Revision anterior cruciate ligament reconstruction

TIMING OF SURGERY AND THE INCIDENCE OF MENISCAL TEARS AND DEGENERATIVE CHANGE

We reviewed 87 patients who underwent revision reconstruction of the anterior cruciate ligament. The incidence of meniscal tears and degenerative change was assessed and related to the interval between failure of the primary graft and revision reconstruction. Patients were divided into two groups: early revision surgery within six months of graft failure, and delayed revision. Degenerative change was scored using the French Society of Arthroscopy system.

There was a significantly higher incidence of articular cartilage degeneration in the delayed group (Mann-Whitney U-test, 53.2% vs 24%, p < 0.01). No patient in the early group had advanced degenerative change, compared to 9.2% of patients in the delayed group. There was no significant difference (Mann-Whitney U-test, p = 0.3) in the incidence of meniscal tears between the two groups.

We conclude that revision reconstruction should be carried out within six months of primary graft failure, in order to minimise the risk of degenerative change.

Revision reconstruction of the anterior cruciate ligament (ACL) is not a common operation but is likely to become increasingly common as more primary reconstructions are undertaken. It is technically more challenging than primary reconstruction for reasons which include a limited choice of graft material, and difficulties in tunnel placement and achieving adequate graft fixation. The inferior outcome of revision reconstruction compared to primary reconstruction has been well documented. The status of the menisci and articular cartilage at revision is a major factor in determining the outcome of revision ACL reconstruction. Previous studies have reported an increased incidence of meniscal tears and articular degeneration in knees undergoing revision compared to those undergoing primary reconstruction, and the link between ACL deficiency and accelerated degenerative change in the knee is well known. Recurrent instability of the knee because of a failed ACL reconstruction would be expected to lead to further degenerative change. Some authors have also suggested that meniscectomy is the main risk factor for early degeneration in the ACL-reconstructed knee, and a significant proportion of knees undergoing a revision procedure will have undergone meniscectomy at or before primary reconstruction. Furthermore, some knees with a non-anatomical primary ACL reconstruction will have been effectively over-constrained, which could potentially contribute to increased degenerative change at the time of revision surgery.

Various authors have therefore recommended early revision ACL reconstruction to reduce the rate of acquired meniscal and articular cartilage lesions. However, to our knowledge there is no study in this literature that has looked specifically at the effect of the delay to revision ACL reconstruction resulting from primary graft failure with regard to the incidence of meniscal tears and articular degeneration. This factor may in part be regulated by the surgeon. This study therefore aimed to establish the incidence of meniscal damage and articular cartilage degeneration at revision ACL reconstruction, and to relate this to the timing of surgery from primary ACL graft failure.

Patients and Methods
We identified 87 patients (65 men and 22 women) from a prospective database. Inclusion criteria for the study were revision ACL reconstruction carried out in our unit between June 1996 and June 2006, age < 55 years at the time of surgery, and no previous revision procedure. The indication for revision in all cases was recurrent symptomatic instability of the knee following failure of the primary
procedure. The mean age of the patients was 28.8 years (18 to 52). The grafts used for the primary ACL reconstructions were chiefly hamstring or patellar ligament autograft (74 of 87 knees; 85%). In the remaining 13 knees (15%) the graft had been either a synthetic ligament, or an extra-articular reconstruction had been undertaken (Jones’ procedure,16 or iliotibial band graft). Carbon-fibre synthetic ligaments were not used in any primary reconstruction. The mean and median time from failure of the primary graft to revision was 20 months (1 to 142) and 11 months, respectively.

The patients’ records were retrospectively reviewed to evaluate the incidence of meniscal tears and degeneration at the time of the revision procedure. As well as basic demographic data we recorded the time from failure of the primary reconstruction (as defined by the recurrence of symptomatic instability of the knee) to revision, the graft material used, the intra-operative findings and the mode of failure of the primary reconstruction. The latter was based on clinical and radiological data supplemented by information from the operation notes at the time of the revision surgery, and was classified as biological, traumatic, technical or infective. It was classified as biological if there was no identifiable traumatic episode leading to recurrent instability of the knee, and if the tunnel positioning of the existing graft was deemed to be satisfactory. Technical failure was considered to be contributory if either or both tunnels were malpositioned. Traumatic failure was defined as a further significant injury of the knee leading to recurrent instability. Infective failures were those reconstructions that were required when the initial procedure had been complicated by septic arthritis.

The mode of failure was deemed to be a combination of factors in patients with a history of trauma and evidence of technical errors at the primary procedure causing recurrent instability.

Information regarding the condition of the articular cartilage and menisci was collected prospectively at the time of revision reconstruction. Articular cartilage status was graded according to the French Society of Arthroscopy (SFA) classification system.17 Details of meniscal surgery carried out prior to the revision procedure were also recorded.

The patients were arbitrarily divided into either early or delayed, according to the time from failure of the primary reconstruction to the revision procedure. In the early group, revision was performed within six months of failure, and in the delayed group the revision was undertaken at least six months after failure. The distributions of age and gender in the groups are shown in Table I.

The primary procedures had been carried in our unit in 61 of 87 knees (70.1%), and in another institution in 21 of 87 knees (24.1%). No information regarding the index procedure was available for five patients. The revision ACL reconstructions were performed by three surgeons (JFK and two who were not authors), 57 of 87 (65.5%) procedures being performed by the senior author (JFK).

Data were analysed using SPSS for Windows (version 11.5; SPSS Inc., Chicago, Illinois). Parametric data were analysed using Student’s t-test, and non-parametric data were analysed using the Mann-Whitney test. Statistical significance was set at a p-value of < 0.05.

Results
There were 25 patients in the early group and 62 patients in the delayed group.

The mechanisms of failure of the primary reconstructions are summarised in Table II. Technical error in tunnel placement was the sole cause of failure in 17 of 87 knees (19.5%) and a contributory factor in a further 16 (18.4%). Malposition of the femoral tunnel was the most common technical error, and was implicated in 26 knees (29.9%) undergoing revision surgery. Further trauma was the sole mode of failure in 34 knees (39.1%) and a contributory factor in a further 14 (16.1%). Infection after the primary operation accounted for graft failure in two knees (2.3%). In 12 knees (13.8%) the failure was classified as biological and in 17 knees (19.5%) more than one factor was implicated.

Incidence of articular degeneration. The incidence of articular degenerative change found at revision ACL reconstruction and classified according to the SFA system was
comparing between the groups (Table III). Taking the study group as a whole, most knees had normal articular cartilage, with 48 knees (55.2%) given a SFA grade of 0. However, a significantly higher proportion of patients in the early group had normal articular cartilage, compared to the delayed group (76.0% vs 46.8%, Mann-Whitney test, p < 0.01). There were no patients with moderate or severe (SFA grade 3 or 4) degenerative change in the early group, compared with eight patients (9.2%) in the delayed group. The incidence of grade 2 or higher degrees of degenerative change was strongly associated with a delay to revision surgery of longer than six months, but this did not reach statistical significance (Mann-Whitney test, p = 0.072).

Incidence of meniscal pathology. The incidence of meniscal pathology at revision was compared between the two groups (Table IV). A distinction was made between knees in which there had been a previous meniscectomy and those with new meniscal tears. Only 19 of 87 knees (21.8%) had stable, intact menisci and normal articular cartilage at the time of revision. A total of 11 knees (12.6%) had some articular changes but normal menisci. There was no significant difference in the incidence of either new meniscal tears or previous meniscectomy between patients in the two groups (Mann-Whitney, p = 0.3). Presumably because so many patients in the study had undergone previous meniscal surgery, there was only one patient (1.1%) who had new tears of both the medial and lateral menisci at the time of revision.

Discussion

We found a significant increase in both the incidence and the severity of articular cartilage degeneration in patients undergoing revision ACL reconstruction more than six months after failure of the primary reconstruction. Only 56% of knees had normal articular cartilage. In a similar previous study that looked at the incidence of articular degeneration at primary ACL reconstruction the overall incidence of normal articular cartilage was 80.3% (89.3% in the early group and 68.7% in the late group). Nonetheless, only 9.2% of patients had the most severe (SFA grade 3 or 4) degenerative changes.

We have not demonstrated a significant increase in the incidence of meniscal tears in patients undergoing revision ACL reconstruction more than six months after primary ACL reconstruction failure. However, the menisci were normal in only 34.5% of knees at the time of revision surgery (40.0% of knees in the early group and 32.3% in the delayed group). This compares less favourably with the results at primary ACL reconstruction, where 45.3% of knees had normal menisci (58.3% of knees in the early group and 28.8% in the delayed group).

Our findings provide evidence to support the view of Noyes and Barber-Westin to recommend early revision ACL reconstruction without a trial of strenuous activities. Early restoration of stability theoretically leads to reduced secondary articular and meniscal damage, with a corresponding return to higher activity level. It remains to be seen whether early revision reduces the risk of degenerative change in the long term. While there is some evidence to show that primary ACL reconstruction in knees with articular cartilage damage can be satisfactory, this group of patients is much less likely to return to their desired level of sporting activity. Moreover, various authors have observed that the presence of articular degeneration is associated with a poorer outcome following revision reconstruction. Our findings suggest that early revision reduces the risk of articular damage and should therefore be more successful in the restoration of knee function.

The main strength of this study is the relatively large numbers of patients with prospective documentation of arthroscopic findings. To our knowledge, no previous study has specifically evaluated the incidence of articular degeneration and meniscal tears and related this to the timing of revision following failure of the primary graft. However, a recently published case series of 50 revision procedures incidentally noted similar findings to ours. The incidence of articular damage in patients revised after three months from ACL graft failure was significantly increased compared to those undergoing revision within three months (80% vs 32%, p = 0.01).

Although our series comprised a large number of revision ACL reconstructions, there were relatively few patients in each group, particularly the early group. With larger numbers and further subdivision of the delayed group it might have been possible to identify significant differences in the rates and severity of articular degeneration. The findings for meniscal pathology, in contrast, showed no obvious trend with time from failure of the primary reconstruction. This may be attributable to the high rate of meniscal tears.

**Table III. Incidence of articular degeneration between early and delayed groups**

<table>
<thead>
<tr>
<th>Overall SFA grade</th>
<th>Early (76.0%)</th>
<th>Delayed (46.8%)</th>
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<tbody>
<tr>
<td>0</td>
<td>19 (76.0)</td>
<td>29 (46.8)</td>
</tr>
<tr>
<td>1</td>
<td>2 (8.0)</td>
<td>11 (17.7)</td>
</tr>
<tr>
<td>2</td>
<td>4 (16.0)</td>
<td>14 (22.6)</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>5 (8.1)</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>3 (4.8)</td>
</tr>
</tbody>
</table>

* SFA, French Society of Arthroscopy

**Table IV. Condition of the menisci at the time of revision anterior cruciate ligament reconstruction**

<table>
<thead>
<tr>
<th>Both menisci</th>
<th>Early (40.0%)</th>
<th>Delayed (32.3%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>10 (40.0)</td>
<td>20 (32.3)</td>
</tr>
<tr>
<td>New tear</td>
<td>10 (40.0)</td>
<td>22 (35.4)</td>
</tr>
<tr>
<td>Previous meniscectomy</td>
<td>5 (20.0)</td>
<td>20 (32.3)</td>
</tr>
</tbody>
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in these patients, many of which predated the primary procedure.

In conclusion, these findings support the view that patients with a failed ACL reconstruction and symptomatic instability should have an early revision reconstruction procedure carried out to minimise the risk of articular degenerative change.

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References