3 Indications for Revision Anterior Cruciate Ligament Reconstruction

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Introduction

Rupture of the anterior cruciate ligament (ACL) occurs in up to 250,000 patients each year in the United States [1]. Annually, 175,000 to 200,000 primary reconstructive procedures (ACL-R) are performed [2]. Failure of ACL-R, as defined by pathologic knee laxity or graft rupture, occurs in 2–6% of patients undergoing primary ACL-R [3, 4]. Risk factors for ACL-R failure include male gender, return to sport, use of allograft during the primary reconstruction, and age younger than 25 years [5–11]. When ACL-R fails, revision reconstruction is considered [12]. Satisfactory outcomes have been seen in 75–97% of patients undergoing ACL revision [13–15]. This chapter discusses the indications and contraindications for ACL revision reconstruction.

Indications

The indications for revision ACL reconstruction are listed in Table 3.1. It is important to note that not all patients experiencing a failed ACL reconstruction require ACL revision. The primary goal of a revision reconstruction is similar to a primary ACL reconstruction, that is, to restore functional stability to the knee. In addition to improving function, restoring knee stability protects the menisci and articular cartilage from injury.

Table 3.1 Indications for revision of failed ACL reconstruction

Early failure (<1 year)
Young patient (<25 years old)
Failed ACL-R in a high-level athlete in a high-risk cutting sport
Failed ACL-R with functional instability
Failed ACL-R in patient undergoing concomitant ligament reconstruction
Failed ACL-R in patient undergoing meniscal repair or transplant
Failed ACL-R in patient undergoing cartilage repair or restoration procedure

Failed ACL-R can be categorized as early (<1 year) or late (>1 year). Early failures frequently occur due to technical errors, failure of graft incorporation, premature return to activity, overly aggressive rehabilitation, or unrecognized concomitant injuries [8, 16–19]. Late (>1 year) failure is frequently associated with repeat trauma [7]. Knee instability resulting from ACL-R failure can lead to chondral injuries in both the tibiofemoral and patellofemoral compartments [7]. The Multicenter ACL Revision Study (MARS) group reported that 90% of knees undergoing

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revision ACL reconstruction had meniscal or chondral injury, with previous partial meniscectomy associated with a higher incidence of articular cartilage lesions [20]. ACL injury is associated with early-onset osteoarthritis [21–24]. Restoring knee stability, especially in the young, active patient with failed ACL-R, should be considered to potentially prevent further meniscal and chondral damage. Timing of revision reconstruction is a consideration. When compared to patients undergoing early revision (< 6 months), patients undergoing delayed revision (> 6 months) have a higher degree of articular cartilage damage [31].

In the athlete with a failed ACL-R, a discussion should be held regarding the chances of returning to sport and the difference between returning to sport and returning to preinjury level of activity. Although unpredictable, 49–75% of patients undergoing revision will return to some level of sport, but only 43% will return to their preinjury level of activity [32–34]. Return-to-sport rates are significantly lower when compared to return to sport following primary ACL-R [32]. However, revision ACL-R may yield the best chance of restoring knee stability [8] and provide athletes the best chance of return to competitive play.

Any patient with failed ACL-R undergoing meniscal repair or transplantation, articular cartilage repair or restorative procedures, or ligamentous reconstruction (PCL, PLC, PMC) should undergo concomitant or staged ACL revision reconstruction. Failing to address pathologic laxity related to ACL insufficiency significantly increases the likelihood of any of these procedures failing. [7, 25–30]

Contraindications

Several technical- and patient-related factors are associated with poorer outcomes and higher rates of failure after revision ACL reconstruction. Thus, it is important to identify these and consider them in surgical planning. A well-executed revision ACL that restores biomechanical stability may meet objective measures of success and yet still fail clinically. Firm contraindications to revision ACL surgery include active infection and significant knee stiffness/arthrofibrosis. The latter of the two is particularly relevant given that over 50% of patients undergoing revision ACL reconstruction report a history of trauma as the cause of their recurrent instability [2]. A summary of contraindications to revision ACL reconstruction are listed in Table 3.2.

Table 3.2 Contraindications for revision of failed ACL reconstruction

Active infection
Arthrofibrosis
Lower demand, older individual without functional instability
Patient unwilling/unable to comply with postoperative rehabilitation and precautions.
Morbid obesity
Advanced arthritis
Uncorrected malalignment
Unaddressed meniscal root tears/meniscal deficiency
Unaddressed pathologic laxity due to posterolateral corner, posteromedial corner, or PCL injuries
Unrealistic patient expectations
Regional pain syndromes

The goal of revision ACL surgery is restoration of functional knee stability, and the patient's goals should be clearly defined prior to the procedure. Older individuals with lower functional demands may not benefit from the procedure, especially if they are not having functional instability. Patients pursuing the procedure for pain-related purposes should be counseled accordingly, and this should be clearly addressed in any patient with symptomatic arthritis, obesity, or regional pain syndromes. Articular cartilage damage (grade 2 or greater) is independently associated with inferior clinical outcomes [10, 35]. Thus, regardless of the surgeon's technical skill and expertise, the presence of symptomatic chondrosis may negatively impact the final outcome.

At baseline, revision ACL surgery has 3–4 times the failure rate of primary ACL reconstruc-

tion and is associated with inferior clinical outcomes, including lower Cincinnati, Lysholm, Tegner, IKDC, and KOOS scores [36]. Therefore, patients with unrealistic functional expectations may be unhappy with the final result. In a similar fashion, surgeons should consider carefully any patient that might be unwilling or unable to comply with postoperative rehabilitation or surgical precautions.

Malalignment and concomitant ligamentous injury is a contraindication to revision ACL-R if not corrected prior to, or at the time of surgery. Varus malalignment causes graft strain [37] and potentially graft failure. In addition to coronal malalignment, sagittal malalignment (increased tibial slope) should be taken into account when planning a revision surgery. Unaddressed posterolateral and posteromedial corner injuries also places strain on the ACL graft which can lead to failure [37, 38] as does untreated meniscal injury or meniscal deficiency. Careful attention should be paid to the presence of meniscal root tears when considering a revision ACL-R. Meniscal deficiency in the setting of a failed primary ACL-R may be an indication for meniscal transplantation.

Illustrative Cases

Case 1 The patient is a 26-year-old male who underwent primary left ACL-R with patella tendon autograft. He returned to all activities, including competitive soccer at 9 months after surgery. Fourteen months after surgery, he re-injured his knee in a traumatic fashion playing soccer. Physical examination was consistent with ACL graft tear, which was confirmed by MRI. No meniscal tear or concomitant ligament injury was identified. He had symmetric, passive knee hyperextension. The etiology of graft failure was felt to be recurrent trauma, ligamentous laxity and increased tibial slope. Because of his desire to return to competitive soccer, he elected to proceed with revision ACL surgery. He underwent a single-stage revision ACL-R with contralateral patella tendon autograft and lateral extra-articular tenodesis (modified Lemaire procedure) (see Figs. 3.1 and 3.2).

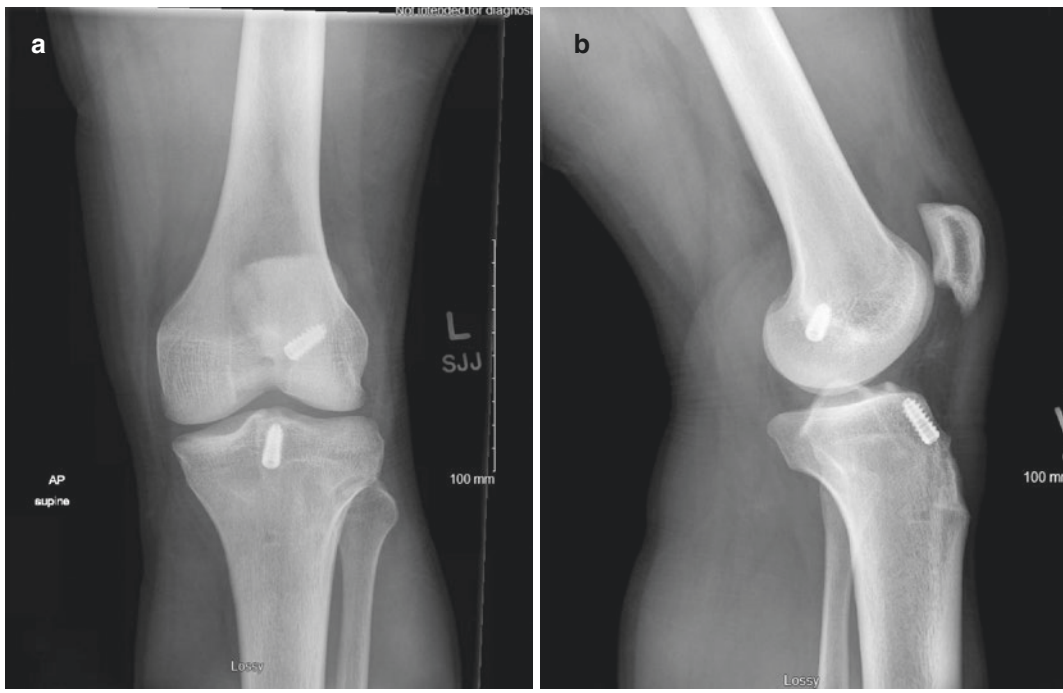

Fig. 3.1 AP (**a**) and lateral (**b**) preoperative radiographs of the left knee prior to ACL revision procedure

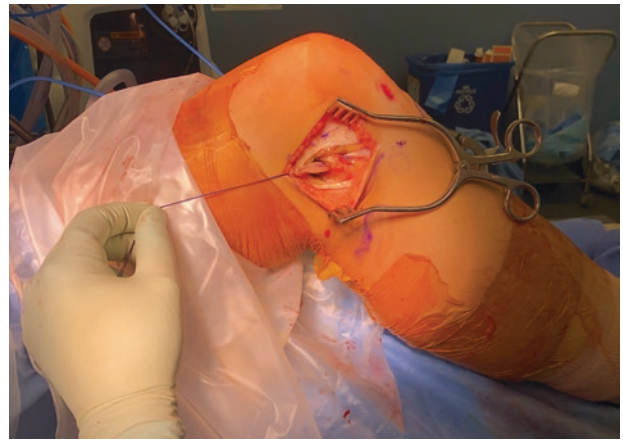

Fig. 3.2 Intraoperative image demonstrating the lateral extra-articular tenodesis with iliotibial band graft tunneled deep to the fibular collateral ligament

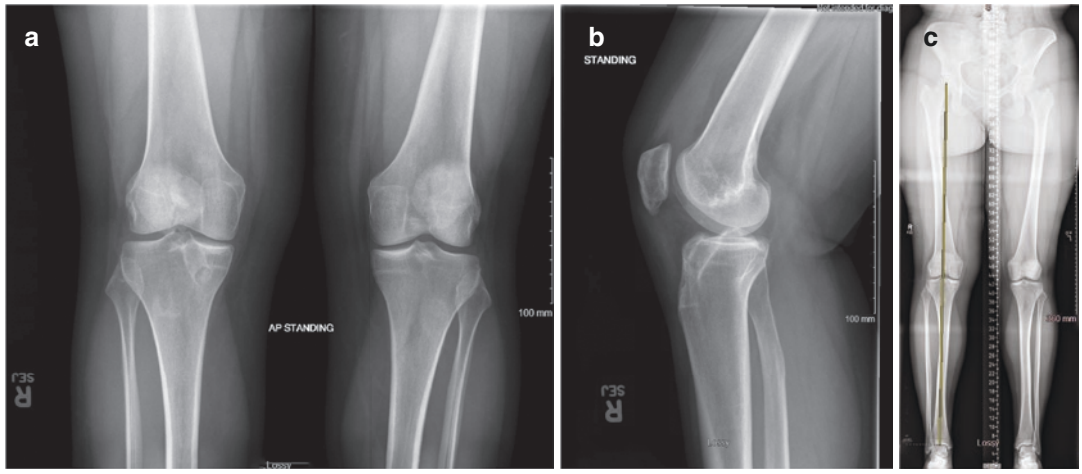

Fig. 3.3 Preoperative radiographs of AP view of bilateral knees (**a**), lateral of the right knee (**b**), and mechanical axis view demonstrating a neutral mechanical axis (**c**)

Case 2 The patient is a 25-year-old female with anterior knee pain and knee instability. She underwent an ACL-R with hamstring graft and partial lateral meniscectomy 8 years prior to presentation. She has had functional instability, including ADLs, since a minor ski injury 1 year ago. Physical examination was consistent with ACL insufficiency, including a high-grade pivot shift. Plain radiographs revealed no arthrosis or malalignment. MRI confirmed a chronic appearing ACL graft tear, lateral meniscus root tear, and vertical and longitudinal tear of the medial meniscus. The etiology of the graft failure was felt to be multifactorial and not related to recurrent trauma. Because of her functional instability, young age, and reparable meniscal tears, revision ACL-R was indicated and she elected to proceed. She underwent revision ACL-R with patella tendon autograft, lateral meniscus root repair, medial meniscus repair, and lateral extra-articular tenodesis (modified Lemaire procedure) (see Fig. 3.3).

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