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Exertional Rhabdomyolysis in Fitness Enthusiasts: Understanding the Risks to Kidney Health

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Abstract: ***Exertional Rhabdomyolysis (ER) is a serious condition caused by excessive physical training, commonly observed in young adults influenced by fitness trends on social media. It involves the breakdown of skeletal muscle, leading to the release of myoglobin and creatine kinase into the bloodstream, potentially causing acute kidney injury, hepatic dysfunction, and other severe complications. This paper examines ERs symptoms, diagnosis, and management, emphasizing the importance of awareness and preventive measures among fitness enthusiasts.***

Keywords: Exertional Rhabdomyolysis, Acute kidney injury, Myoglobin, Creatinine Kinase, Fitness Training and Skeletal Muscle Breakdown.

1. Purpose of the article

The article aims to highlight the risks of exertional rhabdomyolysis, particularly in the context of intense physical training among gym enthusiasts, and discusses its implications for kidney health**.**

2. Significance of the article

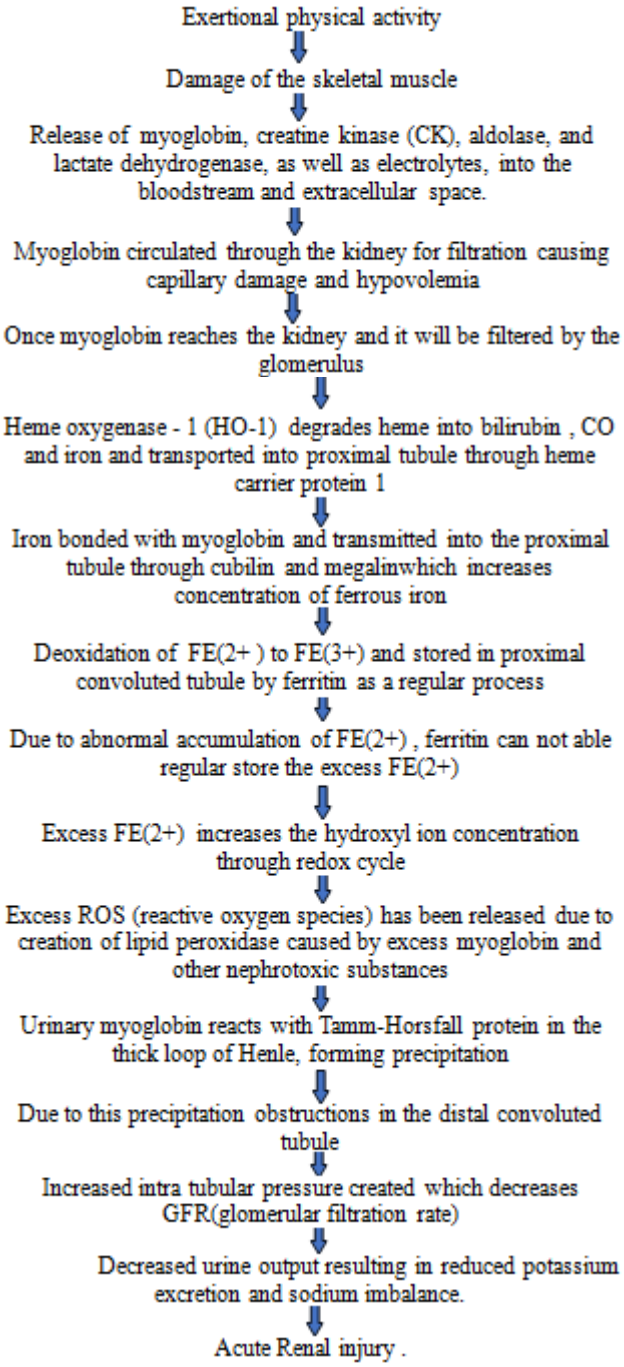
The article significantly contributes to understanding the balance between fitness pursuits and health risks, particularly the impact of intense physical exercise on kidney function, an often overlooked aspect in fitness regimes**.**

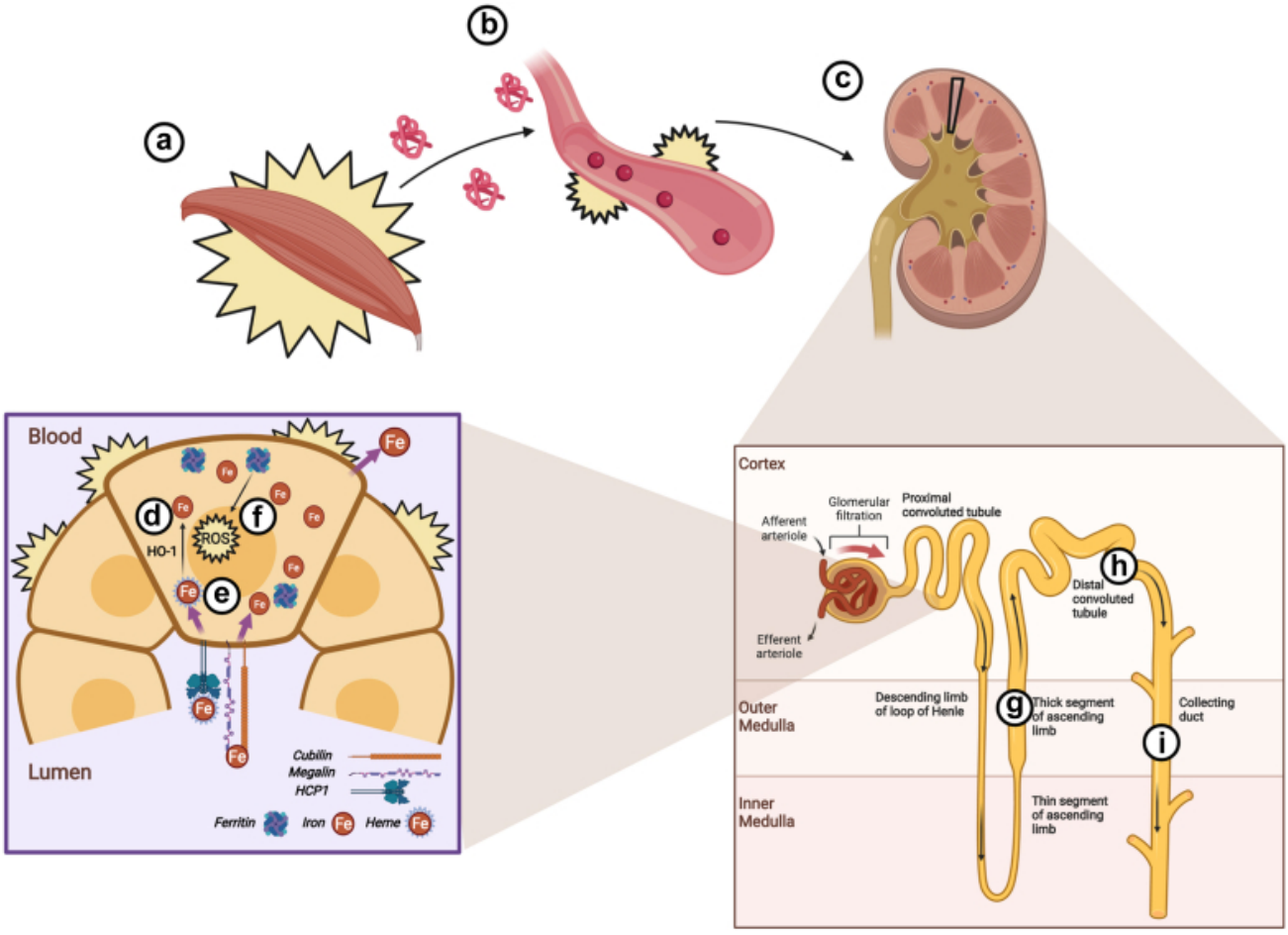
3. Introduction

Sternus physical exercise can cause direct or indirect damage to the skeletal muscle cells. This is called as exertional rhabdomyolysis. exertional rhabdomyolysis cases mostly due to unfit individuals who are attempting exhaustive exercise such as marathon running, weight lifting, a sudden onset start of exercise, or exercise done for a prolonged time[1]. This condition is seen in younger adults who are active in social media about fitness and gym training. It is characterized by release of muscle cell elements such as myoglobin and creatinine kinase into the blood stream and urine. This type of rhabdomyolysis potentially leads to acute kidney injury. however, complications of EIR are serious[2]. EIR can cause not only acute kidney injury (AKI), and also will develop hepatic dysfunction, compartment syndrome, dysrhythmia, heart failure, electrolyte imbalance, and in severe cases, even death[4].

Mechanisms of exertional Rhabdomyolysis causing Kidney Injury:

Exertional rhabdomyolysis develops after intense physical effort or resuming physical work following a long period of inactivity[3].





a) Breakdown of skeletal muscle.
b) Release of myoglobin and other elements
c) Myoglobin infiltrate in the kidney causing capillary damage and hypovolemia
d) Heme oxygenase - 1 degrades heme transported into the proximal tubule by Heme carrier protein 1 to release free ferrous iron.
e) Iron bound to substrates, including myoglobin, is transported into the proximal kidney tubule by megalin and cubilin, further increasing the concentration of free ferrous iron.
f) Ferritin, which oxidizes Fe (2+) to Fe (3+) and stores it, fails to keep up with incoming free ferrous. Fe (2+) reacts with hydrogen peroxide in the Fenton reaction, producing hydroxyl radicals, lipid peroxidation, and overwhelming superoxide dismutase activity.
g) Myoglobin combines with Tamm - Horsfall protein (THP), found in the thick segment of the ascending limb, forming a precipitate.
h) THP - Myoglobin precipitate forms obstructive tubular casts in the distal convoluted tubule
i) Urine output decreases, resulting in reduced potassium excretion and perturbation of water, pH, and sodium balances, putting further pressure on the vascular system. ROS, reactive oxygen species.

4. Presentation

The "classic triad" symptoms of rhabdomyolysis are muscle pain in the shoulders, thighs, or lower back, muscle weakness or trouble moving arms and legs and dark red or brown urine or decreased urination. Some people also experience dehydration, decreased urination, nausea. loss of consciousness[5].

5. Diagnosis

Rhabdomyolysis can be accurately assessed through history collection and physical examination by observing the triad symptoms, and other confirmatory diagnosis are laboratory values of elevation of creatinine kinase and myoglobin. Dipstick urinalysis may show positive for blood, but urine microscopy typically reveals tubular casts (from the precipitation of myoglobin with Tamm–Horsfall protein in the urine), but no blood[6].

Management

- Fluid resuscitation: crystalloid solution resuscitation is one of the mainstay of treatment for non anuric patient with rhabdomyolysis. The aim of fluid resuscitation is reducing the renal vasoconstriction and produce diluted urine.
- Identify the causes of rhabdomyolysis and treat the cause immediately.
- Continuous assessment of airway, breathing, circulation is vital to prevent further worsening of the disease.
- Management of electrolyte abnormalities (sodium, potassium, calcium and phosphorus) helps protect the heart and other organs.
- Hyperkalemia may be fatal and should be corrected vigorously, Hypocalcemia should be corrected only if its symptoms occur.

- Compartment syndrome requires immediate orthopedic consultation for fasciotomy.
- Continuous monitoring of creatine phosphokinase (CPK) is essential, because if the CPK is more than 5000 IU/L have increased risk of developing AKI.
- Appropriate use of antibiotics, vasopressors are needed when concomitant sepsis present.
- Steroids are used in inflammatory myopathies[7].

Nursing management:

1) **Assessing the patient immobility:** rhabdomyolysis may cause muscle swelling, myalgia and weakness of all over the body. It is important to identify the patient physical mobility and plan appropriate interventions.
2) **Assess and monitor the patient's fluid status:** Monitor intake and output chart can help to maintain a fluid status of the patient. Fluid therapy in rhabdomyolysis helps to increase urine output and prevent kidney damage. IV fluids also help flush out excess muscle proteins and electrolytes from damaged muscles. Athletes, service members, and firefighters may require extra fluid intake to maintain the hydration.
3) **Monitor kidney functions and electrolyte values:** Rhabdomyolysis associated with electrolyte imbalances and elevated creatinine and BUN. It will help to monitor the progression of acute kidney injury.
4) **Prepare the patient for dialysis**: Dialysis may be needed in severe cases to help the kidneys filter waste products while recovering.
5) **Pain management:** Assess the characteristics of pain and administer analgesics as per order. Resting the injured muscles is necessary to allow the fibers to recover. When returning to exercise, do so slowly and rest as needed. Treating the muscle pain by using non pharmacological measures like massage and warm compresses.
6) **Maintain adequate circulation:** Elevation of limbs with proper support can help to maintain the circulation. The nurse also monitors the peripheral pulses, skin color and warmth to ensure proper circulation[8].

6. Conclusion

The article concludes that while physical fitness is crucial, it is equally important to recognize the risks of exertional rhabdomyolysis and its potential impact on kidney health. Awareness and appropriate training measures can significantly reduce these risks.

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