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Rhabdomyolysis- Diagnosis and Treatment

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RHABDOMYOLYSIS – DIAGNOSIS AND TREATMENT

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Introduction

Rhabdomyolysis results from the rapid breakdown of skeletal muscle fibers, which leads to leakage of potentially toxic cellular content into the systemic circulation (Hamel et al., 2015, p. 621). Rhabdomyolysis is a syndrome that is characterized by muscle necrosis and the release of intracellular muscle constituents into circulation leading to complications and disease. Rhabdomyolysis symptoms range from minor body aches to life threatening disease and acute kidney injury. The clinical features of rhabdomyolysis include myalgia, muscle weakness, myoglobinuria and muscle swelling that develops over hours to days (Nance & Mammen, 2015, p.793).

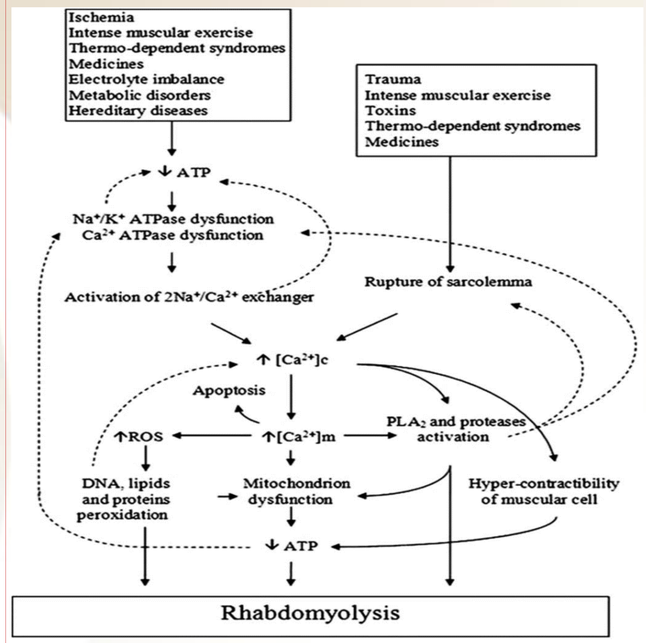
Working in a prison unit I have witnessed several cases of patients that are to be treated for rhabdomyolysis, I have been captivated by these cases and I crave to understand the mechanics of the syndrome. Given the number of cases that come to the unit and are eventually diagnosed with rhabdomyolysis it is pertinent for an advanced nurse practitioner to understand the pathophysiology of the disease. Understanding the mechanics of the disease will help in diagnosis thus timely treating the condition hence improving patient outcomes. Most of the cases encountered are non-traumatic exertional rhabdomyolysis on inmates. They do not have much to do in the prison camps and they do exercises such as squats or push-ups unknowingly causing rhabdomyolysis.

Pathophysiological Processes

- Clinical manifestations and complications of rhabdomyolysis result from muscle cell death, which may be triggered by a variety of initiating events like:
  - Traumatic or muscle compression (e.g. crush syndrome or prolonged immobilization)
  - Nontraumatic exertional (e.g. marked exertion in untrained individuals, hyperthermia, or metabolic myopathies)
  - Nontraumatic nonexertional (e.g. drugs or toxins, infections, or electrolyte disorders)
- Common pathway for injury is an increase in intracellular free ionized cytoplasmic and mitochondrial calcium and sodium.
- An increase in intracellular calcium and sodium draws water into the cell and disrupts the integrity of the intracellular space (Torres, Helmstetter, Kaye, & Kaye, 2015, p. 60)

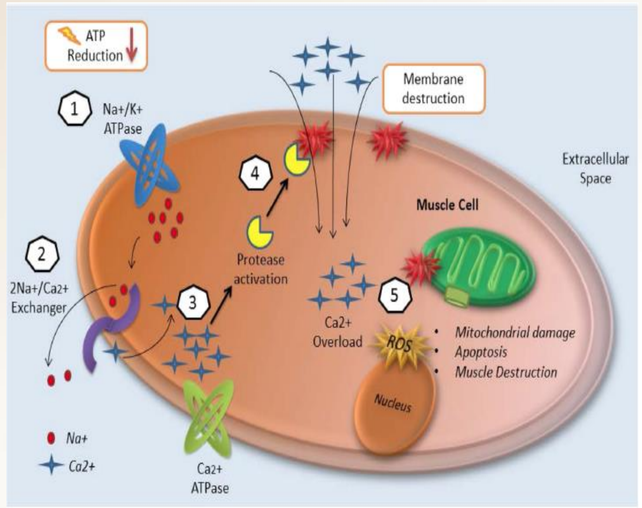
This may be caused by depletion of adenosine triphosphate (ATP), the cellular source of energy, and/or by direct injury and rupture of the plasma membrane.

- Increased intracellular calcium leads to activation of proteases, increased skeletal muscle cell contractility, mitochondrial dysfunction, and the production of reactive oxygen species, resulting in skeletal muscle cell death.
- ATP depletion leads to myocyte injury and the release of intracellular muscle constituents, including creatine kinase (CK) and other muscle enzymes, myoglobin, and various electrolytes
- The end result of these alterations within the muscle cell milieu is an inflammatory, self-sustaining myolytic cascade that causes necrosis of the muscle fibers and releases the muscle contents into the extracellular space and the bloodstream (Torres, Helmstetter, Kaye, & Kaye, 2015, p. 60)



Signs & Symptoms

- The classic triad of symptoms of rhabdomyolysis consists of myalgia, weakness, and tea-colored urine" (Torres, Helmstetter, Kaye, & Kaye, 2015).
- Patients may also present with oliguria or even anuria
- Drug-induced syndromes associated with rhabdomyolysis are characterized by muscle rigidity, hyperthermia, and metabolic acidosis (Chavez et al, 2015)
- Additional symptoms that are more common in severely affected patients include:
  - malaise,
  - fever,
  - tachycardia,
  - nausea and vomiting,
  - and abdominal pain (Miller, 2016)
- Altered mental status may occur from the underlying etiology (e.g., toxins, drugs, trauma, or electrolyte abnormalities (Miller, 2016)



Underlying Pathophysiology

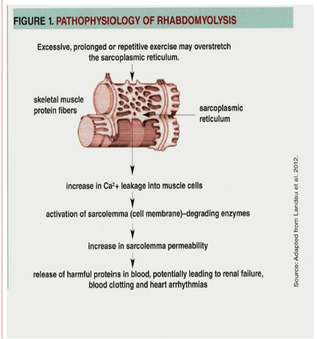
Normal muscle physiology involves the sodium - potassium and sodium – calcium pumps functioning properly to maintain equilibrium between intracellular and extracellular fluid concentration. These pumps depend on energy that is supplied by adenosine triphosphate (ATP). Torres, Helmstetter, Kaye, & Kaye, (2015) state all the processes that happens in the myocytes depends on the availability of sufficient energy in the form of ATP and any insult that damages the ion channels will reduce the availability of ATP for energy thus disrupting proper balance of intracellular electrolyte concentrations (p. 59).

Rhabdomyolysis has several causes, theoretically any form of muscle injury or damage can initiate rhabdomyolysis (Torres, Helmstetter, Kaye, & Kaye, 2015). The most common cause of rhabdomyolysis is drug use, trauma, immobility, medicines and intense muscular exercise. There are other causes that includes medications (statins), body temperature changes, infections, endocrine disorders, and genetic defects that also cause rhabdomyolysis. Complications of rhabdomyolysis includes acute kidney injury, compartment syndrome, disseminated intravascular coagulation and hypercalcemia.

Significance of Pathophysiology

Pathophysiology of rhabdomyolysis is significant to clinicians; knowledge of the pathways of the disease helps a clinician understand what to expect and how to properly manage a patient. Pathophysiology of rhabdomyolysis allows the clinician to be proactive instead of reactive hence reducing complications from the syndrome. The clinician has to understand pathophysiology of rhabdomyolysis and the signs and symptoms of the disease to ensure timely diagnosis and treatment. Rhabdomyolysis can be life threatening and disabling, having a clinician who knows how the syndrome progresses is vital in ensuring better patient outcomes.

While the patient benefits from a knowledgeable clinician, pathophysiology of rhabdomyolysis is also of critical significance to the patient. A patient who is knowledgeable about the disease process and pathophysiology is able to prevent the disease from occurring and has better outcomes when affected by such a disease. Patients who have an understanding of the pathophysiology of any disease are likely to be compliant to treatment regimen and are likely to engage in practices that prevents the disease. Understanding pathophysiology of rhabdomyolysis is important in the overall management of the disease and ensures successful reversal of symptoms.



Implications for Nursing Care

Treatment of Rhabdomyolysis requires early recognition of the symptoms and early intervention before systemic complications set in. Implications of nursing care involves providing ongoing nursing care. The treatment of rhabdomyolysis includes fluid replacement via intravenous therapy. "Volume repletion with saline is essential to avoid hypovolemic shock and acute kidney injury" (Grau & Poch, 2016, p. 2). Nursing care will include sequential monitoring of urine output or volume, color and specific gravity to guide continuous fluid resuscitation. The nurse should be vigilant to ensure no major complications occur, "Serial physical examinations and laboratory studies are indicated to monitor for compartment syndrome, hyperkalemia, acute oliguric or no oliguric renal failure, and disseminated intravascular coagulation" (Muscal & DeGuzman, 2015)

The next key step is identification and correction of the inciting cause (e.g., trauma, infection, or toxins) (Muscal & DeGuzman, 2015). Finding the causative agent and eliminating it will ensure the patient will recover without further complications. Trying to treat the problem without eliminating or correcting the inciting agent will prolong the process of healing or even worsening the patient's condition. Correction of electrolyte, acid-base, and metabolic abnormalities will be achieved with no difficulty if the causative agent has been removed.

Conclusion

Rhabdomyolysis is a major clinical challenge; it manifests itself in different nonspecific symptoms which makes it difficult to diagnosis hence can easily lead to systemic complications. The prognosis of rhabdomyolysis depends on the complications resulting from the rhabdomyolysis and the underlying cause. When treated early and aggressively, an episode of rhabdomyolysis has an excellent prognosis (Zutt, Van der Kooi, Linthorst, Wanders, & De Visser, 2014, p. 657). Clinicians should be aware of the symptoms of the syndrome and be ready to intervene in a timely manner to reduce complications. Clinicians should also be proactive in teaching the patients they work with to ensure that they know the likely cause of the syndrome and how to prevent it.

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