Sickle Cell Trait and Disease Policy

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Acknowledgements

• McLeod Sports Medicine
• Scott Galloway- ATC, Ben Hogan Sports Medicine
• Scott Anderson- Head ATC, University of Oklahoma
• Hillary Plummer- ATC, PH.D Student, University of Auburn
• Brigett Wilson- James R. Clark Memorial Foundation
Why Have I Gotten Involved?

- Head ATC Lamar/Darlington High Schools
- Tyquan Brantley, Lamar High School
  - July 30, 2011
  - Collapsed during sprints
  - Exertional Sickling Crisis
- Led to our dept. policy
- Inquired about state policy
What is sickle cell trait?

• The inheritance of one gene for sickle hemoglobin (S) and one for normal hemoglobin (A)
• Sickle cell trait is associated with increased survival from malaria
• Intense or extreme exertion can cause RBC’s to sickle
• No contraindications to sports participation exist for an athlete with SCT
Who has Sickle cell Trait?

• Approximately 1 in 12 African-Americans (AA) have sickle cell trait (SCT)
  ▪ Some states have higher Incidence rates

• National Incidence rates of SCT are approximately 8% in AA, 0.5% in Hispanics, and 0.2% in whites (but more common in those from the Mediterranean, Middle East, and India)
How do you inherit sickle cell trait?
Players With Sickle Cell Trait

- Ryan Clark- Pittsburgh Steelers
- Curtis Lofton- Atlanta Falcons
- Devard Darling- Florida State
- Terrell Owens- Ex NFL player
- Geno Atkins- Cincinnati Bengals
- Tyrone Goodson- Auburn Tigers
SCT Incidence Rates in the US
1. DC
2. Mississippi
3. Florida
4. South Carolina
5. Louisiana
6. Georgia
7. Maryland
8. Alabama
9. Illinois
10. New York
11. North Carolina
12. Virginia
24. West Virginia

NNSGRC (2009).

Apparent National Incidence: 15.49

NNSGRC (2009).
What is sickle cell disease?

• Sickle cell disease occurs when a person inherits a gene for sickle (S) hemoglobin from one parent and a sickle (S), C, D, E, O, or beta thalassemia gene from the other parent

• Approximately 1 in 400 African Americans have sickle cell disease
  ▪ Some states have higher incidence rates

• The most common are: Sickle Cell Anemia (SS), Sickle-Hemoglobin C Disease (SC), hemoglobin E disease, Sickle Beta-Plus Thalassemia and Sickle Beta-Zero Thalassemia
What is sickle cell disease?

• Hb SS- Most common and most severe
  ▪ Chronic Anemia
• Hb SC- Mild to Moderate Anemia can occur
• Hb E- Most common in people with Southeastern Asian descent
• Beta Thalessemia- Most common in people with Mediterranean descent
Table 7. Cases of Sickle Cell Diseases (SCD) and apparent incidence by state

<table>
<thead>
<tr>
<th>Region</th>
<th>States</th>
<th>Cases</th>
<th>Total Cases</th>
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NNSGRC (2009).

States (By Region)

Apparent National Incidence: S/S: 0.337  S/C: 0.171  S/A: 0.041

* Not required

NNSGRC (2009).
Treatment for Sickle Cell Disease

- Hydrate (8-10 glasses / day)
- Blood Transfusions
- Hydroxyurea
  - Medication that has recently been found to help reduce the frequency of pain crises and acute chest syndrome
  - It may also help decrease the need for frequent blood transfusions
Treatment for Sickle Cell Disease

• Bone Marrow Transplant
  ▪ Have been effective in curing some people with sickle cell disease
  ▪ The decision to undergo this procedure is based on the severity of the disease and ability to find a suitable bone marrow donor
Sickle Cell Disease & Athletics

• Few compete collegiately
  - FB player with Hb SC
    - Not cleared by 2 university’s but cleared by a third
    - Suffered total splenic infarction during weightlifting
    - Quit Football
  - WBKB player wit Hb SC
    - Completed collegiate career despite suffering splenic infarction in her first workout
  - Punter with Hb SC
    - Small splenic infarctions & mild sickling crises, as well as splenic pain on flights
    - Made it through 2 years with supplemental oxygen on flights
Sickle Cell Disease & Athletics

- JUCO BKB player with Hb SC
  - Prior splenic infarction on plane flight
  - Completed career with few complications, but played sparingly
- Fullback with Hb S-BT
  - Limited stamina
  - Goal line situations
- Athletes with sickle cell disease are advised to avoid high-exertion, contact or collision sports even if appropriate hydration can be ensured
History of SCT & Exertional Sickling

• Epidemiological Study 1977-1981
  ▪ 12 recruits died during Basic Training
• African American (AA) recruits with SCT are 27.6 times more likely to suffer sudden unexplained death than AA recruits without SCT
• 39.8 times more likely than NAA recruits
• The main cause of death was rhabdomyolysis
  ▪ Risk of exertional rhabdomyolysis was about 200 times greater for those with SCT
• Linked deaths to Exertional Heat Illness (EHI)
• Began Implementing Universal Interventions to prevent EHI
Army Universal Interventions

• Performance levels should be built up gradually
• Training should cease and restart gradually when substantial myalgia occurs
• Monitor Ambient Conditions
• Adequate hydration
  ▪ Increased water intake with rising environmental heat stress
• Electrolyte Intake
• Monitor Urine Color
• Monitor Weight
History of SCT & Exertional Sickling Cont.

• 10 year follow up study (1982-1991)
• Enforced hydration and close monitoring of environmental conditions
• ↓ in sudden expected deaths in 2.3 million recruits
• 0 occurring in 40,000 recruits with SCT
• Training centers not participating in the trial had rates similar to 1977-1981 study
• Stopped mandated testing per secretary of defense memo in 1996
  ▪ Continue Universal Interventions
Current Military Stance

• 1977-2002 - 26 deaths
• 2002 - Present - ≈15 deaths
  ▪ Last 2 in Ft. Jackson, SC
  ▪ Authors recommended testing anyone who failed PT test
  ▪ Long Road to the same Result

• Led to 2012 ACSM & CHAMP Summit
  ▪ Need More Scientific Evidence
  ▪ Costs do not outweigh the benefits
Army Costs vs. Benefits Analysis

• Costs
  ▪ $250,000 - $1,000,000
  ▪ Expect ≈ 1-2 Sickling Deaths/ year
  ▪ Expect ≈ 10 SCD crises/year + Potential SCT crises (3-5)
  ▪ Estimated 2147 (2066 AA; 81 NAA) enlisted servicemen that have sickle cell trait won't know

• Benefits
  ▪ Prevent ≈ 1-2 Sickling Deaths/ year
  ▪ Prevent ≈ 10 SCD crises during Initial Entry training + Potential SCT crises (3-5)
  ▪ Estimated 2147 (2066 AA; 81 NAA) enlisted servicemen that have sickle cell trait would find out their status and offered genetic counseling

Exertional Heat Illness?

- Dr. Eichner questions military Link of EHI & Exertional Collapses
  - Observed 30 exercise collapses (21 fatal)
  - The military determined 22 were EHI, even when most had core temp. below 102°F
- Parris Island, SC 14 year Marines Study
  - Recruits with SCT had similar occurrences of EHS than recruits without SCT
  - 1 in 200
Exertional Heat Illness?

- Ambient Temperature
  - Most military SCT deaths below 75° F
  - Average temp. of HS & NCAA SCT deaths was 71.5° F
College Football's Serial Murderer: Sickle Cell Trait

Alejandro Bautista
NCAA SCT Deaths
Exertional Deaths 2004-2008

NCAA SCT Deaths

- 1974 - Co., ran 800m
- 1985 - Ark., ran ¾ mile
- 1986 - Miss., ran 1 mile
- 1987 - Ind., ran 1200 m
- 1989 - Utah, ran ¾ mile
- 1990 - NM, ran 800 m
- 1992 - Ga., ran 1000 m
- 1995 - Ariz., ran 900 m
- 2000 - Tenn., ran 800 m
- 2001 - Fla., 1 hr. mat drill
- 2004 - Ohio, ran ~ 10 min
- 2005 - Mo., 1 hr. field drill
- 2006 - Tex., ran 1600 yds
- 2008 - 1 in Fla., 1 in NC
- 2009 - NC, ran 500 yds
- 2010 – Miss., station drills

Testing Mandates

DIII Approves Sickle Cell Measure

By Gary Brown
Newborn Screening Program’s

• All 50 states & D.C. have Universal Newborn Screening for SCT & SCD
  ▪ Not every state implemented the same year

• South Carolina
  ▪ Implemented newborn screening for SCT and SCD beginning in 1987
  ▪ SCDHEC only has electronic files for those born 1997- Present
    ➢ Parents, Individuals (18 +), & Physician/ Team Physician can access results
    ➢ Parental Handout; can call and access results
  ▪ Those born before 1997 can contact pediatrician, birthing hospital, or can get re-tested
Newborn Screening Program’s

• North Carolina
  - Began targeted NS in non-white population in 1987
  - Began UNS in 1994
  - Keep blood record for 5 years and release results to pediatrician and birthing hospital

• Maryland
  - Stored electronic files of UNS for several years
  - Current college age cannot get results in timely manner
  - Contact pediatrician or birthing hospital
  - Submitting physician and parents are only ones who can access results

• Virginia
  - Began UNS in 1989
  - Results can be obtained through DCLS
  - Fillout paper request form. Can take 2 weeks

[Link to Virginia Newborn Screening Services page]
Newborn Screening Program

• West Virginia
  • Began UNS in 2004
  • Results are only released to PCP for confirmatory electrophoresis

• Washington D.C.
  • Testing has been done since 1980
  • UNS are sent to PCP & birthing hospital
How do I find out about my states program?

- NNSGRC
  - State Contacts
    http://genes-r-us.uthscsa.edu/sites/genes-r-us/files/state_contacts.pdf
  - State Information
    http://genes-r-us.uthscsa.edu/resources/consumer/statemap.htm
## SCT Testing Models

### On Site Testing Model Costs

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<thead>
<tr>
<th>Test</th>
<th>Cost Description</th>
<th>Total</th>
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<tbody>
<tr>
<td>Phlebotomist / hr</td>
<td>$65 x 7 Phlebotomists/7 hrs</td>
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<tr>
<td>Sickle Cell Solubility Test</td>
<td>$8.50 x 180 athletes</td>
<td>$1530</td>
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<tr>
<td>Confirmatory Reflex Test</td>
<td>$30 x 45 (25% Pos.)</td>
<td>$1350</td>
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<tr>
<td><strong>Potential Max Cost</strong></td>
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### Patient Service Center Model Costs

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<th>Cost Description</th>
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<td>Blood Draw Quest PSC</td>
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<tr>
<td>Sickle Cell Solubility</td>
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<tr>
<td>Confirmatory Reflex</td>
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<td><strong>Potential Max Cost</strong></td>
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Dr. Jenny Johnson (2012)
### SCT Testing Models

<table>
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<th>Student Athlete Service Model</th>
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<tr>
<td>Potential Max Cost for student athlete</td>
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<td>$62.50</td>
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</table>

Dr. Jenny Johnson (2012).
Since the University of Oklahoma began testing for sickle cell trait in the 1990s, 20 players have tested positive. But only two of them already knew they had it.

“In high school, I had a severe problem with cramping up at practice... I went to doctors, but no one could figure out what was wrong with me. So when I got to OU, I didn’t even know what sickle cell trait was. But they tested me, and the first thing Scott and his staff did was start the education process, making sure I knew everything about it and how to deal with it.”

- Curtis Lofton
Should We Have Our Athletes Tested?

- 4 out of 5 Military Branches Test (Army does not)
  - Navy, Air Force, Marines, & Coast Guard
- Division I, II, & III mandate testing
- NFL Combine & NBA test

“We must continue the screening because we have an obligation to tell the people that they have this trait and to counsel them accordingly.”
- Commander Ludwig, Coast Guard (AFEBM, 2002)
Should We Have Our Athletes Tested?

- Sickle Cell Association of Ontario, Canada & College of American Pathologists support testing

“In my view stigmatization is a fair price to pay for saving the lives of these athletes… Whether it is 9 deaths in 10 years or 1 death in 50 years, this screening has potential to protect the health of these athletes and ensure that they have successful careers”

- Sickle Cell Association of Ontario, Canada
Why do Organizations oppose testing?

- ASH, SCDAA, ASPHO, APHA, APHL, & ASCP do not support mandate of sickle cell trait testing prior to sports participation

**Reasons**

1. Universal Interventions Work
   - 15 deaths in army from 2002 - Present

2. No genetic counseling administered
   - Only 40% are doing their follow up visit in Columbia, SC
   - We offer educational handouts for parents, athletes, and coaches

3. Discrimination and stigmatization
   - No NCAA athletes have been denied participation by the NCAA due to their SCT status
4. Athletes do not usually make their own training schedule or exercise routines
   - Training should be SPORT SPECIFIC
     - Example - Average FB play ≈ 4 sec
     - Average ≈ 40 sec rest between plays

5. Sports Culture
   - Those that can’t keep up are left behind
Why do Organizations oppose testing?

6. Post-Mortem Sickling
   - Passive Congestion of Organs- Kidney, Spleen, Liver, & Lungs
   - Active Congestion of Organs- Heart & Brain

7. No Confirmatory Hb Testing
   - Sickle Dex Test
     - Detects presence of Hb S
   - Confirmatory Hemoglobin electrophoresis
     - Differentiate between SCT & other hemoglobinopathies
Why should we consider a state policy?

• At least 22 deaths in the US since 2000
• #1 non-traumatic killer in college football athletes
  - Conditioning/pre-season (usually day 1)
• Division I African-American FB players with SCT have increased risk of exertional death by 22 fold compared to African American FB players w/o SCT
  - ↑ risk of ED by 33 fold with AA with SCT compared to all d1 football players
Why should we consider a state policy?

• Inter Association Task Force for preventing sudden death in secondary school athletics consensus statement 2013
  ▪ Each State athletic association or legal system is tasked with developing and implementing its own safety standards
  ▪ Guidelines, policies, and laws must be developed and implemented on a state by state basis.

• Majority of coroners can’t correctly identify
  ▪ Label deaths HCM, heat stroke, or unknown

• Kavanagh et al. found that only 37% of positive newborn screening results are reported to patients
  ▪ Treadwell study reported ≈ 16% of people knew their own status
Why do we need a state policy?

• Decreased state funding
  ▪ Decreased Sickle Cell Centers
  ▪ 40% of positive tests do not follow up for genetic counseling at sickle cell center in Columbia
  ▪ Leads to lack of knowledge and understanding of SCT & SCD for the general population

• Lack of continuity of care
  ▪ Some pediatricians and family physicians do not feel competent to discuss conditions included in newborn screening panels
    ➢ Explanations may be too complex for parents
    ➢ Even incorrect or misleading information
Why do we need a state policy?

• Secondary School PPE
  ▪ Inconsistent
  ▪ Inaccurate
  ▪ Who’s filling them out?
• Examples
  ▪ Case #1
    ➢ Senior FB Athlete c/o headache after a football game
    ➢ Treated as a concussion, while in the appt. the mother stated that he has sickle cell disease
    ➢ The hematologist never cleared him
  ▪ Case #2
    ➢ Female with SCD got cleared to play softball
    ➢ The athlete was cleared by PA
    ➢ Waiver brought to district who signed off assuming risk
Why do we need a state policy?

• Legislature mandating SCT testing
  ▪ Student Athlete Bill (ECG & SCT)
  ▪ Medical professionals aren’t always consulted for bills/laws
  ▪ What will the schools without an ATC do with the information

• As of 2014-2015 school year all Division I (2011), II (2012), & III (2014) will be mandating sickle cell trait testing

• High School’s Next?
How have we utilized our policy?

• **Staff Education & Awareness**
  - In turn our staff educates doctor’s, coaches, parents, administration, and athletes
  - Educational handouts
  - Led to more athletes finding out their status & safely participating
  - Allow us to implement our tailored precautions

• **Athletes with SCD**
  - We presented our policy to multiple school districts in regards to athletic participation
Steps We Can Take

• Increase continuity of care by raising awareness
• Awareness must increase through education of medical care professionals, coaches, parents, and others who are involved in the athlete's care team
• I believe adopting a state policy is the best approach to bridge the gap in our current medical care and help prevent future deaths
• Can be accomplished through proper education, guidelines, and protocols
Pathophysiology of Exertional Sickling

- Muscle Hyperthermia
- Lactic Acidosis
- Red-Cell Dehydration
- Hypoxemia
Cascade of Events

- Exertional sickling can lead to hypoxemia
- Promotes ischemic rhabdomyolysis
- Rhabdomyolysis can lead to Myoglobinuria & Hyperkalemia
  - Hyperkalemia can occur without rhabdo.
  - 50% SCT deaths w/o rhabdo.
- Myoglobinuria can cause kidney damage or failure
- Hyperkalemia can cause cardiac arrhythmia
Figure 1  A proposed schematic of the pathophysiological processes which might culminate in exertional death in SCT subjects: a final common pathway of hyperkalaemia is suggested.

Risk Factors

• Sustained Intense Activity
  ▪ Harder & faster you go will determine sickling

• Ambient Heat Stress

• Asthma

• Illness

• New At An Altitude

• Dehydration
Risk Factors

• Sustained heroic effort above customary activity
  ▪ Tyrone Goodson- Auburn WR
    ➢ "The team doctor asked me why I didn't stop the workout if I was feeling bad, but I just couldn't imagine quitting on my team," Goodson said. "You don't want to be that person who gives up and lets other people down. I don't know if it was a bad decision that almost killed me, but at the time I felt like it was the right thing to do."
Exertional Sickling Signs & Symptoms

<table>
<thead>
<tr>
<th>Signs &amp; Symptoms</th>
<th>1. Fatigue</th>
</tr>
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<tbody>
<tr>
<td>2. Leg or Low Back cramping</td>
<td>8. Abdominal Pain</td>
</tr>
<tr>
<td>3. Leg or Low Back pain &amp; weakness</td>
<td>9. Core Temp. ≤ 103°F</td>
</tr>
<tr>
<td>7. Soft, flaccid muscle tone</td>
<td>13. Rapid Tachypnea</td>
</tr>
<tr>
<td></td>
<td>14. Collapse early in exercise</td>
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</tbody>
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*Symptoms in an athlete with SCT should be assumed and treated as exertional sickling*
### Exertional Sickling Crisis vs. Heat Cramps

<table>
<thead>
<tr>
<th></th>
<th><strong>Exertional Sickling</strong></th>
<th><strong>Heat Cramp</strong></th>
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<tbody>
<tr>
<td>Muscle Tone</td>
<td>Look and feel like jello</td>
<td>Visibly Contracted</td>
</tr>
<tr>
<td>Pain</td>
<td>Deep Pain</td>
<td>More Excruciating Pain</td>
</tr>
<tr>
<td>MOI</td>
<td>Slump to the ground with weak muscles</td>
<td>Hobble to Halt with locked up muscles</td>
</tr>
<tr>
<td>Physical Findings</td>
<td>Sicklers lie fairly still not yelling in pain but still coherent</td>
<td>Yell in pain with visibly contracted muscles</td>
</tr>
<tr>
<td>Athletes Response</td>
<td>If treated appropriately can return faster</td>
<td>Longer Recovery</td>
</tr>
</tbody>
</table>
## Non-Traumatic Causes & Features

<table>
<thead>
<tr>
<th>Sickling</th>
<th>Cardiac</th>
<th>Heat Stroke</th>
<th>Asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weakness &gt; Pain</td>
<td>No Cramping</td>
<td>Fuzzy Thinking</td>
<td>Usually known asthma</td>
</tr>
<tr>
<td>Slumps to ground</td>
<td>Falls Suddenly</td>
<td>Bizarre Behavior</td>
<td>Prior episodes, poor control</td>
</tr>
<tr>
<td>Can talk at first</td>
<td>Unconscious</td>
<td>Incoherent</td>
<td>Breathless, may wheeze or not</td>
</tr>
<tr>
<td>Muscles “normal”</td>
<td>Limp or seizing</td>
<td>Can be in a coma</td>
<td>Gasping, panicking</td>
</tr>
<tr>
<td>Temp &lt; 103</td>
<td>Temp irrelevant</td>
<td>Temp &gt; 106</td>
<td>Auscultate</td>
</tr>
<tr>
<td>Can occur early</td>
<td>No warning</td>
<td>Usually occurs late</td>
<td>After Sprinting</td>
</tr>
</tbody>
</table>

Exertional Sickling Collapse

• Call 911
• Administer high-flow oxygen, if available, with a non-rebreather face mask
  ▪ Our first line of defense
• Check vital signs
• Attach an AED
  ▪ Pulseless Electrical Activity (PEA)
    ➢ Caused by metabolic storm (Profound Lactic Acidosis, Hyperkalemia, & ↓ Ca)
    ➢ Effectiveness of AED is unpredictable
• Administer IV fluids
• Tell the doctors the athlete is having a sickle cell crisis and to expect explosive rhabdomyolysis
• Proactively prepare by having an Emergency Action Plan and appropriate emergency equipment for all practices and competitions
AEDs and Athletic Trainers Restart Hearts Saving Lives

Monday, February 24th, 2014

Colleen Shotwell, PhD, LAT, ATC, reached for her automated external defibrillator (AED) and took the steps she has been trained over and over to do. Shotwell, Coordinator of Athletic Training Services at East Stroudsburg University of PA, was providing sports medicine coverage for a women’s basketball game in November 2013, when a visiting team’s athlete, with a history of sickle cell trait, started experiencing exertional sickling, a potentially life-threatening emergency.

Aided by graduate assistant Megan Fowler and athletic training student Denise Smith, Shotwell monitored the athlete’s vital signs and administered oxygen. Within moments, the athlete became unresponsive, and the three immediately applied the AED. The device analyzed, no shock was advised and they were instructed to begin CPR. By the time paramedics arrived, Shotwell stated the AED had analyzed three times and they went through roughly 8-12 cycles of CPR. Due to Shotwell’s swift actions, the athlete was conscious and able to nod and squeeze her hand before being transported to the hospital.

It was only a few years earlier, in December 2010, that Shotwell assisted ESU Athletic Trainer Wendy Deitrich when a young man collapsed playing basketball at a campus sports facility. The AED administered a shock that restarted the heart and saved the life of that 22-year-old student. Not long after that incident, the same AED was used to save an individual attending a graduation ceremony in the Koehler Field House.
Clinical Considerations

• Exertional Sickling

• Lumbar Paraspinal Myonecrosis (LPM)
  ▪ Compartment syndrome can present as exertional sickling collapse
  ▪ New variant of compartment syndrome
  ▪ Retrospective review found 4 out of 13 athletes had suffered LPM
  ▪ LPM should be considered in an athlete with SCT who develops acute low back pain
Clinical Considerations

• Splenic Infarction at Altitude
  - Signs & symptoms of splenic infarction: LUQ pain, nausea, vomiting, respiratory splinting, pleurisy, side stitch, gastroenteritis, renal colic, or bowel obstruction
  - 30 out of 50 reported splenic infarctions in non-black persons
  - Risk begins at altitudes of 5000 ft and higher

• Gross Hematuria
  - Fewer than 5% people with SCT will experience hematuria
  - Results from sickling in deep renal medulla & occasionally associated with papillary necrosis
  - Initial Tx of rest, hydration and iron supplementation
Clinical Considerations

• Hyposthenuria
  ▪ Inability to concentrate urine
  ▪ SCT carriers tend to develop with age
  ▪ Have not been associated with complications in athletes

• Venous thromboembolism
  ▪ Retrospective study found PE in 2.2% SCT compared to 1.5% normal Hb
  ▪ Another study showed twofold increase PE in those with SCT
Recommendations

• Should be excluded from participation in performance tests, such as mile runs and serial sprints
• Slowly build up their intensity while training
• Be allowed to set their own pace
• Be provided adequate rest and recovery
• Stay well hydrated
• No workout if ill
Recommendations

• Educate to create an environment that encourages athletes with sickle cell trait to report any symptoms

• Encourage participation in preseason strength and conditioning programs, which should be sport-specific

• Cessation of activity with onset of symptoms
Summary

• Follow NATA guidelines

• We are the first line of defense for our athletes

• Education

• Awareness & Screening
  ▪ We cannot prevent what we do not know

• Follow up counseling

• Implement Tailored Precautions

• EAP
Summary

• We must improve continuity of care
• These deaths are PREVENTABLE
• Let’s take a proactive approach by creating the safest environment possible for our athletes to successfully compete
• Consider Adopting State policies

No Knowledge + No Precautions = Death
No Knowledge + Precautions = Death
Knowledge + No/Inadequate Precautions = Death
Knowledge + Precautions = Life

In Memory of:

- Ereck Plancher
- Aaron O’Neal
- Tyquan Brantley
- Devaughan Darling
- Dale Lloyd III
Conclusion

• Richard Stearns, President World Vision
  ▪ “Don’t fail to do something just because you can’t do everything... We are not asked to help all of them at once, just one at a time.”
    ➢ Excerpt from The Hole in our Gospel

• We can make a difference, one athlete, one situation at a time
Resources

1. National Athletic Trainers' Association-
   http://www.nata.org/NR062107
2. Educational Initiative on Sickle Cell Trait for the Athletic Population -
   http://health.usf.edu/medicine/orthopaedic/sicklecell/athletes.html
3. James R. Clark Memorial Sickle Cell Foundation-
   www.jamesrclarksicklecell.org/
4. American College of Sports Medicine-
   http://www.csmfoundation.org/ACSM_Sickle_Cell_Trait.pdf
5. NCAA-
Resources

10. The National Newborn Screening and Genetics Resource Center (NNSGRC) - http://genes-r-us.uthscsa.edu
Questions?

Email: jon_hochstetler@yahoo.com
     jonhochstetler@gmail.com
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