

Original Article

Complications of Anterior Cruciate Ligaments Reconstruction Patellar Tendon Versus Gracilis and Semitendinosus Autologous Graft

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ABSTRACT

Objective: To evaluate, out of the possible causes, the risk factors and complications of arthroscopic anterior cruciate ligaments (ACL) reconstruction using PT and STG (four strands) in patients with chronic torn ACL.

Settings: Al Razi Orthopedic Hospital, Kuwait.

Methods: A total of 245 patients with chronic ACL deficient knee underwent arthroscopically-assisted reconstruction with either autologous patellar tendon graft or gracilis and semitendinosus (four strands).

Results: Preoperatively, no significant difference between the two groups was noted with respect to age, or level of activity. A standardized rehabilitation program was used for all the patients after surgery. The patients were evaluated at a minimum of three years postoperatively (range 37-48 months). No significant differences between the two groups (chi square analysis) with respect to subjective complaints, functional level of activity or objective laxity evaluation, including KT 1000 measurement, were found. Patello femoral pain and crepitus developed in 25% and 8% in PT and STG groups, respectively. Fracture of the patella, patellar tendinitis cyclops lesion and loss of movement were common complications noticed in the PT group, while

premature amputation of the hamstring tendon, infection and injury to the saphenous nerve was noted in the STG graft. Late patellar fractures, extensor mechanism rupture, failure of graft fixation and reflex sympathetic dystrophy are rare complications and were not seen in our patients. Details of our complications, possible causes, risk factors and the management of these factors are presented.

Conclusion: Familiarity with the regional anatomy and its variation, proper surgical technique, proper placement of the tibial and femoral tunnels, adequate notchplasty, rigid fixation of the graft, early mobilization with extension of the knee, gradual flexion and rehabilitation with routine use of prophylactic antibiotics are key to avoid or decrease these complications in arthroscopic ACL reconstruction.

It was noticed that isolated tear of ACL is a common injury. It is also clear that most of ACL injuries, if not all, occur in males, as there are not many female sports players in Kuwait. However, we have operated on two female athletes (one Judo and one basketball player) recently. These two females were not involved in the study.

KEY WORDS: anterior cruciate ligaments, autologous graft complications, Patellar tendon, rehabilitation gracilis, semitendinosus

INTRODUCTION

Anterior cruciate ligament (ACL) insufficiency often leads to significant disability. Many operations have been described to treat the instability of the injured knee^[1-5]. Allogenic tendon grafts have been used for a number of years^[6], the most commonly used tendons being those of patellar tendon, tibialis anterior and tendo-calcaneus. The use of allogenic tendon grafts obviates creating a defect at the donor site. However, the graft needs special preparation, storage and tissue matching^[7]. The use of artificial ligaments^[8], as a substitutes for torn ligaments, requires special techniques and

instruments and are expensive. The patellar tendon^[9-15] and gracilis and semitendinosus^[16-21] grafts, in the long term, give the most satisfactory results, regardless of the patient's age, severity of the symptoms or the interval between injury and the operation. The use of sufficiently strong tissue^[22], strong fixation^[23-24], early rehabilitation with early passive extension^[23-26] and the use of arthroscopic techniques has improved the results of intraarticular ACL reconstruction as well as reduced the associated complications^[27-29].

Several authors have reported that non operative treatment of a ruptured anterior cruciate ligament, with coordinated rehabilitation

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and modification of activity resulted in satisfactory function^[30-33]. Others have been convinced that operating is necessary to avoid progressively worse functioning of the knee. These reports have focused on active young patients^[34-37]

Reports have also advised non operative treatment in the middle age population between the ages of 40 and 60 years^[38-39]. Non-operative treatment has been shown to be more likely to fail in young patients and operative treatment is now usually recommended for younger patients who wish to return to competitive activities^[40-43].

Some authors report a substantial number of patients in whom the initial treatment had been non-operative who subsequently had reconstruction of the anterior cruciate ligament^[44-46].

PATIENTS AND METHODS

Between 1994 and 1997, 300 patients with ACL deficient knees underwent arthroscopically assisted ACL reconstruction with either patellar tendon (PT) (130 patients) or double loop (four strands) semitendinosus and gracilis (STG) tendons (115 patients). A total of 245 patients were available for evaluation.

All cases were male; the average age at the time of surgery was 25.8 years (range 21-42). The right knee was involved in 150 (61%) cases while left knee involvement was seen in 95 (39%) patients. In 210 (85%) patients, the injury resulted from sports trauma while 20 (8%) were involved in road traffic accident and 15 (6%) sustained injury at work (Table 1). The mechanism of injury in the sports patients was 128 (52%) external rotation and valgus, 49 (20%) hyperextension and 68 (28%) patients with undetermined injury. All the patients had the same physiotherapy program pre-operatively, the same operative technique by the same surgeon but two types of grafts were used (PT and STG grafts). Most of the 55 patients who were lost to follow-up were non-Kuwaiti and had left the country.

Table 1:
Causes of Injury

Category of Injury	No. of Patients %
Sport injuries	210 (85)
Football	
Basketball	
Handball	
Non-Sports Injuries	35 (15)
Road traffic accident	
Accident at work	

All the patients had the same post-operative rehabilitation program. The indications for reconstruction of ACL were; functional instability during daily active life, functional instability during sports activities and patients with positive Lachman sign that produced a sensation of instability. In addition, patients who had symptoms of locking and recurrent effusion by an associated torn meniscus were advised to undergo surgery to have their knees stabilized. Recurrent subjective instability, which failed to respond to physiotherapy or modifications of activity, was the strong indication for reconstruction. This was not a randomized study.

RESULTS

A total of 245 patients were reassessed more than three years post-operatively (37-48 months). The time from injury to surgery was 3-9 months (average 4.8). Hospital stay ranged from 5 to 15 days.

Operative finding

At the time of surgery, all the patients had complete tears of ACL. The tears in 85 (34%) patients were at midsubstance, 41 (16.5%) at femoral attachment, and 21 (8.5%) at the tibial attachment. In 98 (40%) patients, it was difficult to determine the site of the tear. The medial meniscus was torn in 71 cases (30%), the lateral meniscus in 23 (10%) cases and both menisci in 3 cases (1%). All meniscal injuries were treated by partial meniscectomy because at that time, we were inexperienced in meniscal repair.

Clinical results

The subjective results of ACL reconstruction were evaluated by detailed questionnaires completed by each patient. All the patients were able to return to their employment or to school at an average of 4-6 months (range 2-10 months). Lysholm knee score (48) was 92.5 points (maximum 100 points; range from 85 to 94) and the average Tegner activity score decreased from 8.9 before surgery to 6.8 at follow up (scale 0 to 10) (Table 2). Subjective patient assessments showed that 221 patients (90%) reported overall good results, indicating that they were satisfied with surgery (75% were very satisfied while 15% were satisfied). Occasional giving way was reported by 15 patients (6%) while 9 patients (4%) reported episodes of giving way or pivoting on activity (Table 3). All the athletes were able to return to their sports except 15 patients. Anterior knee pain

with crepitus was reported by 81 patients (33%). Final examinations revealed 6 patients (2.5%) had loss of 10 degrees or less of extension while 20 patients (8%) had loss of 15 degrees or less of flexion (Table 4). The Lachman test was negative for 208 patients (85%) and positive of grade one for 25 patients (10%) and of grade two for 12 patients (5%). Pivot glide was recorded in 25 patients (10%). Instrumented laxity testing KT 1000 injured versus normal (1-N) side-to-side differences at a maximum manual loading and 25 to 30 degrees flexion was reported with a KT-1000 arthrometer at 20 pounds. All of 216 (88%) patients had an injured to uninjured knee difference of 3 mm or less, 23 (9%) patient had 3-5 mm and over 5 mm was noticed in 6 (3%) patients (Table 5). These results were obtained by manual ligament examination and instrumented KT 1000 arthrometer. No statistically significant difference was noted between these results. I K D C scale showed 155 patients (63%) had grade A (excellent), 59 patients (24%) had grade B (good) and 29 patients (12%) had grade C (fair) results. Two patients (0.8%) had grade D (poor) results (Table 6). IKDC scale demonstrated two patients had poor results compared to Lysholm score results. This is due to the fact that I K D C assesses the functional as well as the clinical results on a wider scale than the Lysholm knee score. So it shows the functional disability of the knee in a more precise result. Radiographic examination showed moderate joint disease of patello femoral cartilage in 52 patients (21%). Medial compartment showed moderate degenerative changes in 30 patients (12%) and changes in lateral compartment in 10 patients (5%). It was noticed that all these patients had partial meniscectomy. No statistically significant differences between the two groups with regard to the level of preinjury, activity and age were noted. Radiological knee examination of patients who had partial meniscectomy, showed OA changes, especially those of medial compartment with partial medial meniscectomy, as many of our patients had genu varum.

Table 2:
Lysholm Knee Score and Tegner Activity Score

Lysholm Knee Score	No. of Patients %	Pr.op	Post op	No. of Patients
90 TO 94	163 (66.5)	8 - 9	7 - 9	115 (47)
85 TO 90	82 (33.5)	7 - 8	6 - 8	95 (39)
		6 - 7	5 - 6	35 (14)

Table 3:
Subjective Patients Assessment

Assessment	No. of Patients (%)
Patients satisfied improved surgery (75 very satisfied, 15 satisfied)	221 (90)
Normal knee function	175 (71)
Slight abnormal knee function	66 (27)
Severely abnormal knee function	4 (2)
Symptoms associated with strenuous activity	
Pain	10 (4)
Swelling	3 (1)
Partial giving way	15 (6)
Full giving way	9 (4)
Stiffness	3 (1)

Table 4:
Range Of Motion

Loss of motion	No. of Patients %
Loss of extension	
10 degrees	6 (2.5)
5 degrees of less	20 (8)
Loss of flexion	
15 degrees of less	20 (8)

Table 5:
Ligament Testing Results

Testing	No. of Patients %
Lachman test	
Negative	208 (85)
Grade 1	25 (10)
Grade 2	12 (5)
Anterior drawer	
Negative	198 (81)
Grade 1	22 (9)
Grade 2	25 (10)
Pivot shift	
Negative	220 (90)
Pivot glide	25 (10)
MKT-1000 testing maximum manual (1-N)	216 (88)
- 3 mm	23 (9)
3-5 mm	6 (3)
+ 5 mm	

Table 6:
Overall Evaluation I K D C Scale

I K D C	No. of Patients %
A-Excellent	155 (63)
B-Good	59 (24)
C-Fair	29 (12)
D-Poor	2 (0.8)

COMPLICATIONS

Fracture patella

In two patients fracture patella occurred during the harvesting of the patellar bone block. The fracture was fixed at the time of surgery by a lag screw and the patients underwent the same rehabilitation program. One patient had good results and the other had fair results. None of the other patients had post-operative patellar fracture.

Premature amputation of hamstring tendons

Premature amputation of hamstring tendons occurred in three patients. The semitendinosus tendon was amputated prematurely while the gracilis was cut at its musculotendinous junction. In the three cases, the grafts were augmented with an artificial ligament (Leeds-Keio). Two patients had good results and one patient developed infection followed by arthrofibrosis and loss of movements and had poor results.

Problems with graft fixation

Two patients with patellar tendon graft had problems with the fixation of the patellar tendon graft. One had a screw divergence and the other had a prominent screw. Both cases required revision. A third patient had cutting of sutures at the time of the graft fixation, where the graft was amputated at the junction of the patellar bone block and the patellar tendon, the hamstring was used a graft instead of the amputated patellar tendon. In another patient, there was a failure of the endobutton to anchor on the lateral femoral cortex, which required a lateral femoral condyle incision

Infection

Infection had occurred in three patients, two of them were epileptic and had poor results. In these two cases in spite of arthroscopic debridement, joint culture, lavage and suction drains, the use of CPM machine and repeated manipulation under anesthesia, the two patients did not achieve full range of movements (loss of 10 degrees of extension and 15 degrees of flexion), and their knees remain swollen and painful. The third patient recovered fully and had good results, the three patients were given antibiotics until their signs of infection disappeared and their ESR

returned to normal and their CRP was reported negative.

Patellar tendinitis

Patellar tendinitis was noticed in seven patients (6 PT and 1 STG). They complained of pain and tenderness at the inferior pole of patella and the pain increased during sport activity. They were treated conservatively with anti-inflammatory drugs and physiotherapy. Four patients responded well to the treatment. In one patient, rupture of the patellar tendon occurred after a local cortisone injection was given by the physician at the site of pain. This patient underwent repair of his patellar tendon that was reinforced using STG (Kelikian technique). He was able to play football but he had weak quadriceps. As for the other two patients, one had reinforcement of the patellar tendon by STG (Kelikian technique) and showed good results, while the third patient did not accept surgical treatment.

Patello-femoral pain

Patello-femoral pain was the most common complication as 81 patients (33%) reporting pain of patello femoral origin, which increased with squatting and kneeling (Muslim prayer). Patello femoral pain was more common in patients with PT graft than those with STG graft (61 PT (25%) and 20 STG (8%). The patients were treated conservatively with anti-inflammatory drugs and physiotherapy. Twenty patients did not respond to the conservative treatment, and hence had arthroscopy patellar shaving and lateral retinacular release. Thirteen patients had good results, symptoms improved in five patients and two patients did not show any symptom improvement. X-rays showed degenerative changes of articular surfaces of the patella.

Loss of motion

Loss of motion was the second most common complication, as it was found in 35 (14%) patients (25 PT 10% and 10 STG 4%). PT graft patients had a loss of 10 to 15 degrees of extension and a loss of 20 degrees or less of flexion, while STG patients had a loss of 10 degrees or less of extension and 15 degrees or less of flexion. All patients were treated by physiotherapy and manipulation under anesthesia. In 10 patients, the range of movements improved, but failed to improve in 25 patients. Five patients had arthroscopy, notchplasty, arthroscopic debridement followed by aggressive rehabilitation. Of these patients, three showed good improvement and the other two had fair improvement. Twenty patients with arthrofibrosis had arthroscopic debridement,

gentle manipulation, lateral and medial release and notchplasty. Eleven of these patients improved considerably while the remaining nine required a second arthroscopy and manipulation after three weeks from the previous procedure. Five of these patients showed improvement in their range of motion while four patients had no improvement.

Recurrent pathological laxity

Recurrent pathological laxity was recorded in one patient. This was due to a postrolateral instability that was unrecognized before surgery.

Injury to the saphenous nerve

This complication occurs commonly during harvesting of gracilis tendon. This was reported in one patient who complained of numbness along the medial aspect of the leg down to the foot. The symptoms improved without special treatment. Six patients who had hamstring grafts complained of numbness along the lateral aspect of the leg, which was difficult to explain. After over six months, symptoms improved in five patients while one patient showed only partial improvement.

Cyclops lesion

Two patients who had patellar tendon graft complained of palpable and audible clunk with terminal extension associated with loss of 5-10 degrees of extension. Arthroscopy showed a cyclops lesion (an intraarticular intercondylar notch fibrous proliferation which results in formation of a fibrous nodule anterior to the tibial insertion of ACL graft). Arthroscopic resection of the nodule, notchplasty was performed and resulted in improvement of their symptoms and restoration of nearly full extension.

DISCUSSION

Patello femoral pain and Patellar Tendinitis

ACL injury can lead to significant disability. ACL reconstruction through arthrotomy has been used for many years, while arthroscopic ACL reconstruction in the last few years has replaced the arthrotomy with less complications and early rehabilitation^[49,50,51]. The incidence of patello femoral pain in the literature appears to be highest in patients who had their ACL reconstructed through an arthrotomy. Johnson et al^[50] reported sub-patellar crepitus in 57 (65.5%) patients out of 87 and it was the cause of poor results. Arendt, Hunter and Schneider^[52] reported that 55% of patients complained of anterior knee pain and 69% had crepitus when the knee was examined. They believed that the high incidence of anterior knee pain was postoperative immobilization and early institution of a progressive resistance program with isokinetic

machine. Sachs et al^[53] reported 19% of their patients had patellar irritability on follow up after one year from surgery. They reported a significant positive correlation between patellar irritability and loss of extension with quadriceps weakness. Aglietti et al^[54] reported patello femoral pain in 226 patients who had ACL reconstruction. They reported highly significant correlation between preoperative patello femoral crepitus and postoperative patello femoral pain, and positive correlation between loss of extension and patello femoral pain. They concluded that patello femoral pain is related to several factors, pre-existing patello femoral articulation, congruence, arthrotomy, non-isometric placement, graft impingement, and inadequate rehabilitation. From the above reports and our series, patello femoral pain and crepitus are common complication following ACL reconstruction. The incidence of patello femoral pain is higher in patients who had arthrotomy for their ACL reconstruction and those where patellar tendon was used as a graft than those who had arthroscopic reconstruction and STG was used as a graft. The incidence of patellar pain and crepitus following arthroscopy assisted ACL reconstruction is approximately 16%-7% for PT graft versus 3%-21% for STG graft^[49-55]. In our series, 81 patients had patello femoral pain, symptoms improved in 61 patients who treated conservatively while 20 patients had surgical treatment. Thirteen out of twenty patients had good results and seven had fair or poor results after surgery. We believe that in those patients who did not respond well to conservative treatment, surgery is advisable in the form of arthroscopic patellar shaving and lateral release. We believe patello-femoral pain is related to many factors including pre-existing patello-femoral articulation problems, degeneration, congruence, arthrotomy, non-isometric graft placement, graft impingement and inadequate rehabilitation.

Patellar tendinitis has been reported as a complication following reconstruction of ACL with patellar tendon autograft. Graft and Uhr^[56] reported that 6% of their patients had this complication. Marder et al^[51] reported that 11% of their patients had patellar tendinitis where they had experienced tenderness at the inferior pole of the patella. In our series seven patients (2.8%) had this complication, most of our patients responded to conservative treatment, three patients did not improve with conservative treatment, and one patient had cortisone injections (should not be given and not to be recommended) at the patellar tendon and presented to us with ruptured patellar

tendon. One of the other two patients and the patient with pathological rupture of his patellar tendon had surgery to their tendons with good results (Kelikian technique). We recommend this operation only for the cases in which symptoms are severe and they did not respond to conservative treatment. However, we could not find causes for patellar tendinitis in our patients. It has reported by Graft and Uhr^[56] that their patients developed patellar tendinitis with the initiation of aggressive progressive resistance exercise. Marder et al^[51] reported that their patients experienced tenderness at the inferior pole of the patella after exercise with PT graft versus 0% with STG graft. We recommend the use of surgery, using the technique described above, in cases that do not respond to conservative treatment.

Loss of movement and Cyclops lesion

Loss of movement is another frequent complications of ACL reconstruction. Several authors have reported that loss of extension being more common than loss of flexion. Sachs et al^[53] reported an incidence of 24% of more than 5 degrees loss of extension. Mohtadi et al^[55] reported 7% greater than 10 degrees flexion contracture and less than 120 degrees flexion. Harner et al^[56] reported 11.1% loss of motion defined as a knee flexion contracture greater than 10% and or knee flexion less than or equal to 125 degrees at 2 months after ACL reconstruction. In our series, 14% of our patients developed arthrofibrosis, which needed surgical treatment and more than 80% of them improved after they had arthroscopic debridement and adhesiolysis with manipulation under anesthesia. Lateral and medial release was needed in some cases. We noticed that patients who had this procedure done 6 to 8 weeks post-surgery had better results than those who had it done later on. Some of these patients needed to have the same procedures done. The patients (20%) who did not show improvement in their range had their procedures done more than two months from their ACL reconstruction. Main causes of arthrofibrosis in our series were infection, nonanatomic graft placement, intercondylar notch scaring and inadequate rehabilitation (early extension, weight bearing and patella mobilization are main factors to avoid this complications).

Jackson et al^[57] and Marzo^[58] reported that loss of extension can result after intra-articular ACL reconstruction using PT graft. They recommended proper placement of tibial tunnel, adequate notchplasty and debridement of ACL tibial stump. In our series, two patients had this complication and were treated by arthroscopic excision of

fibrous nodule and notchplasty. To avoid this complication in PT graft, proper excision of the tibial stump and adequate notchplasty, are recommended.

Patellar fracture

Christed and Jakob^[59] reported six cases of incomplete patellar fracture and three cases of complete fracture. This complication can be avoided by attention to surgical technique, treatment of rigid fixation and early mobilization. In our series, two patients developed patellar fractures, one patient had good results after the above treatment and one had fair results.

Infection

Although infections occurred in three cases in our series, it was the most difficult to treat, two patients had poor results and one patient had recovered fully with good results. The routine use of antibiotics is recommended in all cases.

If infection occurs or if there is any doubt of infection, we recommend arthroscopy and arthroscopic debridement, closed drainage and the use of CPM. Negative culture does not rule out the infection as the patient may already be on antibiotics. We advise that patients should continue antibiotics for at least six weeks with repeating ESR weekly, CRP, the use of CPM and active exercise followed by intensive physiotherapy. Some patients may need gentle manipulation under anesthesia, adhesiolysis, lateral, and medial release if they have loss of movement in spite of the above treatment.

Premature amputation of hamstring tendons

This complication occurs because of unfamiliarity with the anatomical variation of pes anserinus, the anatomy of this area, inadequate dissection of interconnection between the two tendons, the crural fascia and between semitendinosus and the medial head of gastrocnemius^[58,60,61]. We had three cases that had premature amputation of semitendinosus. In two of them, the gracilis tendon was reinforced with artificial graft and in the third patient; the patellar tendon was used to replace the STG graft.

CONCLUSION

From the above bibliography review, and from our series, we conclude that familiarity with the regional anatomy and its variation, proper surgical technique, proper placement of the tibial and femoral tunnels, adequate notchplasty, rigid fixation of the graft, early mobilization with extension of the knee, gradual flexion and rehabilitation with routine use of prophylactic

antibiotics are key to avoid or decrease these complications in arthroscopic ACL reconstruction.

It was noticed that isolated tear of ACL is a common injury. It is also clear that most ACL injuries, if not all occur in males, as there are not many female sports players in Kuwait. However, we have operated on two female athletes (one Judo and one basketball player) recently. These two females were not involved in the study.

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