Restrictive Interventions….first, the law

A-0199

§482.13(f)(2) Training Content. - The hospital must require appropriate staff to have education, training, and demonstrated knowledge based on the specific needs of the patient population in at least the following:

(i) Techniques to identify staff and patient behaviors, events, and environmental factors that may trigger circumstances that require the use of a restraint or seclusion.

Interpretive Guidelines state:
"At a minimum, physicians and other LIPs authorized to order restraint or seclusion by hospital policy in accordance with State law must have a working knowledge of hospital policy regarding the use of restraint and seclusion. Hospitals have the flexibility to identify training requirements above this minimum based on the competency level of their physicians and other LIPs and the needs of the patient population that they serve."

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Restrictive Interventions

- Restraints/seclusion are used only when less restrictive interventions, non-physical interventions, and alternative strategies have been determined to be ineffective. The decision for violent restraints/seclusion or non-violent restraints is based upon clinical findings and the patient's behavior.

- The use of restraints/seclusion is in accordance with the order of a physician, physician assistant (PA) or nurse practitioner (NP) who is responsible for the care of the patient, has a working knowledge of policies regarding the use of restraints/seclusion and is authorized to order such by policy.

Atrium Health Policy on Restrictive Interventions. Effective 12/15/23

Restrictive Intervention….what is it?

Term	Description
Restraint	A restraint is any manual method, physical or mechanical device, material or equipment that immobilizes or reduces the ability of a patient to move his or her arms, legs, body, or head freely.
Chemical Restraint	A drug or medication that is used as a restriction to manage the patient's behavior or restrict the patient's freedom of movement. A chemical restraint does not include medications used as a standard treatment for a patient's medical or psychiatric condition, as such are excluded from the standards for chemical restraint use.

Restrictive Intervention….what is it not?

- 1. Orthopedically prescribed devices
- 2. Surgical dressings or bandages
- 3. Protective helmets
- 4. Side rails
  - a) If raised for the bed to be operational (critical care beds in continuous lateral rotation mode, some net bed models)
  - b) When used to meet the following assessed patient needs
    - (1) Patient request
    - (2) Sedated, comatose, paralyzed, unresponsive patient
    - (3) Patient temporarily on a stretcher or being transported
- 5. Untied mitts
  - a) Mitts are considered restraints when pinned or attached to bedding, when used with a wrist restraint, or when applied so tightly that the patient's hands/fingers are immobilized and the patient cannot remove the mitt
- 6. Other methods that involve physically holding a patient
  - a) To conduct physical examinations/tests
  - b) To protect the patient from falling out of bed
  - c) To permit participation in activities without the risk of physical harm
- 7. Handcuffs or other restrictive devices applied by law enforcement officials
- 8. Voluntary mechanical supports used to achieve proper body position, balance, or alignment to allow greater freedom of mobility than would be possible without use of such device
- 9. Positioning or securing devices used to maintain the position, limit mobility or temporarily immobilize during medical, dental, diagnostic or surgical procedures and the related immediate post-procedural processes
- 10. Picking up, redirecting, or holding an infant, toddler, preschool age child for comfort
- 11. Age or developmentally appropriate protective safety interventions such as stroller or swing safety belts, raised crib rails, crib covers, and net beds as requested by the parent or guardian

Restrictive Intervention… details

- ASSESS and DOCUMENT underlying cause of behavior necessitating restraints (i.e. medications, oxygenation, infection, electrolyte imbalance, etc.)

- ALWAYS consider ALTERNATIVES such as reorienting, diversion items, safety education, and/or personal alarms.

- If restraint order not initiated by attending physician, notification to the attending physician should occur as soon as possible after application of restraint.

Restrictive Intervention… details

- Physician, PA, or NP assessments of restraints
  - Non-Violent Restraint: Physician, PA, or NP must examine patients within 24 hours of initiation.
  - Violent Restraint: Physician, PA, or NP must examine patients within 1 hour of initiation.
  - Upon examination, physician, PA, or NP must enter in patient note that restraints were assessed as appropriate.

Restrictive Intervention

PRN orders for restraints are not allowed

and will not be initiated

Restrictive Intervention

Non-Violent	Violent, Self-destructive
MD/NP/PA must asssess patient within 24 hours of restraint initiation	MD/NP/PA must do face-to-face evaluation within 1 hour restraint initiation.
If renewing an order, this must be done prior to the expiration of existing order to avoid potential of a restraint use without an order.	Order limited to: Adult: 4 hours Child 9-17: 2 hours Child <9: 1 hour
Any restraint order without a restraint in use, is considered a PRN order which is not allowed.	MD/NP/PA must assess the patient within 24 hours of restraint initiation if order is being renewed past 24 hours.

Restrictive Intervention

- Facilities must report to CMS each death:
  - That occurs while a patient is in restraints (other than the soft, cloth-like wrist restraint)
  - That occurs within 24 hours of a patient being in restraints (other than the soft, cloth-like wrist restraint)
  - That is known to the hospital that occurs within 1 week after the restraint is removed **and** it is reasonable to assume that the use of restraint contributed directly or indirectly to the patient's death

Malignant Hyperthermia

What is Malignant Hyperthermia?

Malignant hyperthermia is a pharmcogenetic disease of skeletal muscle

May cause a potentially fatal chain of metabolic responses in the presence of triggering agents:

- **Succinylcholine**
- Volatile gases (**Desflurane, Isoflurane, and Sevoflurane**)

Triggering agents cause:

1. Uncontrollable release of intramuscular calcium
2. Sustained muscle contraction
3. Hypermetabolic response

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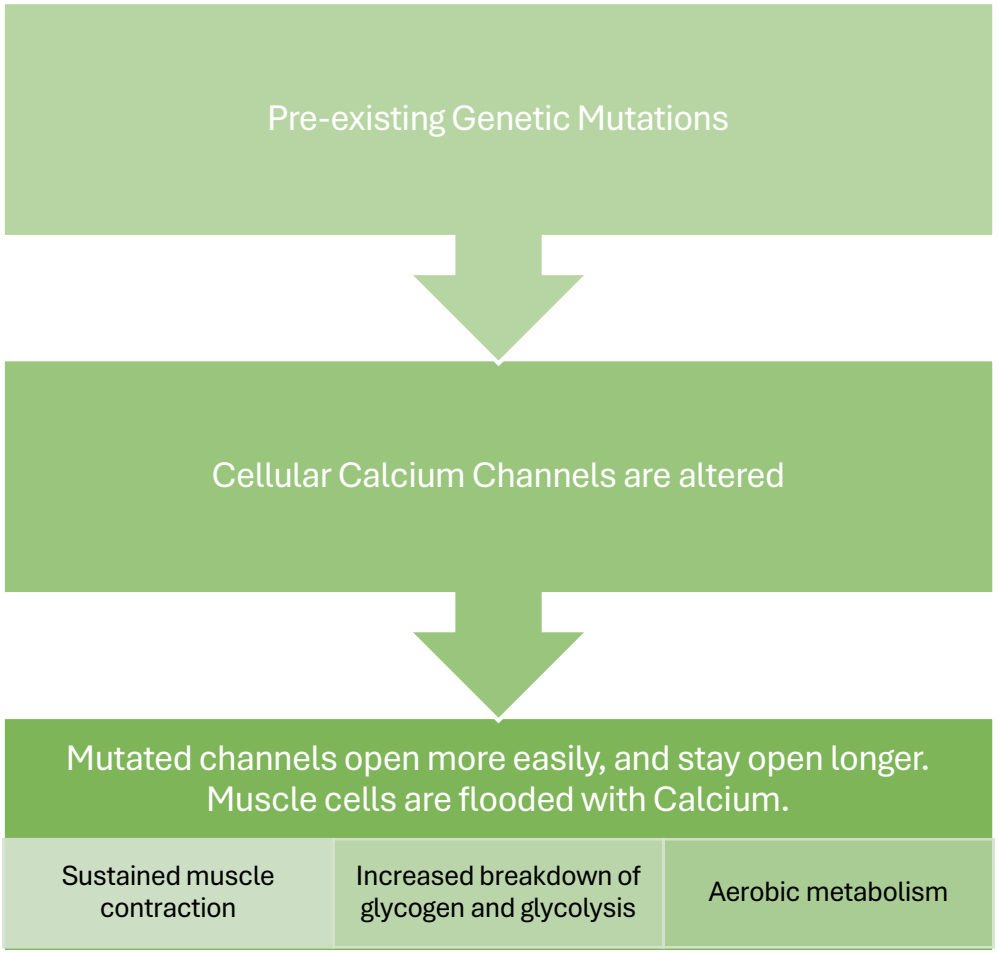
Malignant Hyperthermia

What is Malignant Hyperthermia?



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Malignant Hyperthermia

Autosomal Dominant pattern of inheritance (If one parent has this, there is a high likelihood the child will)

Adult Incidence: 1 per 50,000 – 100,000

Child Incidence: 1 per 3,000 – 15,000

- Frequency is greatest in childhood, peak at 3 years old
- Reaction in neonates and infants is infrequent

Can be fatal even if recognized and treated promptly

- Survivors may experience brain damage, kidney failure, and muscle damage

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Malignant Hyperthermia

- Marked increase in end-tidal CO2 (usually the **first** sign of a problem)
- Increased heart rate
- Unstable and increasing blood pressure
- Sustained muscle contractures and rigidity
- Hyperthermia (**often a LATE sign**)
- Skin over skeletal muscles become hot and mottled; muscle may feel knotted
- Accumulation of lactic acid
- Death is possible within minutes if left untreated

Malignant Hyperthermia

Clinical Presentation

More detailed timeline for those who want the science

Early Signs:

- **Arterial blood gas (ABG)** will show pure respiratory acidosis if MH caught and treated early
- **Mixed venous and peripheral venous blood gas** may indicate hypermetabolism
  - Increase in CO_2, oxygen desaturation with increase oxygen consumption
  - *Possible* increased lactate

Late Signs:

- Temperature may increase quickly
  - 1 degree every 10 minutes
- Profound hypercarbia (increased CO_2)
- Tachycardia
- Severe hypoxia
- Skin mottling
- Metabolic acidosis, rhabdomyolysis (muscle breakdown), coagulopathy, and hyperkalemia (increased potassium)

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Malignant Hyperthermia

Treatment History And Now

Prior to dantrolene, MH was treated with:

- Bicarbonate infusion
- Insulin and Glucose
- Active cooling
  - Iced saline, gastric lavage, cool IV fluids
- Procainamide (didn't work)

Mortality was decreased by 50%

After dantrolene was made available, the mortality rate decreased to **1.4 - 2.9%**.

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Malignant Hyperthermia

- Family History (may go back 2 generations)
  - There are 3 genes associated with MH Susceptibility
  - Children, parents, and siblings of a patient susceptible to MH have a 50% chance of inheriting it.
- ***LUMBEE Indians***
  - There is a strong genetic link to MH susceptibility with this group
  - AH Union is the closest hospital to this community
- More common in males
- Patients with Lockjaw have a higher incidence of positive MH testing
  - 20% progress to MH after succinylcholine
- Certain patient populations
  - Central core disease
  - Muscular dystrophy

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Malignant Hyperthermia

Preop Planning

Most of these actions relate to anesthesia's workflow– but it's good to know

Prevention and Preparation are KEY

- Need an accurate family history (from both sides)
- Stress can trigger (may need additional pre-meds)

If the patient has a known or family history, it's best practice to schedule their case FIRST

Room Preparation

- CRNA will use non-triggering medications (TIVA and/or regional when possible)
- **NO succinylcholine**
- New anesthesia circuit:
  - Circuit will be 'flushed' for 30 minutes prior to procedure
- Prevention measures against exposure to trace gases
  - Charcoal filters
  - Replacing CO_2 absorber.

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Malignant Hyperthermia

Must have end-tidal CO2 and pulse oximetry

Accurate body temperature

- Temperature sensors and probes are preferred over the crystalline skin thermometers

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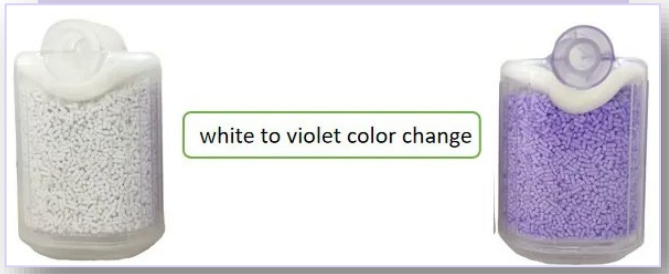
Malignant Hyperthermia

Making the Diagnosis

Increase in ETCO2



IS THE INCREASE BECAUSE OF MH, OR...

Increase metabolism or increase in CO2 production?

Decreased elimination of CO2?

Increased concentration of CO2 being breathed in?

The CRNA will rule out these causes by:

- Checking the circuit
- Checking for bilateral breath sounds
- Checking for exhausted CO2 absorbant

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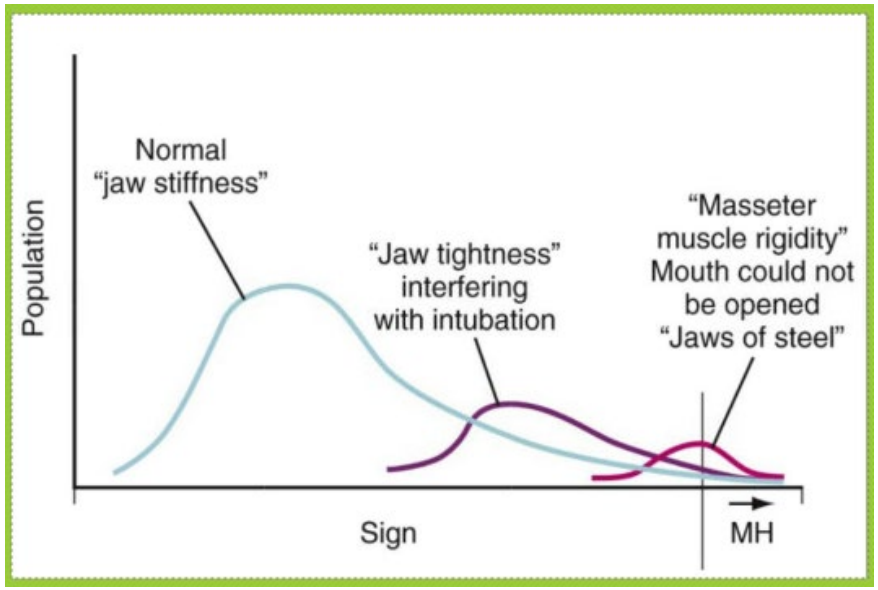
Malignant Hyperthermia

Making the Diagnosis

Muscle Rigidity



The spectrum of masseter muscle responses to succinylcholine varies from a slight jaw stiffness that does not interfere with endotracheal intubation to the extreme "jaws of steel," which is masseter muscle tetany that does not allow the mouth to be opened.

Malignant Hyperthermia

Making the Diagnosis

Increased Temperature

IS THE INCREASE BECAUSE OF MH, OR...

- Sepsis or viral infection causing a slow increase in temperature?
- Overly warmed child?
- Bilateral tourniquets?
- Plastic occlusive wrapping?

The CRNA will rule out these causes based on patient data.

NOTE: Sudden onset of fever can have several different fatal causes

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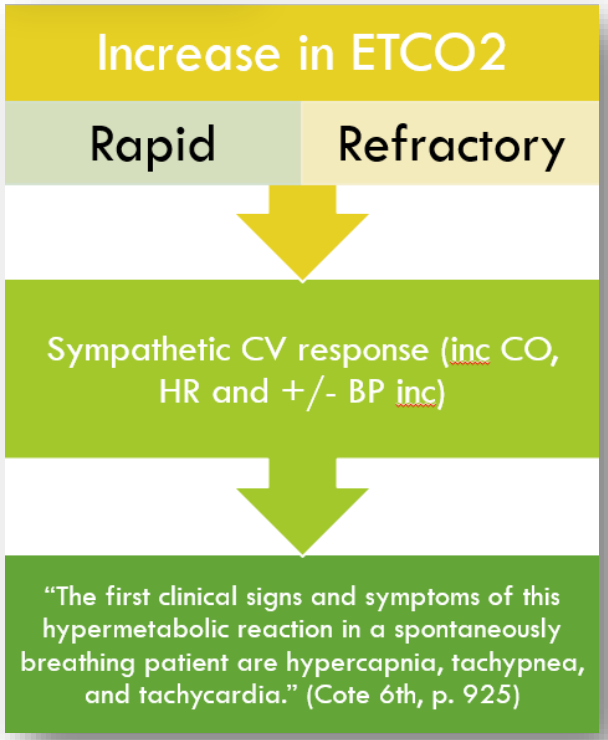
Malignant Hyperthermia



RECOGNITION IS EVERYTHING!

1. Once recognized or *suspected,* anesthesia provider will communicate with team and ask for the MH cart.
2. All volatile gases will be stopped and transitioned to other means
3. If possible, the procedure will STOP.
4. Hyperventilate patient
5. Attach charcoal filter or use another oxygen source
6. Increase FiO2 concentration (at least 10L/min)
7. Give medication

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Malignant Hyperthermia

1. Get the MH cart in the room
2. Prepare dantrolene (2.5mg/kg IV every 5 minutes*)
   - Will need to reconstitute with sterile water

***Our MH cart has a chart that references the correct dose based on the patient's weight**

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Malignant Hyperthermia

How Does Dantrolene Work?

It is a muscle relaxant - It stops in flow of intracellular calcium through the mutated channels

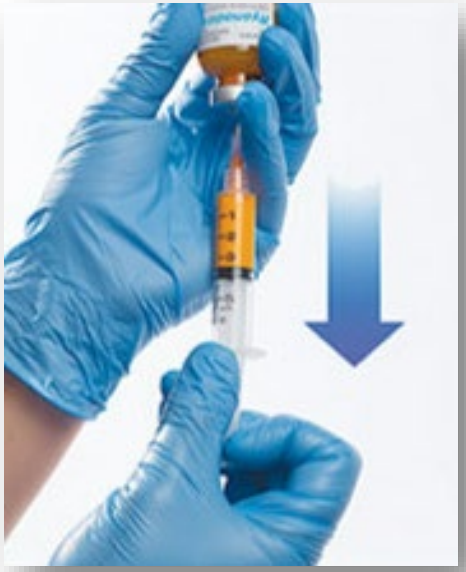
- Reverses hypermetobolic process, usually within minutes
- Very muscular patients may need higher doses
- Administration closer to onset of an MH crisis will reduce complications

Generic (old) preparation

- PH 9-10
- Contained mannitol
- Labor-intensive to mix (need 60 ml sterile water per vial)

Concentrated (Ryanodex)

- Easier to mix
- Quicker onset of benefits



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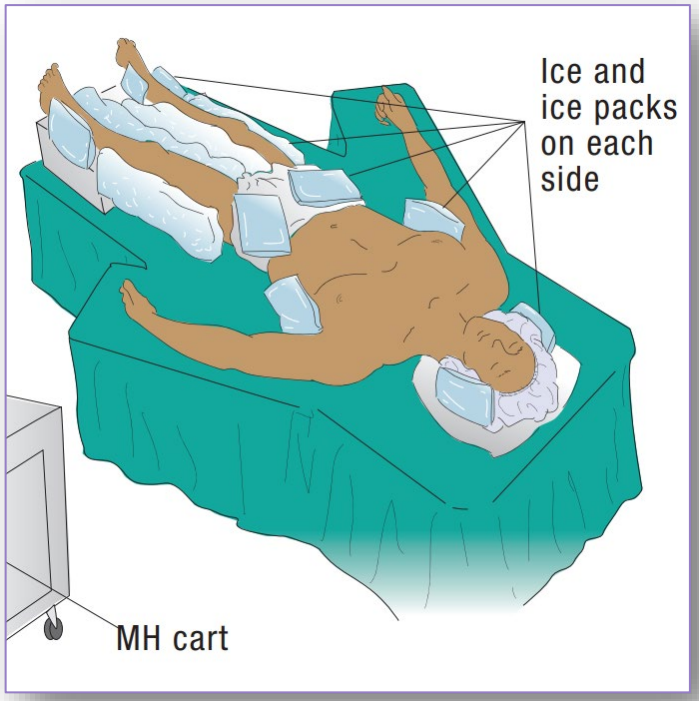
Malignant Hyperthermia



Assist with cooling measures

1. Remove blankets (and bair hugger)
2. Apply ice to axilla, groin, and around head
   - DO NOT APPLY DIRECTLY TO SKIN
3. Provide cold saline
   - For IV or irrigation
4. Get cold water for NG Lavage

Cooling measures will be initiated with patient temp is above 39 C (102.2 F)

Stop when temperature falls below 38.5 C (101.3 F)

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Malignant Hyperthermia

Management

Other Considerations

All patients experiencing malignant hyperthermia will go to the ICU – regardless of the severity.

Hyperkalemia Treatment:

- Calcium gluconate or Calcium chloride
- Sodium bicarbonate
- Regular insulin IV

Arrhythmia Treatment (VF/VT):

- **DO NOT USE calcium channel blocker**
- Amiodarone (following ACLS algorithm)
- Labs:
  - ABG or VBG, electrolytes, serum CK, serum/urine myoglobin, coagulation survey
- Place foley to monitor urine output

Malignant Hyperthermia

Healthcare Professionals

IF YOU NEED TO MANAGE AN MH CRISIS RIGHT NOW:

Please Call MH Hotline at:

1-800-644-9737

Be prepared to give your name, number, facility and email, in the event the call is dropped

(outside of North America: **001-209-417-3722**) and view our **Managing an MH Crisis Page**.

What is the MH Hotline?

HOTLINE

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Malignant Hyperthermia

- For the first 24 hours, need continuous monitoring:
  - Heart rate, respiratory rate, core temperature, oxygen saturation
  - End-tidal CO2
  - Muscle tone
  - Q8h: blood pH, Lactate, potassium, creatinine kinase
- Watch for relapse (for at least 24 hours following cessation of signs)
- Give dantrolene 1mg/kg IV every 4-6 hours (for at least 24 hours)
  - Stop or decrease frequency if:
    - Metabolic stability for 24 hours
    - Core temp is <38 C (100.4 F)
    - CK decreasing
    - No evidence of protein in urine
    - No muscle rigidity

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Malignant Hyperthermia

- Change in level of consciousness/coma
- Cardiac dysrhythmias and dysfunctions
- Pulmonary Edema
- Renal Dysfunction
- Disseminated Intravascular Coagulation
- Hepatic dysfunction
- Muscular Weakness
- Compartment Syndrome

Malignant Hyperthermia

- Consult with MHAUS hotline to determine if further testing is required
  - Muscle biopsy
  - MH molecular genetic testing
- Add succinylcholine and inhalation anesthetics to patient's adverse drug reactions
- Ask patient to contact MHAUS to sign registry consent form
- Refer patient and family to MHAUS for additional resources
  - Sample letters for relatives
  - Medical ID bracelets
  - Sampe letters for future anesthesia care providers

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Malignant Hyperthermia

Cotta, A., Lucas, S. S., Carvalho, E., Leticia, N. F., CunhaJr, A., Monica, M. N., Valicek, J., Miriam, M. M., Simone Vilela, N. N., Xavier-Neto, R., Antonio, P. V., Reinaldo, I. T., Julia, F. P., & Vainzof, M. (2022). Central Core Disease: Facial Weakness Differentiating Biallelic from Monoallelic Forms. Genes, 13(5), 760. https://doi.org/10.3390/genes13050760

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