Revision anterior cruciate ligament reconstruction using tibial or hamstring tendon allografts

Maria Mercedes Reverte-Vinaixa, Joan Minguell, Nayana Joshi, Eugenio Wenceslao Díaz-Ferreiro, Gemma Duarri, Lluís Carrera, Enric Castellet
Department of Trauma and Orthopaedic Surgery, Hospital Universitari Vall d’Hebron, Universitat Autonoma de Barcelona, Barcelona, Spain

ABSTRACT

Purpose. To report outcomes of revision anterior cruciate ligament (ACL) reconstruction using tibial or hamstring tendon allografts and to compare with another study using non-irradiated fresh-frozen bone-patellar tendon-bone allografts.

Methods. Records of 12 men and 7 women aged 18 to 53 (mean, 33) years who underwent revision ACL reconstructions using tibial tendon (n=17) or hamstring tendon (n=2) allografts were retrospectively reviewed. At the time of primary ACL reconstruction, hamstring autografts (n=8) and bone-patellar tendon-bone allografts (n=11) were used. The mean time interval between surgeries was 93 (range, 11–225) months. The causes of failure were traumatic injury (n=7) and technical or biological reasons (n=12). The physical activity level was high in 2 patients, medium in 10, and low in 7. For clinical assessment, the Lysholm test, International Knee Documentation Committee (IKDC) scale, and visual analogue scale (VAS) for pain were used. Patient satisfaction was also assessed.

Results. Four of the patients had laxity and were dissatisfied or very dissatisfied with the outcome; the failure rate was 21%. The mean IKDC score was 63% (range, 25–100%), and the mean Lysholm score was 74% (range, 30–100%). Comparing our patients with those in another study using bone-patellar-bone allografts, there was no significant difference in terms of the VAS for pain, IKDC score, and Lysholm score. Comparing our patients with and without chondral and/or meniscal lesions, there was significant difference in terms of the Lysholm score only (86±11 vs. 57±28, p=0.043). Comparing patients who had used hamstring tendon autografts at the primary ACL reconstruction with those who had used bone-patellar tendon-bone autografts, there was significant difference in terms of the VAS for pain only (4.4±3.1 vs. 1.6±1.0, p=0.020).

Conclusion. Revision ACL reconstruction using tibial or hamstring tendon allografts provided acceptable results, similar to those using the bone-patellar tendon-bone allografts.

Key words: anterior cruciate ligament reconstruction; knee joint; reoperation

Address correspondence and reprint requests to: Maria Mercedes Reverte-Vinaixa, Departament de Cirurgia Ortopédica y Traumatología, Hospital Universitari Vall d’Hebron, Passeig de la Vall d’Hebron 119-129, 08035 Barcelona, Spain. Email: merce83@hotmail.com
INTRODUCTION

The incidence of anterior cruciate ligament (ACL) ruptures has been reported as 36.9 to 60.9 per one million person-years,1–3 10 to 20% of which are re-ruptures. Failure of ACL reconstruction can be due to many causes, including traumatic injury and technical/biological reasons such as incorrect graft placement, non-traumatic failure, and fixation failure. It may also be due to unknown causes related to a lack of biological graft integration, improper tension, non-union or instability associated with undiagnosed tears (such as after posterolateral complex injuries). Comparing different series of ACL reconstructions is difficult, because of differences in surgical techniques, types of graft, methods of graft fixation, and association with chondral or other concomitant intrarticular injuries. We report the outcomes of revision ACL reconstruction using tibial or hamstring tendon allografts, and compare with another study using non-irradiated fresh-frozen bone-patellar tendon-bone allografts.

MATERIALS AND METHODS

Records of 12 men and 7 women aged 18 to 53 (mean, 33.3) years who underwent revision ACL reconstructions using tibial tendon (n=17) or hamstring tendon (n=2) allografts in our hospital between 2007 and 2011 were retrospectively reviewed. At the time of their primary ACL reconstruction, the patients were aged 15 to 44 (mean, 26) years, and hamstring autografts (n=8) and bone-patellar tendon-bone autografts (n=11) were used. The mean time interval between surgeries was 93 (range, 11–225) months.

The mean body mass index of these patients was 25.9 (range, 19.5–33.2) kg/m². The causes of failure were traumatic injury (n=7; 2 occurred in the first 6 postoperative months) and technical or biological reasons (n=12) such as failure of the implant fixation (n=3), incorrect graft placement (n=5), and unknown factors (n=4) probably related to lack of graft integration, inadequate tension, non-union or instability associated with other injuries.

The physical activity level was high (practicing sports >5 days/week) in 2 patients, medium (practicing sports 2–5 days/week) in 10, and low (sedentary or <3 hours of physical activity/week) in 7.

Preoperatively, anteroposterior instability was determined using the Lachman test, whereas rotatory instability was determined using the pivot shift test.

Figure Two-stage revision anterior cruciate ligament reconstruction: (a) the graft failed owing to impingement with the trochlea, (b) removal of the graft and debridement of fibrous tissues within the tunnel, (c) refilling the tunnel with bone allograft, and (d) after 3 months, a new anatomic tunnel is made and double-looped tibial or hamstring tendon allograft is used.
All patients had instability. Seven of the patients reported pain and 2 of them had limited range of movement.

The revision surgery entailed one-stage in 15 patients and 2 stages in 4. The latter had tunnel widening of >100% or >16 mm in diameter, lack of bone stock, or were deemed unsuitable for isometric graft reconstruction.

The revision ACL reconstruction was performed through the anteromedial incision, using a double-looped tibial tendon (n=17) or hamstring tendon (n=2) allografts (Fig.). Fixation entailed a transfixion device (Arthrex) in the femur and an interference screw and a staple in the tibia. Graft isometry was tested prior to fixation. Graft stability and impingement was assessed over the full range of motion of the knee.

A standardised rehabilitation protocol (kinetic chain exercises) was started on day 2. Full weight bearing was allowed as tolerated. Physiotherapy was performed every day to reduce the swelling and therefore pain. A rehabilitation brace was used for 3 weeks. Swimming was allowed after 4 weeks, stationary cycling after 6 weeks, and running after 8 weeks. Competitive or high-demand sports were allowed after 6 months.

Patients were followed up at 6 weeks, 3, 6, and 12 months. For clinical assessment, the Lysholm test, International Knee Documentation Committee (IKDC) scale, visual analogue scale (VAS) for pain, and SF-36 health survey for health-related quality-of-life were used. Patient satisfaction was also assessed. Failure was defined as a laxity of >5 mm or more than grade one in the Lachman or pivot shift test.

Statistical associations were assessed using the bivariate analysis. Quantitative variables were compared using the parametric Student’s-t test with a prior check for normality (using the Kolmogorov-Smirnov test). A p value of <0.05 was considered statistically significant.

RESULTS

At the latest follow-up, 15 patients had normal Lachman test results and 4 patients had laxity. All patients except 2 had normal pivot shift test results. The failure rate was 21%. The VAS for pain was <3 in 15 patients and 4 to 7 in 4. 15 patients were satisfied or very satisfied with the outcome, whereas 4 were dissatisfied or very dissatisfied. No patient developed any complication.

Comparing our patients with 39 patients aged 16 to 57 (mean, 28) years who underwent revision ACL reconstruction using bone-patellar-bone allografts, there was no significant difference in terms of the VAS for pain (2.8±2.5 vs. 2.9±2.5, p=0.850), IKDC score (63±23% [range, 25–100%] vs. 71±22%, T=1.560, p=0.136), and Lysholm score (74±24% [range, 30–100%] vs. 75±22%, T=0.191, p=0.851). Comparing our patients with age-matched normal population in

<table>
<thead>
<tr>
<th>Clinical test</th>
<th>Patients with chondral and/or meniscal lesions (n=11)</th>
<th>Patients without chondral and/or meniscal lesions (n=8)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD IKDC score</td>
<td>73±13</td>
<td>49±28</td>
<td>0.069</td>
</tr>
<tr>
<td>Mean±SD Lysholm score</td>
<td>86±11</td>
<td>57±28</td>
<td>0.043</td>
</tr>
<tr>
<td>Mean±SD SF-36 score</td>
<td>82±13</td>
<td>66±25</td>
<td>0.200</td>
</tr>
<tr>
<td>Mean±SD VAS for pain</td>
<td>1.8±1.1</td>
<td>4.1±3.3</td>
<td>0.120</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinical test</th>
<th>Patients using hamstring tendon autograft (n=8)</th>
<th>Patients using bone-patellar tendon-bone autograft (n=11)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD IKDC score</td>
<td>55±22</td>
<td>68±23</td>
<td>0.200</td>
</tr>
<tr>
<td>Mean±SD Lysholm score</td>
<td>67±26</td>
<td>79±26</td>
<td>0.238</td>
</tr>
<tr>
<td>Mean±SD SF-36 score</td>
<td>76±16</td>
<td>74±16</td>
<td>0.840</td>
</tr>
<tr>
<td>Mean±SD VAS for pain</td>
<td>4.4±3.1</td>
<td>1.6±1.0</td>
<td>0.020</td>
</tr>
</tbody>
</table>

### Table 1
Comparison of patients with and without chondral and/or meniscal lesions in terms of the International Knee Documentation Committee (IKDC) score, Lysholm score, SF-36 score for health-related quality-of-life, and visual analogue scale (VAS) for pain

### Table 2
Comparison of patients who had used hamstring tendon autografts versus bone-patellar tendon-bone autografts at the primary reconstruction in terms of the International Knee Documentation Committee (IKDC) score, Lysholm score, SF-36 score for health-related quality-of-life, and visual analogue scale (VAS) for pain
Comparing 11 patients with a chondral lesion (n=4) or a meniscal lesion (n=4) or both (n=3) with 8 patients without such lesions, there was significant difference in terms of the Lysholm score only (86±11 vs. 57±28, p=0.043, Table 1).

Comparing 8 patients who had used hamstring tendon autografts at the primary ACL reconstruction with 11 patients who had used bone-patellar tendon-bone autografts, there was significant difference in terms of the VAS for pain only (4.4±3.1 vs. 1.6±1.0, p=0.020, Table 2).

DISCUSSION

In studies of revision ACL reconstruction for patients with recurrent instability during daily activity,1–6,9–12 the causes of failure are difficult to determine owing to differences in surgical techniques, types of graft, methods of graft fixation, and association with chondral or other concomitant intra-articular injuries. In a study of 66 patients who underwent revision ACL reconstruction using bone-patellar tendon-bone allografts, the failure rate was 33%.13 In another study of 39 patients using non-irradiated fresh-frozen bone-patellar tendon-bone allografts, the failure rate was 28%.6 In a study of 25 patients treated with irradiated fresh-frozen allografts, 76% of them were satisfied with the outcome.14 In a study using mixed autografts (patellar tendon, Achilles tendon, hamstring tendon), the failure rate was 25%.9 In our study, the failure rate was 22.1%, which is comparable to that of other studies.4,5,9–13,15–17

In a study of revision ACL reconstruction using hamstring autografts (n=21), bone-patellar tendon-bone allografts (n=20), and Achilles tendon allografts (n=15), no significant difference in clinical outcome or stability was noted between different kinds of grafts.4 Non-irradiated fresh-frozen bone-patellar tendon-bone allografts have lower13,14 or similar15 failure rates as irradiated allografts. Tibial or hamstring tendon allografts have some advantages over bone-patellar tendon-bone allografts, because the former are easier to obtain, prepare, and place in an appropriate position. In addition, they have less length limitation, which is important in revision surgery. In our study, on comparing the use of hamstring tendon autografts with bone-patellar tendon-bone autografts at the primary ACL reconstruction, there was significant difference in terms of the VAS for pain only. This may be due to widening of the tunnel for hamstring tendon autografts. The bone-patellar tendon-bone autograft technique is more painful,16 and may thus give rise to more residual pain at the donor site.

The rates of chondral lesions during revision surgery have been reported to be 10 to 90%,1–4,6,9–12,15,16,19,20 In our study, the rate of chondral and/or meniscal lesions was 58%. On comparing our patients with and without chondral and/or meniscal lesions, there was significant difference in terms of the Lysholm score only. The lack of any other significant difference may be due to our small sample size and thus weak statistical power (type II error).

REFERENCES