isolated using a previously established protocol. Finally, GelMa bioink was printed onto electrospun scaffolds. Results: Mean fiber diameters, Young's modulus, and percent porosity were not statistically significant. Mean mass degradation at baseline (483 mg +/- 40.35 mg) was statistically different from week 2 (393.7 mg +/- 80.54 mg) but not week 4 (402.9 mg +/- 90.51 mg) or week 6 (412.2 mg +/-66.46 mg). Strain at failure (SAF) mean values showed statistically significant differences between each time point with baseline (466.7% +/- 271.7%), week 2 (102.1% +/- 54.57%), week 4 (59.73% +/- 36.56%), and week 6 (48.17% +/- 18.04%). Ultimate tensile strength (UTS) mean values showed statistically significant differences between each time point with baseline (1.665 MPa +/- .5262 MPa), week 2 (0.6600 MPa +/- .3288 MPa), week 4 (0.5567 MPa +/- .2191), and week 6 (0.5050 MPA +/- .1846 MPa). We successfully printed GelMA bioink onto our electrospun scaffolds showing proof of concept. Conclusions: We have demonstrated our ability to fabricate tubular scaffolds for TESI with aligned fibers. They maintain their properties in degradation media over 6 weeks in vitro except for a decrease in UTS and SAF. SMCs were isolated, but technical challenges remain. We have demonstrated the ability to print GelMA bioink onto electrospun scaffolds. Future work will print SMCs on electrospun constructs and compare cell viability, seeding efficiency, and tissue formation to statically seeded constructs in vitro.

86. Development of a Sensor-Integrated Uniaxial Bioreactor for Maturation of Muscle Tissue

Adit Mehta, MS James J. Yoo, MD, PhD

Po-Feng Lee, Eric Renteria, Frank Marini, Ji Hyun Kim, Tracy Criswell, Thomas Shupe, Anthony Atala, Joshua Hunsberger, Metin N. Gurcan, Shay Soker, Young Min Ju, James J. Yoo
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Fellow

Introduction: Bioreactors play a crucial role in moderating the dynamic conditioning of engineered tissues. Integrating modern technologies such as cellular stimulators and sensors into bioreactors can enhance tissue development under physiological conditions. This study aimed to develop a standardized self-contained uniaxial bioreactor module for the clinical production of engineered tissue constructs that benefit from unidirectional mechanical and/or electrical stimulation. Methods: To achieve this goal, we have incorporated stimulation and sensing components into the bioreactor design to promote the maturation of muscle tissue construct while maintaining a stable culture environment. The constructed multifunctional uniaxial bioreactor features integrated mechanical and electrical stimulation systems that are easily programmable alongside a force measurement capability. Furthermore, the system includes a sensor loop and a media exchange function to continuously monitor the stability of the culture environment and cellular metabolites over time. An integrated camera system allows for real-time visualization of the tissue maturation process. A media exchange system incorporated into the bioreactor platform is designed to maintain normal physiological conditions over a prolonged time. Results: The multi-functional uniaxial bioreactor was tested and validated using native and tissue-engineered muscle constructs. All the bioreactor hardware and software components are appropriately operated as intended. The feedback from all sensors ensured the desired protocols were generated for the tissue stimulation. Both native and tissue-engineered muscle constructs showed superior tissue morphology and cellular differentiation compared to the non-stimulated control groups. Conclusion: These results validate the effectiveness of the multifunctional uniaxial bioreactor in enhancing muscle cell growth, differentiation, and tissue maturation. This bioreactor may serve as a standard platform for biomanufacturing of tissues which benefit from unidirectional stimulations.

87. Outcomes and Complications of Internal Jugular Vein Stenting in Symptomatic Cerebral Venous Outflow Disorders: A Case Series

Jackson Midtlien, MS Kyle M. Fargen, MD, MPH

Kyle M. Fargen Katherine Belanger Edward Hepworth Ferdinand K. Hui
Surgery-Neurosurgery
Clinical Science - Student

Introduction: Idiopathic intracranial hypertension (IIH) has gained attention due to the recognition of transverse sinus stenosis as a cause of intracranial venous hypertension. This has led to increased interest in understanding and treating cerebral venous outflow disorders (CVD), including internal jugular vein (IJV) stenosis. The aim of this case series is to examine the outcomes and complications associated with IJV stenting in patients with symptomatic CVD. Objective: Examine the outcomes and complications associated with internal jugular vein (IJV) stenting to assess its efficacy and safety in treating CVD. Methods: Between 2019 and 2023, a total of 33 IJV stenting procedures were performed on 29 patients with CVD. The majority (85%) involved isolated IJV stenting under conscious sedation, while 15% included concomitant transverse sinus stenting under general anesthesia. Thirteen patients underwent IJV stenting after open IJV decompression and styloidectomy. The procedures were evaluated based on patient characteristics, stenting location, pre- and post-stenting pressure gradients, and clinical outcomes. Results: The study cohort comprised predominantly male patients (86%) with a mean age of 33.2 years. Temporary ipsilateral neck or ear pain, fullness, and swallowing discomfort were commonly reported post-stenting. Peri-procedural complications occurred in 33% of cases, including intracardiac stent migration and temporary or persistent shoulder pain/weakness. While approximately 75% of patients demonstrated improvement after stenting, only 36% experienced durable improvement over a mean follow-up period of 4.5 months. Notably, 39% of patients reported no symptomatic improvement or experienced worsening following IJV stenting. Conclusions: This study demonstrates potential benefits and complications associated with IJV stenting. Although many patients showed initial improvement, long-term outcomes were less favorable. High complication rates encourages cautious patient selection and consideration of alternative approaches, such as open surgical IJV decompression with styloidectomy. A further understanding of the factors influencing treatment outcomes is needed to develop more effective and safer interventions for patients with CVD.

88. Symptom Resolution and Recurrence in Ventriculoperitoneal Shunting for Refractory Idiopathic Intracranial Hypertension: A Long-Term Outcome Analysis

Jackson Midtlien, MS Kyle M. Fargen, MD, MPH

Nicholas R. Kiritsis, Lucas A. Klever, Kyle M. Fargen, Jennifer B. Aldridge
Surgery-Neurosurgery
Clinical Science - Student

Introduction: Idiopathic intracranial hypertension (IIH) is a debilitating condition associated with symptoms such as pulsatile tinnitus, chronic headaches, and papilledema. Ventriculoperitoneal (VP) shunting has historically been recognized as a treatment option for medically-refractory IIH, but limited research exists on its long-term outcomes. Objective: This study aims to analyze the long-term outcomes of VP shunting in patients with medically-refractory IIH. The focus is on symptom resolution, recurrence, and persistence as key outcome measures. Methods: A single-center, single-operator database was used to retrospectively analyze 45 patients who underwent VP shunting as their first interventional treatment for IIH. Demographic data, diagnostic tests, follow-up dates, and symptom improvement were recorded. The presence of papilledema and additional surgical interventions were also noted. Results: Out of the 45 patients who underwent VP shunting, 71.1% experienced initial symptom relief followed by recurrence, and 17.8% reported persistent symptoms without improvement. The average follow-up time among the cohort was 337 days. Repeat lumbar puncture (LP) was performed in 96.9% of patients with recurrent symptoms, showing a mean decrease in opening pressure (OP) of 7.5 (9.0) cm H2O compared to initial LP. Additional interventions, such as shunt reprogrammingand venous sinus stenting (VSS), were noted in the majority of patients. Variable presentations of ventricular collapse on follow-up CT scans were also noted to be prevalent in the cohort. Conclusions: This study reveals high rates of symptom recurrence and persistence in patients who underwent VP shunting for medically-refractory IIH. The observed frequency of repeat LPs and additional interventions, as well as the irreversible drainage and collapse of the ventricular system further support the observed limitations of VP shunting as a long-term treatment option. Further research on alternative interventions are necessary to improve the management of IIH in these cases.

89. Non-White Race Is Associated With Higher Risk Of Amputation In Patients With Lower Wifi Scores

Caroline Minnick

Gloria Sanin, Ashlee Stutsrim, Tim Williams, Gabriela Velazquez, Cody Blazek, Matt Edwards, Matt Goldman
Surgery-Vascular & Endovascular
Clinical Science - Student

INTRODUCTION Chronic wounds represent a significant source of debilitation and morbidity and disparate outcomes have been shown based upon multiple racial, socioeconomic, and patient-specific factors. This study explored the outcomes of patients d evaluated by an inpatient limb preservation service, particularly focusing on the relationship between race and amputation METHODS A retrospective review of prospectively-collected data was performed evaluating patients seen by the Limb Preservation service at a large academic medical center between 2018 and 2023. Wound, Ischemia, foot infection (WIfI) scores, demographics, and outcomes were collected on the cohort. Patients were categorized into two racial/ethnic groups: “non-white” (including Hispanics and those with unknown race/ethnicity) and “white” (non-Hispanic) Associations between race/ethnicity and amputation outcomes (including potential two-way interactions with other factors) were examined using logistic regression models. RESULTS 731 patients were evaluated. 37% were female and 36% were non-white/non-Hispanic. There was no difference in WIfI scores based on race or ethnicity. 62% of non-white participants and 56% of white participants had moderate/high WIfI amputation risk scores. Minor amputations occured in 20% of patients, and 17% underwent major limb amputations. Nonwhites experienced higher rates of both minor (25% vs. 17%,p=0.012) and major amputations (26% vs. 13%, p<0.0001). Intervention/revascularization rates were similar between groups. Higher WIfI score was associated with an increased risk of any amputation compared to lower WIfI scores [47% vs. 8%, OR 10.9 (6.7-17.7)]. In multivariable models non-white race was significantly associated with risk of any amputation at the very low, low, and moderate risk WIfI scores (OR 4.9, 95% CL (1.0-35) at WIfI=1; OR 8.5, 95% CL 2.4-41 at WIFI=2; OR 2.3, 95% CL 1.1-4.9 at WIfI=3). There was no difference in amputation risk between race/ethnicity groups at the “high risk” WIfIscore (OR 1.0, 95% CL 0.6-1.7 at WIfI=4); race/ethnicity×WIfI interaction P=0.010. Non-white patients with lower WIfI (stage 1 or 2 vs. 3 or 4) were significantly more likely to receive a minor amputation (OR 5.5 (1.5-26) vs. 1.3 (0.8-2.2)) and major amputation (OR 8.2 (2.0-55) vs. 1.5 (0.9-2.6)) when compared to their white counterparts.

CONCLUSIONS Non-white race was significantly associated with adverse limb events, irrespective of WIfI amputation risk score which is consistent with previous research. However, our findings suggest non-white patients appear to be at significantly higher risk for minor/major limb amputation at lower WIfI scores when controlling for common risk factors. The underlying reasons for this disparity remain unclear, emphasizing the need for further investigation and highlighting the potential impact of WIfI scores in risk stratification and clinical decision-making. Future research is needed to elucidate the underlying mechanisms contributing to these disparities and develop effective strategies to address and mitigate racial disparities in patients with lower extremity wounds.

90. Blood Profiling Reflects Alternative Gene Expression Following Renal Transplantation with DCD and AKI Allografts

Alexandra Monetti, BS Giuseppe Orlando, MD, PhD

Surgery-Transplant
Basic Science - Student

Background: Due to the pathophysiology of donation after cardiac death (DCD) and acute kidney injury (AKI) organ donation, DCD and AKI renal allografts are more likely to experience delayed graft function (DGF), while renal grafts from living donors (LD) typically function immediately. The majority of DGF grafts will eventually resume 'normal' physiological activities. Hypothesis: It is hypothesized that gene expression profiling in peripheral blood from patients who have undergone kidney transplantation will provide insights regarding graft repair and regeneration. Methods: Thirteen kidney transplant patients consisting of 4 LD, 5 DCD, and 4 AKI were stratified into early graft function (EGF) or DGF phenotypes. Blood samples were collected from patients on the day of the transplant (D0) and at various time points in the first 30 days following transplantation. Transcriptome analysis (RNA-seq) was performed on peripheral blood samples. Following normalization, data were grouped by time period for each stratification group (EGF: D1, D2, D3, D6-11, D14-20, D23-28 and DGF: D1, D2, D3, D4, D7-12, D17-21, and D23-30) and expression values for each individual were compared to D0 to identify changes in gene expression compared to baseline. Following ANOVA to identify differentially expressed transcripts between AKI/DCD and LD recipients, enrichment and comparison analyses were performed to identify annotated biological pathways altered, over time, by renal transplant. Results: On Day 0, EGF samples seem to cluster separately from DGF specimens, however, the covariate LD, AKI or DCD on D0 does not produce any specific aggregation. From the ANOVA-like output, 694 and 2985 differently expressed genes were detected for DGF and EGF groups respectively, when comparing post-transplantation samples with respect to D0. For both the EGF and DGF groups, differential expression nearly disappeared after day 7. Conclusions: This data suggests that there are differences in the gene expression, depending on the functionality of the renal allograft, as early as day 0 post transplantation. Gene expression remains elevated through the first week after surgery, in both the EGF and DGF groups of DCD/AKI donors suggesting repair and regeneration activities are occurring in these patients during this time. Validation of these findings may allow for the identification of therapeutic targets to enhance regeneration and repair of the damaged allograft.

91. SMALL FIBER POLYNEUROPATHY IS COMMON IN NON-BLADDER CENTRIC INTERSTITIAL CYSTITIS/BLADDER PAIN SYNDROME

Mary Namugosa. MD Stephen J Walker, PhD

Rory Ritts, Robert Evans, Gopal Badlani, Stephen J Walker
Surgery-Urology
Basic Science - Resident

Introduction & Objective: Small fiber polyneuropathy (SFPN) is a condition resulting from damage to Adelta and C sensory nerve fibers that plays a role in pain and temperature perception. While SFPN is known to be a common finding in fibromyalgia and irritable bowel syndrome (IBS), we have also shown that approximately 30% of interstitial cystitis/bladder pain syndrome (IC/BPS) patients exhibit SFPN, making it a potential therapeutic target. The goal of this study is to determine how SFPN fits into the overall IC/BPS clinical picture. Methods: 172 IC/BPS patients (152 F; 20 M) undergoing therapeutic hydrodistension were enrolled in this study. A 3mm punch biopsy was obtained from the mid-calf, processed, stained, and read by a dermatopathologist to determine linear intraepidermal nerve fiber density (IENFD). Co-occurring diagnoses were charted from patient reports and medical records. Univariate analysis was conducted to compare demographics and clinical characteristics of participants with and without SFPN and logistic regression was performed to identify the variables

that impacted the dependent variable SFPN. Results: Of the 172 participants, 58 (34%) were identified to have an IENFD indicative of SFPN based on normative reference ranges that account for age and gender. Notably, 139 (80.8%) had an IENFD less than the median for their demographic. The average age for all participants was 50.74 (±15.0). Age, bladder capacity (BC), and the total non-urologic associated syndromes did not differ significantly based on SFPN status. Logistic regression identified race (OR 3.66, CI 1.223-10.921), HL status (OR 0.176, 0.038-0.820), chronic fatigue syndrome (CFS: OR 6.541, CI 2.188-19.55), migraines (OR 0.233, CI 0.089-0.606) and diabetes mellitus (DM: OR 3.680, CI1.25-10.87) to be correlated with SFPN. Conclusions: SFPN is an important clinical finding in a significant proportion of IC/BPS patients and is likely to co-occur with CFS, but not HL. This suggests that SFPN+ in IC/BPS is associated with a systemic pain disorder phenotype rather than a bladder-centric disease phenotype.

92. 4 axis bioprinting with metamaterials and dual-crosslink bioink for tubular tissue regeneration

Wei Nie. PhD Anthony Atala,MD

Carlos Kengla, Teresa O Ekerhult, Michael Seeds, James Yoo
Wake Forest Institute Regenerative Medicine (WFIRM)
Clinical Science - Fellow

3D bioprinting has received widespread attention in the regenerative medicine due to its excellent customization and patterning ability to integrate cells. Various 3D bioprinted tubular tissues have begun to be used in the repair of trachea, blood vessels and ureters. However, the fragile mechanical properties of traditional bioinks inherently limit their integration into defect sites. Moreover, the long printing time of traditional 3D bioprinting poses a great challenge to the survival rate of subsequent cells. In this research, a 4-axis bioprinting method combining electrospinning, metamaterials, and toughnessenhancing dual network hydrogels is reported. Cell-laden tubular tissues with different structural and mechanical properties were prepared through this newly developed method. Smooth muscle and endothelial cells were arranged hierarchically in the prepared tubular structure and maintained good survival rate in the bioreactor for one month. By introducing a metamaterial structure, the printed tube has flexibility close to that of tubular tissue in vivo and matching mechanical strength. The combination of different materials makes the printed tubular tissue have excellent suture ability and fatigue resistance. More importantly, the entire printing process is very fast. A 5 cm diameter 1 mm tubular tissue was printed in 3 minutes, which is much faster than previously reported tubular tissue printing. Therefore, the developed 4-axis bio-printed tubular tissue based on metamaterial structure and fatigue-resistant dual network hydrogel has great potential in the field of tubular tissue regeneration.

93. Development of a Combined Melanoma/Skin Organoid System to Study Tumor-Stroma Interactions

Gemma Nomdedeu-Sancho, MS Christine Ahn, MD

Anastasiya Gorkun, Naresh Mahajan, Christine Ahn, Anthony Atala, Shay Soker
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Student

Current in vitro melanoma models fail to represent the skin's cellular and structural complexity. Cancer interaction with the tumor microenvironment - specifically cancer-associated fibroblasts (CAFs) - can impact growth and immune response, affecting immunotherapy efficacy. Developing physiologically and architecturally accurate melanoma models is crucial to studying the crosstalk between cancerous and healthy cells that impacts the tumor's response to therapy. We incorporated an aggressive melanoma cell line into spherical layered skin organoids to generate in vitro 3D combined melanoma-skin organoid systems that can be used to simulate melanomagenesis and dermal invasion, explore tumor-stroma interactions, test therapies, and identify early melanoma biomarkers. Melanoma foci quickly proliferated and migrated outside the healthy skin organoids. Harnessing the migratory capacity of melanoma cells, we embedded the organoids in a dermis-like fibroblast-ladden collagen gel. Tumor cells rapidly invaded the gel, thus reproducing melanoma dermal invasion. This model allowed us to analyze the expression of CAF-specific markers and assess melanoma-induced transformation of fibroblasts to support tumor progression. We created a spherical layered melanoma-skin organoid system, which can serve as an in vitro model to study melanoma progression in a three-dimensional realistic environment. By incorporating patient-derived melanoma cells, we expect to enhance our understanding of therapy resistance and improve personalized melanoma treatment.

94. The Role of Prolonged Operative Time, Gender, and Other Risk Factors in Total Knee Arthroplasty Complications

Ayobami Ogunsola, MD Xue Ma, PhD

Marcel G. Brown Leslie Granados Xue Ma
Surgery-Orthopedics
Clinical Science - Fellow

Introduction: Osteoarthritis (OA) is a leading cause of disability in the United States, affecting 32.5 million adults and accounting for $16.5 billion in healthcare spending. This study aims to identify risk factors that increase the risk of complications among patients with knee OA who have undergone arthroplasty procedures. Methods: A total of 194 patients who underwent total knee arthroplasty (TKA) at Davie Medical Center had their charts reviewed retrospectively. Postoperative complications, including superficial wound infection, deep wound infection, wound dehiscence, prolonged postoperative pain, and deep vein thrombosis, were grouped together as 'any complication'. Predictor variables considered in this study included age, gender, smoking history, diabetes, hypertension, chronic kidney disease, as well as Staphylococcus aureus, MRSA (Methicillin-Resistant Staphylococcus aureus) positive nasal swab results. The study employed a Lasso logistic regression model with cross-validation to determine the optimal model Results: The results revealed that males have lower log-odds (coefficient of -0.29652) of experiencing any complications compared to females. A positive preoperative nasal swab with S. aureus or MRSA prior to TKA is associated with lower log-odds (coefficient of -0.8961) of experiencing any complications post TKA, compared to those who tested negative. Non-white individuals have higher log-odds (0.7696) of developing any complications post TKA compared to White individuals. Non-diabetic patients have lower log-odds (-0.0548) of developing any complications after TKA compared to diabetic patients. Additionally, an increase in operative time is associated with an increase in the log-odds (coefficient of 1.6209) of developing any complications post TKA. Hypertension and other cardiovascular diseases are factors that increase the log-odds of complications after TKA. Discussion/Conclusion: Prolonged operative time, female gender, diabetes, racial identity as non-white, hypertension, and a previous diagnosis of any other cardiovascular disease may increase the risk of developing any complication following TKA. Positive preoperative nasal swab test was shown to decrease the risk of developing any complication post TKA. This may be due to the use of prophylactic antibiotics prior to surgery. Further studies are necessary to elucidate the mechanisms of these associations.

95. Colonic Radiographic Patterns in Children with Vesicoureteral Reflux who Underwent Surgical Intervention with Ureteroneocystotomy

Tyler Overholt, MD Steve Hodges, MD

Daniel, Atala, Colaco, Hodges
Surgery-Urology
Clinical Science - Resident

Introduction: The association between constipation and vesicoureteral reflux (VUR) is well established. Rectal dilation is an objective radiographic finding indicative of constipation chronicity and severity. We assessed radiographs for stool burden patterns and presence of megarectum in children with VUR refractory to conservative therapy. Methods: A ten-year retrospective analysis of pediatric patients with VUR identified on voiding cystourethrogram (VCUG) who underwent ureteroneocystostomy at a single tertiary care center was performed. Patients with any co-existing neurologic diagnoses were excluded from this analysis. Demographic and clinical data were recorded. Plain film abdominal radiographs were reviewed for stool burden pattern, as well as for rectal diameter and recto-pelvic ratio (RPR). Megarectum was defined as RPR > 0.61. Quality control analyses were performed by a radiologist to ensure measurement accuracy Descriptive and bivariate statistics were performed as indicated. Results: A total of 89 patients were included. Median (IQR) age was 5 (3-6) years and 69.7% identified as female. The most common reflux grade was III (39.3%), followed by IV (34.8%). Bilateral VUR was identified in 53.9%. The most common stool burden pattern was a combination of right colonic and rectal (61.8%), followed by total colonic (21.3%) and rectal only (14.6%). The median rectal diameter was 4.4 (3.7-5.6) cm. The median RPR was 0.67 (0.53-0.74). A RPR > 0.61 was identified in 62.9%. There was no difference in age, BMI, gender, disease laterality, or VUR grade between patients with and without megarectum ($p > 0.05$). Conclusions: Megarectum is prevalent in patients with VUR, identified in 2 of every 3 patients who required surgical intervention over the last ten years. While constipation is a known risk factor for VUR and UTI's, it is often undertreated. This easily identifiable indicator of chronic constipation can be utilized to guide both counseling and management.

96. Postoperative Oxygen Saturation and Surgical-Site Infection after Major Non-Cardiac Surgery: A Retrospective Analysis

Jacqueline Palermo, BS Ashish Khanna MD, FCCP, FCCM

Ashish Khanna, Daniel Sessler, Amit Saha
Anesthesiology
Clinical Science - Student

According to data from the United States Centers for Disease Control, Surgical Site Infection (SSI) is the third most frequent nosocomial infection. SSI is defined as an infection that affects either the incision or deep tissue at the operation site up to 30 days after surgery. SSIs lead to extended hospitalizations, increased need for ICU admission, and higher morbidity and/or mortality. In the absence of continuous vital sign monitoring, postoperative hypoxemia is undetected and very common. Hypoxia would impair wound healing, oxidative killing by neutrophils, and production of superoxide radicals making patients more susceptible to infection. We sought to assess the association of continuously measured postoperative oxygen saturation on SSI in a cohort of patients recovering from major noncardiac surgery on hospital wards. This retrospective analysis looked at 1390 inpatient adults undergoing major non cardiac surgery at Atrium Health Wake Forest Baptist. Patients had continuous postoperative oximetry monitoring via the ViSi mobile portable monitoring system within the first 48 post operative hours or until discharge. For statistical analysis, postoperative SpO2 was analyzed using SAS version 9.4 and R 3.3.2. There was no significant association between postoperative incidence of hypoxemia measured by area under the threshold value of 90% oxygen saturation and the composite SSI outcome (odds ratio [OR], 1.0005 95% CI, 0.9994-1.0015 ; P = 0.396). Despite postoperative hypoxemia being common, there was no association of low oxygen saturation on a composite of adverse SSI outcomes. Further investigations may point to other modifiable risk factors for SSI outside of oxygenation.

97. Botulinum Toxin-A Injection Reduces Hospitalization Length in Post-Laryngectomy Pharyngocutaneous Fistulas

Kunjan Patel Christopher A Sullivan, MD

MARIA MASCIELLO CHRISTOPHER A SULLIVAN
Surgery-Otolaryngology (Dentistry)
Clinical Science - Resident

Introduction: Pharyngocutaneous fistula (PCF) is a common complication after Total Laryngectomy (TL), occurring in as many as 15-20% of previously non-irradiated patients. Most wounds (60-80%) close with non-surgical wound management such as packing or vacuum assisted therapy. Injection of Botulinum Toxin A (BoNT-A) into major salivary glands has been proposed as a low-risk tool to promote fistula closure by reducing saliva production. Among healthy patients, BoNT-A can reduce saliva production by 80% for up to 4 months. Data on its efficacy for PCF closure is lacking, with only 25 reported cases. The current study investigates salivary gland BoNT-A injection for PCF after TL and its effects on fistula closure rates and length of hospitalization (LOH). Methods: IRB-approved retrospective review of patients with T3/4 laryngeal squamous cell carcinoma undergoing TL and neck dissections without prior chemotherapy or radiation at a tertiary care center. BoNT-A was injected into bilateral submandibular glands within 3 days of developing PCF. Neck incisions were also opened, and all patients received local wound care with packing changes to the wound. PCF closure rates and LOH were recorded and compared with matched historical controls. Results: Six out of six patients (100%) achieved PCF closure without surgical management. Average time to PCF closure was 29.7 days. LOH was 12.1 days. Two-year stage-matched historical controls had PCF closure rates of 84% when managed non-surgically, with a 16.3 day LOH. Conclusion: BoNT-A injection for patients with PCF after TL reduces LOH and improves non-surgical PCF closure rate in this small sample. BoNT-A injection may provide a low-risk tool to aid management of PCF. A prospective study is underway to further evaluate the efficacy of BoNT-A in PCF management.

98. The Effect of the Strengthen Opioid Misuse Prevention Act on Opiate Prescription Practices After Breast Reduction

Abby Peoples, MD Lisa David, MD, MBA

Amelia Davidson Sabine Abukhadra Daniel Zaki Elsa Katarina Acosta Madison Hinson Lisa David
Surgery-Plastic & Reconstructive
Clinical Science - Resident

Introduction: In 2018, the Strengthen Opioid Misuse Prevention Act (STOP Act) was instituted in response to many opioid-related deaths in North Carolina. In 2017, there were 1,953 reported narcotic deaths, of which 659 were attributed to prescription opioids. Despite their efficacy in pain management, widespread opioid prescription poses life-threatening risks to patient populations. The STOP Act went into effect on January 1, 2020. Objective The goal of this study is to quantify the impact of the STOP Act on opioid prescriptions following breast reduction surgery at Wake Forest Baptist Hospital.
Methods: A retrospective chart review was performed to identify patients who have undergone breast reduction surgery procedures between January 1, 2016 and December 31, 2020 at Wake Forest Baptist Medical Center. Demographics, quantity and type of narcotics prescribed, and post-operative painrelated medical visits and phone calls were collected.
Results: Patients included 364 women, ranging in age from 15 to 76 (42.5, ± 16.3). Of this patient population, 92.5% were prescribed an opioid pain medication post-operatively. These patients were prescribed an average of 233.2 total milligram morphine equivalents (MME) postoperatively. There was a statistically significant difference in morphine equivalents prescribed before and after the enactment of the STOP Act. Prior, an average of 261.0 ± 149.6 MME was prescribed and after was 149.8 ± 67.9.
Conclusion: Opioids were prescribed post-operatively to nearly all breast reduction patients at Wake Forest Baptist Health from 2016 to 2020. The change in average MME prescribed postoperatively before and after the STOP Act would indicate that opioids were overprescribed to patients prior to 2020. We hope to analyze data from 2021 to present to further elucidate trends in opioid prescriptions following breast reduction surgery at our institution

99. Photothermal Ablation of Intracellularly Infected Cancer Cells

Spencer Phillips Nicole Levi, PhD

Sijia Liu Scott Northrup Nicole Levi
Surgery-Plastic & Reconstructive
Basic Science - Student

Background: Almost 200,000 people will be diagnosed with skin cancer this year. Recently it was shown that intracellular bacteria in cancer cells effects tumor metastasis by altering the cytoskeleton. Photothermal therapy (PTT) using silver nanoparticles (AgNPs) that absorb near infrared light is becoming an attractive therapeutic method for intracellularly infected cancers due to silver's antibacterial properties and AgNPs' ability thermally ablate cancer cells. Hypothesis: We hypothesized that AgNPs could induce sufficient heat to kill infected melanoma cells and intracellular bacteria upon exposure to infrared light. Methods: Triangular AgNPs containing a strong absorption at 800 nm were synthesized by reducing silver ions in the presence of silver seed solution. Melanoma cell line SKMel28 was infected with Staphylococcus aureus Xen40 stained with SYTO9. To measure the cytotoxicity of the AgNPs, non-infected and infected SKMel28 cells were treated with different concentrations (0, 1, 2.5,5 or 10 μg/mL) of AgNPs, respectively, and allowed to incubate at 37 ^{o}C for 2h or 24h. Cells were counted using a hemocytometer, and viability was normalized to cells incubated with media alone (0 μg/mL of AgNPs). To determine the response of infected and non-infected cell lines to PTT, non-infected and and infected SKMel28 cells were incubated with 0, 10, or 25 μg/mL of AgNPs for 24h and then treated with 5W of 800nm laser for 36s during a 2h total treatment time, with 20 minutes incubation between treatments (3 treatments total). Cells were allowed to recover for 24h, and then were counted with a hemocytometer. Viability was normalized to cells incubated with 0 mg/mL of AgNPs. Results: Cells infected with S. aureus had lower viability after incubation times than cells that were not infected. As concentration of AgNPs increased to 10 μg/mL, cell viability followed a decreasing trend. Similarly, as incubation time increased from 2h to 24h, both infected and non-infected SKMel28 cells saw a decreased viability across nearly all concentrations. SKMel28 cells that underwent PTT show a decreasing trend in viability compared to cells that did not receive PTT. As AgNP concentration increased to 25 μg/mL, cells saw a greater decrease in viability, with those treated with PTT seeing a reduced viability of almost 100%. Conclusions: As concentration of AgNPs and incubation time increased, toxicity to SKMel28 cells also increased, with the 10 μg/mL treated cells having the lowest cell viability after 24h. SKMel28cellsin-

fected with S. aureus responded best to treatment with AgNPs and PTT, seeing a cell viability reduction of roughly 97% at 25 µg/mL.

100. Comparative Physical Motion of Virtual Reality and Saw Bone Training for Tibial Shaft Intramedullary Nail Fixationt

Bryce Polascik, BS Kristen F. Nicholson, PhD

Samuel Rosas Bryce W. Polascik Blake T. Dunson Michael E. Seem Emily M. Potts Jason J. Halvorson Kristen F. Nicholson
Surgery-Orthopedics
Educational Science - Student

INTRODUCTION: Surgical training faces limitations due to variable factors involving time, patient population, institutional protocols, and resources such as saw bone (SB) models. Emerging technologies, including virtual reality (VR) training, aim to mitigate these challenges. However, studies to compare the physical motion of VR versus SB training are lacking. This study serves to evaluate the movements and timing of an intramedullary nail fixation case performed on a SB model to that performed on a VR simulation. METHODS: 7 orthopaedic surgery residents at Atrium Health Wake Forest Baptist participated in a tibial nail training sequence both on a SB model and a VR system. Both methods (SB and VR) were completed at least twice by each participant. Participants were fitted with a set of 14 retro-reflective tracking markers while a 12-camera, 100hz motion capture system collected real-time data. Tracking markers encompassed the trunk, shoulders, elbows, and wrists to evaluate full range of motion (ROM) and movement velocity. Statistical analysis involved sample comparison using two-tailed t-tests, with significance at $p<0.01$. RESULTS: A total of 62 different variables (48 ROM and 14 movement velocity) were analyzed. Of 62 total variables, only 20 (32.26%) exhibited a significant difference between VR and SB interventions ($p<0.01$). Of 48 ROM variables, 31 (64.58%) showed no difference between interventions ($p>0.01$). Of 14 movement velocity variables, 11 (78.57%) showed no difference between interventions ($p>0.01$). CONCLUSIONS: This study is the first-ever to demonstrate that the physical motion of VR training is similar to that of a SB model for intramedullary nail fixation surgery and supports the ability of VR to provide similar training to that of a traditional SB model. The growing utility and accuracy of VR simulations may prompt dialog surrounding its role in the future of surgical education for medical trainees and professionals.

101. DOES 4FACTOR-PCC IMPROVE OUTCOMES FOR MILD TRAUMATIC BRAIN INJURY PATIENTS ON FACTOR XA INHIBITORS?

Jessica Rauh, MD Jason Hoth, MD

Thompson A, Evangelista M, Torosian T, Miller P, Hoth J
Surgery-Trauma
Clinical Science - Resident

Background: 4-Factor Prothrombin Complex Concentrate (4F-PCC) has been demonstrated to be an effective reversal agent for patients taking Vitamin K antagonists; however, the efficacy of 4F-PCC for reversal in patients on Factor Xa inhibitors (XaI) is not clear. Specifically, the necessity of 4F-PCC reversal after mild traumatic brain injury in patients on XaI has not been studied. Our aim in this study was to determine whether the use of 4F-PCC impacts traumatic intracranial hemorrhage progression, clinical decline, or need for neurosurgical intervention in patients with mild traumatic brain injury who took XaI prior to injury. Methods: Retrospective review over 6 years at a level 1 trauma center of patients who were on Factor Xa inhibitors prior to injury who were diagnosed with mild traumatic brain injury per institutional guidelines. The patients were divided into 2 groups: those who received 4F-PCC and those who did not. Charts were reviewed for demographic, injury, and outcome metrics. Results: 140 patients were identified who meet criteria with 103 (74%) of these patients received 4F-PCC while 37 (26%) did not. There was no significant difference in age, gender, BMI, or GCS at admission between the two groups. Median injury severity score was higher in the groups that received 4F-PCC ($p<0.05$); however, the head abbreviated injury score was similar between the two groups (3.4 vs. 3.0, $p=0.05$). There was no significant difference in neurologic decline within 48 hours of admission or need for neurosurgical intervention between groups. Interestingly, there was no difference in intracranial hemorrhage progression between those who received 4F-

PCC and those who did not (16% vs 14, p=0.77). Patients who received 4F-CC had a longer length of stay and need for ICU admission (p<0.05). Conclusion: 4F-PCC is given to patients on XaI with traumatic brain injury in an effort to reduce intracranial hemorrhage progression and prevent neurologic decline. In this study, 4F-PCC given after mild traumatic brain injury did not impact hemorrhagic progression, neurologic decline, or need for neurosurgical intervention. Although limited in numbers, this study certainly suggests that 4F-PCC is not necessarily required in this patient population and that further studies are indicated.

102. Transcystic Laparoscopic Common Bile Duct Exploration for Pediatric Patients with Choledocholithiasis: A Multi-center study

Jessica Rauh, MD Lucas Neff, MD

Garrett Reid, Goeto Dantes, Hanna Alemayehu, Matthew T Santore, Marshall Wallace, Irving J Zamora, Kylie Callier, Bethany J Slater, Derek Krinock, Sabina Siddiqui, Robert Vandewalle, Amanda Witte, Katherine Flynn-O-Brien, Utsav Patwardhan, Romeo Ignacio, Jennifer Leslie Knod, Katerina Dukleska, Michael H Livingston, Stefan Scholz, Maggie Bosley, Lucas Neff
Surgery-Pediatrics
Clinical Science - Resident

Background Patients with choledocholithiasis are often treated with endoscopic retrograde cholangiopancreatography (ERCP) followed by laparoscopic cholecystectomy (LC). Upfront LC, intraoperative cholangiogram (IOC), and possible transcystic laparoscopic common bile duct exploration (LCBDE) could potentially avoid the need for ERCP. We hypothesized that upfront LC+IOC +/- LCBDE will decrease length of stay (LOS) and the total number of interventions for children with suspected choledocholithiasis. Methods A multicenter, retrospective cohort study was performed on pediatric patients (<18 years) between 2018 to 2023 with suspected choledocholithiasis. Demographic and clinical data were compared for upfront LC+IOC +/- LCBDE and possible postoperative ERCP (SF) versus preoperative ERCP prior to LC (EF). Complications were defined as postoperative pancreatitis, recurrent choledocholithiasis, bleeding, or abscess. Imaging studies included ultrasound (US), magnetic resonance cholangiopancreatography (MRCP), and computerized tomography (CT). Statistical analysis completed using Microsoft Excel and R software. Results Across seven institutions, 280 children with suspected choledocholithiasis were treated with SF (n=172) or EF (n=108). There were no differences in age, gender, or body mass index. Of the LCBDE patients (78/156), 82% had definitive intraoperative management with the remaining 18% requiring postoperative ERCP. Complications were fewer and LOS was shorter with OR1st (3/156 vs. 15/96; 2.81 vs 4.87 days, p<0.05). The SF group received fewer imaging studies than the EF group (1.2 vs 1.6; p<0.05). The number of US and CT scans was similar between the two groups (140/172, 81% vs. 78/108, 72%; p=0.07 and 17/172, 10% vs. 14/108, 13.0%; p=0.42). The SF group utilized significantly less preoperative MRCP (45/172, 26% vs 60/108, 56%; p<0.05). Conclusion A surgery first approach for children with choledocholithiasis is associated with fewer ERCPs, shorter LOS, decreased complications, and receive less diagnostic imaging, especially MRCP. Postoperative ERCP remains an essential adjunct for patients who fail LCBDE. Further educational efforts are needed to increase familiarity and the adoption of IOC and LCBDE in pediatric patients with suspected choledocholithiasis.

103. Preeclampsia Reduces Middle Cerebral Artery Resistance Post-Pregnancy in the Setting of Sustained Hypertension in Rat

Jonathan Ray, MS Liliya M. Yamaleyeva, MD, MS, FAHA

Xuming Sun, Hossam Shaltout, Victor M. Pulgar, Liliya M. Yamaleyeva
Surgery-Hypertension
Basic Science - Fellow

Preeclampsia (PE) is a pregnancy disorder characterized by new onset hypertension and end-organ dysfunction. The maternal cerebral vasculature is especially vulnerable to alterations and cerebrovascular disease remains the most common cause of morbidity in patients with PE. Dysfunctional maternal cerebral blood flow autoregulation and altered hemodynamics in PE may predispose to hyperperfusion-induced cerebral injury; however, the mechanisms remain incompletely understood. We evaluated whether exposure to a PE-like syndrome in transgenic rat (TGA-PE: female TG for angiotensinogen mated to male TG for renin) alters left middle cerebral artery (LMCA) hemodynamics in late-gestation (LG) or

post-pregnancy. Systolic (SBP) and diastolic (DBP) blood pressures and heart rate (HR) (by tail cuff; NIBP-8, Columbus Instruments) and LMCA pulsatility index (PI) (by transcranial Doppler (TCD); Vevo 2100), were performed in LG and at 2- and 5-months post-pregnancy. SBP and DBP were elevated in TGA-PE vs. Sprague-Dawley (SD) in LG (n=5-6), and at 2 (n=6-9), and 5 months (n=2-3) postpregnancy ($p<0.05$). HR was elevated in TGA-PE vs. SD in LG (493.5±10.6 vs. 392.5±14.2 bpm, $p<0.05$, n=5-6), but not at 2- or 5 months post-pregnancy. LMCA PI was lower in TGA-PE vs. SD at 2 months postpregnancy (1.01±0.07 vs 1.41±0.09, $p<0.05$, n=5-7) and tended to decrease in LG and at 5 months postpregnancy. There were no strain differences in LMCA blood flow velocities at any studied time point. There was a moderate-to-high negative correlation between PI and BP for TGA-PE (SBP: $r(3)=-0.566$, $p>0.05$; DBP: $r(3)=-0.761$, $p>0.05$) and a significant negative correlation between PI and HR for TGA-PE ($r(3)=-0.892$, $p<0.05$). In summary, PE-like syndrome in TGA-PE resulted in higher SBP and lower LMCA resistance versus SD at 2 months post-pregnancy. There was a negative correlation between blood pressure and LMCA resistance in TGA-PE suggesting dysfunctional autoregulation of cerebral blood flow similar to that seen in PE patients. Therefore, we conclude that the TGA-PE model may provide a suitable platform to investigate the mechanistic link between PE and development of cerebrovascular disease.

104. A Surgery First Approach to Acute Choledocholithiasis in Pediatric Patients in Low Resourced Weekend Hours, A Multi-Center Study

Garrett Reid, MS Lucas Neff, MD

Garrett Reid, Jessica L Rauh, Bonnie Laingen, Elizabeth Azar, Goeto Dantes, Marshall Wallace, Amelia Collings, Gloria D Sanin, Gabriel E Cambronero, Maggie E Bosley, Aravindh S Ganapathy, James W Patterson, Romeo Ignacio, Jennifer Leslie Knod, Bethany Slater, Kylie Callier, Michael H Livingston, Hanna Alemayehu, Katerina Dukleska, Stefan Scholz, Matthew T Santore, Irving J Zamora, Lucas Neff
Surgery-Pediatrics
Clinical Science - Student

Background Choledocholithiasis is increasingly managed with endoscopic retrograde cholangiopancreatography (ERCP) followed by laparoscopic cholecystectomy (LC), a surgery second approach. Intervention by ERCP can be limited on weekends. We hypothesize that a surgery first approach utilizing LC with intraoperative cholangiogram and possible laparoscopic common bile duct exploration (LC+IOC+/-LCBDE) decreases length of stay (LOS), time to intervention (TTDI), and MRCP usage for pediatric patients admitted after-hours (AH). Methods A multicenter, retrospective cohort study was conducted on pediatric patients between 2018- 2023 with suspected choledocholithiasis. Demographics, clinical data, and complications were compared. OR1st patients underwent LC+IOC +/- LCBDE, OR2nd underwent preoperative ERCP followed by LC. Business hours (BH) patients were admitted between Monday-Thursday. The AH group included patients admitted between Fridays, 00:00 - Sundays, 23:59. TTDI was defined as time to LC, patients that received interval LC were excluded. Results From four institutions, 252 pediatric patients were identified, 156 managed OR1st (91 BH, 65 AH) and 96 managed OR2nd (53 BH, 43 AH). LOS was shortest for OR1st BH followed by OR1st AH, both of which are shorter than OR2nd BH and AH (68.7h, 95.2h, 125.6h, 121.8h; $p<0.05$). TTDI was decreased in OR1st (OR1stBH 23.8h, OR1stAH 41.8h, OR2ndBH 58.0h, OR2ndAH 68.8h; $p<0.05$). The OR1st groups received less preoperative MRCPs, OR-2ndAH received the most (OR1stBH 23%, OR1stAH 18%, OR2ndBH 53%, OR2ndAH 56%; $p<0.05$). Conclusion Children with choledocholithiasis treated with an OR1st approach had a shorter LOS, less TTDI, and received less preoperative MRCPs both during BH and AH. An OR1st approach should be considered for children with choledocholithiasis and can be performed any day, any time.

105. Investigating the Relationship between Bleeding, Clotting, and Coagulopathy during Automated Partial REBOA Strategies in a Highly Lethal Porcine Hemorrhage Model

Antonio Renaldo, BS Dr. Elaheh Rahbar

Antonio C. Renaldo, Hebah Soudan, MBBS, Aravindh S. Ganapathy, MD, Gabriel E. Cambronero, MD, James W. Patterson III, Magan R. Lane, Gloria D. Sanin, MD, Nathan Patel, MD, Jacob AP Niebler, James E. Jordan, PhD, Timothy K. Williams, MD, Lucas P. Neff, MD, Elaheh Rahbar, PhD
Biomedical Engineering
Basic Science - Student

Introduction: Uncontrollable bleeding in response to a traumatic injury is a major cause of death. Early preventable deaths are largely attributed to uncontrolled hemorrhage, whereas later trauma-deaths are due to trauma-induced coagulopathy (TIC). The use of endovascular hemorrhage control devices, such as partial or intermittent REBOA (pREBOA, iREBOA) have been successful in mitigating early deaths from uncontrolled bleeding, but their impact on TIC remains relatively unknown. In this study we aimed to evaluate the coagulopathy associated with automated pREBOA and iREBOA use in an uncontrolled porcine hemorrhage model. Methods: Yorkshire swine (n=8/group) were subjected to an uncontrolled hemorrhage by liver transection, followed by 90 minutes of automated partial REBOA (pREBOA), intermittent REBOA (iREBOA), or no balloon support (Control), and 80 minutes of resuscitation with donor blood. Blood samples were serially collected over the duration of the experiment. To quantify whole blood clotting kinetics and clot strengths, a citrated kaolin heparinase (CKH) assay was run on a Thromboelastography (TEG) 5000 (Haemonetics, Niles, IL). Based on prior work, we defined hypercoagulability as an α-angle (α) or Maximum Amplitude (MA) greater than 72. A linear mixed model was used to assess differences in coagulation metrics over time and between groups, and Pearson's chi squared test was used to evaluate differences in mortality and hypercoagulability; statistical significance was set at $p=0.05$. Results: The liver injury was highly lethal, with 63% of the pigs in the Control group dying before end of experiment, while all animals receiving an automated pREBOA or iREBOA intervention survived ($p<0.01$). Pigs in the iREBOA group lost significantly more blood (1646.93mL vs. 2766.30mL) than those in the pREBOA group ($p=0.04$). Clotting kinetic metric, R-time, significantly decreased over time ($p<0.01$) in all groups, but there was no statistical difference between iREBOA and pREBOA groups. However, animals in the iREBOA group were more likely to be hypercoagulable as indicated by high MA and α-angles at the end of intervention (T90, $p=0.03$), compared to the pREBOA group. Lastly, we saw low levels of fibrinolysis, with baseline LY30 <2% and LY30 significantly decreased throughout the experiment in all animals regardless of intervention group ($p<0.01$). Conclusions: The use of an automated partial or intermittent REBOA strategy resulted in survival of all animals, compared to 63% mortality in control animals with no balloon support. When comparing coagulopathy and blood transfusion needs between pREBOA and iREBOA, groups, pREBOA was associated with less hypercoagulability, and had significantly less blood loss. Additionally, the reduced resuscitation needs in the pREBOA group indicates a slight advantage of using this automated strategy over iREBOA.

106. Advancing Treatment with Customized Alginate-Based Bioink for 3D-Printed Human Islet Structures in Transplantation

Arunkumar Rengaraj, PhD Giuseppe Orlando, MD, PhD

Wonwoo Jeong, Lori N. Byers, Emmanuel C.Opara, Sang Jin Lee, Amish Asthana, Gisuseppe Orlando
Surgery-Transplant
Clinical Science – Fellow

Islet transplantation is a potential therapy for diabetes, but islets face challenges like immune attacks and inadequate nutrient supply post-transplantation. We propose a 3D bioprinting approach to create immunoprotective architectures that enhance islet integration while ensuring adequate oxygen and nutrients. We investigated two alginates (LVM and MVG) combined with hyaluronic acid and gelatin at different concentrations (LVM 1.5%, 2.0%, MVG 1.1%, 1.6%). These materials, termed bioinks, were analyzed for viscosity under varying shear stress conditions. Printability was assessed by adjusting pressure (20-80 kPa) and printing speed (10-80 mm/min). Stability under physiological conditions was tested through frequency sweep and cyclic compression and relaxation tests. Cytocompatibility was evaluated using NIT-1 islet-like clusters, showing no significant damage to cell viability. Functionality was examined by measuring Glucose-Stimulated Insulin Secretion (GSIS). All bioinks exhibited favorable shearthinning properties, enabling uniform line printing without compromising cluster integrity at 30 kPa. While some reduction in functionality compared to non-printed clusters was observed in the GSIS analysis, ongoing efforts aim to match non-printed cluster functionality. In conclusion, 3D bioprinting offers promise for improving islet transplantation in diabetes treatment. Optimizing bioink compositions and printing parameters holds potential for enhancing bioprinted islet functionality, representing a crucial avenue for further research in diabetes therapy.

107. Mast Cells and Interstitial Cystitis/Bladder Pain Syndrome Revisited

Rory Ritts, MD Stephen J Walker, PhD

Mary Namugosa, Wencheng Li, Robert Evans, Gopal Badlani, Stephen J Walker
Surgery-Urology
Clinical Science - Resident

Introduction and Objectives: For patients undergoing evaluation or treatment for interstitial cystitis/bladder pain syndrome (IC/BPS), a bladder biopsy is often collected and evaluated for evidence of pathology. Due to significant variation in sample processing and reporting among individual pathologists, which can complicate interpretation of these results by the clinician, the objective of this study was to provide a detailed review of pathology report findings from a large IC/BPS patient cohort to identify commonalities and differences. Methods: A retrospective review of the pathology reports generated from analysis of bladder biopsies, taken from the posterior bladder wall of 461 IC/BPS patients in our IRB-approved study that had undergone therapeutic hydrodistension, was conducted. Biopsies had been sent to the pathology department with instructions to assess mast cell count. Results: Staining strategy for mast cell visualization differed between pathologists and included mast cell tryptase (MCT) (61.0%), CD117 (29.3%), Toluidine Blue (2.0%), a combination of two stains (3.7%), or no specified stain (4.0%). Mast cell count was either reported as a number (85.0%), a range (8.5%), or qualitatively (6.5%). Regarding the field of view, pathologists used either a high-powered field (HPF) (84.6%), mm^2 (8.5%), or did not specify (6.9%). The average mast cell count across all stains and fields of view was 27.92 ± 21.41. However, when stratifying by field of view the average mast cell count per HPF was significantly lower than per mm^2 across all stains (23.68 vs 80.29; $p<0.001$). Stratifying by stain, the average mast cell count with CD117 was significantly lower than MCT (22.46 vs 30.66; $p<0.001$). This trend remained significant when considering only CD117 and MCT counts per HPF (22.46 vs 25.16; $p=0.047$). Additionally, reports identified acute inflammation (6.3%) and/or chronic inflammation (78.3%). Squamous metaplasia was found in 1.3% of samples. Conclusion: There is a lack of standardization regarding histological analysis of bladder biopsies from patients with IC/BPS, leading to inconsistent data and confusion surrounding the significance of mast cell counts and other inflammatory markers.

108. SPLENIC ARTERY EMBOLIZATION: IT IS FEASIBLE BUT IS IT SAFE?

Heidi Roeber, MD Martin Avery, MD

Craig Follette, DO Heidi Roeber, MD Gregory R. Lombana, BS Madison Simas, MD Sophia Alvarado, BS Mary Alyce McCullough, MD Audrey L. Spencer, MD Amy Hildreth, MD Preston R. Miller III, MD Martin Avery, MD
Surgery-Trauma
Clinical Science – Resident

Objectives: Nonoperative management (NOM) of blunt splenic injury (BSI) is well accepted in appropriate patients. Splenic artery embolization (SAE) in higher grade injuries likely plays an important role in increasing the success of NOM. However, NOM with SAE adds risk of procedural complications compared to NOM alone. We previously implemented a protocol requiring referral of all BSI grades III-V undergoing NOM for SAE. While initial data was promising, risk of complications as well as longitudinal outcomes are unknown. We aimed to examine failure rate and safety profile of the protocol. We hypothesized the failure rate and complications would be low. Methods: A retrospective study was performed at our Level 1 trauma center over a 9-year period. Injury characteristics and outcomes in patients sustaining BSI grades III-V were collected. Outcomes were compared for NOM on protocol (SAE) and off protocol (no angiography or angiography but no embolization). Complications for angiographies were examined. Results: Between January 2010 and February 2019, 570 patients had grade III-V BSI. NOM was attempted in 359 (63%) with overall failure rate being 8% (31). Of these, 305 were on protocol while 54 were off protocol (41 no angiography and 13 angiography but no SAE). On protocol group failure rate was 6.1% (19), but the failure rate for the off protocol group was significantly worse ($p<0.0001$) at 24.5% (13). Significantly lower failure rate in the on protocol group was seen within each grade of injury (Grade III, 3% vs. 11%, $p=0.03$, Grade IV, 9% vs. 28%, $p=0.04$, Grade V, 20% vs. 100%, $p=0.007$). Complications occurred in only 8 of the 318 who underwent angiography (2%). These included 5 access complications and 3 abscesses. Conclusion Routine SAE for all high-grade BSI slated for NOM is safe with a low complication rate. Failure of NOM was significantly improved as compared to non SAE patients at all grades of injury.

109. Man Vs Machine: Provider Directed Vs Partially Automated Critical Care Management (PACC-MAN) In A Porcine Model Of Distributive Shock

Gloria Sanin, MD Timothy Keith Williams, MD, FACS

Gabriel Cambronero, James Patterson, Elizabeth Wood, Magan Lane, Elaheh Rahbar, Jason Adams, Austin Johnson, Lucas Neff, Timothy Williams

Surgery-Vascular & Endovascular
Basic Science - Resident

BACKGROUND: Critical care management of shock is a labor intensive process. PACC-MAN is an automated closed-loop system that incorporates physiologic and hemodynamic inputs to deliver prompt and scaled interventions while avoiding excessive fluid or vasopressor administration. To understand PACC-MAN efficacy, we compared PACC-MAN to provider-directed management (PDM). We hypothesized that PACC-MAN would achieve equivalent resuscitation outcomes to PDM while maintaining normotension with lower fluid and vasopressor requirements. METHODS: Twelve swine underwent 30% controlled hemorrhage, 45min of aortic occlusion to generate vasoplegia, transfusion to euvolemia, and randomization to PACC-MAN or PDM for 4.25hrs. Primary outcomes were crystalloid volume, vasopressor administration, total time spent at hypotension (MAP < 60 mmHg), and total number of interventions. RESULTS: Weight-based fluid bolus volume trended lower for PACC-MAN vs. PDM (73.1 ml/kg vs. 87.1 ml/kg, p=0.06) despite more frequent, yet smaller, fluid boluses administered by PACC-MAN (31 vs 9, p=0.005). There was a non-significant trend towards higher cumulative norepinephrine dose (33.4 mcg/kg vs 7.5 mcg/kg, p=0.09) and number of titrations (22 vs 11, p=0.15) with automation. Percent time in hypotension during critical care was equivalent (PACC-MAN: 5.4% and PDM: 3.0%, p=0.30). Urine outputs were similar between PDM and PACC-MAN (21.5 ml/kg vs 14.02 ml/kg, p=0.13). Final lactate and creatinine levels were equivalent. CONCLUSION: Automated resuscitation without human intervention achieves similar outcomes to provider directed intervention in this distributive shock model. This is the first translational comparison of automated critical care versus providers. Further refinement and longer studies are needed to demonstrate efficacy of the PACC-MAN system. Rapid increases in artificial intelligence will likely play an important role.

110. Impact Of Regional Differences And Neighborhood Socioeconomic Deprivation In The Outcomes Of Patients With Lower Extremity Wounds Evaluated By A Limb-Preservation Service

Gloria Sanin, MD Timothy Keith Williams, MD, FACS

Caroline Minnick, Ashlee Stutsrim, Timothy Williams, Gabriela Velazquez, Cody Blazek, Matthew Edwards, Matthew Goldman
Surgery-Vascular & Endovascular
Clinical Science - Resident

Introduction: Management of lower extremity (LE) wounds has evolved considerably with the establishment of specialized limb preservation services. While clinical factors are known contributors to limb outcomes, racial disparities and gender also influence the risk for limb loss. The Distress Community Index (DCI) score is a validated index of social deprivation created to provide an objective measure of economic well-being in U.S communities. Few studies have examined the potential influence of geographic/residential deprivation on outcomes in patients with LE wounds. We examined relationships between socioeconomic deprivation and outcomes of hospitalized patients evaluated by a dedicated limb preservation service (FLEX). Methods: Patients referred to FLEX over a 5 year period were included. Wound characteristics including Wound, Ischemia, foot infection (WIfI) stage were collected. DCI scores were determined using indices of education, housing vacancy , unemployment , poverty , household income, employment level, and commerce. Outcomes included any minor or major amputations, any endovascular or open LE revascularization, or any wound care procedures. Disease etiology, demographic, and anthropometric data were collected. Associations between neighborhood deprivation and limb-specific outcomes were evaluated in models for the DCI and each of its components separately. Results: 677 patients were included. Thirty-eight percent were female, with a mean age of 65 years. Sixty percent had WIfI stage 3 or 4 risk of amputation and 43% had WIfI stage 3 or 4 risk of revascularization. Mean (SD) ABI and toe pressure were 0.96 (0.43) and 80 (57) mmhg, respectively. Thirty-five percent were non-white. Amputation was performed in 31% of patients while 17% had revascularization. The mean (SD) distress score was 64 (24). The mean (SD) values for the DCI distress score components were: % without HS degree 15 (5); % poverty rate 17 (7); % adults not employed 24 (6); % housing vacancy rate 11 (4), median income ratio 90 (24); % change in employment 6 (16); % change in business establishments 3 (8). Mean DCI distress scores did not differ across WIfI risk of amputation, revascularization, or wound scores. Likewise, overall DCI distress score was not related to any of the outcomes in univariable or multivariable LR models. In univariable LR models for amputation, higher poverty rate (odds ratio (OR) for SD increase 1.20, 95% confidence limits (CL) 1.02- 1.42, P=0.025) was significantly associated with the outcome. In multivariable models, non-white race was strongly associated with amputation (OR 1.86, 9% CL 1.30-2.65, P=0.0007); however, neither DCI distress score nor any of its components remained significantly associated with the outcome. Conclusions: Despite known racial disparities in limb-specific outcomes, an aggregate measure of community level distress was not found to be related to outcomes. While poverty rate demonstrated a significant relationship with amputation in univariable analysis, this association was not found in multivari-

able models. Notably, non-white race emerged as a predictor of amputation, underscoring the importance of addressing racial disparities in LE outcomes.. Further investigation of potential determinants of LE outcomes is needed, particularly the interaction of such factors with race.

111. THE VIRTUAL HUDDLE FOR PATIENT SAFETY: PROVIDER PERCEPTIONS OF A NOVEL PACU TO ICU HANDOFF

Juhi Saxena, BS Lucas Paul Neff, MD

Mary A. McCollough, Chelsea M. Blanton, Elizabeth C. Wood, Micaela Gomez, Anthony M. Brenner, Amanda Goodin-Sherrill, Lucas P. Neff, Ashley L. Talbott
Surgery-General
Clinical Science - Student

Introduction: The transition of care from the Post-Anesthesia Care Unit (PACU) to the intensive care unit (ICU) is a critical juncture in a patient's path to recovery. Gaps in communication between care teams, especially during transitions from the PACU to the ICU are associated with an increase in patient safety incidents and worse outcomes. The geographic separation between the PACU and ICU, indeterminate PACU lengths of stay, staffing shortages, and the highly dynamic nature of the patient's immediate postoperative period all highlight the need for enhanced handoff protocols. Our study aims to evaluate care team perceptions of the preexisting unstructured handoff paradigm and of a novel, formalized handoff involving all key providers during the ICU transitions of care. Methods: A structured PACU-to-ICU virtual "face-to-face" handoff was implemented at a large academic medical center using a telehealth communication mechanism embedded within the electronic medical record platform. To assess team member perceptions of the handoff's benefit, a 12-question pre- and postintervention survey was administered to key care team members (148 pre, 121 post) to include: anesthesia, surgical, operating room nursing staff, PACU, and ICU. All survey responses were recorded on a 5-point Likert scaled format, ranging from 1 (strongly disagree) to 5 (strongly agree). Data analysis compared mean responses utilizing an unpaired t-test. Results: One hundred twenty-one (82%) clinical care team members responded to a post-intervention survey. Respondents reported enhanced procedural comprehension ($p<0.01$) and improved understanding of handoff expectations ($p<0.01$). Consistency of handoff reports improved ($p<0.01$), as did quality of information reported ($p<0.01$). Improvements in perception of patient safety were also noted amongst respondents ($p <0.01$). Postoperative nursing staff and advance care providers perceived the formalized handoff as more patient safety-focused ($p <0.01$) and efficient ($p < 0.05$). Overall, handoff satisfaction improved as well ($p< 0.05$). Conclusion: This novel, formalized PACU-to-ICU handoff intervention improved postoperative handoff understanding and communication amongst care teams across the perioperative care continuum. By employing EMR telehealth capabilities, handoffs were more consistent, efficient, and patient-safety focused. While further studies are necessary to examine ultimate downstream effects on serious patient safety events, overall care team satisfaction and perception of effective care may serve as a preliminary indicator of safer interdisciplinary transitions of care.

112. Patient-Derived Tumor-on-a-Chip Platform Potentiates Adaptive Immune Response Against Primary Tumor Cells

Cecilia Schaaf, DVM Konstantinos Votanopoulos, MD, PhD
Tiefu Liu, Damian Hutchins, Mitra Kooshki, Nicholas Edenhoffer, Steven Forsythe, Robyn Greissinger, Lance Miller, Pierre Triozzi, Shay Soker, Adam Hall, Konstantinos Votanopoulos
Surgery-Oncology
Clinical Science - Fellow

Background: Adoptive cellular therapy (ACT) is a promising anti-tumor immunotherapy whereby a patient's T-cells are isolated, expanded/modified to improve cytotoxicity, then reinfused. While current ACT modalities show success in select trials/patients, major challenges limit ACT in all tumors including insufficient cell numbers and failure to target heterogeneous tumors. To improve ACT, we developed a novel biomimetic device where patient-derived tumor organoids (PTOs), enriched with antigen presenting cells, are co-cultured with autologous peripheral blood mononuclear cells (PBMCs) in a microfluidic tumor-on-a-chip system (TOC). As PBMCs circulate through the device, they are exposed to dispersed tumor polyclonal neoantigens, leading to formation of patient- and tumor-specific organoid interacting lymphocytes (OILs). Objectives: Validate a 3D tumor-on-a-chip (TOC) platform to generate organoid interacting lymphocytes (OILs) with anti-tumor reactivity. Method: Patient specimens were collected from melanoma (2), mesothelioma (6), and metastatic appen-

diceal adenocarcinoma (9) surgical cases. In the TOC system, patient-derived tumor cells were combined with autologous antigen presenting cells derived from healthy spleen or lymph node in a UV-crosslinked heprasil and collagen matrix to generate immune-enhanced PTOs. Autologous PBMCs were circulated through the TOC system for 7 days to produce organoid interacting lymphocytes (OILs). For controls, uncirculated PBMCs and isolated tumor infiltrating lymphocytes (TILs) were expanded in flasks. Resultant CD8+ uncirculated PBMCs, TILs, and OILs were examined by Isoplexis single-cell secretome analysis to compare activation and polyfunctionality via single cell cytokine secretion profiles. To assess anti-tumor reactivity, OILs and controls were re-introduced to the autologous PTO via co-culture for 7 days. In co-culture media, secreted bulk cytokine profiles were compared by Isoplexis CodePlex. Key cytokine quantifications were confirmed by ELISA. Using the 7 day co-culture organoids, NanoString Geomx spatial proteomic analysis identified key lymphocyte activity and phenotypes during anti-tumor reactivity. Data were analyzed using student t-test and differential expression from linear mixed-effect model. Results: Compared to uncirculated CD8+ PBMCs and TILs, CD8+ OILs showed increased polyfunctional strength index (percentage of polyfunctional single cells multiplied by signal intensity of functional group cytokines), particularly in effector T-cell associated cytokine profiles (INF-γ, granzyme B, perforin). Upon reintroduction to PTOs to assess anti-tumor reactivity, OILs excreted an increased predominant type I cytokine profile and an activated caspase-independent apoptosis profile compared to both TILs and uncirculated PBMCs. Within OILs, the increased immune cell activation biomarkers and apoptosis signaling proteins were positively correlated, highlighting both immune and apoptosis activation. Conclusion: Compared to TILs and uncirculated PBMCs, OILs produced by the TOC system show increased polyfunctionality and cytotoxicity-associated pathways, independent of tumor type. With further validation of the OILs' increased tumor-targeting efficacy, we propose a new potential ACT modality to target a broad array of tumors previously untreatable by current therapies.

113. Farnesol Repurposing for Biofilm Prevention and Treatment of the Superbug Acinetobacter baumannii

Li Tan, PhD Adam J. Katz, MD, FACS

Rong Ma, Adam J. Katz and Nicole Levi
Surgery-Plastic & Reconstructive
Basic Science - Fellow

Purpose: Acinetobacter baumannii is a multidrug-resistant (MDR) superbug that is frequently isolated from burn patients. Burn patients with A. baumannii infection have more severe comorbidities, and higher mortality. A. baumannii's ability to form biofilms significantly contributes to its resistance and virulence. Farnesol is an FDA-approved GRAS (generally recognized as safe) compound commercially available as a cosmetic and flavor enhancer, and has been suggested as a potential adjuvant for conventional antibiotics. The purpose of this study was to determine whether farnesol alone, without any antibiotics, is safe, and effective, for both prevention and treatment of A. baumannii biofilms in vitro, and in ex vivo burn wounds. Methods: A. baumannii was cultured in media containing farnesol for 24 hours to evaluate its effect on biofilm formation, while 24-hour-old bacterial biofilms were exposed to farnesol overnight to examine its efficacy on disruption of established biofilms. Reductions in surviving colony forming units (CFUs) were quantified by serial dilutions. The effect of farnesol on biofilms was visualized using the Live/Dead viability assay, followed by quantitative analyses of the three-dimensional biofilm structure. Efficacy of farnesol against biofilm-associated skin infections was assessed using ex vivo intact, or thermally burned, human skin. Results: Farnesol (0.5 mg/ml in ethanol) inhibits biofilm formation of A. baumannii, resulting in a 50-fold reduction of CFUs; while 6 mg/ml of farnesol disrupts established A. baumannii biofilms with a more than 1600-fold. These results were further confirmed and visualized by Live/Dead viability microscopic analysis. No resistance to farnesol was observed even after prolonged culture in the presence of sub-inhibitory farnesol doses. Farnesol combats A. baumannii biofilms by direct killing, while also facilitating biofilm detachment. Furthermore, farnesol was safe, and effective, for both prevention and treatment of A. baumannii biofilms in an ex vivo burned human skin model. Conclusions: Farnesol as a single agent is highly effective for both prevention and treatment of A. baumannii biofilms both in vitro and ex vivo. Current treatment options for A. baumannii infections rely upon combination therapy of last-resort antibiotics; therefore, we propose that farnesol could be repurposed to combat life-threating A. baumannii infections, due to its proven safety, convenient topical delivery, and excellent efficiency, plus its superiority for evading drug resistance.

114. Impact of Covid-19 on Thrombotic Complications in Microsurgery

Marion Tapp, MD Ramon Llull, MD;PhD

Mary Duet; Robert Giglio; Ramon Llull; Bennett Calder; J. Michael Robinson; Ramon Lllull
Surgery-Plastic & Reconstructive
Clinical Science – Resident

Background: Studies have demonstrated an increased risk of vasculitis and microvascular thrombi in patients with COVID-19. Additionally, while the creation of the SARS-CoV-2 vaccine was instrumental in the management of the pandemic, there are similar concerns regarding pro-thrombotic events. Following the declaration of the COVID-19 pandemic's end, we sought to analyze the true impact of this infection on microsurgery as both anecdotal and scientific evidence would suggest an increased rate of thrombosis. Methods: An IRB review was conducted of women undergoing autologous breast reconstruction between January 2019 and March 2022. Patient history and postoperative complications were collected including COVID related data. Patients were divided into 3 cohorts based on date of surgery and history of infection or vaccine. Statistical analysis was performed. Results: Within the study population, 216 patients had surgery prior to the start of the COVID pandemic and 311 patients had surgery during the pandemic. There was a 3.2% incidence of thrombotic events (VTE or flap compromise) prior to the pandemic and a 6.4% incidence during the pandemic. Patients operated on during the pandemic were further subdivided based on prior covid infection or vaccine. There was no statistically significant difference between groups. Conclusion: Microsurgeons are constantly seeking to mitigate thrombotic risk in their patient population and previously little was known about the specific impact of COVID-19 on microsurgical outcomes. Based on our analysis, COVID-19 does not significantly increase the rates of thrombotic events (flap compromise or VTE) in DIEP flap breast reconstruction.

115. Feasibility and Efficacy of Continuous Flow Local Anesthetic Pumps for Post-Operative Analgesia Following Kidney Transplantation

Parth Thakker, MD Alan Farney, MD, PhD

Davis Temple Caroline Minnick Dominick Ponzi William Doares Gopal Badlani Christopher Webb
Emily McCracken Guiseppe Orlando Colleen Jay Alan Farney Robert Stratta
Surgery-Urology
Clinical Science - Resident

Introduction: An estimated 15% of the US population live with chronic kidney disease and 30% of these patients undergo renal transplantation. The cornerstone of post-operative analgesia in these patients is narcotics however chronic narcotic use in kidney transplantation patient shas been associated with increased risk of graft loss. Transversus abdominus plane blocks have been implemented however the benefits in reducing post-operative narcotic consumption are short-lived. Continuous flow local anesthetic infusions have gained traction in redudcing post-operative pain. Herein, we sought to compare the efficacy of continuous flow local anesthetic pumps compared to patient controlled anesthetic pumps (PCA) in reducing inpatient narcotic consumption in patients undergoing primary kidney transplantation. Materials and Methods: In this single-center, retrospective analysis of patients undergoing primary kidney transplantation via a unilateral Gibson incision, we collected demographic and operative data, peri-operative outcomes, complications, and inpatient narcotic consumption. Continuous data was summarized with medians and interquartile ranges and compared using Wilcoxon rank-sum test. Categorical data was summarized with frequencies and percentages and was compared using Fisher's exact test. Results: A total of 498 patients underwent primary kidney transplantation from 2020 to 2022. 296 (59%) patients received a PCA and 202 (41%) patients received a continuous flow local anesthetic pump (CFLAP) for post-operative pain control. The median age (53.5 vs 56.0 years, p=0.08), median Charlson Comorbidity Index (4 vs 4, p=0.22), BMI (29.5 vs 28.9, p=0.17), was similar between the CFLAP and PCA groups. The median total inpatient oral morphine equivalent requirement was significantly lower in the CFLAP group (4.08 vs 103.8 MME, p<0.001). Median days to return of bowel function (ROBF) was shorter in the CFLAP group (2 vs 3 days, p=0.03). Median length of stay was similar (4 vs 4 days, p=0.80). Wound-related complications were no different between groups (4.4% CFLAP vs 3.0% PCA, p=0.21). Two (0.9%) patients in the CFLAP group had a cardiac arrhythmia due to local anesthetic toxicity, requiring lipid rescue. Conclusions: Compared to PCA, anesthetic pumps provide a 96% reduction in inpatient narcotic consumption and decreased time to bowel function return with a similar wound-related complication rate in patients undergoing kidney transplantation. The utility of anesthetic pumps may also be applicable to patients undergoing any unilateral, abdominal, surgial incision.

116. Non-surgical Non-pharmacologic Therapy for Nasal Obstruction: A Systematic Review

Cameron Todd, MD Brian Downs, MD

Sydney Means, Brian Downs
Surgery-Otolaryngology (Dentistry)
Clinical Science - Resident

INTRODUCTION: Nasal obstruction is a major quality of life problem that often requires medical or surgical therapy. We set out to characterize the literature on non-surgical, non-pharmacologic treatment for nasal obstruction that did not involve wearable devices or products. METHODS: A systematic review was conducted according to PRISMA guidelines. A comprehensive search of Englishlanguage literature from the Pubmed, EMBASE, and Web of Science databases was performed on June 27th, 2022. Studies were excluded that involved surgical procedures, pharmacologic therapy, or medical devices requiring continuous use for benefit. We also excluded studies that did not include outcome measures at least 24 hours after intervention. RESULTS: Of the 2025 articles initially identified, 5 met criteria for inclusion in the study. The level of evidence ranged from II to IV per PRISMA guidelines. Study heterogeneity prevented meta-analysis. Electromyographic stimulation (EMG) of the nasal muscles, Buteyko breathing techniques, and nasal biofeedback training with EMG demonstrated improvement in nasal obstruction scores and avoidance of surgery. The single study of regular exercise did not demonstrate differences in nasal resistance between endurance athletes and non-athletes. CONCLUSION: There is some evidence that EMG training, breathing techniques, and biofeedback training can be used to treat nasal obstruction and avoid surgery for patients. This evidence provides support for a trial of such therapy for patients who are either poor operative candidates or desire nonsurgical, non-pharmacologic therapy.

117. The Eradication of Staphylococcus aureus Biofilms on Photothermal Silicone Nanocomposites

Erica Monette Vargas, BS Nicole Levi, PhD

Nicole Levi, Bradley Burden
Surgery-Plastic & Reconstructive
Clinical Science - Student

In many surgical procedures, silicone is one of the most common materials implanted in the body and once these devices become infected the standard method treatment involves antibiotics or removal of the implant. Bacteria growth is optimal in an environment rich with polymers, polysaccharides, extracellular DNA, and water. Together these components make up a structure known as a biofilm and bacteria in this environment are more susceptible in growing resistance to antibiotics. There is a need for new techniques to mitigate bacterial infections on implantable devices, especially once it becomes difficult to treat with antibiotics. In an event of an infection, the body triggers an immune response to increase its temperature and prevent bacteria from proliferating. In this study, the concept of generating heat to thermally kill bacteria is taken a step further by applying photothermal laser therapy on nanoparticle infused medical- grade silicone. Specifically, Staphylococcus aureus Xen29 and Xen40 biofilms were grown on silicone infused with photothermal poly[4,4-bis(2-ethylhexyl)-cyclopenta[2,1-b;3,4-b']dithiophene-2,6-diyl-alt- 2,1,3-benzoselenadiazole-4,7-diyl] (PCPDTBSe) nanoparticles. During laser irradiation, these nanoparticles quickly generate heat throughout the silicone. To evaluate the effects of photothermal laser therapy, the number of colony forming units (CFUs) after treatment were quantified. Furthermore, individual components of the biofilms after laser treatment were characterized through different fluorescent microscopy staining reagents. Nanocomposite sheets were made by homogenously mixing 10 milligrams of PCPDTBSe nanoparticles per 1 gram of silicone and thermally cured. 5mm disks were punched out of silicone and nanocomposite sheets. For each strain, planktonic cultures were aliquoted on each disk and placed in an incubator overnight to develop biofilms. The following day, disks were subject to photothermal laser therapy at various wattages (1W, 3W, and 5W) and times (10-300s). After treatment, disks were sonicated and serial dilutions were preformed to quantify CFU/mL on agar plates. Additionally, staining reagents such as SYTO 9 and Propidium Iodide (PI) were used to evaluate live/dead cells, polysaccharide structures were evaluated by Wheat Germ Agglutinin (WGA) 555, and extracellular DNA was evaluated by TOTO 3 Iodide. There were no significant reductions for CFUs/mL for silicone, however, nanocomposite silicone showed significant decreases in bacteria. Xen29, had a 6-log reduction at 1W, 300s and complete eradication at 3W, 120s and 5W, 60s. Xen40 had a 2-log reduction at 1W, 180s and complete eradication at 1W, 300s, 3W, 120s, and 5W, 60s. Results showed that lower powers and longer times or higher powers and shorter times were equally effective in the bacteria count on the disks. Clinically, having

a 3-log reduction or more in CFUs is essential to effectively mitigate infections within the body. The results show significant reductions to and above this magnitude. SYTO 9 and PI stains indicated an increase in dead to live cells. WGA 555 and TOTO3 showed an observable fluorescent intensity difference for polysaccharides and extracellular DNA structures after treatment. Disruption of these structures may provide insight on how to decrease bacteria robustness and make the bacteria more susceptible to antibiotic treatment.

118. Characterization of Retrobulbar Hemorrhages and Orbital Compartment Syndrome

Kevin Vo, MD Jagger Koerner, MD, MBA
Surgery-Ophthalmology
Clinical Science - Resident

Retrobulbar hemorrhages (RBH) can lead to orbital compartment syndrome which is one of the few ophthalmic emergencies that require acute surgical intervention to preserve vision. Often, a lateral canthotomy and cantholysis (LCC) is immediately required to release the lower lid and allow for reduction in intraocular pressure. This study aims to characterize the RBH seen in the emergency department and determine which factors, not specific to ophthalmologic training, were associated with the need for LCC. RBH was evaluated at the Atrium Health Wake Forest Baptist Hospital (AHWFB). Patients were included if they were greater than 17 years old, seen from August 2021 to March 2022, and evaluated at AHWFB and consulted by ophthalmology, and had a computerized tomography (CT) scan documenting RBH. Patients were excluded if they were transferred to AHWFB hospital having already completed LCC. Data was collected on demographics, CT findings, and ophthalmologic exam. A total of 47 eyes were included in this study. Physical exam findings that were statistically significant for LCC included relative afferent pupillary defect (p= 0.0018), lid tautness (p= 0.0002), and retropulsion (p= 0.0035). CT findings that were statistically significant included posterior tenting on CT (p= 0.0067), proptosis (p= 0.0004), and presence of orbital wall fracture (p= 0.0289). Factors evaluated that were not significant included anticoagulation (p = 0.0508) and orbital emphysema (0.4164). There are numerous findings on CT and physical exam that are associated with the need for LCC. Not surprisingly, some factors had a greater significance compared to others. The next steps would include obtaining more data from LCC performed at AHWFB, aggregating those factors set forth in this study, and developing a clinical calculator to assist non-ophthalmologic physicians in deciding whether or not a patient requires immediate LCC.

119. Challenging the Limits of Prolonged Cold Ischemia in Deceased Donor Kidney Transplantation

Jigish Vyas, MD Dr. Alan Farney

Webb, Garner, Jay, McCracken, Farney, Orlando, Stratta
Surgery-Transplant
Clinical Science - Fellow

Introduction: Prolonged cold ischemia time (PCIT) is known to influence outcomes following deceased donor kidney transplantation (DDKT) and is a major risk factor for kidney nonuse and delayed graft function (DGF). The study purpose was to analyze our overall experience with DDKT in the setting of PCIT. METHODS: Single center retrospective review of DDKTs according to PCIT, defined as CIT ≥40 hrs. Standardized management algorithms were used to preserve nephron function (including machine preservation) and all patients received depleting antibody induction with tacrolimus, mycophenolate, and steroids. DGF was defined as the need for dialysis for any reason in the 1st week post-KT. Primary nonfunction (PNF) was defined as failure to render the patient dialysis-free following KT. The Kidney Donor Profile Index (KDPI) was used to characterize overall donor kidney quality. RESULTS: From March 2002 to April 2018, we performed 91 DDKTS with PCIT (CIT range 40-50 hours, mean 43±2.6, median 42.5 hours). Mean donor age was 44.7±15.8 years, mean KDPI was 60±25% and the DD group included 30 standard criteria donors (SCD), 38 donation after circulatory death (DCD) donors, and 23 expanded criteria donors (ECD). 15 DDs also exhibited acute kidney injury (terminal serum creatinine [SCr] level ≥2.0 mg/dl). A total of 83 kidneys (91.2%) were imported from other donor service areas and all kidneys were managed with hypothermic machine perfusion (mean pump time 18.6 hours, mean terminal flow 113.5 ml/min, mean terminal resistance 0.26 mm Hg/ml/min). Mean recipient age was 54 years, mean waiting time was 22 months, and mean dialysis vintage was 37 months. With a mean follow-up of 101 months (median 93 months, minimum 55 months), one-year patient and kidney graft survival rates were 95.6% and 85.7%, respectively, and were similar according to DD category. 5-year patient and kidney graft survival rates were 82.4% and 65.9%, respectively, and were likewise similar according to DD category. The incidence of PNF was 5.5% (7.9% DCD vs 3.8% SCD/ECD, p=0.65) and the incidence of DGF was 52.7% (76.3% DCD vs 35.8% SCD/ECD, p=0.0002). In patients with functioning grafts, one-year SCr levels were 1.7± 0.6 mg/dl

and eGFR levels were 45.6±17 ml/min/1.73m2. CONCLUSIONS: These findings suggest that in highly selected circumstances, transplantation of DD kidneys with PCIT managed with pump preservation may result in acceptable medium-term outcomes irrespective of DD category. However, because the incidences of PNF and DGF are twice as high with DCD donor kidneys compared to brain-dead donors, we recommend caution in this setting. With broader geographic sharing and more complicated logistics, the routine discard of DD kidneys with PCIT may not be warranted.

120. Insulin dependence in diabetic macular edema does not affect response to anti-VEGF therapy

Sean Wang, BE Sally Ong, MD

Annie Elander Jonathan Groothoff Sally Ong
Surgery-Ophthalmology
Clinical Science - Student

Background: Diabetic macular edema (DME) is the main cause of vision loss in patients with diabetes due to increased permeability of blood vessels in the retina. One of the first line treatments for DME is intravitreal anti-vascular endothelial growth factor (anti-VEGF) injections; however, a significant number of patients with DME do not respond optimally to these injections. Insulin therapy has long been established in the management of diabetes, but few studies have explored whether insulin-dependence complicates anti-VEGF treatment outcomes in patients with DME. This study sought to assess whether patients with insulin-dependent diabetes experienced a difference in functional and anatomic responsiveness to anti-VEGF therapy when compared to patients with non-insulin dependent diabetes. Hypothesis: Insulin dependence is associated with worse functional and anatomical response to anti-VEGF therapy in patients with DME. Methods: This was a retrospective, single center study of 121 patients (189 eyes) who received anti-VEGF treatment for DME. Data were collected from the electronic medical record and optical coherence tomography machines over 24 months from DME diagnosis. Patients were divided into insulin (n=155) and non-insulin dependent (n=34) groups. Logarithm of minimal angle of resolution (logMAR) was used to analyze best corrected visual acuity (BCVA). Primary outcome measures were changes in BCVA, central foveal thickness (CFT), and macular volume (MV). Data analysis was performed using one way ANOVA on IBM SPSS Statistics. Results: There was no statistically significant difference in functional and anatomic response to anti-VEGF therapy between groups. The average change in BCVA over 12 months was 0.14 logMAR (insulin dependent) compared to 0.15 logMAR (non-insulin dependent) (p=0.936) and over 24 months, 0.41 logMAR (insulin dependent) compared to 0.27 logMAR (non-insulin dependent) (p=0.242). The average change in CFT over 12 months was 51.31 μm (insulin dependent) compared to 36.46 μm (non-insulin dependent) (p=0.762) and over 24 months, 89.13 μm (insulin dependent) compared to 59.04 μm (non-insulin dependent) (p=0.601). The average change in MV over 12 months was 0.19 mm3 (insulin dependent) compared to 0.08 mm3 (non-insulin dependent) (p=0.923) and over 24 months, 1.33 mm3 (insulin dependent) compared to 0.90 mm3 (non-insulin dependent) (p=0.749). Conclusions: The results of this study suggest that dependence on exogenous insulin does not affect functional and anatomical treatment outcomes in patients receiving anti-VEGF or combined anti-VEGF and steroid injections for DME. This conclusion supports limited data that has suggested that insulin dependence does not affect outcomes in patients with DME treated with anti-VEGF injections.

121. Atypical Infections in Acute Hand Infections: A Cost Analysis

Isabella Waung, BA Christopher J. Tuohy, MD, MMCi

Garrett Scott Bullock, Christopher J. Tuohy
Surgery-Orthopedics
Clinical Science - Student

Background: Acute hand infections are common problems treated by orthopedic surgeons, emergency room physicians, and family physicians. The standard of care for irrigation and debridement (I&D) surgeries for hand infections is intraoperative specimens for gram stains, aerobic, anaerobic, fungal, and acid-fast bacillus (AFB) cultures. However, fungal and AFB cultures are rarely positive. Since atypical organisms like mycobacterium are difficult to grow, require special incubation and weeks of monitoring, this routine process incurs both institutional costs as well as unnecessary charges for patients. The purpose of this project was to assess the prevalence of positive atypical cultures for fungi and mycobacterium, analyze patient risk factors to increase the positive predictive value for atypicalcultures, and to calculate the cost and potential savings related to the routine ordering of atypical cultures. Hypothesis: We hypothesized that 1) less than 5% fungal and AFB cultures would be positive, 2) certain risk factors would predict increased rates of positive atypical cultures, and 3) there can be cost savings from refraining from ordering atypical cultures routinely. Methods: We examined the medical records of patients undergoing surgical I&D with intraoperative fungal and/or acid-fast cultures taken between 1/2013 to 1/2023 from

seven AHWFB hand surgeons. 375 patients met the inclusion criteria for a total of 423 patient encounters. Demographics, comorbidities, and culture results were recorded. Epidemiological calculations were performed for initial and recurrent prevalence with 95% confidence intervals using the Clopper-Pearson method. To assess the potential differences in infections between comorbidities, a firth's corrected logistic correction was performed. The cost of each culture at AHWFB was determined by the associated laboratory codes for each test. Results: Of the 423 patient encounters, there were a total of 7 (1.8%, 95% CI: 0.9, 3.4) primary fungal infections and 3 (0.8%, 95% CI: 0.2, 2.0) primary mycobacterium infections. There was 1 (14.3%, 95% CI: 0.7, 52.1) recurrent fungal infection and 2 (66.7%, 95% CI: 13.5, 98.3) recurrent mycobacterium infections. There was no difference in patients that reported suffering from comorbidities (taking DMARDs, actively undergoing chemotherapy, IVDU, diabetes mellitus) and patients that did not have diagnosed comorbidities and the odds of infection (OR: 2.90, 95% CI: 0.7, 12.3; p = 0.148). The cost of fungal and AFB cultures to patients at AHWFB was $150 and $238, respectively. By not routinely ordering atypical cultures, cost savings would be on average $384.44 per patient. The cost savings of not ordering fungal and AFB cultures for all patients in this study would be $61,800 and $85,442, respectively. Conclusions: These results supported our hypothesis that less than 5% of atypical cultures would be positive. Because the analysis of comorbidities was not statistically significant, likely from type II error, the treating physician should keep a higher index of suspicion for more unique cases of infection. Consequently, we don't recommend the routine ordering of fungal and AFB cultures for acute hand infections due to increased costs for patients and hospitals.

122. High BMI Should Not Exclude Candidates for Deceased Donor Kidney Transplantation: A Single-Center Paired Donor Kidney Analysis

Christopher Webb, MD Robert Stratta MD

Jigish Vyas, Matthew Garner, Colleen Jay, Emily McCracken, Alan Farney, Giuseppe Orlando, Robert Stratta
Surgery-General
Clinical Science – Fellow

Introduction: The effect of high recipient body mass index (rBMI) on deceased donor kidney transplantation (DDKT) outcomes is unclear. Methods: Single center retrospective review of adult DDKTs in which mate donor kidneys were transplanted into recipients with a BMI ≥38 and <38 kg/m2 (control group). Results: From 11/2001 to 11/2022, 40 pairs of DDKTs were identified. Mean rBMIs were 39.7±1.9 and 28.6±4.9 kg/m2 (p<0.001). Mean recipient ages (53 years) and cold ischemia times (23 hours) were comparable. The high rBMI group had significantly more female (75% high BMI vs 32.5% controls) and black patients (62.5% high BMI vs 32.5% controls), with longer mean waiting times (24 vs 19 months) and dialysis vintage (57 vs 40 months, all p<0.05). Length of initial hospital stay (mean 6.0±6.3 vs 4.6±1.2 days) and incidence of delayed graft function (37.5% vs 30%) were slightly higher in the ≥38 rBMI group. Within the first 90 days, readmissions, re-operations, wound complications, and major infections were comparable. With mean follow-up of 75 months, patient survival (77.5% vs 65%) and kidney survival (67.5% vs 60%) rates were slightly higher in the high rBMI group. Conclusions: Using a mate donor kidney analysis, high BMI recipients have similar medium-term outcomes compared to their paired lower BMI counterparts. Using a BMI ≥38 kg/m2 to exclude patients is not warranted and unfairly limits access of morbidly obese patients who are over-represented by female and black patients.

123. 3,4-Diaminopyridine reverses off-target effects of intramuscular BoNT/A injections without compromising therapeutic benefits

Travis Wentz, PhD Patrick McNutt, PhD

Travis G. Wentz, Celinia A. Ondeck, Zachary D. Chandler, Lalitha M. Karchalla and Patrick M. McNutt
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Fellow

The clinical administration of botulinum neurotoxin type A (BoNT/A) produces local muscle paralysis by blocking acetylcholine release at motor nerve terminals. However, in some cases, diffusion of BoNT/A from the injection site can cause weakness at distal muscle groups. The FDA-approved drug 3,4- diaminopyridine (DAP) is a potassium channel blocker that has shown promise in reversing neuromuscular weakness caused by systemic exposure to BoNT/A in mice, rats, and nonhuman primates. Based on mechanistic studies showing that DAP efficacy is inversely proportional to the degree of paralysis, we hypothesized that DAP could treat the off-target effects of BoNT/A diffusion without altering the extent or duration of paralysis in targeted muscles. Male and female CD1 mice (24 g mean weight) were administered 0.25-1.25 LD50

BoNT/A in the extensor digitorum lateralis muscle (EDL) on day 0. Mice were treated once a day from 3-9 days with 0.03-2.0 mg/kg DAP by subcutaneous (SQ) injection. Digit abduction scores (DAS, a surrogate for on-target toxin effects) and systemic signs of botulism (a surrogate for off-target toxin effects) were measured before and 30 min after DAP treatment using established methods. DAP produced dose-dependent effects on both DAS and duration of paralysis. Daily injections of ≥ 0.125 mg/kg DAP transiently improved DAS and significantly reduced the duration of paralysis. Accelerated recovery from paralysis was correlated with increased muscle weight and reduced morphological evidence of atrophy, suggesting that high-dose DAP treatments had muscle sparing effects. In comparison, treatment with 0.063 mg/kg DAP, which produces clinically relevant blood levels in mice, did not alter the duration of paralysis. While 0.063 mg/kg of DAP did not change DAS scores from 3-5 days, toxic signs were significantly improved on each day, demonstrating the selective reversal of off-target effects. Finally, we found that 0.063 mg/kg DAP was more effective in reversing DAS in EDLs paralyzed by 0.5 LD50 versus 1.25 LD50 BoNT/A, consistent with the hypothesis that DAP is more effective in less-paralyzed tissues, We found that clinically relevant doses of DAP selectively reverse unwanted muscle relaxation caused by the diffusion of BoNT/A from the injection site without interfering with BoNT/A efficacy in the targeted muscles. These data indicate that DAP can be used to pharmacologically refine the precision of BoNT/A injections. They also suggest that supratherapeutic doses of DAP can accelerate recovery from muscle paralysis by reducing muscle atrophy, which may have implications for inadvertent exposure to BoNT/A. Collectively, these data warrant further preclinical and clinical investigation to explore the potential use of DAP to reverse BoNT/A effects.

124. Assessing Knowledge about Living Kidney Donation among Transplant Candidates and Relationship to Action

Hope Werenski, MD Colleen Jay, MD, MS

Robert Stratta, Emily McCracken, Alan Farney, Giuseppe Orlando, Amber Reeves-Daniel, Colleen Sheehan, Colleen Jay
Surgery-Transplant
Educational Science – Resident

Introduction: Living-donor kidney transplantation (LDKT) provides superior outcomes to patients with end-stage renal disease (ESRD) compared to dialysis or deceased donor kidney transplant (DDKT). Advantages include shorter wait times and longer patient and allograft survival rates. Patient barriers to seeking a living donor include inadequate education, unease discussing their disease state, discomfort approaching others about live donation, and inability to answer questions posed by the donor. We administered pre-education questionnaires to kidney transplant candidates at our center to determine the relationships between LDKT knowledge, comfort, and action between patients by age and race. Methods: One hundred ninety kidney transplant candidates completed questionnaires prior to participating in living donor education sessions administered between 2/1/2023 and 6/26/2023. The questionnaire assessed patients' perceived knowledge of LDKT (5-point Likert scale), actual knowledge of LDKT (composite with maximum score of 25), comfort with LDKT (composite with maximum score of 70), and action (defined as approaching any potential donor). Questionnaires were administered via paper or REDCap link. Results: The mean age of candidates was 53±14 years, and 47% of patients were Black. Higher perceived knowledge predicted action (good/very good/excellent 62% action vs fair/poor 38% action, p=0.02). Higher comfort also corresponded to action (composite comfort: 42±16 for action vs 34±16 no action, p=0.0004). Actual knowledge score did not differ between those with action or no action (composite knowledge: 18.8±3.2 for action vs 18.5±3.5 no action, p=0.53). There was no correlation between age and perceived knowledge, actual knowledge, or comfort. Younger patients were more likely to take action (action: 51±14 years vs no action: 56±12 years, p=0.01). There were no significant differences between White and Black candidates in perceived knowledge (White 3.2±1.2 vs Black 3.1±1.3, p=0.4), composite comfort (38±17 vs 38±17, p=0.84), or action (56% vs 58%, p=0.88). However, White candidates had higher composite knowledge scores (White 19±3 vs Black 18±3, p=0.01). Conclusions: Patients with higher perceived knowledge and comfort were more likely to have approached possible donors about living kidney donation. However, action did not differ according to actual knowledge. Younger patients had higher rates of action, but racial differences were not detected in perceived knowledge, comfort, or action. Given the relationship with perceived knowledge and comfort on action in approaching potential donors, educational and awareness programs for kidney candidates are paramount, especially among older candidates.

125. Pre-Formed Skin Organoids in Bioprinted Skin Improving Long Term Functionality of Full Thickness Wounds

Kelsey Willson Anthony Atala, MD

Gorkun, Anastasiya; Mahajan, Naresh; Jorgensen, Adam; Clouse, Cara; Soker, Shay; Atala, Anthony
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Student

INTRODUCTION: The United States spends nearly $2 billion each year treating full thickness skin wounds, primarily using autologous grafts to cover/close wounds with reduced scarring. Despite being the gold standard, autologous grafts are limited for many patients as they require sufficient harvest sites and result in a new wound. While a few cellularized skin substitutes are available for patients, these contain only fibroblasts and keratinocytes which limits their ability to develop into functional skin, with hair follicles, glands, pigmentation, and appropriate vasculature. Here we present 3D printed skin constructs with 6 cell types organized into dermal, hypodermal, and epidermal layers which integrate and form functional skin with pigmentation when used to cover a full thickness wound. METHODOLOGY: Four groups were used to analyze the effects of bioprinted skin on wound healing; wound only, tri-layered hydrogel (non-cellularized), tri-layered bioprinted skin, and tri-layered skin patterned with pre-cultured skin organoids (re-organized skin). Briefly, a fibrin hydrogel containing glycerol, gelatin, hyaluronic acid, and fibrinogen was used to print square 2.5*2.5 cm constructs onto a piece of non-adherent Adaptic™ dressing. Cellularized constructs consisted of three layers: epidermis (keratinocytes and melanocytes), dermis (endothelial cells, fibroblasts, follicular dermal papillary cells) and hypodermis (adipocytes). Each construct was seeded at 20e6 cells/mL. For re-organized skin, 25% of the cells were pre-cultured for 3 weeks as organoids, then added to the dermal layer during printing. Printed constructs were matured for 7 days in vitro. 2*2 cm wounds were created on the backs of athymic nude mice. Hydrogels were secured to the wound using prolene. All wounds were covered with non-adherent Adaptic™, Tegaderm™, and a gauze bolster. Wound healing was visually monitored weekly. Animals were euthanized at 14, 21, 56, and 91 days, at which points the wound site was collected for histological analysis including immunohistochemistry (cell location), Masson's Trichrome (collagen deposition), Picrosirius Red (collagen orientation), and Fontana Masson (melanin production). RESULTS: 3D printing was successfully used to create cellularized constructs patterned with hypodermal, dermal, and epidermal layers. Samples measured 2.5*2.5 cm at the time of printing and were cultured for 1 week with no contraction prior to implantation. Following wound creating and construct application, animals were monitored visually for changes to the wound bed. Minimal contraction of the wound site was observed in either cellularized group, with wound areas maintaining 56.65 ± 32.1% and 44.28 ± 18.33% for bioprinted and reorganized skin compared to 13.91 ± 8.65 % and 7.27 ± 8.53% in the hydrogel and wound only groups over 91 days (normalized to the original wound size). Histochemical analysis of skin showed the development of a humanized epidermis with rete ridges in only the reorganized skin group. Immunohistochemical staining was used to monitor the location of the different cell types, allowing visualization of the maturing epidermis and locational tracking of the keratinocytes. Animals implanted with the reorganized skin showed keratinocytes present in the dermal layer indicating retention of the implanted organoids, and migration to epidermal/subepidermal structures over the remainder of the study. Extracellular matrix remodeling was quantified through picrosirius red staining, which showed less bundled fibrotic tissue in the two cellularized groups compared to the noncellularized controls. Pigmentation in the wound bed was monitored during the study visually with surgical images quantified using a monospectral analysis via custom code showing increased color variation in the reorganized skin group compared to the tri-layered bioprinted skin without organoids. Skin from each time point was stained with Fontana Masson showing melanocytes present in each cellularized construct despite the differences in visible pigmentation. CONCLUSIONS: We have successfully developed a multi-layered construct which aided in wound closure in a mouse model. The cellularized constructs resulted in reduced contraction and less long-term fibrotic healing during the 91 day study. The addition of organoids to the cellularized system resulted in the humanization of the epidermis and functionalization of melanocytes leading to the development of rete ridges and visible pigmentation. This is a promising step in developing a full thickness skin construct that can be translated to the clinic as an alternative to autologous skin grafts.

126. Production of Vascularized Functional Liver Tissue Constructs with Long-term Survival

Kelsey Willson Anthony Atala, MD

Lee, Sang Jin; Moon, Young-Wook; Bishop, Colin; Yoo, James; Atala, Anthony
Wake Forest Institute Regenerative Medicine (WFIRM)
Basic Science - Student

Production of Vascularized Functional Liver Tissue Constructs with Long-term Survival Purpose: While tissue engineering has advanced significantly as a field, the goal of developing large functional tissues on the bench has remained out of reach. A major hurdle to this development is the lack of internal vascularization within an engineered construct. Establishing adequate vascularization in vivo is critical in supplying oxygen and nutrients to implanted cells and tissues and removing cellular waste products. Unfortunately, large tissue constructs generated in vitro that lack vascularization have resulted in poor viability as diffusion profiles within the system prove inadequate for material transport. The NASA Vascular Tissue Challenge marked addressing this deficit as a critical objective to develop technologies that can create viable thick metabolic tissues that can be used to advance research on human physiology, fundamental space biology, and medicine and act as a stepping-stone towards the fabrication of large functional tissues from the bench. Here, we present the development of such tissue, capitalizing on bioprinting technologies to fabricate a large vascularized functional human liver construct that can be maintained for 30 days with high viability. Methodology: Vascularized human liver tissue constructs of 1.5 cm in diameter and 6 cm in length were fabricated using an extrusion-based 3D printing system, seeded with hepatocytes (HepG2's) in the bulk hydrogel and human umbilical vein endothelial cells (HUVECs) within the vascular channels. Briefly, alginate, mixed with trypsinized HepG2s, was cast into a cylindrical mold. A sacrificial material of gelatin with calcium chloride was then extruded into the alginate, creating a close-packed pattern of parallel channels. Following printing, the samples were allowed to crosslink fully in excess calcium chloride overnight at 37 °C. This step enables the gelatin within the channels to liquefy and diffuse into the crosslinking bath while the construct stabilizes. This results in a solid alginate cylinder patterned with hollow lumens. The liver tissue constructs were maintained in a media bath for 4 days to allow endothelial cell attachment, followed by media perfusion for 30 days using a peristaltic pump. The tissue samples were removed every 10 days and analyzed for cellular viability and biochemical functionality (albumin/bilirubin production). Immunohistochemistry was used to confirm the location of hepatocytes and endothelial cells within the construct. Results: Alginate and calcium chloride were successfully used to fabricate constructs patterned with internal vascular channels running the entire construct length. The final constructs were cylindrical and maintained their structural integrity over 30 days while undergoing perfusion. The liver tissue samples showed high viability (96.71%±3.43) following fabrication and maintained a greater than 94% viability throughout the 30-day time point. The liver tissue constructs produced albumin and bilirubin at 1.64 ng/e6 cells ± 0.24 and 2.65 µg/mL ± 1.97, respectively (assayed at 10, 20, and 30 days), comparable to human liver tissue. Immunohistochemistry was performed to visualize the development of albumin and bilirubin within the bulk matrix. In addition, the retrieved construct samples were stained with Von Willebrand's Factor to monitor the location of endothelial cells within the sample. Conclusion: We have successfully created sizeable, vascularized liver tissue constructs patterned with hollow channels using 3D bioprinting. The combination of perfusion and internal channels maintained high viability for 30 days. The liver tissue constructs produced albumin and bilirubin levels comparable to human liver tissue. The developed system is the first step towards constructing large, vascularized tissues engineered in vitro. This system holds significant potential in improving knowledge of how large tissues and angiogenic systems develop under different circumstances, including environmental aberrations such as those experienced by astronauts, including microgravity and increased radiation. Future work includes optimizing this system for use on the International Space Station, where tissue functionality and development will be monitored. Data collected from these systems with improved physiological relevance may lead to discoveries that enhance crew performance and health as the world looks towards traveling through the stars

127. A Novel Taxonomy of Intraoperative Cholangiograms in Suspected Choledocholithiasis: A Tool for Advancing Transcystic Laparoscopic Common Bile Duct Exploration Outcomes Research

Elizabeth Wood, MD Lucas Neff, MD

Juhi Saxena, Micaela Gomez, Maggie E. Bosley, Lucas P. Neff
Surgery-General
Educational Science – Resident

Introduction: Cholangiography for visualization of the biliary tree during laparoscopic cholecystectomy is an important diagnostic roadmap in the context of suspected choledocholithiasis (CDL). The renewed interest in transcystic laparoscopic common bile duct exploration (LCBDE) necessitates a general description of the range of CDL presentations to facilitate accurate comparison of differing LCBDE techniques. Our aim was to establish a novel classification system of intraoperative cholangiograms (IOCs) to advance research efforts in this field. Methods: A novel cholangiogram classification system, featuring 8 distinct presentations of choledocholithiasis was applied to a dataset of 80 preintervention IOCs for suspected choledocholithiasis according to the presence of stones or sludge, stone size, filling defects, presence of meniscus or tapered contrast filling pattern, and anatomical variants. The classification system is as follows: A (no common bile duct stones, duodenal filling present, concern for air bubbles), B (no common bile duct stones, no duodenal filling, concern for sludge), C1 (stone(s) < 2x size of cystic duct with duodenal filling), C2 (stone(s) < 2x size of cystic duct without duodenal

filling), D1 (stone(s) ≥ 2x size of cystic duct with duodenal filling), D2 (stone(s) ≥ 2x size of cystic duct without duodenal filling), E1 (congenital anatomical variant and/or common duct stricture), and E2 (surgically altered biliary anatomy). An additional description of cystic duct anatomy was included, given the increased adoption of transcystic entry methods into the biliary tree for LCBDE. Results: Cholangiogram review yielded preintervention classifications for 6 of 8 variants (A-E): A (7.5%), B (3.75%), C1 (23.75%), C2 (42.5%), D1 (15%), and D2 (7.5%). Analysis of cystic duct diameter yielded no significant differences among classification groups, indicating no predominant pattern of cystic duct anatomy within a given classification. Conclusion: An intraoperative cholangiogram classification system for suspected choledocholithiasis is foundational to answering key clinical questions for transcystic laparoscopic common bile duct exploration. Future efforts to correlate the success of differing LCBDE techniques within specific choledocholithiasis variants may yield clinically meaningful guidance for surgeons given the increasing variety of techniques and devices for transcystic LCBDE.

128. Relationship Between Limb Dominance and 1st Metatarsophalangeal Joint Arthritis

Faraji Woodson, MS Ashleigh Wells Medda, DPM

Ashleigh Wells Medda
Surgery-Orthopedics
Clinical Science – Student

Background: This study's objective was to determine if a relationship exists between limb dominance and the development of 1st metatarsophalangeal joint (MTPJ) osteoarthritis. While arthritis is a frequent condition found throughout the body, the 1st MTPJ is the most common location of arthritis in the foot. To our knowledge there is no current literature evaluating the relationship between 1st MTPJ arthritis and limb dominance. This proposed retrospective study sought to evaluate if a relationship exists between limb dominance and the development of 1st MTPJ arthritis. Hypothesis: We hypothesized that patients would develop 1st MTPJ arthritis in the foot of their self-reported dominant leg. In addition, we hypothesized that patients would develop 1st MTPJ arthritis on the ipsilateral side of their self-reported dominant hand. Methods: After obtaining approval from the Institutional Review Board, a retrospective chart review was conducted from January 1st, 2018-January 1st, 2024 on patients who underwent 1st MTPJ arthrodesis by surgeons throughout all locations at Atrium Health Wake Forest Baptist. These patients were contacted by telephone and after freely consenting, were asked 4 questions to determine their leg dominance and 4 questions to determine their hand dominance. Patients over the age of 18, who underwent 1st MTPJ arthrodesis with CPT code 28750 for 1st MTPJ arthritis were included in the study. Patients who identified as ambidextrous, and patients with hallux valgus were excluded from the study. Results: 40 of 137 patients who met the inclusion criteria for the study completed the telephone survey. 27 of 40 patients underwent 1st MTPJ arthrodesis for 1st MTPJ arthritis on the same foot that was deemed their dominant foot. 28 of 40 patients underwent 1st MTPJ arthrodesis for 1st MTPJ arthritis on the foot ipsilateral to their dominant hand. Conclusions: The study shows that most patients developed 1st MTPJ arthritis on their self-reported dominant foot. Also, most patients developed 1st MTPJ arthritis on the foot ipsilateral to their dominant hand.

129. Predictors of Complications of Pediatric Facial Trauma

Avery Wright, BS Christopher Runyan MD, PhD

Madison Hinson, Amelia Davidson, Samuel Kogan, Christopher Runyan
Surgery-Plastic & Reconstructive
Clinical Science – Student

Background: There has been much debate about the utility of the Glasgow Coma Score (GCS) in terms of predicting outcomes of pediatric trauma. Some studies argue that GCS can reliably predict outcomes, whereas others have pointed out its shortcomings, such as its interobserver discrepancy and reliance on a verbal response, and suggested other predictive measures. Applying an objective measure to predict complications of pediatric facial trauma outcomes could help guide treatment and serve as a primaryjustification tool for medical decisions. Methods: This retrospective examination uses a multi-center database to evaluate pediatric (<18 years old) facial trauma patients (N=1094) visiting Atrium Heath Wake Forest Baptist (AHWFB) hospital and Atrium Health Carolinas Medical Center (AHCMC) from 2020 to 2022. The number of complications, consultations, moderate and significant physical impairment, number of surgical interventions, and deaths were compared to GCS, number of soft tissue injuries and fractures, and length of hospital stay. Results: For both AHWFB and AHCMC, a lower GCS was the factor that most strongly corresponded to post-trauma complications, significant physical impairment, and deaths (p=0.000). At AHCMC, more soft tissue injuries contributed most to increased consultations

(p=0.000); a longer hospital stay contributed most to moderate physical impairments (p=0.000); and the number of facial fractures contributed most to the number of surgical interventions (p=0.000). At AHWFB, the number of soft tissue injuries correlated most with moderate physical impairment (p=0.000) and surgical interventions (p=0.000). Conclusion: In two large North Carolina hospital systems, GCS, compared to the length of hospital stay and the number of injuries, was found to have the highest correlation and therefore greatest predictive potential for the number of post-trauma complications, significant physical impairments, and deaths due to pediatric facial trauma. Acknowledging the correlation GCS has with outcomes can help guide healthcare decisions and expectations by informing patients and their families of possible complications based on their initial post-trauma status.

130. Prognostic Factors of Functional Recovery After Mechanical Thrombectomy for Acute Ischemic Stroke

Brock Yager, MS Stacey Wolfe, MD, FAANS

Horn, A., Kawas, M., Whitlow, C., Wolfe, S.
Surgery-Neurosurgery
Clinical Science - Student

Background: Mechanical thrombectomy (MT) is standard of care for 30% of acute ischemic strokes (AIS) caused by large vessel occlusion (LVO). Identification of ideal treatment candidates for mechanical thrombectomy is critical. It has been suggested that structural brain reserve may play an important role in recovery after stroke, which may explain the large variability in patient outcomes despite successful reperfusion. This has led to investigation for an effective marker for potential brain recovery. We used commercially available software to transform clinically acquired MRI brain imaging into quantitative volumetric data for patients with LVO who underwent successful revascularization (TICI 2b or better). Hypothesis: 1. Cortical thickness will predict functional outcomes quantified with mRS in patients undergoing mechanical thrombectomy for large vessel occlusion. 2. We will be able to use standard of care clinical images to quantify cortical thickness using a validated convolutional neural network. Methods: Retrospective analysis of the Atrium Wake Forest Stroke Thrombectomy and Aneurysm Registry was performed. Patients that underwent MT for LVO with successful revascularization (Thrombolysis in Cerebral Infarction (TICI) score of 2B or greater) were included. Clinically obtained T1-weighted images were transformed using the convolutional neural network SynthSR. FreeSurfer was used to quantify baseline cortical thickness. Ordinal logistic regression was used to adjust for baseline mRS and relevant covariates. Results: Successful FreeSurfer segmentation occurred in 213/223(95.6%), leaving a sample with mean age of 67.5 ±14.6 and female ratio of 105/213(49.3%). We found that the superior temporal cortex, after adjusting for baseline mRs and relevant covariates, was significantly correlated to mRs>2 at 90 days with (p=0.05), This was also true for the insular cortex and precuneus with (p<0.05) and (p<0.05) respectively. Conclusions: We have demonstrated that increased mean cortical thickness in the insula, superior temporal cortex, and precuneus on clinically obtained MRIs correlates with functional outcomes at 90 days using mRS following mechanical thrombectomy for cerebral large vessel occlusion. This highlights how neural networks could be applied to answer clinical questions on the management of patients in the acute stroke setting. Additionally, this study illustrates how databases of traditionally unusable clinical MRIs may be interrogated in retrospective analyses to provide insight and answer critical questions. These techniques may have real clinical implications for patient management and complication prevention as well as guiding future research endeavors.