

## Reconstruction of the anterior cruciate ligament as day surgery

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### Abstract

Rupture of the anterior cruciate ligament (ACL) can be a disabling injury with regards to work and sport. The surgical treatment of this injury has been revolutionalized in recent years most noticeably with increased utilization of arthroscopy. Surgical technical advances and more aggressive rehabilitation has enabled us to perform this procedure as day surgery between 60-93% of the time. © 1997 Elsevier Science B.V.

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### 1. Introduction

The evolution of treatment in anterior cruciate ligament (ACL) rupture has enabled patients to recover fully from this serious knee injury and allows them to return to previous levels of function. The surgical reconstruction procedure itself has been revolutionized over the past 10-15 years and these advancements in technique have enabled patients to return to activities of daily living earlier and with less restrictions. This has led to less time away from work and sport and return to normal or near normal function.

The complex anatomic nature of the ACL initially lead to attempts at repairing the ruptured ligament with the intention to re-establish the complex nature of the ligament. The tenuous nature of the repaired injured fibers required prolonged protection, including bracing or casting of the knee postoperatively, which resulted in prolonged immobility. Despite various attempts, the end result of ligament repair was poor as there was a high failure rate with recurrent instability and poor function [1-3].

Extra-articular knee reconstruction was attempted but this has also fallen into disfavor. Most of these surgical procedures resulted in an anterolateral tenodesis requiring more extensive surgical dissection but did not consistently prevent anterior subluxation of the lateral tibial plateau [4]. This was not surprising as it is extremely difficult for a peripheral tenodesis to adequately perform the complex function of a centrally placed ACL. These reconstructions also tend to stretch out over time [5,6]. Another detraction from extra-articular reconstruction has been the increased use of intra-articular grafting. Once intra-articular grafting became more reliable and commonplace, any positive effects of extra-articular grafting were negated. These extra-articular procedures are still occasionally used by some surgeons to augment intra-articular reconstruction but without improved results over intra-articular grafting [7-10].

Artificial ligaments have been used to aid in the repair and reconstruction of ACL ruptures. Use of synthetic ligaments in Europe and North America has not led to improved clinical results [11,12]. This lack of improvement combined with increased complications [13,14] has led to the virtual cessation of the use of synthetic grafts.

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With increased use of arthroscopy there was a natural opportunity to refine the surgical technique for ligament reconstruction in the knee. Arthroscopic surgery allowed less surgical dissection and trauma to the knee while permitting more accurate graft placement. These factors allowed greater range of motion (ROM) immediately postoperatively as a result of less surgical trauma to the knee joint while ensuring that extremes of ROM would not place undue stress on the newly inserted graft.

Through increasingly accurate graft placement and aggressive rehabilitation it was noted that there was a significantly lower incidence of loss of ROM with the intra-articular reconstruction [15,16]. This in turn led to more aggressive postoperative rehabilitation in contrast to previous regimes of casting or bracing in a fixed position to 'protect' the graft until it had healed. It is likely more damage than good was achieved with prolonged immobilization as ligaments heal more quickly and strongly when moderately stressed. With arthroscopic verification of graft placement and direct observation of graft movement to document appropriate graft tension through a full ROM, a quicker rehabilitation protocol was introduced.

The typical advanced rehabilitation included regaining immediate full ROM although some surgeons initially restrict ROM from 30–90°, once again to prevent excessive tensioning of the graft as the knee reaches full extension or flexion. Further research [17–19] including testing on cadaveric knee models and clinical evaluation demonstrated that grafts were not under undue tension at full extension and now most rehabilitation protocols allow for full ROM and weight bearing as tolerated immediately postoperatively.

## 2. Technique

ACL reconstructions initially began as large procedures requiring extensive hospital stays with prolonged immobilization. Hospital stays up to 7–10 days were not uncommon. As the procedure became more refined the stays shortened to 4–6 days. Introduction of arthroscopy and intra-articular reconstruction also shortened the hospital stay and most currently, in Australia, the hospital stays range from 2–4 days.

A continuation of this aggressive trend has led to the current protocol that we use. The once prolonged hospital stay has now been shortened to a day surgery procedure in most cases in our hospitals. Once the diagnosis has been made and surgical treatment has been decided as the treatment of choice, patient education begins. The surgical procedure as well as the rehabilitation expectations are described to the patient. The patient is referred to a physical therapist for instructions on quadriceps rehabilitation preoperative as well as immediate postoperatively.

Patients are admitted to hospital on the morning of the surgical procedure after having been NPO for a minimum of 8 h prior to the procedure. They are seen by nursing staff, anesthetist, and pre-operatively by the surgeon. Under general anaesthetic a full examination of the affected knee is performed with comparison to the unaffected side. A tourniquet is applied to the affected leg which is exsanguinated prior to tourniquet inflation. The leg is prepped and draped and the surgical procedure commenced.

A preliminary arthroscopy is performed through inferolateral and inferomedial portals and any meniscal pathology is dealt with, including meniscal repairs, at this time. ACL disruption is documented and the intercondylar notch is cleared out along with debridement of remaining ACL stump. The arthroscope is removed temporarily and graft harvest is performed.

A 2–3 cm incision just medial to tibial tubercle is made followed by incision of the superior border of pes anserine to expose the hamstring tendons. Semitendinosus and gracilis tendons are harvested up to muscle belly utilizing a specialized tendon harvester to ensure adequate graft length of 22 cm. The tendons are folded over (making four tendons in cross-section) and sutured together. The graft is measured with a sizing block. Anatomic placement of drill holes is performed on the femur and tibia using arthroscopic guidance. The graft is passed through the tibial drill hole (drilled to graft diameter) into the femoral drill hole which is pre-drilled to graft diameter for a 30 mm depth. The graft is locked into the bony canals using 7 mm soft threaded cannulated screws (RCI-Smith and Nephew Endoscopy, Andover, USA) for stable interference fixation. Ligament stability is tested as well as knee ROM and closure is performed.

No drain is inserted as all exposed vessels are cauterized prior to closure. 2-0 Vicryl (polyfilament absorbable) subcutaneous sutures are inserted to close the deep space and 3-0 Maxon (monofilament absorbable) is placed subcutaneously and cut at the level of the skin after steri-strips are applied. Local anaesthetic (Marcaine 0.5% with Adrenalin—20 ml) and morphine (10 mg) are inserted into the portals and incision site as well as intra-articularly. The wound is dressed with Melolin and Velband with a crepe bandage applying mild compression. A cryopac is applied over the knee.

The patient is taken to the recovery room and observed until awake. Once meeting the discharge requirements of being alert and orientated, having no nausea or vomiting, able to take oral fluids, and able to ambulate, the patient is discharged. Physiotherapy instructions are given prior to discharge to begin moving the knee within limits of pain tolerance. The patient is reviewed in 7–10 days for wound healing. Physiotherapy is continued during this time to regain knee ROM and obtain control of the extensor mechanism.

### 3. Experience

This surgical procedure is now performed as day surgery in the majority of our patients. Over approximately a 1 year period from mid-95 to mid-96, 370 ACL reconstructions were performed by a single surgeon (LAP) at the Castlecrag Private Hospital in Sydney. Of these patients 60% were discharged on the day of surgery while 40% remained in hospital overnight. Of the 40% requiring overnight stay, 18% were for geographical reasons, 21% were for pain and/or nausea, while 1% was per the doctor's request. During approximately the same period 130 ACL reconstructions were performed by the same surgeon at Mater Misericordiae Hospital in Sydney. Of these, 93% were discharged on the day of surgery and only 7% required an overnight stay which was due to geographic reasons in 5% and social reasons in 2%.

In most hospitals this procedure still has a 2–4 day hospital stay. There are many factors which can be manipulated to shorten this period. Surgical factors are important. The operative procedure must be quick and precise to minimize operative time and decrease surgical trauma and postoperative pain. The surgeon should be performing this procedure frequently and regularly for the best reproducible results and safety. Anaesthetic should include minimal premedication, induction by early recovery agent such as propofol, and no paralysis during the case. Postoperative pain management consists mainly of long acting local anaesthetic (Marcaine) and morphine subcutaneously and intra-articularly. Expectation of same day discharge by all hospital staff including nurses and physiotherapists should be maintained to aid in rapid recovery. These preparations enable the patient to commence ambulation with crutches and quadriceps rehabilitation immediately in the postoperative period with discharge in the early afternoon. With the appropriate education of all people involved, a day surgical environment can be created to safely perform ACL reconstruction as day surgery.

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