Classifying GBL by Both Severity and Attrition

Written by Jill Shuman

Although the common location of the glenoid bone defect has been identified [Saito H et al. *Am J Sports Med* 2005], it is a challenge to manage patients with glenoid instability because the degree of glenoid bone loss (GBL) varies. There are many types of GBL, ranging from acute fracture to complete resorption.

Matthew T. Provencher, MD, Massachusetts General Hospital, Boston, Massachusetts, USA, discussed a trial of 140 patients designed to (1) quantify GBL as well as attritional bone loss in recurrent anterior stability, (2) determine how much bone loss is remaining to repair the glenoid, and (3) determine the associations of demographic factors with GBL and attritional mass.

Patients aged 18 to 65 years with Hill-Sachs lesions 5%, GBL > 5%, and skeletal maturity met the inclusion criteria. Patients with posterior instability, multidirectional instability, history of prior anterior shoulder stabilization surgery, and Samilson grade 2 glenohumeral arthritis or higher were excluded from the study. All patients had histories of recurrent anterior instability and underwent preoperative 3-dimensional computed tomography (CT) scanning with reconstruction.

The researchers performed a digital analysis to determine the amount of GBL on the basis of surface area and then evaluated the amount of bone that could be replaced to repair the glenoid defect. The patients were stratified by percentage of attritional bone loss. Type 1 was defined as minimal attritional (< 34% attrition; n = 12 [9% of total]), type 2 as partial attritional (34%–67% attrition; n = 42 [30% of total]), and type 3 as severe attritional (> 67% attrition; n = 86 [61% of total]) bone loss. The researchers then looked at multiple predictors of instability recurrence, such as age, number of instability events prior to the first CT, and time elapsed between the first instability event and CT.

Dr. Provencher then reviewed the results of the study. The mean total GBL was the same for all types of attrition and differed only by the amount of bone remaining to repair the glenoid. There was no significant difference (p for trend = .09) in type of attritional loss by age, although the trend was toward more acute glenoid fractures in younger patients with type 1 defects. More instability events resulted in greater attritional loss of the glenoid bone. The mean total time of instability was notable in that there was greater attritional loss in patients with longer periods from the initial instability event. Attritional loss increased after 1 year, with greater loss up to 2 years after the initial event. Of the 140 patients studied, mean GBL was 16%, with an attritional amount of 72%, meaning that 28% of bone fragment remained. These findings suggest that in the majority of patients in this cohort, there was insufficient bone to reconstruct the native glenoid.

According to Dr. Provencher, these findings support the work of others showing that age at first dislocation and the number of dislocations are the strongest predictors of GBL in anterior shoulder instability [Milano G et al. *Am J Sports Med* 2011].

Tunnel Motion Greater With Bone–Patellar Tendon–Bone Anterior Cruciate Ligament Autografts

Written by Nicola Parry

James N. Irvine, Jr, MD, University of Pittsburgh, Pittsburgh, Pennsylvania, USA, presented data from a study that was conducted to analyze *in vivo* human anterior cruciate ligament (ACL) graft motion during activities of daily living in patients who had received bone–patellar tendon–bone (BTB) or hamstring (HS) autografts. The results showed that BTB autografts have more femoral tunnel motion than HS autografts 6 weeks after ACL reconstruction.

Graft type is one of numerous surgical variables that influences graft-tunnel healing following ACL reconstruction. However, the optimal choice of graft remains controversial because of a lack of evidence-based consensus available to guide surgeons' decision making. According to Dr. Irvine, although clinical and kinematic outcomes of BTB and HS autografts are similar, data from animal studies have suggested that their healing processes may differ.

With this in mind, Dr. Irvine and colleagues conducted a prospective study to compare postoperative BTB and HS graft motion within the femoral and tibial tunnels and the intra-articular graft. They hypothesized that BTB autografts would have less intraosseous tunnel motion, greater midsubstance strain, and less anterior tibial translation than HS autografts at 6 weeks following ACL reconstruction as a result of faster osteointegration.

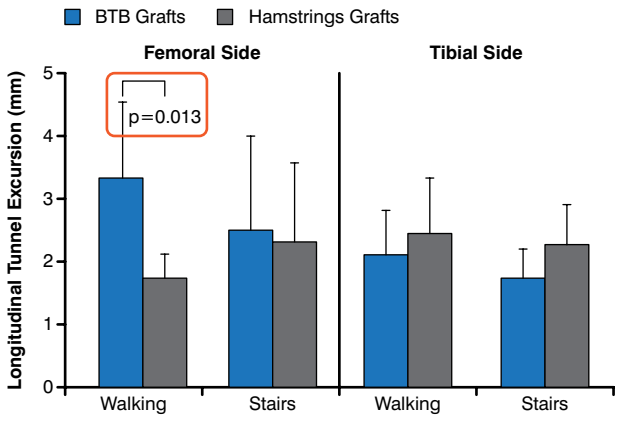
The study included 12 patients (ages 16 to 37 years; mean age, 24 years) who received BTB (n = 6) or HS (n = 6) autografts. A single surgeon performed anatomic single-bundle ACL reconstruction through a medial portal with the same technique for ACL tunnel placement and used suspensory fixation in all cases. Outcome measurements included graft motion within bone tunnels, midsubstance ACL strain, and knee kinematics at 6 weeks postoperatively.

Prior to implantation, six .8-mm tantalum beads were embedded into each graft, pairs of which were located within each bone tunnel and in the graft midsubstance. Computed tomographic scans were obtained 6 weeks postoperatively and used to create 3-dimensional femur and tibia bone models. Cylindrical coordinate systems were then fit to the bone tunnels to examine tunnel motion, and dynamic stereo x-ray images were collected while patients walked on a treadmill and descended stairs. Longitudinal (along tunnel axis) and transverse (within tunnel cross section) graft motion was quantified by 2 methods. One was described as graft excursion, defined as the total path distance traveled by the graft over a set period of time (walking: 200 ms following foot strike; stair descent: 300 ms following single-leg support).

Postoperative rehabilitation was similar in both groups, with all patients having returned to their activities of daily living at 6 weeks postoperatively. The grafts were still moving in all patients within the femoral and tibial bone tunnels at the 6-week follow-up testing. The BTB group displayed significantly more longitudinal graft excursion within the femoral tunnel compared with the HS patients (Figure 1). It is important to note that all patients were doing well at follow-up. The findings of this study showed no evidence of faster graft osteointegration of BTB over HS, no detectable midsubstance strain because the grafts were still moving within the bone tunnels, and no difference in knee kinematics between the grafts, Dr. Irvine said.

Dr. Irvine acknowledged that some limitations of this study included its small sample size and the absence of contralateral knee data. Although 1-year follow-up testing remains under way for this trial to assess whether the pattern of findings in this study changes as healing progresses, future studies using quantitative magnetic resonance imaging will be essential to further assess graft healing.

Figure 1. Longitudinal Graft Motion in Bone Tunnels 6 Weeks After ACL Reconstruction



ACL, anterior cruciate ligament; BTB, bone–patellar tendon–bone autograft.

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On November 12, 2014, the bracket was added to this figure.

Autograft ACL Repair More Durable Than Allograft

Written by Nicola Parry

Craig R. Bottoni, MD, Tripler Army Medical Center, Honolulu, Hawaii, USA, presented data from a study that was conducted to assess the long-term results of primary anterior cruciate ligament (ACL) reconstructions using either allograft or autograft. The results showed that, in a young, athletic population, reconstructed ACLs failed 3 times as often with allografts compared with autografts.

ACL reconstructions are becoming increasingly common, and with >250,000 tears occurring each year in the United States, resulting in >100,000 reconstructions, the use of allografts is also becoming more common. With this in mind, Dr. Bottoni and colleagues conducted a prospective, randomized controlled study to compare the long-term clinical and subjective outcomes after 100 primary ACL reconstructions in 99 patients with a symptomatic ACL-deficient knee who received either hamstring autograft tissue (n=50; mean age, 28.9 years) or tibialis posterior tendon allografts (n=50; mean age, 29.2 years).

Participants were predominantly active-duty military personnel. All allografts were from a singular American Association of Tissue Banks–approved tissue bank, and they were aseptically processed and fresh frozen without terminal irradiation. Graft fixation was the same in all cases, and all patients followed the same rehabilitation protocol, using physical therapists who were blinded to their patients' surgical procedure. Patients underwent preoperative and postoperative assessments of graft integrity, knee stability, and functional status, and they also completed telephone- and Internet-based questionnaires.

Exclusion criteria included patients younger than 18 years old, as well as those who had multiligamentous injury or had undergone previous knee ligament surgery. The primary outcomes were graft integrity, subjective knee stability, and functional status.

After a minimum of 10 years of follow-up, 2 patients died, and 1 was lost to follow-up. In the population that remained for analyses, however, more than 80% of all grafts remained intact and had maintained stability. Autografts had a failure rate of 8.3%, however, compared with 26.5% for allografts (p=.031; Figure 1). Dr. Bottoni