Genitourologic Illness & Injuries in Athletes

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Disclosures

- No financial disclosures
Conditions to be Covered

- HEMATURIA
- PROTEINURIA
- ACUTE RENAL FAILURE/ RHABDOMYOLYSIS
- INFECTION
- STRESS INCONTINENCE
- TRAUMA
  - renal, bladder, ureters

- DRUG EFFECTS
- MALE/FEMALE GENITALIA TRAUMA
“The average kidney is much SMARTER than the smartest human” - Penn State Nephrologist

“Wait a minute here, Mr. ADAMS ... Maybe it isn’t kidney stones after all.”
Causes of Hematuria
EXERCISE-INDUCED HEMATURIA

- Most common presenting urinary symptom.
  - 20% of all marathoners (Eichner, 1990)
  - 50-70% of all ultramarathoners (Schiff, 1978)
  - “Runners get bloody urine” (Bernardo Ramazzini, 1713)
    - “Father of Occupational Medicine”
EXERCISE-INDUCED HEMATURIA

- DEFINITION:
  Hematuria, gross or microscopic, which occurs after strenuous activity and resolves within 48 hours
  - >3 RBC’s/HPF OR > 1,000 RBCs/ml (light microscopy)
EXERCISE-INDUCED HEMATURIA

- **ETIOLOGY**
  - Usually occurs after prolonged strenuous activity. (*running, biking, and swimming*)
  - Can be from **trauma to the renal vasculature**.
    - Either from a direct blow or from jostling.
  - Can be **caused by renal ischemia**.
    - Is caused by the shunting of blood to the active muscles and renal vasoconstriction to preserve filtration pressure.
EXERCISE-INDUCED HEMATURIA

ETIOLOGY

- The bladder can be the source of bleeding.
  - Contusions are caused by slapping of the flaccid wall against the fixed trigone.
- The Urethra and Prostate can bleed due to direct trauma.
- Increased catecholamines may increase RBC fragility by releasing lysolecithin.
EXERCISE-INDUCED HEMATURIA

ETIOLOGY

- NSAIDS use and Hyponatremia in Ironman Triathletes:
  - 330 athletes from 2004 New Zealand Ironman
  - NSAID use was 30% & Hyponatriemia was 1.8%
  - Lower serum NA correlated with:
    - NSAID use
    - Female gender
    - Lower pre-race body weight
    - Younger age
    - Smaller weight loss during race.

  (Noakes et al, MSSE 38(4), 2006.)

- NOTE: COX-1 and COX-2 are expressed in both NSAIDS and by Kidneys and this selectively inhibits kidneys

  (Whelton et al, AM J Med, 2001)
Differential Diagnosis

- Bleeding diathesis
  - (i.e. liver failure, Sickle Cell Dz)
- Meds and certain foods
  - (i.e. pyridium, quinine, nitrofurantoin, phenytoin, rifampin, vegetable juices)
- Renal calculi
- Autoimmune Dz
  - (i.e. Lupus, Wegeners)
- Malignancy
- Henoch-Schleon Purpura
- Benign Familial Hematuria
- Medullary Sponge Kidney
- UTIs
  - Bacterial (E.coli)
  - Fungal/Granulomatous (Goodpasture’s)
  - Parasitic (Schistosomiasis)
- Paroxysmal exercise Hemoglobinuria
  - Footstrike Hemolysis
- Alports (deafness)
EXERCISE-INDUCED HEMATURIA

WHO GETS A FULL WORKUP

- Hematuria that does not clear in 24-72 hours.
- Gross hematuria or recurrent hematuria.
- Males > 40 years of age.
- Hematuria not related to prolonged or intense physical activity.
**PROTIENURIA**

- MOST COMMON UROLOGIC FINDING IN ATHLETES.
- Caused by increased renal filtration pressure causing increased glomerular permeability.
  - This is caused by the low flow state yielding
  - Decrease in renin, angiotensin II and ADH.
**PROTIENURIA**

- Intensity and duration of activity are the main determinants.
- Can show 2+ to 3+ dipstick measurements.
- Usually occurs within 30 minutes of exercise and clears within 48 hours of cessation.
PERSISTANT PROTIENURIA

- R/O Benign Orthostatic Proteinuria.
- Dietary history can be important.
- R/O HTN and other renal diseases.
  - LABS: CBC, glucose, BUN and creatinine.
  - May need 24 hour urine for protein and creatinine.
  - IVP or Spiral CT scan
  - Urinary protein electrophoresis.
Athletic Pseudonephritis

- Transient, benign hematuria with proteinuria (Gardner, 1956)
- More common than actual nephritis
- RBC casts are often noted in those with h/o trauma (i.e. football players)
- Generally clears with 2 days of rest
INFECTIONS of GU TRACT

- UTI
  - Female > Male
- STDs
- Epidydmitis
- Prostatitis
UTIs in Athletes

- Caused by:
  - Sports-associated
    - Cycling, diving
  - Lifestyle-associated
    - promiscuous
  - Travel-associated
  - General Population-related
EPIDIDYMITS

- Tender and indurated early but may become hard and fixed.
- Develop fever and elevated WBC’s.
- Etiology in men < 35 yo: Chlamydia
- Etiology in men > 35 yo: E coli
- R/O gonorrhea
ACUTE RENAL FAILURE

- Can occur due to decreased renal flow secondary to dehydration.
- The most common cause of ARF in athletes is **Rhabdomyolysis**.
  - Can be caused by severe muscle trauma due to extreme exertion or direct trauma.
Rhabdomyolysis

- Causes an increase in CPK, aldolase, myoglobin, potassium, phosphorus and glutamic-oxaloacetic transaminase.
  - *Myoglobin is a nephrotoxin*
- Treat renal failure in athletes as you would in any other patient.
- Exertional muscle damage (elbow flexor) from eccentric exercise with profound CK-Mb elevation did not relate to renal impairment.
# Causes of Rhabdomyolysis

<table>
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<tr>
<th>Direct Muscular Injury</th>
<th>Drugs</th>
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<td>Heroin</td>
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<tr>
<td>Burns</td>
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<td>Excessive Activity</td>
<td>Amphotericin B</td>
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<tr>
<td>Jogging</td>
<td>Lovastatin</td>
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<tr>
<td>Seizure</td>
<td>Tricyclic antidepressants</td>
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<td>Delirium tremens</td>
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<td>Impaired carbohydrate metabolism</td>
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<td>Impaired lipid metabolism</td>
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<td>Tissue Hypoxia</td>
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<tr>
<td>Vascular obstruction</td>
<td>Gas gangrene</td>
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<tr>
<td>External compression</td>
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<tr>
<td>Sicke cell disease</td>
<td>Epstein-Barr</td>
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<tr>
<td>Metabolic Disorders</td>
<td>Coxsackie</td>
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<tr>
<td>Diabetic ketoacidosis</td>
<td>Rickettsial</td>
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<td>Hypokalemia</td>
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<tr>
<td>Hyponatremia</td>
<td>Temperature Related</td>
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<td>Thyroid storm</td>
<td>Hypothermia</td>
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<td></td>
<td>Hyperthermia</td>
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<td></td>
<td>Neuroleptic malignant syndrome</td>
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<td>Idiopathic</td>
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Rhabdomyolysis

- **Common Causes:**
  - Exercising in extreme **HEAT** w/o proper hydration.
  - **ALCOHOL** and many other drugs.
  - **McARDLE’S** syndrome-- genetic lack of muscle phosphorylase.
  - Happens more w/ **ECCENTRIC** Contractions than Concentric Contractions
    - Mike Tyson Squats
      https://www.youtube.com/watch?v=8yrUenyGeA4
Types of INCONTINENCE

- Three basic types of incontinence
  - STORAGE PHASE
    - 1) Stress
      - Most common in athletes
      - “too much straining” - increase intra-abdominal pressure
    - 2) Urge
      - “Gotta go, Gotta go” - bladder/detrusor instability/spasm
  - VOIDING PHASE
    - 3) Overflow
      - “too much water over the dam” - outflow obstruction
Etiology of Incontinence

- Genetic Factors
- GYN Surgery
- Vaginal Births
- Neurologic Disease
- Gastrointestinal Disease

- Pulmonary Disease
- Smoking
- Obesity
- Occupational Factors
- Recreational Activities
- Prostate Surgery
Anatomy

Side view of a woman's bladder and related structures

- Bladder outlet supported by pelvic floor muscles
- Urethra
- Vagina
- Pelvic floor muscles wrap around the underside of the bladder, uterus, and rectum giving support
Incontinence can be classified as stress, urge or overflow.
- Active women can experience all three.
- Up to 47% of exercising women experience stress incontinence (Bo et. Al., 1994).
- Only 30-35% of these women seek medical attention. (avg. 7-9yrs.)
- 72% of Female Trampolinist/Gymnast have urine leakage while exercising.

Rates of Incontinence by Sport

Figure 1. Rates of incontinence in women vary by sport, with higher rates in high-impact activities.

STRESS INCONTINENCE

- Continence requires an active urethra-sphincter mechanism, a compliant bladder and the absence of involuntary bladder contractions.

- Urine storage and expulsion is regulated by the ANS (T10-S4) & the “micturition center” of the CNS.
STRESS INCONTINENCE

- Caused by either high intra-abdominal pressure or inability to control the pelvic floor muscles.
  - More common with high impact sports.
  - High impact motions subject the pelvic floor muscles to forces 3-4x the woman’s body weight.
More Causes

- High Dynamic Sports that have high intra-abdominal pressure
  - (gymnastics, combat sports, horseback riding and weight lifting)
- Can even occur in nulliparous athletes.
- Low estrogen states can cause atrophic changes to the vagina and urethra.
DIFFERENTIAL DIAGNOSIS

- Urgency, frequency and urge incontinence & nocturia suggests *Detrusor Instability* in women without neurologic deficits.
- Always rule out a UTI.
- Assess neurologic status.
  - *Anal Wink* maneuver will cause contraction of the pelvic floor >> intact sacral reflex center.
- R/O prostate conditions in males.
Kegel exercises increase the tone of the external urethral musculature.

- Sometimes “electrical Kegel’s” are required.

- Limit fluids and bladder irritants before exercise.

- Caffeine, ETOH, nicotine, acidic beverages and nutri-sweet are not bladder friendly.
TREATING STRESS INCONTINENCE

- Some women insert a moist tampon to stabilize the neck of the urethra.
- Mechanical devices
  - Pessaries & Bladder-neck Support Prosthesis
TREATING URGE INCONTINENCE

- STRESS TRMT: Alpha-mimetic therapy gives improvement in up to 60% of women.
  - Ditropan (oxybutnin) /Detrol
  - Pseudoephedrine
  - Phenylpropanolamine
  - Must be aware of the side-effects.

- URGE TRMT: Imipramine is also used to increase the urine storage(anticholinergic side-effects)
What about the athlete w/ ONE kidney?

Sports recommendations are controversial

• Get informed consent from the athlete and/or parent prior to the sports season

• Most causes of kidney trauma are related to MVA or recreational activities such as bicycling, less commonly seen in team sports

• Can be seen in skiing, snowboarding, in-line skating

• Football most common team sport to cause kidney trauma, but rarely does it result in kidney loss. Often have full recovery

• Athlete (and parent) should be educated on risk for kidney injury in sport when determining whether or not to participate in contact sports… if their one kidney goes out there is no back-up
RENAL TRAUMA

- **Contusion** - hematuria, Spiral CT w/ Contrast or IVP (-) - observe.

- **Subcapsular Hemorrhage** - Spiral CT w/ Contrast or IVP (+) - observe

- **Cortical laceration** - Spiral CT w/ Contrast or IVP (+) - observe, re
RENAL TRAUMA

- **Caliceal laceration** - Spiral CT w/ Contrast or IVP shows internal extravasation with intact capsule - observe & possibly surgery.

- **Renal fracture** - Spiral CT w/ Contrast or IVP shows separation of the pelvicaliceal system - surgery.
Kidney Trauma

- **RENAL TRAUMA**
  - Vascular pedicle injury- IVP does not show kidney, presents in shock Rare in sports *Thank God!!*
TREATMENT: Traumatized Kidney

- **Class I:** contusion/bruise/subcapsular hematoma: conservative
  
  *Trmt:* watch & restrain from strenuous activity for 2-3 weeks.

- **Class II:** cortical lesion  
  
  *Trmt:* same class I

- **Class III:** calceal laceration, if hemorrhage,  
  
  *Trmt:* Surgery!

- **Class IV:** complete renal fracture  
  
  *Trmt:* Surgery!

- **Class V:** vascular/ pedicle injury,  
  
  *Trmt:* Surgery!
Traumatic injury to Ureters

- Rare in sports, (most often in rapid deceleration - i.e. NASCAR crashes)
  - Our case: College Soccer Goalie

- Often need to be addressed surgically if flow is obstructed / disrupted.

- Microsurgical Repair vs. Stent
Traumatic Injury to Bladder

- Bladder contusion
- Bladder detrusor muscle irritability:
  - aka "Biker's bladder"
- Prostate irritation
- “Bladder Slap” syndrome (i.e. runners)
- Serious bladder injuries (i.e. ruptures) usually are caused by blunt trauma on a distended bladder.
NEPHROTOXIC DRUGS COMMONLY USED BY ATHLETES

- **NSAIDs** *Papillary Necrosis*
  - 54% of idiopathic hematuria *(Kraus et al., 1984)*
  - 1.8% assoc with Hyponatriemiia in Ironman Triathletes *(Noakes et al., MSSE, 2006)*

- **Thiazides & Dilantin** *Allergic Interstitial Nephritis*

- **Triamterene** *Nephrolithiasis*

- **Oral contraceptives** “Loin-pain” Hematuria syndr.

- **Anticoagulants** *Hematuria*

- **Amphotericin** *Renal toxicity, Hematuria*
HERNIAS

- Three most common are indirect inguinal, direct inguinal, and femoral.
- Palpate the external inguinal rings and inguinal canal while the athlete Valsalvas.
  - Direct- globular mass close to the pubes.
  - Indirect- elliptical mass along the spermatic cord.
HERNIAS

- Be aware of incarcerations or strangulation.
- Surgical repair is recommended for large or symptomatic hernias.
- RTP
  - Indirect: 8-10 weeks for contact sports.
  - Direct: 12 weeks for contact sports.
GENITAL TRAUMA

- Direct Testicular Trauma
  - Can cause a contusion
    - Ice and elevate for 24 hrs.
    - If pain persists consider torsion.
    - If the mass expands think of fractured testicle.
  - If you can not feel the epididymis separate from the testicle think epididymitis.

Ultrasound of testicular trauma
Torsion of the Spermatic Cord

Extravaginal torsion occurs in neonates.

Intravaginal torsion occurs in prepubertal and pubertal boys.

Consider a torsion whenever you have pain and swelling.

Can be Bilateral (Internally rotate ~180°)

THIS IS A SURGICAL EMERGENCY!!!
Torsion of the Spermatic Cord

- Presents with swelling and pain, which can radiate to the groin.
- Testicle can be riding high with abnormal epididymis.
- R/O epididymitis
  - Elevation of scrotum < pain epididymitis.
  - Elevation of scrotum > pain torsion.
Traumatic injuries to the Penis & Urethra

- Penile contusion
- Fracture of penis
- Pudendal neuropathy
- Traumatic urethritis
- Exercised-Induced Hematuria
- Protienuria
EXTERNAL GENITALIA

- Penile trauma can cause vascular injuries and impotence.
- The vulva are very vascular and any trauma can cause hematomas.
- Be aware of pudendal nerve irritation due to racing bicycle seats.
SCROTAL MASSES

- **Varicocele** is common in 20% of males.
  - Sx. If painful, decreasing testicular size or infertility.

- **Spermatoceles** are extravasation of sperm due to trauma or infection.
  - Treat if large or painful.
SCROTAL MASSES

- **Hydrocele** is a cystic mass surrounding the testicle and epididymis.
  - Caused by decreased absorption of tunica vaginalis secretion.
  - Due to trauma, infection or malignancy.
    - IF ACUTE W/O TRAUMA THINK MALIGNANCY.

Transillumination of Hydrocele
SCROTAL MASSES

- **Hematocele** is a blood accumulation in the tunica vaginalis.
  - Does not transilluminate.
  - Ice, elevate and bed rest.

- **TESTICULAR CANCER IS THE MOST COMMON MALIGNANCY IN 15-35 YEAR OLD MEN!**
Testicular Exam

- 2012 USPSTF recommendation is to NOT perform testicular exam on asymptomatic males: Evidence C
References