Large ACL Study Yields Clinical Insights for Treatment
Data demonstrate link between failure and allograft use in young athletes

Kurt P. Spindler, MD, of Vanderbilt University Medical Center, and investigators of the Multicenter Orthopaedic Outcomes Network (MOON), won the 2012 Kappa Delta Ann Doner Vaughan Award for the paper, “Prognosis and Predictors of ACL Reconstructions using the MOON Cohort: A Model for Comparative Effectiveness Studies.” The manuscript describes the collective results of 2- and 6-year follow-up studies coordinated through the MOON consortium and outlines the clinical significance and impact of the results on orthopaedic practice.

The MOON project reports on a large sample size—2,340 procedures—with a follow-up rate of better than 90 percent. Among its most significant findings is that failure of anterior cruciate ligament (ACL) reconstruction is age and allograft-dependent. As a result, clinical practice is moving away from the use of allograft as the graft choice in high school, college, and elite athletes with ACL injuries.

MOON was established in 2002 to enroll and longitudinally follow a population cohort of patients who received ACL reconstructive surgery to determine the modifiable predictors (or risk factors) of long-term outcomes. The objective was to establish patient-specific, predictive models of clinically important outcomes. The prospective multicenter cohort study has the following goals:

- Identify both the short- and long-term prognosis and predictors of sports function, activity level, and general health through validated patient-reported outcomes
- Identify the symptoms and signs of osteoarthritis (OA)
- Quantify the incidence of ACL reconstruction graft and/or contralateral ACL failures and additional surgical procedures

According to the authors, the multivariable analysis seeks to identify which of the many factors related to the injury, intra-operative treatment, postoperative care, physical patient characteristics, and behavioral patient characteristics contribute to clinically relevant outcomes.

Practical implications
“Our results are changing existing clinical practice paradigms by providing the best evidence for physicians to use in discussions with patients about their prognosis, decisions about graft source, treatment options for meniscus and/or articular cartilage injuries, as well as lifestyle choices that affect the knee to improve outcomes,” the authors write. “In orthopaedics and sports medicine, our study design and statistical modeling is novel and challenges current experience-based physician decision making.”

Patient were in two cohorts—population and nested—with different inclusion/exclusion criteria.

Both groups excluded patients who needed bilateral ACL reconstruction or concurrent procedures for other knee ligaments, and patients who had prior osteotomies or meniscus transplantations. The more selective criteria for the nested cohort limited that group to younger patients (12–33 years old) with a previously uninjured knee that was injured in sports.

Five validated patient-reported outcome instruments were used; two measured sports function, one focused on activity level, one on general health, and a pain subscale for symptoms of osteoarthritis.

So far, the authors have published nine manuscripts associated with the 2-year follow-up results. The detection of more unfavorable outcome with the use of allograft and the association of graft failure and younger age were two of the starkest findings.

The authors write that their data “clearly display that for both graft choices, the younger the age, the greater the failure; but allograft, especially in patients younger than 30 years old, has a clinically relevant difference in failure.” For example, if an autograft is used in an ACL reconstruction in an 18-year-old patient, the risk of failure is 6 percent, if an allograft is used, the risk of failure jumps to 20 percent. As a result of these findings, the authors note, all MOON surgeons now use autograft for high school, college, and competitive athletes in their primary ACL reconstructions, and the data have been presented and recommended at local, regional, and national meetings.

The study yielded additional information with clinical implications, including the following:

- A bone bruise is not a cause of knee pain at index ACL reconstruction surgery.
- Activity level decreases by 4 points after ACL surgery.
- The contralateral tear rate is 3 percent.
- The success of meniscal repair is 94 percent.
- The return to play rate among high school and college football players is approximately 70 percent.

Longer follow-up continues
The authors have partially analyzed the data obtained at 6-year follow up. In the ipsilateral ACL reconstruction group, for example, 19.2 patients have had additional surgery 6 years after the index surgery. The graft failure rate was 5.6 percent, with an ACL tear rate for the other knee of 6.5 percent, for a combined recurrent ligament disruption rate of 12.1 percent.

As the authors continue to assemble and interpret the data, they note that the nested cohort is “ideally designed to evaluate the initiation of early signs and symptoms of OA.” They currently have 196 ACL reconstructions at minimum 2-year follow-up and expected to expand to more than 400 at completion, which will provide a sufficient sample size for multivariable analysis for OA predictors.

“Planned longitudinal follow-up at 6 and 10 years will identify risk factors for OA progression,” the authors write, noting that “several experts in the field of OA have found that post-ACL injury OA closely mimics degenerative OA, which affects 60 million Americans.”

Continuing studies will help