Pre-injury cartilage biomarkers associated with subsequent ACL injuries

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U.S. Army researchers made a surprising discovery while examining the impact of an anterior cruciate ligament (ACL) tear (a common knee injury), on four serum biomarkers associated with cartilage health. The researchers found that pre-injury concentrations for all but one of the four serum biomarkers studied were associated with the subsequent likelihood of ACL injury. The findings were presented today at the annual meeting of the American Orthopaedic Society for Sports Medicine (AOSSM).

"We expected to see post-injury differences in biomarkers, but were astonished that the biomarkers showed measurable differences months or years prior to injury," said U.S. Army Lt. Col. Steven Svoboda, M.D., during his presentation, titled The Association between Serum Biomarkers of Cartilage Turnover and Subsequent Anterior Cruciate Ligament Rupture. "If we can identify people predisposed to ACL tears, one day we may be able to prevent injuries before they occur."

Svoboda, an orthopedic surgeon at Keller Army Community Hospital in West Point, N.Y., is director of the John A. Feagin, Jr., Sports Medicine Fellowship and head team physician for the West Point football program. Svoboda presented the Army research findings at the AOSSM's O'Donoghue Sports Injury Research Award Presentation. This award is given annually to the best overall paper that deals with clinical based research or human in-vivo research.

Researchers measured pre-injury levels of four biomarkers of cartilage

turnover and metabolism in 45 ACL-injured subjects and 45 control subjects who were matched to the injured subjects by height, sex, weight and age to see if there were differences. Pre-injury samples for all subjects were stored in the Department of Defense Serum Repository, which maintains serum samples drawn from service members at various points during their military careers.

They found that small differences (1 nanogram/milliliter) in pre-injury levels of three of the four biomarkers were associated with being more likely to sustain a subsequent ACL injury than the control group. In fact, an increase in one biomarker was associated with being 19 times more likely to sustain a later injury.

ACL tears are endemic, with 150,000 ACL injuries in the U.S. each year among military personnel, athletes and others with physically demanding careers or pursuits. Several recent studies have shown that high-risk biomechanical movement patterns, specifically excessive knee valgus angle during landing – or landing knock-kneed – causes increased pressure on the joint. "Our study adds to existing knowledge by raising the possibility of a link between risky movement patterns and biochemical processes associated with cartilage metabolism," added Dr. Svoboda. "Coaches and athletic trainers of the future may help athletes with high biomarker levels reduce their risk of ACL injury by improving their balance and motor control or correcting how they jump and land."

The study also has implications for the study of post-traumatic osteoarthritis (PTOA) because a high percentage of those who experience ACL tears go on to develop PTOA. An imbalance in the ability of cartilage to regenerate itself has been theorized as a critical component in the development of osteoarthritis.

The ACL injured cases for this study were 45 of 71 subjects from an existing clinical trial comparing outcomes for ACL reconstructions

performed with two different autograft techniques. Patients were predominately male (86.7 percent) with a mean age of 20.26 years. The study was supported by a grant from the Orthopaedic Research & Education Foundation.

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