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Original article

Lateral meniscus allograft transplantation: Clinical and anatomic outcomes after arthroscopic implantation with tibial tunnels *versus* open implantation without tunnels



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ABSTRACT

Meniscus allograft transplantation (MAT) is used to treat patients with knee pain after total or subtotal meniscectomy. The graft can be inserted during open or arthroscopic surgery. The objectives are anatomic horn positioning and strong fixation to the bone and capsule of an appropriately sized graft.

Hypothesis: Arthroscopic MAT with trans-tibial bone fixation ensures better mid-term functional outcomes and limits allograft extrusion.

Patients and methods: We conducted a retrospective single-centre study of 23 consecutive patients who underwent MAT between 2001 and 2010. Among them, 11 had open surgery and anchoring of the horns without tunnels and 12 had arthroscopically-assisted surgery with bony fixation of the horns through trans-tibial tunnels. The two groups were comparable at baseline. Mean follow-up was 66.1 months. Post-operative outcomes were assessed using the IKDC score and KOOS, standard radiographs of both knees, and either magnetic resonance imaging or computed arthrotomography. We measured joint space narrowing, meniscal extrusion in the sagittal and coronal planes; and the degree of cartilage coverage by the graft using an index developed for this study.

Results: The overall failure rate was 17.4% (4/23, two cases each of complete and partial graft removal). Joint space narrowing increased by 28% *versus* the pre-operative value ($P=0.009$). IKDC and KOOS values were not significantly different between the two groups. Absolute meniscus extrusion was greater in the arthroscopy group (4 mm vs. 3 mm, $P=0.03$).

Discussion: Osteoarthritis of the transplanted compartment is unavoidable. Open surgery is associated with less meniscal extrusion. The clinical outcomes are independent from the technique used. Other factors require investigation, including graft rehabilitation, quality peripheral suturing, and intermeniscal ligament reconstruction.

Level of evidence: IV, retrospective study.

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1. Introduction

Patients with a history of meniscectomy are at considerably increased risk for knee osteoarthritis compared to the general population [1] and develop the disease 10 to 20 years earlier than do patients with primary knee osteoarthritis. Total meniscectomy has now been virtually superseded by partial meniscectomy, meniscus repair, or surgical abstinence with the goal of sparing the meniscus [2]. Nevertheless, large irreparable lesions may require total or subtotal meniscectomy. These procedures carry a risk of

subsequent functional impairments and early knee osteoarthritis, most notably at the lateral compartment.

Meniscus allograft transplantation (MAT) may constitute a treatment option in young patients who have knee pain after meniscectomy but have not yet developed advanced osteoarthritis. Studies of MAT have shown good pain relief and functional improvements in the short, medium and long terms [3–5]. The anatomic objectives of MAT are to obtain anatomic horn positioning and strong fixation to the bone and capsule of a properly sized meniscus graft; meeting these objectives increases the likelihood of restoring joint homeostasis, thereby ensuring good knee function in the long term.

MAT was initially performed during open surgery, and graft fixation was confined to the periphery [6,7]. Techniques involving bone fixation of the horns using plugs inserted into tibial tunnels or a

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bony bridge [8] with no tibial tunnel (lateral grafts [9,10]) were developed. Arthroscopic techniques [11] were then devised on the theoretical grounds that soft-tissue lesions, scarring, and the risk of infection would be minimised; cartilage assessment improved and the meniscus horns positioned with greater accuracy.

Here, we compared two groups of patients who underwent lateral MAT. One group was managed by open surgery with fixation to the capsule but not to the bone and the other by arthroscopy-assisted surgery with trans-tibial and peripheral graft fixation. Our working hypothesis was that the arthroscopic technique with trans-tibial bony fixation produced better medium-term functional outcomes and minimised allograft extrusion.

2. Patients and methods

Between 2001 and 2010, two surgeons performed lateral MAT in 23 patients at the Versailles Hospital, Le Chesnay, France. Of the 23 patients, 11 underwent open MAT and 12 arthroscopy-assisted MAT (Table 1). Both groups were composed of consecutive patients.

At baseline, the two groups were comparable for all study variables except a history of varus osteotomy, which was noted for four patients in the open-surgery group versus none in the arthroscopy group.

2.1. Open surgery technique

A 3- to 4-cm lateral approach was used. The femoral attachments of the lateral collateral ligament and popliteus were identified. Osteotomy of these attachments was achieved by removing a bone slice about 1 cm in thickness. PDS 0 sutures were inserted through the graft at 3-mm intervals. The graft was then positioned into the compartment and the sutures used for fixation to the capsule (Fig. 1). At the end of the procedure, the popliteus/lateral collateral ligament complex was reattached using a 3.5-mm screw and a washer (Fig. 2).

2.2. Arthroscopy-assisted technique

After freshening of the meniscal wall, two guide wires were aimed at the tibial insertion sites of the anterior and posterior horns, using a ligamentoplasty aiming system. The tunnels were then created using 5-mm cannulated bits. Sutures were run through the tunnels and left for later use. A PDS loop was inserted through the popliteus. Both horns of the graft were tied using high-strength suture material, and a PDS 0 suture was inserted through the popliteal hiatus. After extension of the lateral approach, the graft was introduced by pulling on the sutures through the posterior

Table 1

Comparison of the groups managed with open surgery and arthroscopy-assisted surgery for lateral meniscus allograft transplantation: baseline data and follow-up.

	Open surgery	Arthroscopy	P value
n	11	12	
Age, years	26.7	28	0.62
F/M	4/7	2/10	0.54
Time since meniscectomy, years	10.1	8.9	0.45
Cartilage lesions 0/1/2	3	1	0.57
Cartilage lesions 3/4	8	11	0.57
Joint space narrowing	24%	21%	0.96
History of osteotomy	4	0	
History of ligamentoplasty	1	2	0.59
Mean follow-up, months ^a	32	43	0.13
Lost to follow-up	1 (18 months)	3 (24 months)	0.59

n: number of patients; cartilage damage 0/1/2, numbers of patients without cartilage damage and with stage 1 or 2 cartilage damage; cartilage damage 3/4, numbers of patients with stage 3 or 4 cartilage damage.

^a At first re-evaluation in the open-surgery group.

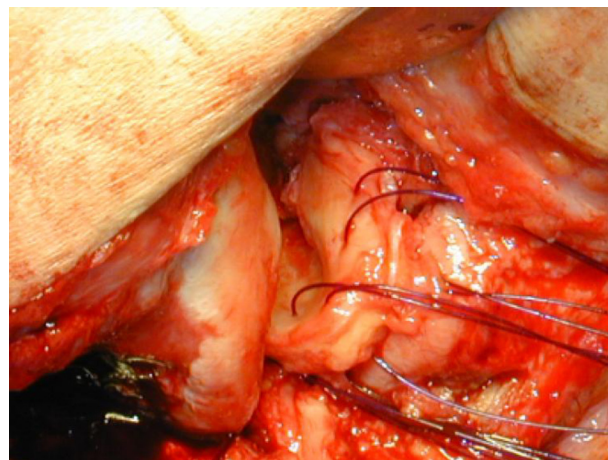


Fig. 1. The lateral collateral ligament/popliteus complex has been displaced, the graft is being introduced, and the PDS 0 sutures will be stitched to the capsule.

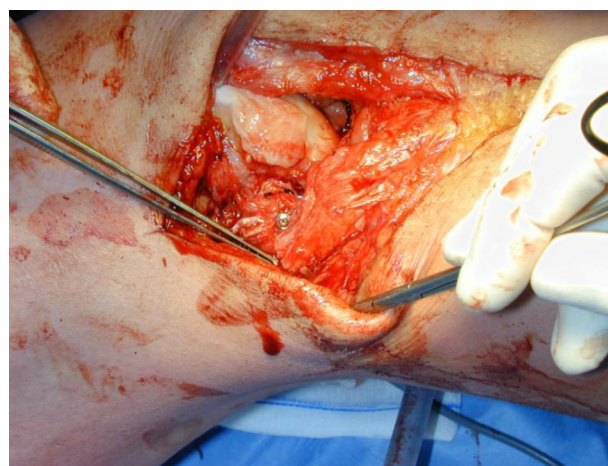


Fig. 2. At the end of the procedure, the osteotomy performed to detach the lateral collateral ligament/popliteus complex is re-implanted using a 3.5-mm screw.

horn and popliteus then secured using Fast-Fix (Smith & Nephew) at the posterior and middle graft segments. The anterior segment was not sutured to the capsule (Fig. 3). At the end of the procedure, both horns were sutured to the anterior aspect of the tibia using buttons.

2.3. Post-operative care

Patients in both groups wore a long-leg splint maintaining the knee in extension for one month. Flexion was not to exceed 90° during the next month and was subsequently unrestricted. Weight bearing was eliminated for six months then resumed gradually.

2.4. Post-operative assessments

Patients in the open-surgery group were re-evaluated in 2007, after a mean follow-up of 31.8 months. Patients in both groups were seen in 2012, after mean follow-up of 63.3 months (range, 22–122) overall, 73.3 months in the open-surgery group, and 43.4 months in the arthroscopy group. The two groups were compared using the data collected in the open-surgery group at the first re-evaluation, as the follow-up durations were then similar in the two groups.

Patients were assessed using the subjective and objective IKDC scores and the KOOS. Radiographs of both knees were obtained in the antero-posterior, lateral, and schuss views. Magnetic resonance

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