Repair Versus Reconstruction in Acute Posterolateral Instability of the Knee

Brandee S. Black, MD, MEd and James P. Stannard, MD

Abstract: Acute posterolateral corner injuries of the knee are rare and, when present, are frequently associated with concurrent ligament injury, neurovascular damage, or fractures of the femur or tibia. Early surgical treatment has been shown to be superior to delayed and nonoperative treatment of multiligamentous knee injuries. Historically, repair has been advocated. High-quality studies comparing repair versus reconstruction have shown that reconstruction yields superior results with respect to failure of the construct and similar outcomes with respect to patient satisfaction. Our preferred technique for reconstruction of the acute posterolateral corner with reinforcement is described.

Key Words: posterolateral corner (PLC), reconstruction, repair, outcomes


Acutely (< 3 wk from injury), primary repair has been advocated for PLC structures. In 2 small case series studied by Owens et al10 and Shelbourne et al11 repair of the PLC with a mean postoperative follow-up of 4 and 4.6 years, respectively, has shown satisfactory subjective results. A combined repair/reconstruction has been advocated, repairing avulsions with suture anchor or screw fixation and reconstructing midsubstance tears. Multiple authors have presented their preferred technique for reconstructing the PLC using various anatomic and biomechanical characteristics to aid in reconstruction.13,14 These authors report anecdotal evidence of successful reconstructions using their techniques. Until more recently, few comparative studies have provided long-term outcomes that support either repair and/or reconstruction of the posterolateral corner.

STUDIES COMPARING REPAIR VERSUS RECONSTRUCTION

Two cohort studies directly comparing repair versus reconstruction of the PLC have been conducted. Stannard et al15 and Levy et al16 identified 57 and 28 knees, respectively, with PLC injuries that met inclusion criteria for the study. Mean characteristics and functional results for each study were similar (Tables 1, 2).

Stannard’s group prospectively assigned patients with PLC injuries into the repair group if their surgery was within 3 weeks of injury and if the tissue at the time of surgery could support a repair. If either of these criteria was not met, the patient underwent reconstruction. Of the 57 knees in the study, 44 (77%) had a multiligament injury. Failure of the cohort that underwent repair was 37%, whereas failure of the reconstruction group was 9%. Patients who had a revision of their failure had good final results, but required additional surgery to achieve those results. International Knee Documentation Committee (IKDC) objective scores were normal or near-normal in 78% of patients. Subjective IKDC scores had a mean of 60 (range, 17.2 to 100) at final follow-up. No significant difference among the individual groups in the IKDC objective or subjective scores at final (after revision reconstruction) follow-up was found. There was no difference between the final (after revision reconstruction) mean Lysholm scores for patients with a successful repair, failed repair, successful reconstruction, or failed reconstruction (88.2, 86.8, 89.6, 92, respectively). Return to work was evaluated by the authors, and 37 of 56 patients (66%) were able to return to their preinjury employment. Thirty-one (55%) had returned to prior recreational activities, whereas 25 (45%) returned to lesser activities. Complications were present in 14 patients. Eighteen complications were identified for the 14 patients, an incidence of 25% for the cohort. No significant differences were found when comparing the incidence of complications among the repair (21%) versus the reconstruction (27%) cohort. Complications included arthrofibrosis (10 patients, 18%), heterotopic ossification (2 patients, 4%), hematoma (2 patients, 4%), severe osteoarthritis (1 patient, 2%), fistula (1 patient, 2%), medial femoral condyle osteonecrosis (1 patient, 2%), and iatrogenic peroneal nerve injury (1 patient, 2%).

Levy and colleagues compared functional outcomes after surgical treatment of multiligamentous knee injuries. The initial cohort included patients who underwent repair of medial and lateral sided injuries, followed by delayed cruciate ligament reconstructions (n = 10). The second cohort included patients with single-stage multiligamentous
knee reconstructions. Overall, failure of the group of patients undergoing repair was found to be 40%, whereas failure in the reconstruction cohort was found to be 6%. There were no statistically significant differences between mean IKDC subjective scores (79 vs. 77, \( P = 0.92 \)) and mean Lysholm scores (85 vs. 88, \( P = 0.92 \)). Age, sex, injury mechanism, time to surgery, interval between stages, total number of ligaments injured, or location of tear was not found to effect failure. Secondary surgical procedures were required in 7 patients (40%). Procedures included hardware removal in 3 patients (30%) from the repair group and no patients from the reconstruction group (\( P = 0.002 \)). Manipulation for stiffness was required in 1 patient from the repair group (10%) and 2 patients from the reconstruction group (11%). One patient in the repair group (10%) required debridement and antibiotics for a superficial wound infection.16

### VARIABLES AFFECTING OUTCOME

PLCs are rare in isolation, representing only 1.6% of all acute ligamentous knee injuries.4 Therefore, the study of PLC injuries must include multiligamentous knee injuries. Multiligamentous knee injuries are not only relatively uncommon, but also heterogeneous with respect to the anatomic knee injury patterns.17,18 There are many associated injuries that may also be present, including a knee dislocation, that further complicate the study of posterolateral instability of the knee. In knee dislocations, the estimated risk for associated vascular (popliteal artery and/or vein) compromise is 32% to 50%, the estimated incidence of peroneal or tibial nerve injury is approximately 20% to 30%, and the incidence of associated fractures is 60%.19

What is known is that early operative treatment of multiligamentous knee injuries has been demonstrated to result in improved functional and clinical outcomes when compared with nonoperative treatment or delayed surgery.4,20,21 However, even with appropriate early surgical intervention complications can occur. The most common complications include pain, arthrofibrosis, and ligament instability despite multiligamentous knee reconstruction.18

Various rehabilitation protocols have been suggested after surgical treatment of PLC injuries. A balance must be sought between early mobilization to prevent stiffness and immobilization to promote healing and stability.17,22 Adjustments to the postoperative rehabilitation protocol may be necessary because of the complex pattern of knee ligament injuries, the “personality of the knee,” and the individual response to different protocols.23 The senior author of this paper (J.P.S.) strongly believes in anatomic reconstruction using allograft tissue. He uses an aggressive rehabilitation protocol following knee dislocations that allows immediate weight-bearing with the knee locked in extension. He also begins motion immediately after surgery (0 to 30 degrees) and progressively advances toward 90 degrees by 4 to 6 weeks after surgery. Closed kinetic chain exercises are the primary exercises for the first 5 months, with a progression to open chain exercises during the sixth month.

### PREFERRED SURGICAL TECHNIQUE FOR THE POSTEROLATERAL CORNER

Anatomic posterolateral reconstruction of the knee has been shown to restore static varus and external rotation stability without overconstraint in cadaveric knees.24 Many techniques have been described, including fibular-based reconstructions, the LaPrade technique, the split biceps femoris tendon transfer, and the free tendon graft figure-of-eight technique, to name a few.1,2,6,25,26 The key structures to providing stability to the PLC are the fibular collateral ligament, popliteus tendon, and the popliteofibular ligament (Fig. 1).

We describe a modified 2-tailed technique for reconstruction using tibialis anterior allograft, with a reinforcing posterolateral capsular shift sewn into the strut of the graft. This “belt and suspenders” technique allows for anatomic reconstruction of the PLC and also eliminates redundant posterolateral capsule while theoretically increasing the strength of the reconstruction.

Once the posterolateral aspect of the knee is exposed, a 5- to 6-mm drill hole is made from anterior to posterior through the lateral tibia and then tapped with a 7-mm tap. The exit point is where the popliteus tendon traverses the back of the tibia. Great care must be taken when drilling this tunnel to avoid damage to the popliteal vessels, which

### TABLE 1. Summary of Demographics in Studies Comparing Repair Versus Reconstruction of PLC Injuries

<table>
<thead>
<tr>
<th>References</th>
<th>No. Patients</th>
<th>Mean F/U (mo)</th>
<th>Associated Multiligament Knee Injury</th>
<th>Isolated PLC Knee Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Repair</td>
<td>Recon</td>
<td>Repair</td>
<td>Recon</td>
</tr>
<tr>
<td>Levy et al15</td>
<td>10</td>
<td>18</td>
<td>34</td>
<td>28</td>
</tr>
<tr>
<td>Stannard et al15</td>
<td>35</td>
<td>22</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Total/Ave.</td>
<td>45</td>
<td>40</td>
<td>33.5</td>
<td>30.5</td>
</tr>
</tbody>
</table>

Ave indicates average; F/U, follow-up; Recon, reconstruction.

### TABLE 2. Summary of Functional Results in Studies Comparing Repair Versus Reconstruction of PLC Injuries

<table>
<thead>
<tr>
<th>References</th>
<th>Mean Lysholm Score</th>
<th>IKDC (Subjective)</th>
<th>Failures (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Repair</td>
<td>Recon</td>
<td>Repair</td>
</tr>
<tr>
<td>Levy et al15</td>
<td>85</td>
<td>88</td>
<td>79</td>
</tr>
<tr>
<td>Stannard et al15</td>
<td>88</td>
<td>91</td>
<td>61.7</td>
</tr>
<tr>
<td>Total/Ave.</td>
<td>86.5</td>
<td>89.5</td>
<td>70.4</td>
</tr>
</tbody>
</table>

Ave indicates average; IKDC, International Knee Documentation Committee; Recon, reconstruction.
generally lie slightly lateral to the midline at the level of the
knee joint. The allograft is trimmed to a 5 to 6 mm size and
passed from posterior to anterior in the tunnel. A 7-mm
bioabsorbable ligament screw is used to secure the graft.
The proximal fibula is then drilled from anterolateral to
posteromedial with a 5-mm drill. Fluoroscopy is used to
find the isometric point on the lateral femoral condyle and
that area is decorticated. The isometric point is located at
the intersection between a line drawn from the anterior
aspect of the posterior femoral cortex and the Blumensaat
line (Fig. 2). A long 4.5-m bicortical screw (drilled with a
3.2-mm drill bit) is placed at this point with a spiked liga-
ment washer. The graft is wrapped from the posterior tibia
up around the screw and washer, down and through the
fibular tunnel, and then up to the screw and washer (Fig. 3).
The graft is tensioned with the knee flexed from 40 to 60
degrees and the foot internally rotated. A No. 2 suture
reinforces the free end of the graft, which is anchored under
the screw and washer. Posterolateral capsular tissue is
identified, brought distal and anterior, and then sewn to the
anterior arm of the graft as reinforcement.

CONCLUSIONS
Study of acute posterolateral instability of the knee is
difficult because of the wide variation of injured structures
and patient heterogeneity in the polytrauma setting. Two
high-quality studies, however, have shown that recon-
struction of the PLC demonstrates improved outcomes
compared with repair alone in the setting of multi-
ligamentous knee injury. The average failure rate was found
to be 7.5% after reconstruction and 38.5% after repair with
similar mean Lysholm and IKDC scores at final follow-up.

FIGURE 1. Photograph (A) and illustration (B) of the anatomy and relationships of the fibular collateral ligament, popliteus tendon,
popliteofibular ligament, and lateral gastrocnemius tendon (lateral view of a right knee). Reprinted with permission from LaPrade et al. Copyright American Orthopaedic Society for Sports Medicine, Rosemont, IL. All permission requests for this image should be made to the copyright holder.

FIGURE 2. Determination of the isometric point at the distal femur. The point lies at the intersection of the Blumensaat line and a line
extended from the anterior aspect of the posterior femoral cortex. An intraoperative radiograph (A) and an artist’s depiction (B) of the
anatomic point.
We describe a modified 2-tailed technique for PLC reconstruction, acknowledging that there are many methods for reconstructing the PLC. Further study is warranted comparing the different anatomic PLC reconstruction techniques in an effort to improve outcomes. Multicenter efforts, in which large patient volumes across the spectrum of injury patterns, will allow for offset of the rarity and heterogeneity seen in this patient group.17

REFERENCES


