

# Exertional Rhabdomyolysis

(ages 12-18)

CONE HEALTH PEDIATRICS  
Updated October 2018

## Making the Diagnosis

1. Recent history of exercise with severe muscle pain
2. CK elevated to 5x the upper limit of normal (CK elevations occur for many other reasons, such as inflammatory myopathies and muscular dystrophies; so elevated CK in the absence of exertion should warrant a broader work-up)
3. UA positive for blood in the absence of RBCs, may or may not have dark urine

## Initial Evaluation in Emergency Room (or Inpatient Ward if direct admit)

1. Administer 1-2 20 mL/kg NS or LR boluses
2. Obtain history of the following:
  - sickle cell disease or sickle cell trait (Exertional Collapse Associated with Sickle Cell Trait or ECAST can be a rapidly progressive, potentially fatal illness)
  - past episodes of documented rhabdomyolysis or symptoms consistent with rhabdomyolysis
  - family history of rhabdomyolysis or metabolic diseases
  - History of anabolic steroid use
3. Obtain baseline labs:
  - CMP
  - Phosphorus, uric acid, CK
  - urinalysis with microscopy and urine myoglobin
  - SICKLEDEX test if sickle cell status is unknown (all ethnicities)
  - Send lactic acid if patient has known sickle cell trait or is ill-appearing.
4. If patient known to be positive for sickle cell trait or if sickle cell status is unknown, repeat labs (CMP, lactate) **every 4 hrs and notify PICU of patient**
5. For history that does not fit with the diagnosis, consider other etiologies: drugs/toxins, ethanol, infections (including viral), crush injury, metabolic disturbances (including CPT II deficiency and McArdles), GSD VII (may present with “second wind” phenomenon due to decreased delivery of free fatty acids and ketones to muscle), status epilepticus

## Inpatient Management required for (not an all-inclusive list):

1. Signs of acute kidney injury (BUN, creatinine)
2. Potential compartment syndrome (early signs of compartment syndrome include decreased peripheral sensation, severe pain (disproportionate to injury) worsening pain with passive stretching, and swelling. The loss of a pulse and paresis are late signs)
3. Known presence of sickle cell trait
4. Limited or unreliable follow-up

## Continuing inpatient management

1. Total fluid intake per day: minimum 2 times maintenance rate (as calculated by the Holliday-Segar method), LR slightly preferred over NS to avoid hyperchloremia. Typical rates are 200-300 ml/hr
2. Repeat CMP, Phos, uric acid, CK and UA 6 hrs after initial labs (**unless sickle cell trait positive or unknown, then repeat labs 4 hrs after initial labs**)
3. After the second round of labs, frequency of lab work will be determined at primary team's discretion based on patient's clinical status.
4. Peak CK often occurs after 2-3 days. Other electrolyte abnormalities to watch for are metabolic acidosis, hyperkalemia (from damaged muscles), hypocalcemia (from muscle deposition of Ca, only treat this if patient has cardiac arrhythmias or seizures as IV calcium can worsen muscle deposition), hyperphosphatemia
5. Urinary heme dipstick results of >2+ are associated with a higher rate of renal failure<sup>i</sup>
6. Alkalinization of urine to pH>6.5 theoretically can prevent urine cast formation but is not routinely recommended. May be beneficial in children with elevated K levels.
7. Neurovascular checks to be performed by RN q4 hrs for 24 hrs (Serial monitoring of pain, pulses and perfusion is aimed at detecting compartment syndrome. If worrisome then consult pediatric surgery)
8. Strict I/Os
9. RN to notify MD if UOP < 2 mL/kg/hr (over 8 hrs). If uop < 2 ml/kg/hr, consider 1 L NS bolus and increasing IVF rate
10. Continuous cardiorespiratory monitors
11. Pain control with acetaminophen (avoid NSAIDs and opiates if possible)
12. In the absence of symptomatic volume overload, furosemide (or other diuretics) should not be used solely for the purpose of increasing urine output, as it can precipitate urine myoglobin.

## Discharge

1. Serum CK with consistent trend down and normal renal function and electrolytes with UOP >2 mL/kg/h (There is not a set CK needed for discharge. CK may remain above 1000 and patient is still safe for discharge as long as symptoms are resolving)
2. Urine dip must be heme negative, or if clearly menstruating, must contain intact red blood cells on urinalysis with microscopy
3. Must demonstrate good oral fluid intake
4. Able to ambulate
5. Set up follow-up at 3-4 days post-discharge with primary care provider for 1) repeat serum CK, 2) full chemistries, 3) urine myoglobin and 4) urinalysis with microscopy
6. Avoid IV contrast for radiology procedures for 6 weeks after event

## Return to Play Guidelines (for low risk patients)



### PHASE one

- Rest for 72h and encourage hydration (no activities or sports during this time)
- Sleep 8 hours consecutively each night
- Follow up after 72 hours for repeat CK and UA.
  - If CK<1000 proceed to PHASE two
  - If CK>1000 return in 72h to repeat labs. Consider sports medicine referral if CK>1000 after 2 weeks



### PHASE two

- Begin light activities (no strenuous physical activities during this time)
- Follow up 1 week after starting PHASE two
  - If no return of clinical symptoms (no muscle weakness, swelling, pain, or soreness), begin PHASE three
  - If some symptoms remain, follow up in 1 week intervals until symptoms are better



### PHASE three

- Gradual return to regular physical activities including sports
- Follow up as needed

Consider Sports Medicine referral at any point if the patient is not progressing to the next phase after a prolonged period of time or for difficult return to play decisions

Include these return to play guidelines in discharge summary & AVS so that patient gets a consistent message between hospitalization and outpatient care

Low risk patients do not have persistent elevation of CK>2 weeks, no acute renal injury, no suspicion of metabolic disease, and no sickle cell trait

*Adapted from O'Connor F, et al. Return to Physical Activity After Exertional Rhabdomyolysis. Current Sports Medicine Reports. 2008, 7 (6): 328-331*

This clinical pathway is based upon medical evidence and a consensus of pediatric practitioners at Cone Health Pediatrics. These clinical pathways are intended to be a guide for practitioners with a special emphasis on those working at community hospital sites. Management needs to be adapted for each specific patient based on the practitioner's professional judgment, unique patient circumstances, the needs of each patient and their family, and the availability of resources at the health care institution where the patient is located.

Accordingly, these clinical pathways are not intended to constitute medical advice or treatment, or to create a doctor-patient relationship between/among Cone Health physicians and the individual patients. These clinical pathways may not be in every respect accurate or complete, and may not apply to a particular patient or medical condition.

## Evidence Base

USUHS. Clinical Practice Guideline for Managing ER. Accessed 10/12/2018 at:

[https://www.usuhs.edu/sites/default/files/media/mem/pdf/clinical\\_practice\\_guideline\\_for\\_managing\\_er.pdf](https://www.usuhs.edu/sites/default/files/media/mem/pdf/clinical_practice_guideline_for_managing_er.pdf)

Youyang Yang, Lindsay P. Carter, Rebecca E. Cook, Elahna Paul, Kevin R. Schwartz. A Case of Exertional Rhabdomyolysis: A Cheer for Standardizing Inpatient Management and Prevention. *Hospital Pediatrics*. 2016 (6).

OConnor F, et al. Return to Physical Activity After Exertional Rhabdomyolysis. *Current Sports Medicine Reports*. 2008, 7 (6): 328-331

Asplund et al. Challenging Return to Play Decisions: Heat Stroke, Exertional Rhabdomyolysis, and Exertional Collapse Associated With Sickle Cell Trait. *Sports Health* 2015, 8 (2): 117-120.

(i) Rebekah Mannix, Mei Lin Tan, Robert Wright, Marc Baskin. Acute Pediatric Rhabdomyolysis: Causes and Rates of Renal Failure. *Pediatrics*. 2006 (118)

---