



Original Article

Allograft of the knee extensor in cases of patellar tendon rupture in total arthroplasty patients[☆]



Fernando Fonseca

Centro Hospitalar e Universitário de Coimbra, Serviço de Ortopedia, Coimbra, Portugal

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ABSTRACT

Objective: Retrospective study to evaluate the functional results of patients with total knee arthroplasty and rupture of the patellar tendon, submitted to transplantation of the extensor knee apparatus with fresh frozen allograft.

Method: Nine patients, operated between 2003 and 2015, with a minimum of one year of follow-up. All patients were reviewed by performing a functional evaluation using the Knee Society score. Preoperative values were compared with those of the final evaluation.

Results: Mean survival was 2.7 ± 1.9 years (14–1). The knee score improved from 38 ± 4.5 to 70 ± 8.5 , and functional score from 30 ± 6.5 to 90 ± 3.5 . Mean extension deficit was 5 (1–15). Mean range of motion was 80 (60–100).

Conclusion: The use of allograft is a solution for extreme cases of patellar rupture after total knee arthroplasty, providing reasonable functional results and representing an alternative to knee arthrodesis.

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Transplante de aloenxerto de aparelho extensor do joelho em casos de rotura do tendão patelar em pacientes com artroplastia total

RESUMO

Objetivo: Estudo retrospectivo para avaliação dos resultados funcionais de pacientes com artroplastia total do joelho e rotura do tendão patelar submetidos a transplante total de aparelho extensor do joelho congelado.

Método: Nove pacientes, operados entre 2003 e 2015, com um mínimo de um ano de seguimento. Procedeu-se a uma avaliação funcional com o escore da Knee Society, compararam-se os valores no pré-operatório e na última avaliação.

Resultados: Sobrevida média de $2,7 \pm 1,9$ anos (14–1). O escore joelho melhorou de $38 \pm 4,5$ para $70 \pm 8,5$ e o escore funcional de $30 \pm 6,5$ para $90 \pm 3,5$. Déficit de extensão médio de 5 (1–15). Arco de movimento médio de 80° (60–100).

Palavras-chave:

Ruptura

Ligamento patelar

Artroplastia do joelho

Transplante

Aloenxerto

[☆] Study conducted at Serviço de Ortopedia, Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal.

E-mail: pereirafonseca@gmail.com

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Conclusão: O uso de aloenxerto é solução, de recurso, para casos extremos de rotura do tendão patelar após artroplastia total do joelho, parece apresentar resultados funcionais razoáveis e apresenta-se como uma opção à artrodese do joelho.

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Introduction

Patellar tendon rupture in patients who have undergone total knee arthroplasty is a rare^{1,2} and highly disabling condition with diverse etiologies.³ Several treatments are available, from simple suture to allograft.⁴ The use of complete extensor apparatus allograft (tibial tuberosity, patellar tendon, patella, and quadriceps tendon) is an uncommon and technically challenging solution that presents acceptable results.⁵

This study is aimed at evaluating the authors' experience with this type of treatment.

Materials and methods

A retrospective study with a mean duration of six years (1–14 years) was performed in nine patients who had undergone total knee arthroplasty and presented rupture of the patellar tendon, who then received a frozen complete knee extensor apparatus allograft. All patients were operated and followed by the author.

There were nine patients, two males and the remaining, females. The mean age at surgery was 66.4 ± 10.2 years. The mean time between implantation of the primary prosthesis and rupture was 7.0 ± 2.9 years. In six patients, the rupture was caused by trauma; in the others, it was secondary to previous surgery for treatment of knee stiffness (two cases) or infection (one case), and an arthroplasty revision was performed at the same time.

The allograft comprised the entire knee extensor apparatus, frozen at -80°C , in accordance with current quality standards.¹

In all cases, the surgery was performed using an anterior medial approach, over the previous incision. After identifying the patella and extensor apparatus, it was longitudinally divided, with total patellectomy and identification of the anterior tibial tuberosity. In it, a diamond-shaped bed was opened, so as to impact the donor graft into the recipient area. Fibrotic tissues and those of poor quality and viability of the quadriceps tendon were also excised. While the patient's recipient bed was being prepared, another team thawed the allograft and prepared its tibial tuberosity for placement on the patient's recipient bed. The final implantation of the graft began by inserting the tibial tuberosity of the graft on to the patient's

tibial tuberosity bed; the graft was secured with screws or cerclage wiring, according to the patient's local condition. The final suture to the patient's quadriceps muscle was made in extension, under tension with nonabsorbable sutures (Fig. 1).

Postoperatively, the knees were immobilized with an articulated orthosis locked in extension for the first three weeks; weight-bearing was authorized with the support of Lofstrand crutches. Three weeks after surgery, the orthosis joint was unlocked and patients were encouraged to perform knee flexion and extension exercises. Six weeks after surgery, the orthosis was removed; patients were required to continue using Lofstrand crutches for another two weeks. At eight weeks, patients were encouraged to walk about without crutches and continue to perform joint mobility exercises.

Thromboembolic prophylaxis was conducted; oral antibiotic therapy (amoxicillin and clavulanic acid) was continued for a further two weeks after surgery.

Clinical and radiographic assessment² (Fig. 2) were performed at six weeks, six months, one year, and yearly thereafter. In each evaluation, the Knee Society score and the functional knee score,⁶ validated for the Portuguese language,⁷ were used; active joint range of motion was measured with a goniometer.

The data included in the present study refer to the last evaluation as seen in the medical records.

Results

Two patients who underwent the procedure died, at one and four years after the surgery, from causes unrelated to the procedure. In the three patients in whom arthroplasty revision was associated, complications were observed (infection in one case and suture dehiscence in the other two), requiring re-intervention with knee arthrodesis until the end of the first year. Thus, the study focused mainly on six cases, with a mean follow-up of 2.7 ± 1.9 years (1–4).

The mean Knee Society scores were 70 ± 8.5 (60–87) and 68 ± 7.5 (50–80) on functional evaluation; preoperatively, those values were 20 ± 3.5 (0–40) and 25 ± 7.5 (0–45), respectively.

Regarding active mobility, the mean lack of extension was 6 ± 0.5 (0–8). The mean active flexion was $90^\circ \pm 5.5^\circ$ (80–100; Fig. 3). The mean range of motion was 82 ± 6.5 (90–100).

Overall survival was 44%, the main complications being observed during the first year after surgery (Fig. 4).

¹ Guidelines from the Bone Tissue Bank of the Hospital and University Center of Coimbra, approved by the Portuguese Institute of Blood and Transplantation.

² According to the protocol of the Orthopedic Department that anticipates knee radiographs on an anteroposterior view, lateral view at 30° of flexion, and a skyview of the patella with 30° of flexion.

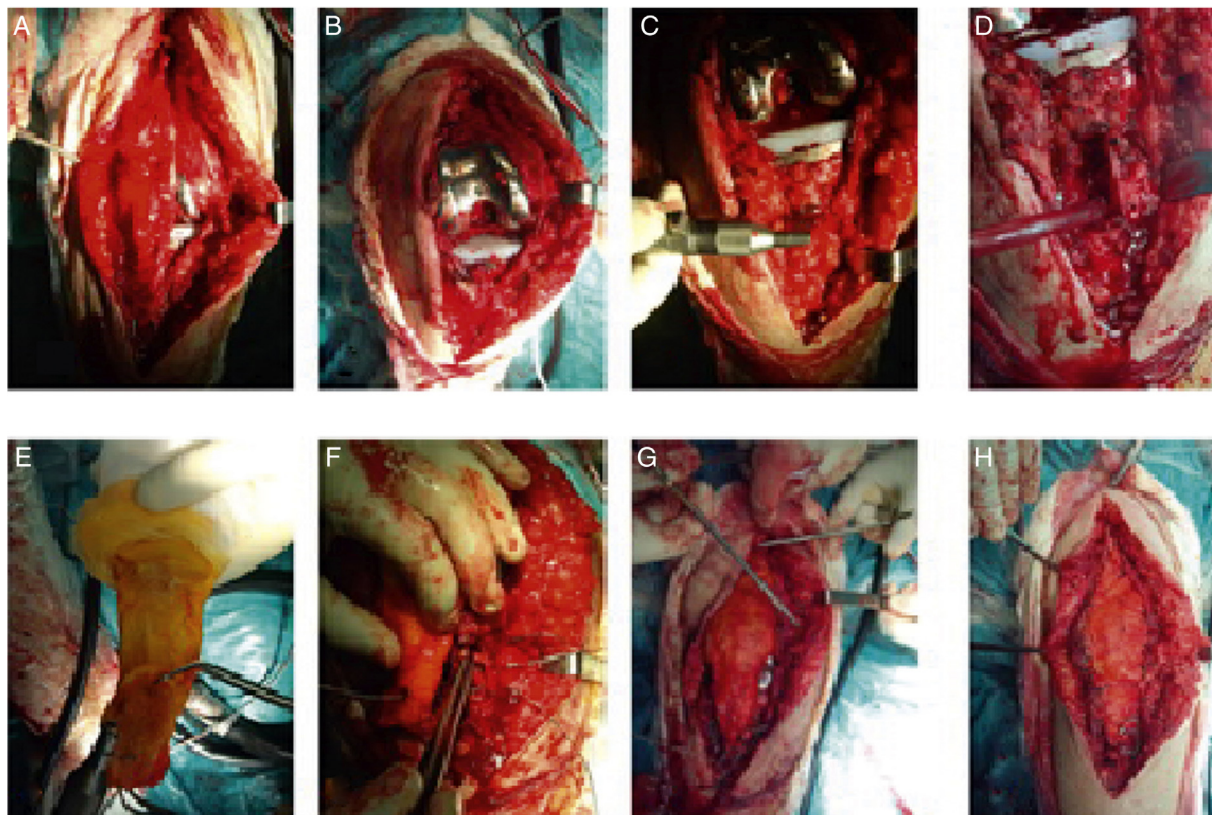


Fig. 1 – (A) Medial approach and extensor apparatus identification; (B) excision of the extensor apparatus of the knee; (C) preparation of the recipient bed in the anterior tibial tuberosity; (D) detail of the recipient bed; (E) allograft preparation; (F) placement into the anterior tibial tuberosity; (G) fixation with cerclage wires; (H) final assembly with suture to the quadriceps muscle.

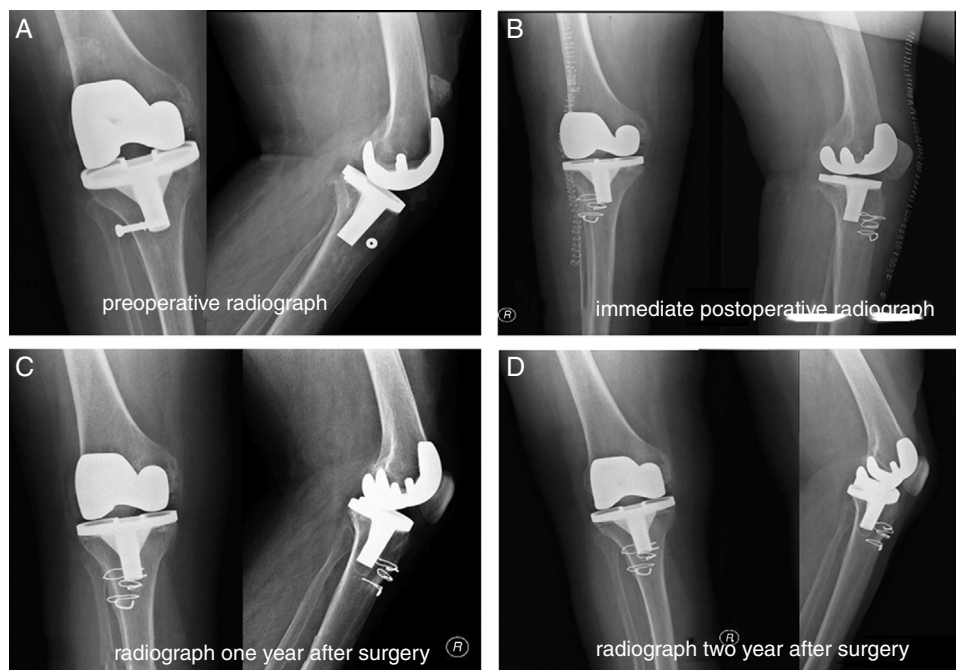


Fig. 2 – (A) Preoperative radiograph; (B) immediate postoperative radiograph; (C) radiograph one year after surgery; (D) radiograph two years after surgery.



Fig. 3 – Clinical assessment one year after surgery. A deficit in active extension can be observed.

Discussion

Patellar tendon rupture after total knee arthroplasty is a rare but highly taxing complication for the patient.^{2,3} Several treatment options are available, including the use of a complete knee extensor allograft, as described by Noronha et al.⁸ in isolated patellar tendon ruptures and by Emerson et al.⁹ in ruptures observed in patients who have undergone total knee arthroplasty. Chen et al.¹⁰ demonstrated that allograft integration is more time-consuming, but equally effective, and preserves the biomechanical properties. These data are in line with those described with the use of bone-tendon-bone allograft for anterior cruciate ligament reconstruction.¹¹

The extensor apparatus allografts used in the present study were provided by the Bone Tissue Bank of the medical service, collected from donors with brain death or already deceased. The selection criteria followed the protocols set forth by Portuguese legislation and were in accordance with the quality standards of the Tissue Bank.¹² The use of allograft is not free from risks or complications; despite being extremely low, an increased risk of transmission of diseases and infection from the donor to the host cannot be excluded.¹² In all cases, frozen allografts were used as they reduce the risk of immunogenicity and do not compromise the biomechanical properties of the allograft.^{13,14}

In the studies retrieved from the literature,^{5,9,12,15-20} the functional results are fair, with some improvement in the

patients' quality of life. With the exception of the study by Nazarian,²⁰ the number of patients is scarce. The final mobility observed in each series showed a range of motion of approximately 90°. It was also observed that patients presented an extension lag between 1.5°²⁰ and 59°.⁵ The differences were related to the allograft fixation technique; the greatest deficits were observed in patients in whom the suture to the quadriceps tendon was made in flexion and with little tension.⁶ A significant complication rate was observed, ranging from 86%⁵ to 7%.¹² Therefore, this is a high-risk option that should only be used as a last resort.

The findings of the present study are in line with several previously published studies. The surgical technique used, followed the recommendations by Burnett et al.⁵ The authors benefited from the knowledge of the literature, which indicates worse functional results when sutures were placed under low tension and in flexion.

Functional results, notably mobility, were fair, as evidenced by the range of motion and functional evaluation of the knee; nonetheless, they were certainly better than what would have been achieved by other treatments, as recently reported by Vaishya et al.²¹

The complications observed in this series (33%) were in agreement with those observed in the long-term follow-up study by Brown et al.²² The observed complications required arthrodesis in patients in whom it was necessary to simultaneously revise the prosthesis. The technique described by Vince and Bédard²³ was used to impact the graft into the anterior tibial tuberosity. However, the poor results are due to complications inherent to arthroplasties, notably skin complications described in the literature.²⁴ Contrary to what was advocated by Emerson et al.,⁹ the skin suture became quite tense postoperatively. This led to an early suture dehiscence, with subsequent skin necrosis, and finally to secondary graft infection. From the experience gained, the authors recommend an assessment of the patient's skin; when in doubt, working together with a plastic surgeon is recommended.

In the present series, the survival rate was 44.4%; while lower than expected, the result is justified by the three cases of complications previously discussed. After the first year of surgery, the patients were stable and able to perform their daily activities.

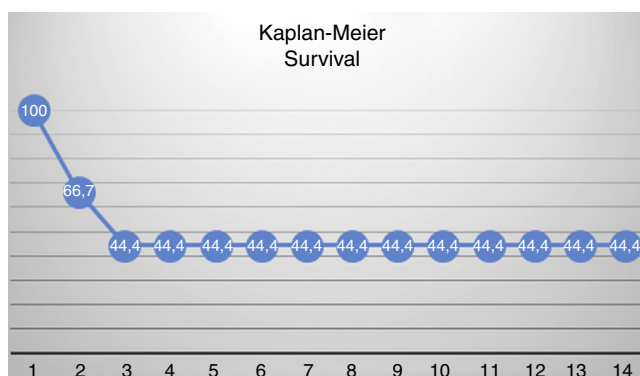


Figure 4 – Survival.

Morbidity is still high and the functional results are only fair; the procedure is more satisfactory to the surgeon than to the patient. These aspects should be clearly presented to the patient, who should also be aware of the inability to meet a high functional demand after the procedure.

Conclusions

Frozen allograft of the knee extensor apparatus is a good option in the treatment of patellar tendon rupture in patients who underwent total knee arthroplasty. However, this solution has high morbidity and the results are far from exceptional.

The solution should be well-studied; the local conditions, especially skin conditions, should be evaluated, and the limitations and possible complications must be explained clearly and succinctly to the patient.

Conflicts of interest

The author declares no conflicts of interest.

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