Ortopedia Traumatologia Rehabilitacja
© MEDSPORTPRESS, 2009; 4(6); Vol. 11, 360-365

Free Corticoperiosteal Flap in the Treatment of an Infected Bone Defect of the Tibia. A Case Report.

Andrzej Kaminski[1,2(A,B,D,E,F)], Heinz Bürger[1(B,D,E)], Ernst Josef Müller[1(D,E)]

[1] Landeskrankenhaus Klagenfurt, Department of Traumatology, St. Veiter Str. 47, 9020 Klagenfurt, Austria
[2] University Hospital Bergmannsheil, Department of Orthopaedic Surgery, Bürkle-de-la-Camp-Platz 1, 44789 Bochum, Germany

SUMMARY

The treatment of septic bone defects represents a significant challenge in orthopaedic surgery. Non-vascularised cancellous bone grafts are very commonly used. In contrast, thin and malleable periosteal grafts have generally only been investigated in animal models. The free corticoperiosteal flap is used only in exceptional cases in traumatology. This case report describes the treatment of an infected and non-reactive bone defect in the shaft of the tibia. This case involves a septic non-union over two years old with evidence of methicillin-resistant Staph. aureus. A vascularised corticoperiosteal flap was used to bridge this defect. The procedure was supplemented by rigid internal fixation. There were no postoperative complications. Bone healing was documented eleven months after the described treatment. No further invasive procedures were required. The patient was able to return to his original occupation as a store manager. Stable internal fixation is an important precondition for successful treatment. The method described in this article can be considered for short defects when a conventional cancellous bone graft appears to be contraindicated.

Key words: corticoperiosteal flap, treatment, non-union

BACKGROUND

One of the most common operative methods in the treatment of bone defects is to bridge the defect with a non-vascularised cancellous bone graft [1]. However, the application of this technique is limited by several factors. Firstly, only short defects of less than five centimetres can be bridged with this method, and secondly, the technique is possible only in a well-perfused and infection-free milieu [2]. Poorly vascularised, long and/or infected defects have a low chance of healing. In these cases, vascularised bone grafts can be used. The free fibula transfer is a classical forerunner of this method. However, the technique is difficult and complications are frequently encountered. The grafts are rigid and not malleable. Graft necrosis and infection are the complications associated with the procedure. Alternatives are therefore sought for bridging infected osseous defects. The osteogenic potential of thin and malleable periosteal grafts has been investigated in defects of long bones in an animal model [3,4,5,6]. However, their use in clinical practice has been documented in only a few cases [7,8]. This article reports on the treatment of a chronic infected bone defect of the tibia with a free vascularised corticoperiosteal bone flap.

CASE REPORT

The patient suffered from haematogenous osteomyelitis of the right tibia in childhood. Because of this, three to four surgical procedures were performed during childhood. The details from this period are lacking as the treatment took place in a Lebanese hospital. There was a residual varus deformity of the tibia, without a fistula and without further exacerbations of the osteomyelitis in adulthood. The extremity was capable of full load-bearing. At the age of 41 years, the patient sustained a right-sided compound lower leg fracture. At this time peripheral vascular disease was angiologically confirmed in the form of a two-vessel supply of the affected lower leg with occlusion of the anterior tibial artery. External fixation was performed elsewhere by means of an Ilizarov fixator (Fig. 1). A septic non-union developed with a fistula and evidence of methicillin-resistant Staph. aureus (MRSA). Twenty-eight further operations were performed within 25 months, six of them involving a change of implant/procedure while 17 were debridement procedures. To optimise soft tissue cover, a local pedicled medial gastrocnemius flap was performed. The septic pseudarthrosis failed to heal. Finally, the patient was advised to have a below-knee amputation as a last resort. The patient wished to preserve the limb and then consulted us. At that time there was fistulating chronic osteomyelitis with evidence of MRSA. The patient complained of pain on weight-bearing. Radiographically there was no bony consolidation (Fig. 2). A bradytrophic bone defect was present. His CRP at this time was 7.3 mg/dl.

We undertook operative management in a single procedure. The intramedullary nail was removed and the pseudarthrosis gap was cleared out. Approx. 7 mm of the tibia was resected until punctate bleeding from the bone was observed. The medullary cavity was

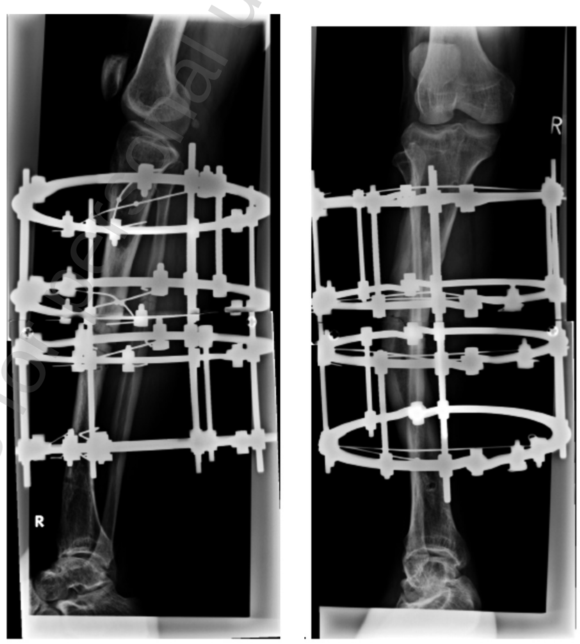

Fig. 1. Primary management of the compound lower leg fracture. Pre-existing varus deformity

Fig. 2. Persistent septic pseudarthrosis after a total of 29 operations

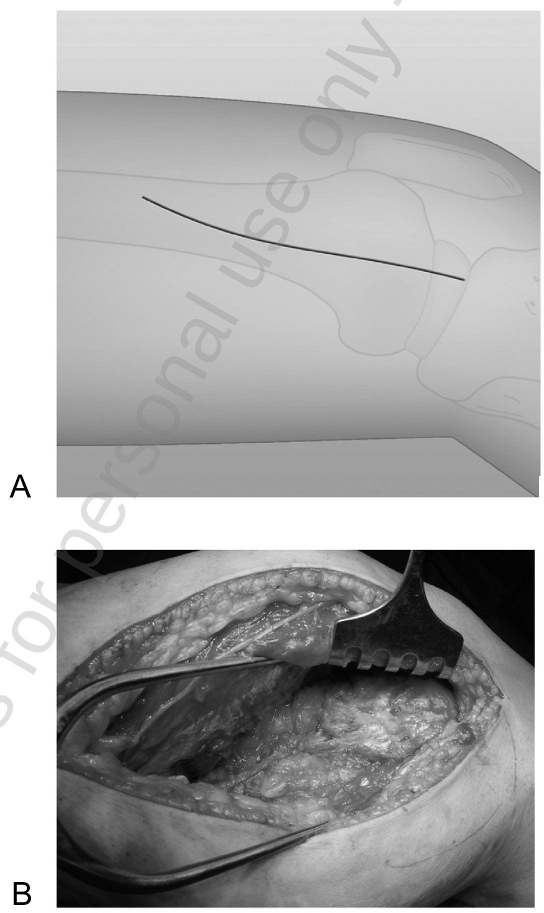

Fig. 3. A. The incision to raise the flap is made over the medial distal femur. B. The vastus medialis muscle is retracted anteriorly

drilled and irrigated. This was followed by jet lavage of the surgical site with 9 litres of Ringer's solution. The procedure was changed so that a medullary nail of larger diameter was used. The proximal part of the posterior tibial artery was then exposed for vascular anastomosis. Partial fibular resection was performed in the course of vessel dissection. Dissection from the medial aspect appeared too difficult because of the presence of the gastrocnemius flap. A thin corticoperiosteal flap was finally raised from the contralateral medial femur using the technique described by Doi and Sakai [7]. Dissection was begun using a tourniquet with a medial incision along the posterior border of the vastus medialis (Fig. 3). After a longitudinal incision of the fascia, the muscle was mobilized and retracted anteriorly. The descending genicular vessels were then exposed on the periosteum of the femur (Fig. 4). The artery and accompanying veins were followed proximally as far as the femoral vessels. The vascular pedicle was not divided yet. An attached corticoperiosteal flap about 7-8 cm long and 4-6 cm wide was elevated with a curved osteotome (Fig. 5). The cortical part had to remain as thin as possible (approx. 1.0 mm) in order to maintain flap malleability and yet be thick enough not to damage the periosteal cambium layer. The tourniquet was released and flap perfusion was examined. The vascular pedicle was then dissected proximally, close to the femoral artery. The malleable flap was then wrapped around the pseudarthrosis gap from lateral to dorsomedial and was fixed to the tibia with transosseous sutures. The vascular anastomosis was constructed microsurgically using the end-to-side technique. The patient was mobilised on the second postoperative day. Full weight-bearing of the affected extremity was allowed. Concomitant antibiotic treatment with vancomycin and rifampicin was continued for four weeks postoperatively. After discharge from the hospital, the patient was examined every three months in our surgery. An x-ray was also performed at each examination. No special drug therapy was given after the completion of the antibiotic therapy. During the first three months after discharge from the hospital, the patient hat outpatient physical therapy. The goal of this treatment was muscle development and the prevention of immobility problems.

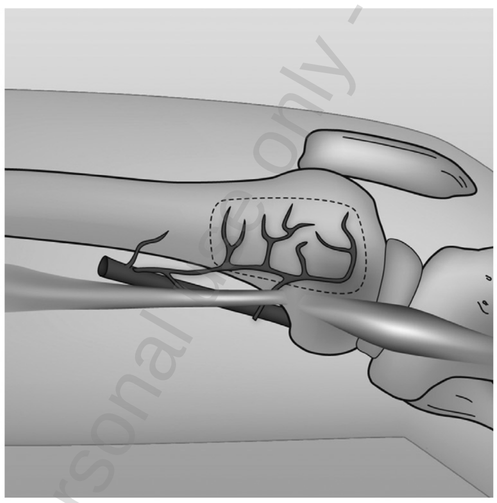

Fig. 4. Exposure of the blood vessels

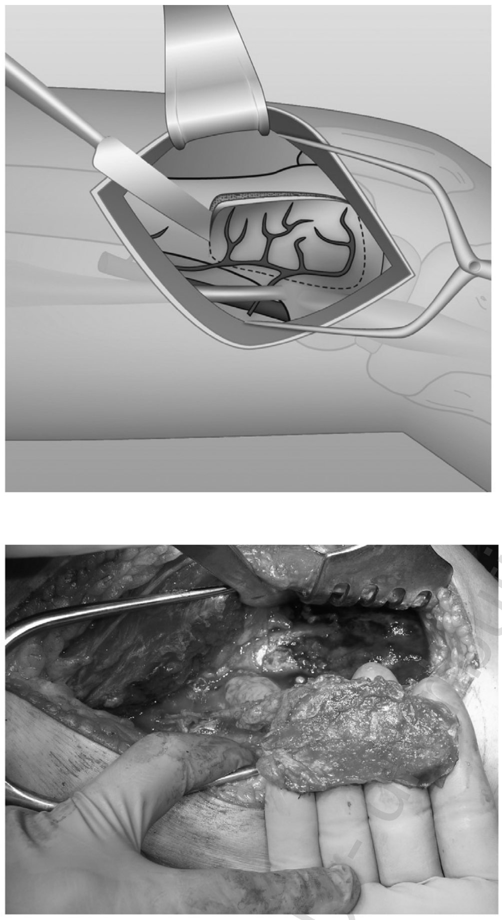

Fig. 5. The flap is elevated while still attached to its vascular pedicle

Fig. 6. Evidence of bony consolidation eleven months after the change of procedure and free microvascular corticoperiosteal flap

Bone healing was documented eleven months after the described treatment (Fig. 6). In a 17-month postoperative follow-up period, no further invasive procedures were required. The patient was able to return to his original occupation as a store manager. He currently complains of a tendency to swelling after prolonged weight-bearing and sensitivity to the weather, but no regular pain.

DISCUSSION

Bridging the atrophic and infected bone defect with a conventional cancellous bone graft appeared to be contraindicated in our patient. Grafting the short defect with a rigid vascularised bone segment was not feasible either. Use of elastic, malleable, thin periosteal grafts to increase osteogenic potency has been investigated experimentally [5] but has been described very rarely in traumatological practice [7, 8]. We do not know of any published reports of clinical use of such periosteal grafts for bridging infected defects in the long bones of the lower limbs. The case we present here is the first description. Elevating a narrow cortical margin (approx. 1 mm) serves to preserve the biologically active internal cambium layer of the periosteal graft. Because of the malleability of the graft, close and spatially limited contact with the recipient bone is achieved, whereby osteogenic potency is increased [9]. The graft can be obtained reliably since the descending genicular artery is regularly present as the supplying vessel and is of sufficient size for microsurgical anastomosis [8].

However, stable internal fixation is an important requirement for a successful outcome. The osteogenic potency of the periosteal flap cannot compensate for insufficient and unstable management.

CONCLUSIONS

The procedure described in this paper is technically complex but can be used particularly for short and bradytrophic bone defects where a conventional non-vascularised cancellous bone graft appears to be contraindicated.

ACKNOWLEDGMENTS

Our special thanks to Mr Thomas Koslowski for patiently producing the drawings.

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Liczba słów/Word count: 1662 **Tabele/Tables:** 0 **Ryciny/Figures:** 6 **Piśmiennictwo/References:** 9

Adres do korespondencji / Address for correspondence
Dr Andrzej Kaminski, e-mail: kaminski@t-online.de
Attending Orthopaedic Surgeon Universitätsklinikum Bergmannsheil Chirurgische Klinik
44789 Bochum, Bürkle-de-la-Camp-Platz 1, Germany, Tel. 0049 234 3023423

Otrzymano / Received 12.05.2009 r.
Zaakceptowano / Accepted 26.08.2009 r.