

Extra-articular tenodesis for anterior cruciate ligament rupture in amateur skiers

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Thirty one amateur skiers with 33 knees which had had a symptomatic chronic rupture of the anterior cruciate ligament (ACL) treated with the Lemaire operation were reviewed retrospectively at an average of 4.5 years. Of the patients 23 were women. The operation failed to control symptoms in 17 out of the 33 knees. However the operation did control symptoms in 13 out of 19 knees in patients over 35 years old, compared with only three out of 14 knees in patients under 35 years old. Clinical and objective testing however showed that most knees were still unstable. Despite this 21 patients continued skiing. One patient with a successful result switched to playing tennis. Five patients gave up all sports. Four further patients, all under 35 years old, returned to skiing after an additional intra-articular reconstruction of the anterior cruciate ligament. An isolated extra-articular procedure in amateur skiers under 35 years old with symptomatic chronic ACL rupture is not recommended. They need at least an intra-articular reconstruction to control their symptoms and to stabilize the knee.

Keywords: Extra-articular tenodesis, anterior cruciate ligament deficiency, amateur skiers

Skiing is a popular winter sport and it has been noted that rupture of the anterior cruciate ligament (ACL) is reaching epidemic proportions in skiers. There are, for instance, an average of four ruptures a day from the slopes of Aspen, Colorado, USA¹. The most likely people to rupture their ACL are the occasional skiers on their late afternoon ski run when they are tired^{1,2}.

Management of top level skiers has been reported²⁻⁴. Higgins and Steadman⁴ reviewed 27 top-class professional skiers in whom they had performed an intra-articular ACL repair for acute rupture, with excellent results. They had had bad results with conservative management in this class of athlete. However the patients who present with a chronically ruptured ACL tend to be amateur rather than professional skiers.

Extra-articular operations for a ruptured ACL using a graft of fascia lata have been used for a long time⁵⁻⁷. We have used the Lemaire operation^{8,9} which routes a 16 × 1.5-cm strip of fascia lata that remains attached to Gerdy's tubercle under the lateral collateral

ligament and then through an osseous tunnel under the head of the lateral gastrocnemius muscle. It then passes back under the lateral collateral ligament and is attached to another osseous tunnel under Gerdy's tubercle. This operation has a reported success rate from 75% to 91%^{10,11} although a review of sportsmen put the success rate at 42% to 51%^{12,13}.

This study reviews our experience using the Lemaire operation as the sole procedure to control instability from a chronically ruptured ACL in a group of amateur skiers.

Material and methods

Between June 1978 and June 1988, 93 patients, 27 of whom were women, underwent an isolated extra-articular Lemaire operation for rupture of the anterior cruciate ligament. Of these patients 34 were skiers. Three patients were lost to follow-up, two of them having gone abroad. Of the remaining 31 patients, two had bilateral injuries. There were therefore 33 knees in the study. Of the patients 23 were women and eight were men. Five patients (four women and one man) skied regularly in competitions, but were not professionals, 24 patients skied regularly but not in competitions, and two patients only skied occasionally for a holiday.

The mean age of the patients was 35 years old (range 15-56 years), the delay between injury and operation was 2.3 years (range 6 months to 11 years), and the average follow-up was 4.5 years (range 6 months to 11 years). There were 18 right knees treated and 15 left knees.

The sporting level and knee function were assessed using the Arpège system¹⁴⁻¹⁶. The competitive skiers were classed 'competitive' (C), the regular skiers were classed 'leisure' (L), and the occasional skiers were classed 'active' (A). The Arpège system scores knee function in three categories, each with a maximum of nine points, giving a maximum total of 27 points. The categories are stability, pain and endurance, and mobility. The numerical value given in the assessment depends on the sporting class that the patient has attained. A competitive or leisure patient will score nine for stability only when the knee is completely stable during sports, when the knee can be used normally in sports that involve pivoting and contact with other players (e.g. football), and when the patient can run and jump. The active patient however will score nine points if they can run and jump, walk normally on any ground,

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and can climb stairs normally. The Arpège functional assessment therefore has two elements, the sporting class, and the functional score, and the latter depends on the former.

A subjective assessment was also made by the patients with the categories: very satisfied, satisfied, disappointed, and dissatisfied.

The results of the affected knees were subdivided into two groups according to their results: those that were successful were called group 1, and those that were failures were called group 2. Success was defined as a good or excellent functional result, with a good or average sporting class result, and also with the patients being subjectively satisfied or very satisfied. A failure was defined as all patients who were not a success and any patient who required a later intra-articular ACL reconstruction.

Six group 1 and nine group 2 knees had a partial medial meniscectomy at the time of the operation. One knee in group 1 had a medial meniscal suture. Two group 2 knees had had a previous partial medial meniscectomy. One knee in each group underwent a partial lateral meniscectomy. Eight successful knees and five of the failed knees had only the Lemaire operation performed with no operation on the meniscus (or previous meniscectomy).

Fifteen patients were reviewed clinically, of whom 12 were in the successful group. Information on the other 16 patients was taken from their notes and five of them were also contacted by telephone.

Clinical assessment of stability included the Lachman's test and the pivot shift. The radiological assessment consisted of a unilateral weight-bearing radiograph of both knees in both the frontal and sagittal planes^{17,18}. The frontal (posteroanterior) view allows assessment of joint line changes, and the sagittal (lateral) allows assessment of any anterior tibial translation (subluxation). The difference in anterior translation between the affected and the normal knee is termed the anterior tibial translation difference (ATTdiff). This test was performed on 11 patients. Seven patients had a radiological Lachman's test¹⁷ where a lateral radiograph of the knee is taken in 20° flexion with the patient supine. The patient maintains this position with a 7-kg weight hanging from the ankle. Comparison of the difference in translation with the normal knee being termed the radiological Lachman's test difference (LTdiff). This has recently been shown to correlate well with the results of the KT-1000 arthrometer¹⁹ (MedMetric, San Diego, California, USA).

Analysis of selected data was made using the SPSS/PC statistical package (SPSS, Chicago, Illinois, USA). The significance level selected was 0.05.

Results

There were 16 knees in group 1, and 17 knees in group 2. Four patients in group 2 had had a subsequent intra-articular modified Jones reconstruction of the ACL. The mean age of the successful (group 1) patients was 40 years old (range 18 to 55), and of the failures was 32 (range 15–56) years old ($P = 0.023$; F test). The mean follow-up was 6 (range 2 to 11) years for group 1, and 3 years (range 6 months to

8 years) for group 2 ($P = 0.012$; F test). The delay between injury and operation was 2.2 years (range 6 months to 5 years) for group 1, and 2.4 years (range 7 months to 11 years) for group 2.

Age

Analysis of the patients by age showed that 13 out of the 19 knees in patients over 35 years old were successful, and 11 out of the 14 knees in patients under 35 years old were failures ($P = 0.008$; Pearson's R). The three successful knees in the patients under 35 years old were: one in a woman aged 18 at the time of her operation who had a medial meniscal tear sutured; one in a woman aged 28; and the last in a man aged 23. Neither of the last two had a meniscal lesion. Of the younger patients with failed knees, and not including a girl aged 15 years who had an open physis, one had had previous medial meniscectomy, six underwent a medial meniscectomy at the time of their Lemaire operation, and one had a lateral meniscectomy. Only two patients did not have a meniscal lesion, a man aged 23 years old and a woman aged 28 years old.

Sporting class

The sporting class results in group 1 were good for 12 knees, average for three knees, and one was not classified as the patient had her result affected by her other knee. For group 2, eight knees were classed as good, three were average, and two were bad. This excluded four patients who had a subsequent intra-articular ACL reconstruction performed because of continuing symptoms. In group 1 all patients continued skiing except for one who changed to tennis. In group 2 five patients gave up all sports, the rest continued skiing, including those who had subsequent ACL reconstructions.

Functional results

In group 1 the total Arpège score changed from an average of 18.5 to 25.5. In group 2 it changed from 18.5 to 22 ($P < 0.001$; F test). In group 1 all knees were perfectly stable functionally, whereas in group 2 only one knee was.

Subjective results

The subjective assessment of those patients who had only had a Lemaire operation to treat their ACL rupture was: six knees very satisfied; 10 knees satisfied; six knees disappointed; and seven knees dissatisfied. This excludes the four patients who underwent an intra-articular ACL reconstruction.

Clinical stability

All patients had a positive Lachman's test before their operation, as did all 17 patients where the Lachman test was noted after the operation. All patients had a preoperative positive pivot shift test. The postoperative pivot shift at 1 year was positive in four out of 11 successful knees, and five out of seven failures. At

follow-up 12 of 15 knees had a positive pivot shift, being negative in three of the nine successful knees. All three successful patients under 35-years old had a positive pivot shift.

Bilaterality

One of the bilateral patients had both knees in group 1, another patient had a knee in each group. Both were female. A further patient in group 1 sustained an ACL rupture in her opposite knee but declined to have this operated on. The girl aged 15-years old with open physes had had a subsequent bad result. She had an intra-articular ACL reconstruction on her opposite knee for a subsequent injury.

Radiological assessment

Four knees had radiological evidence of degenerative arthritis with joint space narrowing and subchondral sclerosis, one of which was being considered for a valgus tibial osteotomy. All four had clinical effusions (one other patient was noted to have an effusion at follow-up). Three were from group 2 and all had had a medial meniscectomy. Two knees had evidence of remodelling changes secondary to ACL rupture, but not definite osteoarthritis.

The mean (range) LTTdiff at follow-up was 4 (0–8) mm. The mean (range) ATTTdiff was 3 (0–8) mm. The four patients with osteoarthritis had a mean(range) ATTTdiff of 6 (5–8) mm ($P = 0.016$; F test). This probability level should be treated with caution as the numbers are small.

Discussion

Many extra-articular operations using a fascia lata graft have been described to treat a ruptured ACL^{5–8, 11, 20, 21}. The reported general success rates vary from 57% good results with the Ellison procedure⁷, 75% to 91% with the Lemaire^{10, 11}, 82% with the Losee²², 74% with the MacIntosh²³. However the results for sportsmen are not so encouraging with rates varying from 30% to 75% good^{11–13, 20, 21, 23, 24}. The main problem with the reported results is that they depend on the definition of success. On sporting class assessment, this study showed 26 of 33 knees were good or average (79%). Twenty one of 31 patients (68%) were able to return to skiing. Furthermore the results are likely to be even better in a predominantly non-sporting population. The curious finding is that despite having post-operative clinical instability almost the same as that before the operation some patients were still happy.

It is clear that some skiers do need an ACL to be able to ski comfortably. The results of Higgins and Steadman⁴ showed that, in professional skiers, an aggressive approach in patients who maximally load their knees had a high rate of success. The figures in this study of lesser athletes show that a less invasive operation does not have as good results and suggest that a more aggressive approach is also required for symptomatic amateur skiers. We have had an 83% success rate when a modified Jones intra-articular

reconstruction has been performed in addition to the Lemaire in patients with chronically ruptured ACLs. In this series 88% were active in sports and 16% were skiers¹⁶. This compares with a 21% success rate in the same aged patients in this study. Our overall results are similar to those reported by Burgot *et al.*¹² using the same operation on a predominantly sporting population.

Length of follow-up

In our study, if only those patients followed up for longer than 1 year are assessed, then the success rate would have risen from 48% to 59%. Our patient population is widespread with only about 40% being local. If the operation was not successful the patients tended to fail to attend the routine 1-year follow-up appointment, or the review clinic. In these patients dissatisfaction with the result was already noted.

Age of patient

The predominant factor that led to success or failure in this study was the age of the patient. This is probably because the older patient does not load the knee to the same extent as a younger patient. The operation worked reasonably well for patients over 35 years old (68% successful), and badly for those under this age (21%). This is exactly the opposite view to Kennedy *et al.*⁷ when reporting results of the Ellison procedure, and Saillant *et al.*¹³ for the Lemaire, but agrees with Burgot *et al.*¹² also with the Lemaire.

Bad results

Bad results have been reported to be associated with a number of factors:

1. *Delay to surgery.* There was no significant difference in the time taken to surgery from injury between our successful and unsuccessful patients, unlike other studies^{7, 11, 13} which showed that the longer the delay the worse the outcome.
2. *Meniscectomy.* Previous or peroperative meniscectomy, either on the lateral side^{10, 13}, or both medial and lateral¹¹ have been implicated in bad results. The numbers in this study are small but they do show that the three successful patients under 35-years old had intact, or repaired menisci. Most of the patients had undergone meniscectomies on the medial side.
3. *Instability.* An extra-articular tenodesis is designed to control the pivot shift. It never controls anterior tibial translation in the sagittal plane. Therefore the patients will always have a positive Lachman test. Varying degrees of instability have been implicated as causing poor results, in particular a positive pivot shift^{12, 13, 20, 23}. This view was not confirmed by this study, but the numbers seen were small. In an operation that is designed to control the pivot shift the reported positive rate afterwards varies from 16 to 86%^{12, 22–24}. It seems likely that fascia lata stretches with time, and probably is one of the reasons why the operation fails in the young sporting patient, and that early poor results do not improve with time.

Arthritis

Many studies have shown poor results correlating with the presence of pre-existing osteoarthritis or chondral damage^{11, 13, 20, 23}. Although pre-existing damage was not noted in this study, all the patients with osteoarthritis had had a medial meniscectomy and three of four had bad results. The correlation with the amount of anterior tibial translation is interesting as excessive anterior tibial translation seems to be the mechanism for later onset arthritis. For operations on a ruptured ACL to reduce the risk of osteoarthritis, this laxity needs to be controlled^{25, 26}.

Sex

The skiers in this study were predominantly women. It is interesting to note that 24 of the 27 women who had the Lemaire performed for ruptured ACL were skiers. Top level women skiers have more injuries in general than men skiers and are thought to be at risk because of generalized laxity, and smaller muscle mass². However this was from a study of 91 skiers with 67 injuries of which only four were ACL ruptures. In another report from this centre reviewing top level skiers with a ruptured ACL, 10 were women and seven were men³. In the amateur skier one explanation might be that men cope well without an ACL, thus explaining the view that the ACL is not necessary for skiing. It is possible to ski without an ACL, but that does not mean that the knee is sound.

It should be emphasized that the patients in this study were pre-selected since they were symptomatic, and that it has been reported that women patients usually have worse functional and subjective results after surgery than men²⁴. This may have biased the results relative to other published work. However the results in this study are similar to those of a group comprising 80% men who were predominantly sportsmen¹².

Skiers with a ruptured ACL put more demands on their knees than nonsportsmen. Some of them suffer from symptoms of instability and pain when skiing. The Lemaire extra-articular fascia lata tenodesis abolished symptoms in 68% of patients over 35-years old. However patients under 35-years old fared worse, especially if meniscectomy was required. Patients who were unhappy with their treatment failed to attend follow-up. Reporting only those followed-up, or those followed-up for over a year, will improve the apparent success rates for this operation. Extra-articular tenodesis alone is not a suitable operation for amateur skiers with a ruptured ACL.

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