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Case report

Intercalary diaphyseal endoprosthetic reconstruction for tibial septic non-union in an elderly patient: A case report

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ABSTRACT

The surgical treatment of septic non-union is challenging and carries a high failure rate. Bone defect management and fracture site stabilisation are key treatment objectives. We report the case of a 75-year-old woman who underwent intercalary endoprosthetic reconstruction of a large tibial defect due to septic non-union after two previous treatment failures. The two-stage procedure involved extensive excision of infected tissues and implantation of an antibiotic-loaded cement spacer followed by insertion of an intercalary endoprosthesis. Within only 2 months after the procedure, the patient was able to walk with no assistive device and no limp. After 12 months and 6 months after antibiotic discontinuation, the laboratory tests and imaging studies showed no evidence of infection. Intercalary endoprosthetic reconstruction may be a valid treatment option to avoid amputation for recurrent septic non-union, particularly in elderly patients.

1. Introduction

Non-union is among the main complications of leg fractures [1]. When repeated surgical procedures are needed and/or the fracture is open, the risk of infection is increased and progression to septic non-union may occur [2]. The treatment, which is now well standardised, involves controlling the infection, stabilising the fracture site and managing the bone defects [3–5]. Septic non-union often requires extensive bone resection to achieve healthy margins, combined with an appropriate antibiotic regimen. Surgery for septic non-union carries a high rate of failure, requiring further surgery. Subsequent surgical procedures are increasingly burdensome and the risk of amputation is substantial if they fail [6]. Furthermore, the postoperative recovery is slow, with a time to weight bearing of 3 to 6 months [3,7] that is often poorly tolerated by elderly patients.

We chose to implant an intercalary prosthesis generally used for reconstruction after tumour surgery in an elderly patient with a large bone defect in the tibial diaphysis due to septic non-union with two previous failed surgical procedures. The goal was to fill the defect and to allow a rapid return to weight bearing, while controlling the infectious process.

2. Case-report

A 75-year-old woman sustained closed fractures of the tibial and fibular diaphyses when she fell on the stairs in June 2013. She was admitted to our department in November 2015 after seven surgical procedures with four internal fixations, including two-stage Masquelet induced membrane reconstruction, two debridements with irrigation and an internal saphenous flap (Fig. 1).

At admission, she had recurrent septic non-union with a discharge through the scar and local pain. The imaging studies showed a fracture of the fixation plate and absence of bone healing (Fig. 2).

Given the septic nature of the non-union, two-stage surgery was deemed the best option during a multidisciplinary discussion. For the second stage, the choice between an inter-tibio-fibular graft and an intercalary prosthesis was to be made based on the size of the bone defect.

Resection of 6 cm of bone was performed on 7 December 2015. A gentamicin- and vancomycin-loaded cement spacer (Palacos® G+V, Heraeus, Hanau, Germany) was implanted. The antibiotics were stopped 2 weeks before surgery, during which multiple bone samples were taken for microbiological studies, which identified six organisms: *Staphylococcus epidermidis, Enterococcus faecalis,*

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Fig. 1. Photograph showing the poor condition of the skin, with marked remodelling and thinning. Note the saphenous flap.

Fig. 2. Radiograph after seven surgical procedures: septic non-union, fracture of the plate and absence of signs of bone healing.

Escherichia coli, Corynebacterium striatum, Propionibacterium acnes, and *Actinomyces haliotis*. The antibiotic regimen was changed accordingly, to vancomycin, ceftriaxone and fusidic acid (Table 1). The limb was immobilised in a simple bivalve resin boot that allowed non-weight-bearing ambulation with a crutch.

For the second stage, the extensive bone resection and need to ensure a simple postoperative course in this elderly patient prompted the implantation of a custom-made, 6-cm-long endoprosthesis (Mutars® Implantcast GmbH, Buxtehude, Germany). The proximal non-cemented stem was 16 by 120 mm and the distal cemented stem 15 by 60 mm (Fig. 3). Distal cementation was decided because of the short length of the distal stem. In the event of recurrent infection, the uncemented proximal stem would allow amputation with optimal tibial bone preservation and without requiring the removal of intramedullary cement. This second stage was performed 4 months after the first stage, after an antibiotic-free interval (Fig. 4). Varus malunion required same-stage osteotomy of the fibula with removal of the previously implanted pin.

The patient resumed weight bearing immediately. The postoperative course was uneventful, with no local or systemic complications. The antibiotic treatment was continued intravenously for 2 weeks after the second stage then orally for 3 months, given the negative microbiological results of the intraoperative specimens.

At follow-up 1 year after surgery and 6 months after antibiotic discontinuation, the patient was able to walk without pain and without using an assistive device (Video 1). Locally, the results were satisfactory (Fig. 5). Imaging studies performed after 1 year showed no evidence of loosening (Fig. 6), and the laboratory tests were normal with a C-reactive protein level below 1 mg/L.

3. Discussion

To our knowledge, this is the first reported case of intercalary endoprosthetic reconstruction to treat septic non-union of the tibia.

The management of septic non-union of the tibia raises both pharmacotherapeutic and surgical challenges. Two-stage surgery is generally required, with the first stage consisting in extensive oncological resection that can produce a large bone defect. This defect is filled during the second stage (e.g., using an iliac bone graft or vascularised fibular graft) and a new internal fixation method is applied [4,8]. During the interval between the two stages, which lasts 6 to 12 weeks, the patient is given antibiotics selected based on the results of the first-stage intraoperative specimens [4]. Temporary stabilisation of the fracture site may be required during the interval, although the implantation of an antibiotic-loaded cement spacer with cast immobilisation is also appropriate.

Specific challenges arise, however, in complex cases with multiple surgical procedures, a large bone defect, and/or patient

Table 1
Results of microbiological studies at each surgical procedure, with the antibiotics used.

Date Surgical procedure	Microbiological findings	Antibiotic therapy
August 2013 Hardware removal + nailing	Multiple organisms	Ceftriaxone + ciprofloxacin
November 2013 Fistula	Not documented	Pristinamycin
February 2014 Masquelet 1st stage	*Staphylococcus epidermidis* *Corynebacterium*	Daptomycin + sulfamethoxazole trimethoprim
April 2014 Masquelet 2nd stage	Negative	Daptomycin + sulfamethoxazole trimethoprim followed by doxycycline
January 2015 Treatment for non-union	Negative	Doxycycline
December 2015 Bone resection	*Staphylococcus epidermidis* *Enterococcus faecalis* *Escherichia coli* *Corynebacterium striatum* *Propionibacterium acnes* *Actinomyces haliotis*	Vancomycin + ceftriaxone + fusidic acid
April 2015 Intercalary prosthesis	Negative	Vancomycin + ceftriaxone + fusidic acid + followed by amoxicillin

Fig. 3. Radiograph and computed tomography showing the large bone defect left by the resection, as well as positioning of the cement spacer.

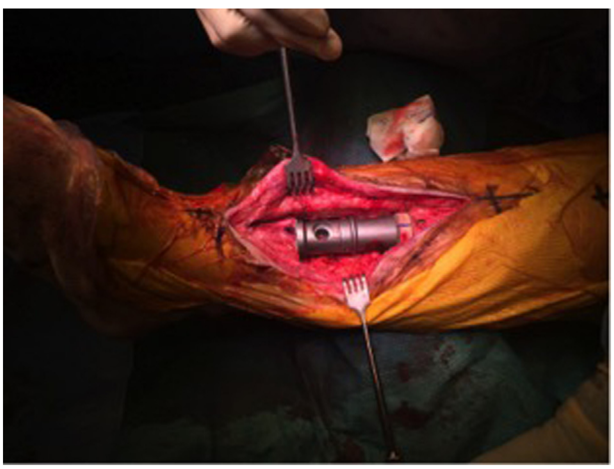

Fig. 4. Intraoperative photograph: intercalary prosthesis implanted into the distal third of the tibia through an anterior approach. The rotation mark made before the bone resection is designed to minimise the risk of rotational abnormalities during reimplantation.

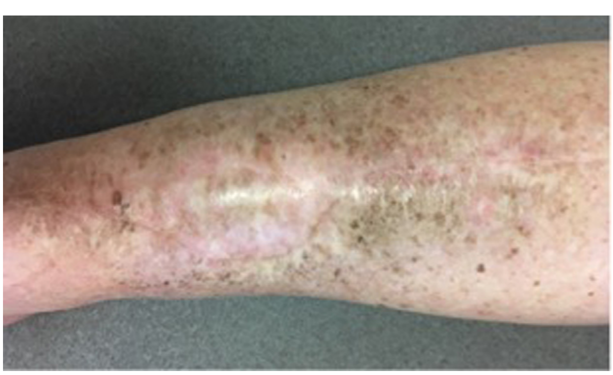

Fig. 5. Appearance of the skin 1 year after surgery: note the absence of local inflammation.

vulnerability. In these cases, an alternative to amputation may be the implantation of an intercalary prosthesis that both fills the bone defect and stabilises the fracture site [9,10]. In contrast to other techniques, intercalary prosthetic reconstruction allows immediate weight bearing [11,12]. Despite these advantages, intercalary prosthetic reconstruction remains a surgical option of last resort because, in the event of further infection, amputation must be

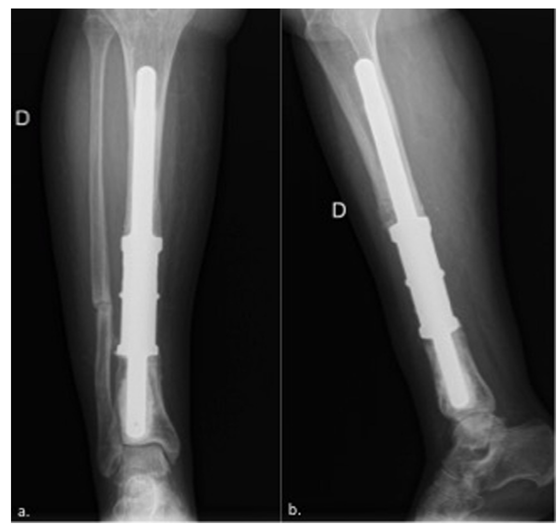

Fig. 6. Radiograph at last follow-up 12 months after surgery: the intercalary prosthesis is well integrated, the fibula has healed, and there is no evidence of loosening or recurrent infection.

performed above the proximal end of the prosthesis. Given that good primary stability is a crucial requirement, only diaphyseal fractures are eligible for intercalary endoprosthetic reconstruction. The higher risk of loosening associated with overweight/obesity would seem to contraindicate this method. In studies of intercalary endoprosthetic reconstruction of the lower limb, 27 to 39% of patients experienced mechanical complications (aseptic loosening or fracture of the implant) within 1 to 8 years [10,13,14]. Another option may consist in using a silver-coated implant to potentially decrease the risk of secondary infection [15].

In conclusion, after failed surgery for, or recurrence of, septic tibial non-union, particularly in elderly patients, intercalary endoprosthetic reconstruction may constitute a satisfactory treatment option that both fills the bone defect and stabilises the limb, thereby allowing immediate weight bearing. Nevertheless, this option should be considered only as a last resort, when amputation is the only other possibility.

Disclosure of interest

The authors declare that they have no competing interest.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.otsr.2017.09.011.

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