

The Student-Athlete with Sickle Cell Trait

October 1975 • Revised June 2008

Sickle cell trait is not a disease. It is the inheritance of one gene for normal hemoglobin (A) and one gene for sickle hemoglobin (S), giving the genotype AS. Sickle cell trait (AS) is not sickle cell anemia (SS), in which two abnormal genes are inherited. Sickle cell anemia causes major anemia and many clinical problems, whereas sickle cell trait causes no anemia and few clinical problems. Sickle cell trait will not turn into the disease. However, it is possible to have symptoms of the disease under extreme conditions of physical stress or low oxygen levels. In some cases, athletes with the trait have expressed significant distress, collapsed and even died during rigorous exercise.

People at high risk for having sickle cell trait are those whose ancestors come from Africa, South or Central America, Caribbean, Mediterranean countries, India, and Saudi Arabia. Sickle cell trait occurs in about 8 percent of the U.S. African-American population and rarely (between one in 2,000 to one in 10,000) in the Caucasian population. It is present in athletes at all levels, including high school, collegiate, Olympic and professional. Sickle cell trait is no barrier to outstanding athletic performance.

Sickle cell trait is generally benign and consistent with a long, healthy

life. As they get older, some persons with the trait become unable to concentrate urine normally, but this is not a key problem for college athletes. Most athletes complete their careers without any complications. However, there are three constant concerns that exist for athletes with sickle cell trait: gross hematuria, splenic infarction, and exertional rhabdomyolysis, which can be fatal.

Gross hematuria, visible blood in the urine, usually from the left kidney, is an occasional complication of sickle cell trait. Athletes should consult a physician for return-to-play clearance.

Splenic infarction can occur in people with sickle cell trait, typically at altitude. The risk may begin at 5,000 feet and increases with increasing altitude. Vigorous exercise (e.g., skiing, basketball, football, hiking, anaerobic conditioning) may increase the risk. Splenic infarction causes left upper quadrant or lower chest pain, often with nausea and vomiting. It can mimic pleurisy, pneumothorax, side stitch, or renal colic. Splenic infarction at altitude has occurred in athletes with sickle trait. Athletes should consult a physician for return-to-play clearance.

Exertional rhabdomyolysis can be life-threatening. During intense

exertion and hypoxemia, sickled red cells can accumulate in the blood. Dehydration worsens exertional sickling. Sickled red cells can “logjam” blood vessels in working muscles and provoke ischemic rhabdomyolysis. Exertional rhabdomyolysis is not exclusive to athletes with sickle cell trait. Planned emergency response and prompt access to medical care are critical components to ensure adequate response to a collapse or athlete in distress.

The U.S. Armed Forces linked sickle trait to sudden unexplained death during basic training. Recruits with sickle trait were about 30 times more likely to die than other recruits. The deaths were initially classified as either acute cardiac arrest of undefined mechanism or deaths related to heat stroke, heat stress, or rhabdomyolysis. Further analysis showed that the major risk was severe exertional rhabdomyolysis, a risk that was about 200 times greater for recruits with sickle cell trait. Deaths among college athletes with sickle trait, almost exclusively in football dating back to 1974, have been from exertional rhabdomyolysis, including early cardiac death from hyperkalemia and lactic acidosis and later metabolic death from acute myoglobinuric renal failure.

The Student-Athlete with Sickle Cell Trait

In other cases, athletes have survived collapses while running a distance race, sprinting on a basketball court or football field, and running timed laps on a track. The harder and faster athletes go, the earlier and greater the sickling. Sickling can begin in only two to three minutes of sprinting, or in any other all-out exertion of sustained effort, thus quickly increasing the risk of collapse. Athletes with sickle cell trait cannot be “conditioned” out of the trait and coaches pushing these athletes beyond their normal physiological response to stop and recover place these athletes at an increased risk for collapse.

A sickling collapse is a medical emergency. Even the most fit athletes can experience a sickling collapse. Themes from the literature describe sickling athletes with ischemic pain and muscle weakness rather than muscular cramping or “locking up.” Unlike cardiac collapse (with ventricular fibrillation), the athlete who slumps to the ground from sickling can still talk. This athlete is typically experiencing major lactic acidosis, impending shock, and imminent hyperkalemia from sudden rhabdomyolysis that can lead to life-threatening complications or even sudden death. The emergent management

of a sickling collapse is covered in the references.

Screening for sickle cell trait as part of the medical examination process is an institutional decision. The references allude to growing support for the practical benefits of screening and campuses that screen are increasing in frequency. Screening can be accomplished with a simple blood test that is relatively inexpensive. Although Sickle Cell Trait screening is normally performed on all U.S. babies at birth, many student-athletes may not know whether they have the trait. Following the recommendations of the National Athletic Trainers Association (NATA) and the College of American Pathologists (CAP), if the trait is not known, the NCAA recommends athletics departments confirm Sickle Cell Trait status in all student-athletes during the Medical Examination (Bylaw 17.1.5) period. In a 2006 survey of NCAA Division I Football Bowl Subdivision schools, 64 percent of respondents screened for sickle cell trait; however, precautions were inconsistent. If screening is done, it may be done on a voluntary basis with the informed consent of the student-athlete and should be offered to all student-athletes, because sickle cell trait occurs in all populations. If a test is positive, the student-athlete

should be offered counseling on the implications of sickle cell trait, including health, athletics and family planning. Screening can be used as a gateway to targeted precautions.

Precautions can enable student-athletes with sickle cell trait to thrive in their sport. These precautions are outlined in the references and in a 2007 NATA Consensus Statement on Sickle Cell Trait and the Athlete. Knowledge of a student-athlete’s sickle cell status should facilitate prompt and appropriate medical care during a medical emergency.

Student-athletes with sickle cell trait should be knowledgeable of these precautions and institutions should provide an environment in which these precautions may be activated. In general, these precautions suggest student-athletes with sickle cell trait should:

- Set their own pace.
- Engage in a slow and gradual preseason conditioning regimen to be prepared for sports-specific performance testing and the rigors of competitive intercollegiate athletics.
- Build up slowly while training (e.g., paced progressions).

The Student-Athlete with Sickle Cell Trait

- Use adequate rest and recovery between repetitions, especially during “gassers” and intense station or “mat” drills.
- Not be urged to perform all-out exertion of any kind beyond two to three minutes without a breather.
- Be excused from performance tests such as serial sprints or timed mile runs, especially if these are not normal sport activities.
- Stop activity immediately upon struggling or experiencing symptoms such as muscle pain, abnormal weakness, undue fatigue or breathlessness.
- Stay well hydrated at all times, especially in hot and humid conditions.
- Maintain proper asthma management.
- Refrain from extreme exercise during acute illness, if feeling ill, or while experiencing a fever.
- Access supplemental oxygen at altitude as needed.
- Seek prompt medical care when experiencing unusual distress.

The NCAA is in the process of developing an educational video for the membership and its student-athletes on the topic of sickle cell trait and athletics.

References

1. NATA Consensus Statement: Sickle cell trait and the athlete, June 2007.
2. Clarke CE, Paul S, Stilson M, Senf J: Sickle cell trait preparticipation screening practices of collegiate physicians. *Clin J Sport Med* 2007;16:440a
3. Eichner ER: Sickle cell trait. *J Sport Rehab* 2007;16:197-203.
4. Eichner ER: Sickle cell trait and athletes: three clinical concerns. *Curr Sports Med Rep* 2007;6:134-135.
5. Kark JA, Posey DM, Schumacher HR, Ruehle CJ: Sickle-cell trait as a risk factor for sudden death in physical training. *N Engl J Med* 1987;317:781-787.
6. Gardner JW, Kark JA: Fatal rhabdomyolysis presenting as mild heat illness in military training. *Milit Med* 1994;159:160-163.
7. Bergeron MF, Gannon JG, Hall EL, Kutlar A: Erythrocyte sickling during exercise and thermal stress. *Clin J Sport Med* 2004;14:354-356.
8. Eichner ER: Sickle cell trait and the athlete. *Gatorade Sports Science Institute Sports Science Exchange* 2006;19(4):1-4.
9. Browne RJ, Gillespie CA: Sickle cell trait: A risk factor for life-threatening rhabdomyolysis? *Phys Sportsmed* 1993;21(6):80-88.
10. Dincer HE, Raza T: Compartment syndrome and fatal rhabdomyolysis in sickle cell trait. *Wisc Med J* 2005;104:67-71.
11. Makaryus JN, Catanzaro JN, Katona KC: Exertional rhabdomyolysis and renal failure in patients with sickle cell trait: Is it time to change our approach? *Hematology* 2007;12:349-352.
12. Mitchell BL: Sickle cell trait and sudden death – bringing it home. *J Nat Med Assn* 2007;99:300-305.