
 RIVERSIDE

EXERTIONAL
RHABDOMYOLYSIS

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Disclosures

- None



PARENTING
Who Says It Has To Be Difficult?

Overview

- Case Presentation
- Definition
- Causes
- Predisposing conditions
- Diagnosis
- Treatments
- Complications

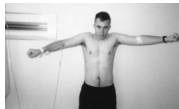
Case Presentation

- 14yo high school rower presents to emergency department for bilateral arm pain and swelling for past 2 days
- No injury
- First year crew athlete who began a pre-season training regimen that included rowing 5 days a week and doing cross-fit 3 days a week



Case Presentation

- Meds include OTC ibuprofen and acetaminophen for pain control
- PMH, PSH and ROS are otherwise negative
- Exam: diffuse tenderness throughout L arm musculature with diminished ROM of the L elbow, but no N/T. 2/4 pulses and no signs of compartment syndrome



Case Presentation

- Labs (normal except below)
 - ▣ RBC 4.23 L
 - ▣ Hgb 12.6 L
 - ▣ HCT 38.0 L
 - ▣ CKMB 13400 U/L H
 - ▣ AST 180 H
 - ▣ ALT 57 H

Case Presentation

- Community ED Treatment
 - ▣ Fluids (NSS)
 - ▣ Morphine 2mg
 - ▣ Motrin 400mg
 - ▣ Transfer to Pediatric ER/Hospital with diagnosis of exertional rhabdomyolysis



Case Presentation

- Pediatric ER
 - ▣ Exam
 - Forearm circumference
 - R 27.75 cm
 - L 28.75 cm
 - ▣ Labs
 - Stayed essentially the same
 - CK 12054 U/L
 - Urine myoglobin Negative
- Admitted to general pediatrics floor

Hospital Course

- Six day course of aggressive IV fluid rehydration
- CK and LFTs continued to rise, plateaued and trended down
 - ▣ Peak CK 26000 U/L
- Discharged home with pediatric follow-up
- Pediatrician labs
 - ▣ LFTs near normal
 - ▣ CK 272 U/L



Follow-Up

- Pediatrician re-evaluated 10 days later
- Still in significant arm pain that is not improved with acetaminophen
- Rechecked labs
 - CK 94 U/L
 - LFT's normal
- Referred to Sports Med for return to play guidance and continued pain

Sports Medicine Office

- Fatigable weakness and pain in left shoulder with rotator cuff muscle testing, fatigable weakness in all strength testing of the elbow more pronounced than right, grip strength diminished on left
- Left forearm paresthesia with negative Tinel's at cubital and carpal tunnel as well as a negative Spurling maneuver



Sports Med Return to Play

- Tylenol with codeine for pain
- Refrain from gym and school sports
- Graded return to play over a 6-8wk period with physical therapy
- Patient did not go to PT and had exacerbation of pain 5 months later
- CK levels were normal and finally went to PT/OT and has now returned to normal activity (volleyball and basketball) without issues

Definition

- Rhabdo – striated
- Myo – muscle
- Lysis – break down of cells

Bad blood
Rhabdomyolysis can be caused by injuries or conditions that damage skeletal muscle. Heat stroke, severe exertion or trauma can increase the risk.

BROKEN DOWN
Muscle-fiber contents known as myoglobin are released into the bloodstream when damaged muscle tissue ruptures.

SIDE EFFECTS
KIDNEY DAMAGE
Myoglobin is filtered out of the body through the kidneys but breaks down into substances that can cause renal injuries.

DARK URINE
Urine of an abnormal color (red or dark brown) can indicate kidney damage.

Source: U.S. National Library of Medicine

Rhabdomyolysis Etiologies

- Trauma
- Non-Trauma Exertional
 - ▣ Extreme overuse
 - ▣ Thermal regulation issues
 - ▣ Metabolic Myopathies
- Non-Trauma Non-Exertional
 - ▣ Toxins (i.e. Alcohol/Drugs)
 - ▣ Infections
 - ▣ Electrolyte abnormalities

Rhabdomyolysis Incidence


- 26,000 cases a year in the United States
- 47% are exertional in nature

CK elevation	Condition	Frequency (%)
> 10,000 IU/L	Rhabdomyolysis	1/10,000 (0.01)
> 10X ULN	Myopathy	1/1,000 (0.1)
Normal or increased*	Myositis	Unknown
Normal	Myalgia	5/100 (5)

Source: J Am Pharm Assoc © 2008 American Pharmaceutical Association


Exertional Rhabdomyolysis

- The acute breakdown skeletal muscle cells causing a release of myoglobin and other muscle cellular contents through out the circulatory system




History

- First reported in 1967 in Army recruits undergoing basic training at an altitude of 4060ft.
 - Started as acute renal failure
 - Soon after cases were reported in the Air Force
- Attention grew in 1971 when 40 men from a single marine platoon were hospitalized due to rhabdomyolysis



Clinical Signs/Symptoms

- Myalgias
- Muscle swelling
- Muscle weakness
- Darkened (brown or tea colored) urine



Day 7 post-exercise. Arm at Day 8 post-exercise. Arm 1 day after Day 14 post-exercise. Arm



Laboratory Findings

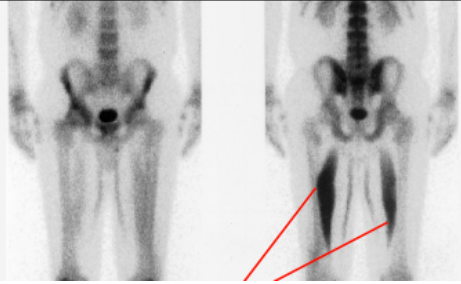
- Elevated Serum Creatine Kinase (CK)
 - Greater than 5000
- Myoglobinuria
 - Urine dipstick positive

Other Laboratory Findings

Electrolyte/Enzyme	Blood Level Change
Potassium	Increased
Calcium	Decreased
Phosphate	Increased
Creatine Kinase	Increased
Serum Creatine	Increased
Lactate Dehydrogenase	Increased
Uric Acid	Increased
pH	Decreased

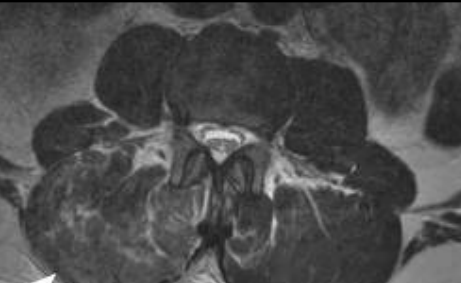
Imaging with Exertional Rhabdomyolysis

- Usually not necessary
- Can localize muscle involvement with Scintigraphy with technetium-99m methylene diphosphonate with local radiotracer uptake
- MRI particularly T2-Weighted, fat-saturated images demonstrate diffuse muscle hyper-intensity



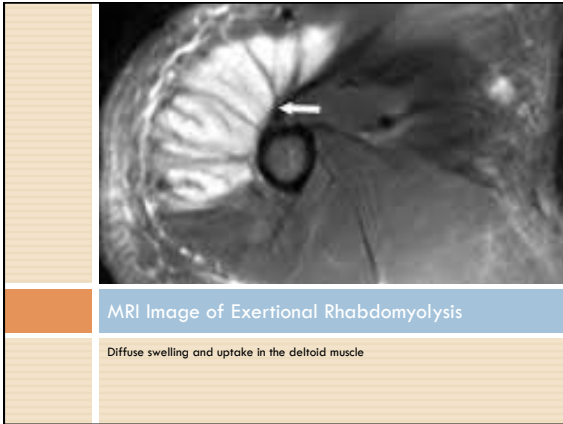
Scintigraphy with technetium-99m methylene diphosphonate with local radiotracer uptake

Uptake in adductor mangus bilaterally



MRI Image of Exertional Rhabdomyolysis

Diffuse uptake in the paraspinal musculature




Predisposing Factors

- Deconditioned athlete participating in high intensity, high repetition physical activity
- Exercise in hot, humid conditions
- Sickle cell trait, particularly at higher altitudes
- Can occur in conditioned athletes
- Metabolic myopathies
 - Disorders of glycogenesis, glycolysis or lipid metabolism

Medicines that can contribute to Exertional Rhabdomyolysis

- Prescription Drugs
 - Amphetamines
 - Methadone
 - SSRI's
 - Anti-psychotics
 - Statins
 - Antihistamines
- Drugs of abuse
 - Alcohol
 - LSD
 - Heroin
 - Cocaine




Recommended measures for preventing Exertional Rhabdomyolysis with SCT

- Implement a pre-season conditioning program
- Modify exercises as needed during season
- Implement aggressive hydration protocols
- Educate athletes on beverages that can cause diuretic effect
- Avoid strenuous activity in hot and humid conditions
- Avoid strenuous activity in altitudes over 2500ft
- Modify activity after illness or sleep deprivation


Treatment

- Hydration, hydration, hydration
 - ▣ Normal saline until CK drops below 1000U/L



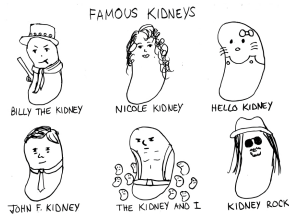
Sequelae from Exertional Rhabdomyolysis

- Myoglobinuria
- Renal Failure (5-7% of time)
- Disseminated Intravascular Coagulation
- Death



Renal Failure with Exertional Rhabdomyolysis

- Rare
- Caused by myoglobin precipitating into the renal tubules



NSAID usage during exercise

- NSAIDs have been shown to decrease kidney function
- Has been associated with exertional rhabdomyolysis particularly after marathons
- NSAIDs decrease GFR leading increased dehydration and predisposition to further renal injury


Return to Play

- Once discharged from hospital, care must be taken to gradually recondition athletes for activity
- Slow progression and build up over time
- Weekly check-ups recommended



Randall et al's RTP secondary to intense push-up training

- Phase 1
 - ▣ Active and Passive ROM of shoulder and elbow as pain allows
- Phase 2
 - ▣ When ROM has returned upper body ergometer at low intensity for 5m progressing daily until workload can be maintained for 15m



Randall et al's RTP secondary to intense push-up training

- Phase 3
 - ▣ Isotonic weight training with light weights for specific muscle weakness, modified pushups, and bench press. Modified pushups progressed daily from wall to stool to chair to floor until able to do normal pushup

Randall et al's RTP secondary to intense push-up training

- Phase 4
 - ▣ Patient is allowed to resume normal exercise routine with the restriction of only preforming 1 set of pushups in a 24h period. Restriction maintained until patient is able to perform at their pre-injury number of pushups without sequelae such as muscle soreness or loss of normal ROM

**Modified Kersey Method
to increase pushup performance**

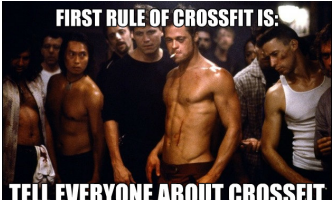
- 1. Perform 3 sets at 50% of pre-training 2m pushup test score
- 2. When able to complete 3 sets add a 4th
- 3. When able to complete 4 sets, return to performing 3 sets at 75%
- 4. When able to complete 3 sets add a 4th
- 5. When able to complete all reps for 4 sets return to performing 3 sets but at 90% of pre-training pushup test score

Special Consideration

- Extent of muscle damage
- Underlying physical condition
- Previous training (particularly with any weights) and experience

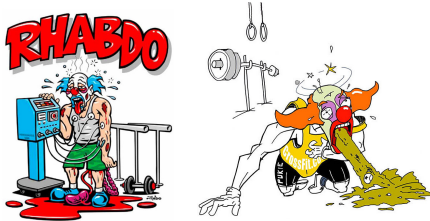
The Problem with High Intensity Circuit Exercise Programs

- We love a quick effective way to lose weight
- Many times we engage in physical activity we are deconditioned for leading to injury mainly due to poor form or poor instruction



Uncle Rhabdo

- Glorified by those who have had this condition while doing CrossFit
- NY Times article first to highlight issue



CrossFit

- Over time CrossFit has worked to eliminate the stigmata that injuries like this with a focus on proper instruction and form over sheer repetition
- It is important whenever engaging in an exercise program like this to critically evaluate the gyms



Education

- Valuable to mention with community hydration discussions and heat illness
- Reach out to gyms and teams and work to educate your community to prevent this from happening



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