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Reconstruction of patellar tendon following implantation of proximal tibia megaprosthesis for the treatment of post-traumatic septic bone defects

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KEYWORDS

Patellar tendon reconstruction
megaprosthesis
soft tissue coverage

ABSTRACT

Introduction: Latest advances made in joint replacement implants allows reconstruction of entire limbs. These special prostheses or megaprostheses were originally designed for the treatment of severe oncological bone loss. Nowadays, however, the indications and applications of these devices are expanding to other orthopaedic and trauma clinical conditions. Since 2008 we have implanted 152 megaprostheses in non-oncological conditions: 87 were implanted for post-traumatic failures aseptic/septic (represented by complex non-unions and critical size bone defects); 26 total femur, 52 distal femur and 9 proximal tibia. In this group of patients bone and soft tissues conditions are completely different compared to patients with oncological back ground. The presence of infection and previous surgeries can lead to adhesion, scar interference, muscular and tendon impairment and skin problems that lead to reduced function and severe joint stiffness. The purpose of this study is to evaluate the results of treatment of reconstruction of patellar tendon during implantation of proximal tibia megaprosthesis for the treatment of septic post traumatic critical bone defects.

Patients and methods: In this retrospective study, we evaluated 9 patients treated with proximal tibia megaprosthesis who underwent patellar tendon reconstruction. All patients presented a complete patellar tendon disruption at the time of prosthesis implantation. Procedures of reconstruction included a tendon-plasty of quadriceps and/or patellar tendons, a pie crusting of quadriceps fascia, a reinforcement of the apparatus with synthetic tendon graft substitutes (LARS) and a medial gastrocnemius muscular flap to reconstruct the extensor mechanism and obtain skin coverage when needed. The average follow up was 18 months (9–36). For each of the cases, we analysed the complications occurred regarding septic recurrence, patellar fracture, quadriceps and patellar tendon rupture and number of reinterventions. The clinical outcome was assessed by the WOMAC Score.

Results: In all cases there was no infection recurrence or skin related problems. None of the patients require prosthesis revision due to loosening or device failure. No patellar fracture or quadriceps tendon failure was recorded.

One patient presented a rupture of the reconstructed patellar tendon due to a trauma incident 18 months after the implantation and he required revision surgery. From a clinical point of view the average WOMAC score was 62.4 at 1 month rising to 72.6 at 3 months, 78.2 at 6 months, 76.4 at 1 year and 74.8 at 18 months.

Conclusion: When proximal tibia megaprosthesis is implanted and there are soft tissue and patellar tendon deficiency, soft tissue reconstruction can be achieved by appropriate lengthening of the tendon and a gastrocnemius flap reinforced by LARS. Such an approach allows restoration of the extensor mechanism and coverage of the prosthesis in an area where skin problems are frequently very common.

Introduction

Critical bone defect of traumatic or prosthetic origin continue to be a complex problem for the orthopaedic surgeon. Patients not infrequently have undergone a number of previous procedures limiting the options of reconstruction or may possess a number of

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comorbidities which impair the healing potential of the affected extremity. The aetiology of critical bone defects include acute traumatic loss, extended bone resections performed to treat non-union or underlying septic complications.

Although bone reconstruction techniques have been developed and refined over the years, their applications can still lead to long-term treatment and complications may occur leading to serious long-term impact on both the quality of life of the patient and on the welfare costs.

There are various reconstructive strategies to treat bone defects such as autograft and allogeneic bone grafting, bone transport, biological based therapies in the form of monotherapy [1] or polytherapy [2,3], the use of standard prosthesis and/or megaprosthesis.

Lately, a classification system NUSS (Non Union Scoring System) was introduced allowing the evaluation of the risk factors and comorbidities of the patient, bone and other tissues, which can be used to obtain a prognosis and to provide guidance on surgical treatment [4,5]. Patients with a score higher than 75 points present very compromised general and local conditions and further reconstructive treatment is not recommended. The recommendations for this group of patients include primary amputation, arthrodesis or the implantation of a prosthesis. In patients who do not wish to consider primary amputation as a solution of their problem, our approach to provide a reasonable functional solution has been the replacement of all or part of the affected extremity with mega-prosthesis. Our philosophy of substitution treatment can quickly restore function rather than chasing again unsuccessful attempts to reconstruction [6,7].

In such cases, bone and soft tissues conditions are completely different from the routine oncological patient group. The quality of the knee extensor mechanism is very often in a critical condition particularly in post-traumatic septic patients who have undergone multiple surgeries. Tissue adhesion, scar interference, muscular and tendon impairment, soft tissue retractions, osteoporosis and skin problems lead to a reduced function of the knee, severe joint stiffness and also create adverse condition during the reconstructive step.

A specific complication that can lead to very poor results involves anterior tibial apophysis avulsion and partial tear or complete disruption of the patellar tendon. In such case, limitations exist intraoperative on how to restore the tendon loss and post-operatively how to manage the rehabilitation program of the patient. In addition, in cases where the entire proximal part of tibia is removed, reconstruction of the extensor apparatus must be reinserted directly into the prosthesis and adequate soft tissue must be present to cover to prosthetic component. In this study, we present our results of reconstruction of patellar tendon during implantation of proximal tibia megaprosthesis for the treatment of septic post traumatic critical bone defects.

Patients and methods

Between January 2008 and January 2016 we treated 152 non oncological patients with mega-prosthesis for large bone resections. The implants performed were: 54 proximal femurs, 52 distal femurs, 9 proximal tibias, 7 distal tibias, 26 total femurs, 4 arthrodesis for large resection of the knee. The implant used in all cases was the prosthesis Megasystem-C (Waldemar LINK, Germany). In this retrospective analysis we evaluated 9 patients treated with proximal tibia mega-prosthesis who underwent patellar tendon reconstruction. All the patients presented a septic condition and were treated in two surgical steps (1st step: device removal + resection of septic bone and non-union + implantation of antibiotic spacer; 2nd step: after an average period of 3 months: removal of the antibiotic spacer and implantation of definitive mega-prosthesis). The average follow up time was 18 months (9–36) since the second procedure. All patients presented a complete patellar tendon disruption at the second stage.

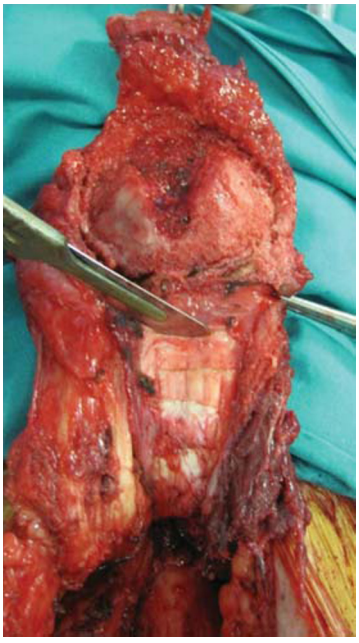

Fig. 1. Tendon-plasty for lengthening the quadriceps tendon.

Techniques of reconstruction

- Tendon-plasty of the quadriceps and/or patellar tendons to stretch the tendon fibres and enable functional reconstruction (9/9 patients) (Figure 1).
- Pie crusting of quadriceps fascia to lengthen it and enable functional reconstruction and future mobilization, thus reducing the strain on the new apparatus and limiting new rupture (7/9 patients) (Figure 2).
- Anchoring the apparatus reinforced by synthetic tendon graft substitutes (LARS) directly to the prosthetic element using an appropriate plate built for this purpose (9/9 patients) (Figure 3).
- Medial gastrocnemius muscular flap to reconstruct the extensor mechanism (9/9 patients) and obtain skin coverage if needed (5/9 patients) (Figure 4).
- Reinforcement of the patella through peripheral cerclage with non-absorbable metal core wire in patients with severe osteoporosis and at high risk of fracture (3/9 patients).

All reconstructions were performed by a single operator and by the same team during this period. Patient follow-up was performed with

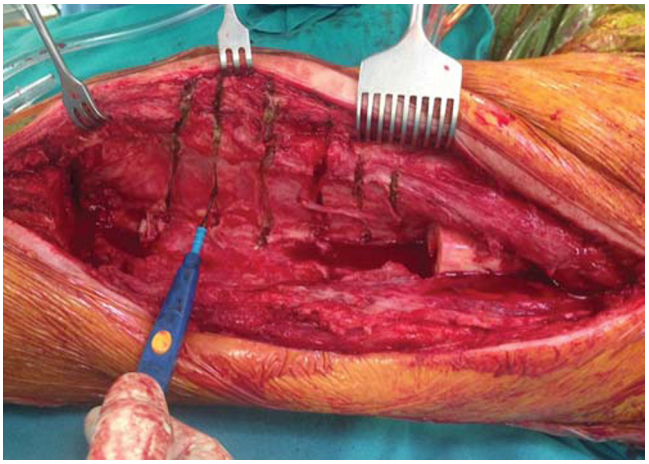

Fig. 2. Pie crusting of quadriceps fascia.