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Technical note

Free antero-lateral thigh flap for total knee prosthesis coverage after infection complicating malignant tumour resection

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ABSTRACT

Background: Infection is a common complication of major lower limb-sparing surgery with massive total knee prosthesis (MTKP) reconstruction after extensive tumour resection. When free tissue transfer is required to cover the prosthesis, musculo-cutaneous flaps are usually preferred based on proven efficacy when used in both one-stage and two-stage procedures. The use of a free fascio-cutaneous antero-lateral thigh (FC-ALT) flap in 3 patients with infected knee reconstructions is reported here.
Material and method: A retrospective study was performed of 3 patients in whom a free FC-ALT flap was used during a two-stage procedure to treat MTKP infection after femoral sarcoma resection.
Results: Free FC-ALT flap transfer and exchange arthroplasty were successful in all 3 patients. Two years after the procedure, no patient had required amputation or experienced recurrent infection.
Conclusion: A free FC-ALT flap can provide adequate coverage of infected MTKP and deserves to be viewed as a valid alternative to free muscle flaps.

1. Introduction

After malignant bone tumour resection at the lower limb, the most widely used limb-sparing option is massive total knee prosthesis (MTKP) reconstruction with or without an allograft. Infection is the most common post-operative complication after MTKP reconstruction [1,2] and carries a very high risk of amputation [1]. The standard treatment of chronic infection is removal of the prosthesis with implantation of an antibiotic-loaded cement spacer and intravenous antibiotic therapy followed by long-term oral antibiotics. Implantation of a new prosthesis must often be delayed for several months, until the clinical and laboratory findings are satisfactory, and carries a high failure rate [1,3]. A tissue transfer may be required if the surrounding soft tissues exhibit scarring, radiation injury, and/or retraction. The objective is to cover the prosthesis and allow mobilisation of the knee with no risk of tissue compromise, dehiscence, or necrosis, which would expose the implant and lead to recurrent infection. Pedicled flaps are the first choice in this situation. However, their surface area may be insufficient or their pedicle damaged by previous surgery, particularly as multiple procedures are often required in these complex cases. Large free flaps may then be needed [1,4–7].

Free tissue transfers can be performed during the same stage as prosthetic reimplantation [1,6] or a few weeks earlier to limit the risk of prosthesis exposure should the flap experience a complication [7,8]. In this situation, free muscle or musculo-cutaneous flaps are considered the reference standard based on their excellent blood supply and considerable resistance to infection [1,4,7]. However, fascio-cutaneous flaps are being increasingly used for limb coverage in patients with or without infection.

Here, we report the outcomes of a different coverage technique in which a free fascio-cutaneous antero-lateral thigh (FC-ALT) flap was used in a two-stage procedure in patients with MTKP infection after resection of distal femoral sarcoma.

2. Methods

Between 2012 and 2014, 3 patients managed at the sarcoma referral centre at the university hospital in Marseille, France, underwent limb-sparing surgery with a free FC-ALT flap after MTKP infection (Table 1). All 3 patients had had oncological resection surgery for a sarcoma in the distal third of the femur, following

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Table 1
Main features in the 3 patients.

Patient #1 (Figs. 1 and 2)	Patient #2 (Figs. 3 and 4)	Patient #3
35-year-old female	30-year-old male	64-year-old female
History		
1994: osteosarcoma distal fourth of the right femur	2009: sarcoma distal fourth of the femur	May 2012: sarcoma distal fourth of the femur
Excision/reconstruction by MTKP + femoral allograft + radiotherapy	Excision/reconstruction by MTKP + femoral allograft	Excision/reconstruction by MTKP + femoral allograft
2007: exchange prosthesis	2011: osteo-articular infection	2013: tibial fracture
2012: prosthetic infection	Removal of the material	Knee prosthesis infection
2013: removal of the prosthesis + external fixation	Implantation of a spacer and coverage by medial gastrocnemius muscle flap	2013: exchange TKP
2014: two-stage reconstruction by FC ALC flap and MTKP	Persistent infection	2014: removal of the prosthesis + external fixation
	Removal of the spacer and immobilisation in a splint	Two-stage reconstruction by FC ALC flap, MTKP, and femoral and tibial allograft
	2012: two-stage reconstruction by FC ALC flap, MTKP, and femoral allograft	
Microbiology		
Staphylococcus aureus Multi-susceptible	*Staphylococcus aureus* Multi-susceptible	*Pseudomonas aeroginosa* susceptible + *Proteus mirabilis* multi-susceptible
Antibioc therapy		
Rifadin + fusidic acid	Rifadin + fusidic acid	Cifloxacin + Ceftazidime
Functional outcomes: range of motion		
−0.11111	−0.05556	−0.05

MTKP, massive total knee prosthesis.

by same-stage bone and joint MTKP reconstruction with allografting. The infection had led to multiple surgical procedures including two-stage prosthetic revision (removal with implantation of a spacer followed by implantation of a new prosthesis) and pedicled flaps. Two patients had required removal of the spacer to control the infection and obtain skin wound healing. The antibiotics were selected during multidisciplinary meetings at the university hospital's referral centre for osteo-articular infections. When wound healing was achieved and the infection seemed eradicated (no laboratory evidence of inflammation and negative cultures of joint fluid sampled under ultrasound guidance 1 month after antibiotic discontinuation), two-stage surgery was performed to implant a new prosthesis and ensure coverage using a free FC-ALT flap. All 3 patients were managed by the multidisciplinary team at the osteo-articular infection referral centre.

2.1. Operative technique

The first stage was performed by a plastic surgeon specialised in microsurgery. The free FC-ALT flap was harvested from the opposite thigh. The size of the skin paddle was determined before the incision, based on the volume of the future prosthesis and on whether limb shortening was expected. A centimetre was added to the theoretically appropriate size to allow for any skin retraction. The incision at the knee was performed by re-opening the previous incisions (Fig. 1). Old sinus tracts or adhesions were resected in some cases. The superficial femoral blood vessels were always selected as the receiver site and were prepared by a medial incision at the distal third of the thigh.

The flap was then transferred to the knee, partly folded over (as the skin paddle was intentionally far larger than the defect

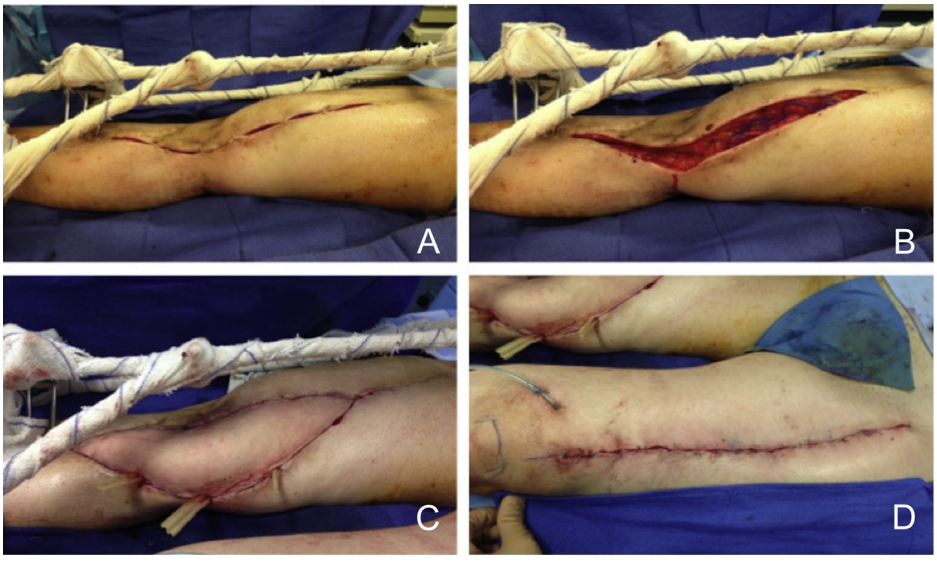

Fig. 1. Patient #1: 35-year-old woman treated for a sarcoma of the distal fourth of the femur. Infection of the reconstruction prosthesis required removal of the material. Retraction of the soft tissues in the entire knee region precluded implantation of a new prosthesis (A). First surgical stage: anterior incision through the scar of the previous incision (A, B). A free fascio-cutaneous antero-lateral thigh flap with a skin paddle measuring 11 × 30 cm is positioned within the incision, partly folded over, and sutured in place (C). Direct closure of the donor site (D).

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