Research

Bone-patellar tendon-bone autografts versus hamstring autografts for reconstruction of anterior cruciate ligament: meta-analysis

David J Biau, Caroline Tournoux, Sandrine Katsahian, Peter J Schranz, Rémy S Nizard

Abstract

Objectives To compare bone-patellar tendon-bone autografts with hamstring autografts for reconstruction of the anterior cruciate ligament.
Data sources Medline, WebSPIRS, Science Citation Index, Current Contents databases, and Cochrane Central Register of Controlled Trials.
Review methods All randomised controlled trials reporting one or more outcome related to stability (instrumented measurement of knee laxity, Lachman test, or pivot shift test) and morbidity (anterior knee pain, kneeling test, loss of extension, or graft failure). Study quality was assessed by using a 5 point scale. Random effect models were used to pool the data. Heterogeneity in the effect of treatment was tested on the basis of study quality, randomisation status, and number of tendon strands used.
Results 24 trials of 18 cohorts (1512 patients) met the inclusion criteria. Study quality was poor for nine studies and fair for nine studies. The weighted mean difference of the instrumented measurement of knee laxity was 0.36 (95% confidence interval 0.01 to 0.71; $P = 0.04$). Relative risk of a positive Lachman test was 1.22 (1.01 to 1.47; $P = 0.04$), of anterior knee pain 0.57 (0.44 to 0.74; $P < 0.0001$), of a positive kneeling test 0.26 (0.14 to 0.48; $P < 0.0001$), and of loss of extension 0.52 (0.34 to 0.80; $P = 0.003$). Other results were not significant.
Conclusion Morbidity was lower for hamstring autografts than for patellar tendon autografts. Evidence that patellar tendon autografts offer better stability was weak. The poor quality of the studies calls into question the robustness of the analyses.

Introduction

The best choice of graft for reconstruction of the anterior cruciate ligament is debatable.[1] The bone-patellar tendon-bone autograft (the criterion standard) is still preferred to the newer hamstring tendon autograft for the first reconstruction.[2] Patellar tendon grafts are thought to offer better stability, but hamstring grafts have lower morbidity. Randomised clinical trials show contradictory results.[3 w1-w24] Two meta-analyses, one of four and one of six randomised or quasi-randomised clinical trials, could not clarify the results of most outcomes.[4 5]

We performed a meta-analysis to compare the two types of autografts for reconstruction of the anterior cruciate ligament to provide up to date knowledge for doctors who have to decide between the two transplants with regard to stability and morbidity.

Methods

Search strategy

We searched Medline, WebSPIRS, Science Citation Index, Current Contents databases, and Cochrane Central Register of Controlled Trials up to March 2005; we cross checked the reference lists of published trials (search terms are on bmj.com). We had no restrictions on date of publication, language, or publication status. We consulted selected authors, main and specialised orthopaedic journals, and organisations with an interest in the topic to ask if they knew of other published or unpublished trials.

Trials selection and study characteristics

We selected trials that were randomised or quasi-randomised, included patellar tendon and hamstring autograft reconstruction without augmentation in the comparison, had a mean follow-up of more than one year, and had one or more primary outcome related to stability and morbidity (see appendix A on bmj.com for a description of the most used tests).[6]

Data abstraction and quantitative data synthesis

Two of the authors independently extracted data using standardised forms. Disagreements were resolved by discussion and if necessary with the help of other authors. We used a random effects model to analyse data. We tested for heterogeneity between trials. We tested for variation in the effect of treatment based on study quality, randomisation status, and number of strands used in the hamstring tendon group.

Additional references w1-w24, details of the outcome tests (appendix A), the five point quality score (appendix B), and search terms appear on bmj.com

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Results

Eligible studies

The search strategy generated 1494 studies of which 24 were relevant.[w1-w24] When data in studies overlapped, we merged them by outcome to have the longest follow-up and then the most patients included. Eighteen merged cohort studies were analysed.

Study characteristics

The studies were published between 1991 and 2005, and analysed 1512 patients (765 in the control group and 747 in the hamstring group). Follow-up ranged from 12 to 102 months, with a mean of 36 months.

All patients in the control group received a patellar tendon autograft. In the treatment group, a four strand hamstring autograft was used in 10 studies,[w2 w3 w5 w6 w10 w14 w16 w17 w19 w23] a four or a three strand autograft in two studies,[w9 w18] a two strand autograft in four studies,[w4 w7 w21 w22] and the number of strands used was unclear in two studies.[w8 w15]

Study quality was poor in nine studies (scored ≤ 2)[w6-w8 w15-w17 w19 w21 w23] and fair in nine studies (scored 3 or 4).[w2-w5 w9 w10 w14 w18 w22] No studies fulfilled all quality items (scored 5) (see bmj.com).

Quantitative data synthesis

Stability

The table shows the results of the meta-analysis of outcome measures. The difference in laxity between the operated side and the normal contralateral side was greater in the treatment group than in the control group (table). Knee laxity at 89N was available for 239 patients in the treatment group and 209 patients in the control group in five studies.[w6 w9 w10 w18 w19] The weighted mean difference was 0.36 mm (95% confidence interval 0.01 to 0.71; P = 0.04). Knee laxity at maximum manual force was available for 85 and 84 patients in the treatment and control groups in three studies.[w4 w5 w22] The weighted mean difference was 0.70 mm (0.02 to 1.39; P = 0.04).

Data on the Lachman test were available for 754 patients in eight studies.[w3 w7 w9 w10 w16 w17 w19 w21] The test was positive in 122 of 355 patients in the treatment group (34%) and 118 of 399 in the control group (30%). The relative risk of a positive Lachman test was 1.22 (1.01 to 1.47; P = 0.04).

Data on the pivot shift test were available for 815 patients in 10 studies.[w2-w4 w7 w10 w14 w16 w17 w19 w23] The test was positive in 99 of 411 patients in the treatment group (24%) and 78 of 404 in the control group (19%). The relative risk of a positive pivot shift test was 1.23 (0.95 to 1.6; P = 0.11). On all tests, heterogeneity was not significant.

Morbidity

Data on anterior knee pain were available for 1011 patients in 14 studies.[w2 w3 w5 w7-w9 w10 w14-w16 w18 w19 w22 w23] Anterior knee pain was reported in 69 of 536 patients in the treatment group (13%) and 105 of 475 in the control group (22%). The relative risk of anterior knee pain was 0.57 (0.44 to 0.74; P < 0.0001).

Data from the kneeling test were available for 334 patients in four studies.[w3 w14 w15 w18] The test was positive for 22 of 187 patients in the treatment group (12%) and 75 of 147 in the control group (51%). The relative risk of a positive kneeling test was 0.26 (0.14 to 0.48; P < 0.0001).

Data on loss of extension were available for 920 patients in 10 studies.[w2 w3 w9 w10 w14 w16 w18 w19 w21 w23] Loss of extension ≥ 5° was reported in 28 of 460 patients in the treatment group (6%) and 43 of 460 in the control group (9%). The relative risk of loss of extension was 0.52 (0.34 to 0.80; P = 0.003).

Data on graft failure were available for 1088 patients in 11 studies.[w4 w5 w8-w10 w14 w17-w19 w21 w23] Graft failure was reported in 22 of 534 patients in the treatment group (4.1%) and 19 patients of 554 in the control group (3.4%). The relative risk of graft failure was 1.33 (0.73 to 2.44; P = 0.35). On all tests, heterogeneity was not significant.

Subgroup analyses

Quantitative interaction tests on the effect of treatment based on study quality, randomisation status, and number of strands were not significant.

Discussion

Patients with hamstring autografts reported fewer anterior knee symptoms and extension deficits than patients with patellar tendon autografts, and we found no evidence that patellar tendon autografts provided better stability than four strand hamstring autografts.

Outcome measures in meta-analysis of comparisons with patellar tendon autografts

	2, 3, and 4 strand hamstring autografts					4 strand hamstring autografts				
Outcome	Weighted mean difference or relative risk (95% CI)	P value	Test for heterogeneity	No of patients	No of studies	Weighted mean difference or relative risk (95% CI)	P value	Test for heterogeneity	No of patients	No of studies
IMKL (89N)*	0.36 (0.01 to 0.71) mm	0.04	0.84	448	5	0.28 (–0.10 to 0.66)	0.15	0.96	332	3
IMKL (maximum manual force)*	0.70 (0.02 to 1.39) mm	0.04	0.30	169	3	0.0 (–1.08 to 1.08)	1	NA	61	1
Lachman test†	1.22 (1.01 to 1.47)	0.04	0.79	754	7	1.13 (0.85 to 1.50)	0.41	0.83	703	8
Pivot test†	1.23 (0.95 to 1.60)	0.11	0.68	815	10	1.14 (0.89 to 1.47)	0.29	0.75	520	4
Loss of extension†	0.52 (0.34 to 0.80)	0.003	0.67	920	7	—	—	—	—	—
Anterior knee pain†	0.57 (0.44 to 0.74)	<0.0001	0.93	1011	12	—	—	—	—	—
Kneeling test†	0.26 (0.14 to 0.48)	<0.0001	0.13	334	4	—	—	—	—	—
Graft failure†	1.33 (0.73 to 2.44)	0.35	0.99	1088	11	—	—	—	—	—

*Weighted mean difference.
†Relative risk for the remainder.
IKML=instrumented measurement of knee laxity, NA=not applicable.

Knee stability

Many factors during and after surgery can influence anterior tibial translation: cycling of the graft, degree of knee flexion and the tension applied to the graft at the time of fixation, bone to bone versus tendon to bone healing, and rehabilitation.[7-11] To reduce confounding variables, authors standardised most of the procedures (surgical technique and rehabilitation) in both groups. However, these variables could have different effects on knee laxity in the two types of autograft even when they were distributed equally between groups, and the better outcome for knees reconstructed with patellar tendon autografts could have been overestimated owing to these methodological issues.

Stabilisation of the joint should have a protective effect against degenerative joint disease.[12] However, to prevent later osteoarthritis, it seems more important to stop pivoting of the joint than to reduce anterior-posterior laxity[13]; we found no difference between groups with regard to the pivot shift test.

Knee morbidity

Morbidity at the graft harvest site is the most important factor in the differences seen between the two groups. It has been argued that morbidity at the harvest site is lower by the end of the first year, but all studies had a follow-up of more than 12 months.[14] Even if improvements in surgical techniques and rehabilitation programmes can reduce anterior knee symptoms after reconstruction using patellar tendon autografts, these patients are still prone to develop anterior knee symptoms and late patellofemoral osteoarthritis.[15-17]

The two main reasons for loss of mobility after anterior cruciate ligament surgery are impingement and capsulitis (arthrofibrosis). Technical errors that cause impingement should be distributed equally between the two groups. Patients who have a patella tendon reconstruction are susceptible to anterior knee pain and synovitis,[w13] and this correlates with the development of arthrofibrosis.[18] Quadriceps weakness and inhibition[w5 w13 w17 w21] and anterior knee symptoms after patella tendon reconstruction can result in delayed or inadequate rehabilitation and deferred recovery of full extension, which may cause permanent loss of extension.[19 20]

Limitations of the study

The effect of medical professionals plays an important part in trials not investigating drugs—the results could have been biased if surgeons had more expertise in one of the two techniques. Patients' characteristics and technical issues (such as cycling of the graft, degree of knee flexion and graft tension when securing the graft, and fixation devices) cannot be analysed in a meta-analysis of aggregate patient data, and ideally data from individual patients should be analysed.[21]

Conclusions

Patients with hamstring autografts report fewer anterior knee symptoms and extension deficits than patients with patellar tendon autografts. The small improvement of stability in patellar tendon autografts compared with four strand hamstring autografts is of questionable importance for most patients.

What is already known on this topic

Hamstring autografts and patellar tendon autografts are the two preferred options for reconstruction of knees with damaged anterior cruciate ligaments

The stability and morbidity outcomes of these autografts are unclear

What this study adds

Patients with hamstring autografts report fewer anterior knee symptoms and extension deficits than patients with patellar tendon autografts

The stability of patellar tendon autografts and four strand hamstring autografts is similar

The poor methodological quality of the studies calls into question the robustness of the analyses, so it is difficult to make definitive conclusions. The methodological quality of surgical trials needs to be improved.

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Breast cancer in the family—children's perceptions of their mother's cancer and its initial treatment: qualitative study

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Abstract

Objectives To explore how children of mothers newly diagnosed with breast cancer perceive their mother's illness and its initial treatment; to contrast their accounts with the mothers' perceptions of their children's knowledge.
Design Qualitative interview study with thematic analysis.
Setting Home based interviews with mothers and children in Oxfordshire, England.
Participants 37 mothers with early breast cancer and 31 of their children aged between 6 and 18 years.
Results Awareness of cancer as a life threatening illness existed even among most of the youngest children interviewed. Children described specific aspects of their mother's treatment as especially stressful (seeing her immediately postoperatively, chemotherapy, and hair loss). Children suspected that something was wrong even before they were told the diagnosis. Parents sometimes misunderstood their children's reactions and underestimated the emotional impact or did not recognise the children's need for more preparation and age appropriate information about the illness and its treatment.
Conclusions As part of their care, parents newly diagnosed with a life threatening illness need to be supported to think about how they will talk to their children. General practitioners and hospital specialists, as well as nurses, are well placed to be able to help with these concerns and if necessary to be involved in discussions with the children. The provision of appropriate information, including recommended websites, should be part of this care. More information specifically designed for young children is needed.

Introduction

Relatively little has been published about communication with children when their parent is newly diagnosed as having cancer. A recent review of the literature found that communication was important for the children's psychological adjustment.[1] The few studies that have involved direct interviews with children have been very small, have explored aspects at different stages of the mother's illness, or have not provided accounts from both child and parents. Children are exposed to an enormous amount of information about cancer,[2] but we know little about whether children of different ages notice this information and how they make sense of it. We explored the accounts of mothers with breast cancer and their children to identify children's awareness and understanding of their parent's cancer, their reactions to the diagnosis and treatment, and what information they would have liked to have been given and seemed to need.

Methods

Mothers' interviews—We recruited mothers with stage I-IIIa breast cancer and children under18 from one dedicated cancer centre. Their treatment for a new diagnosis of breast cancer involved surgery (lumpectomy or mastectomy), supplemented by chemotherapy and radiotherapy as necessary. Seventy three women were approached. We conducted detailed semistructured interviews with 37 mothers about their experience of talking about their illness with their family and their perspectives of their children's reactions to the diagnosis and treatment.

Children's interviews—Thirty one children agreed to be interviewed. Nine children were aged 6-10 years (four girls and five boys), 13 were aged 11-15 (eight girls and five boys), and nine were aged 16-18 (four girls and five boys). A child psychiatrist saw children at home, without their parents present, for an hour long, semistructured interview about their experience of their mother's illness. Twenty five children were seen individually, and six chose to be interviewed with a sibling. A general discussion established a warm relationship, followed by questions about the child's awareness of cancer before the mother's illness; experience of the illness, diagnosis, and further treatment; and sources of support and information about breast cancer.

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