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*CASE REPORT*

# Midfoot reconstruction with free vascularized fibular graft after wide resection : A case report

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**Malignant foot tumours are often treated with amputations due to anatomical difficulties. Limb salvage techniques are difficult to perform, as a stable, sensible and plantigrade foot should be obtained to prevent further problems. In this report, we present a midfoot reconstruction with a vascularized free fibula, osteomized in a V-shape after wide resection of a midfoot synovial sarcoma. We describe the reconstruction of both longitudinal arches in which using a vascularized autograft facilitated union, remodeling of the bone, and obtaining a functional foot.**

**Keywords** : synovial sarcoma ; foot reconstruction ; vascularized free fibula.

## INTRODUCTION

Musculoskeletal sarcomas are uncommon ; they account for 0.2% to 0.9% of malignant tumours (*1*). Below the ankle is an unusual location for malignant sarcomas (*3,7,17*). Osteosarcoma and Ewing sarcoma are the most common bone tumours (*7,17*), while synovial sarcoma is the most common soft-tissue sarcoma of the foot (*3,7,12*). Synovial sarcoma is a malignant mesenchymal tumour. The classic histological presentation is a biphasic pattern, composed of spindle cells and epithelioid cells. Monophasic spindle cell sarcoma has also been recognized, which is very difficult to distinguish from fibrosarcoma (*3,12*). Foot involvement is observed in approximately 1% of all synovial sarcomas (*3,12*). It is a locally and systemically aggressive tumour. Established treatment includes a combination of chemotherapy and surgery with or without radiotherapy (*13*).

The main goal of treatment is to achieve wide resection with safe margins for local control of the disease. For this purpose, both amputation and limb salvage techniques are described as possible treatment options for midfoot sarcomas. Providing a stable, sensible and plantigrade foot results in better function than amputation, with or without an orthosis. Recently, the combination of adjuvant medical oncological treatment made limb salvage more feasible (*13*). There is limited information published about limb salvage surgery techniques for this region.

Free vascularized fibular transfer is a useful technique for reconstructing bone defects after wide resections. It was first described by Taylor *et al* and

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*Fig. 1.* — AP and lateral foot radiographs show the osteolytic lesion at midfoot (a, b). Axial, sagittal and coronal T1-weighted magnetic resonance images reveal extensive mid-foot involvement (c, d, e).

became one of the most popular treatment modalities in tumour or trauma surgery with bone defects (*14*).

In this study, we describe a method for midfoot reconstruction with a vascularized free fibula, osteotomized in a V-shape after wide resection of the tumour.

## CASE REPORT

A 13-year-old male was referred to our clinic for foot pain and swelling. He had been suffering pain for 4 months before the diagnosis. His initial treatment had begun in another clinic for mid foot sarcoma. Radiological evaluation included direct radiography, MRI and chest computerized tomography. Plain radiographs revealed navicular sclerosis. The diagnosis of synovial sarcoma was made following open biopsy. The patient was administered chemotherapy and radiotherapy. After repeating radiologic evaluations, a limb salvage technique was preferred over amputation as the surgical treatment (Fig. 1).

### Surgical Technique

A long S-shaped incision was made from the hindfoot to the first metatarsal base. The midfoot, from the anterior margin of the calcaneus and talus to the midtarsal level, was removed with safe margins, which were checked with intraoperative frozen section analysis. All midfoot bones were removed, including the biopsy tract (Fig. 2a). A substantial midfoot defect was thus created, which required further reconstruction (Fig. 2b).

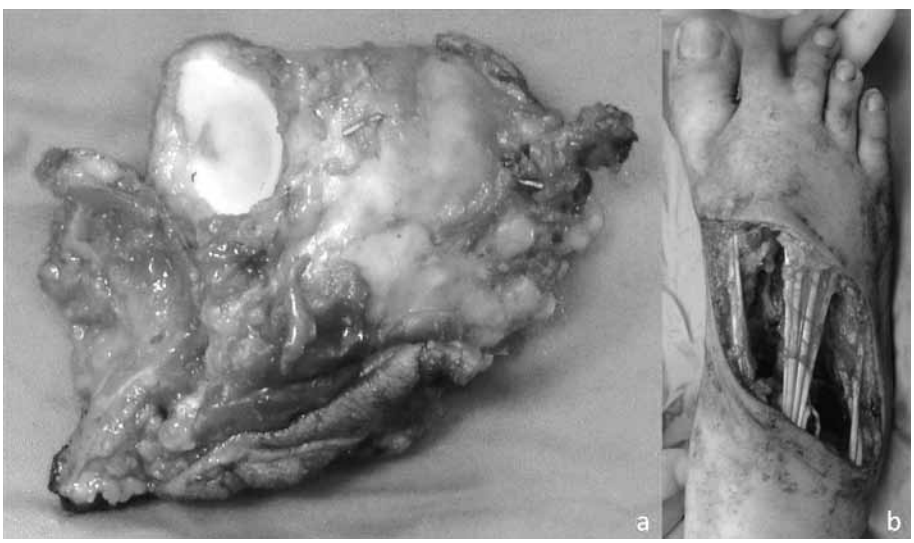

*Fig. 2.* — Photograph showing midfoot resected material including the biopsy tract (a). A substantial midfoot defect persists after resection (b).

***Fig. 3.*** — AP and lateral foot radiographs taken two months postoperatively. The foot is immobilized in a short leg cast

A vascularized fibular graft was harvested from the ipsilateral leg, with the distal 6 cm of the fibula preserved for stabilization of the ankle joint. The shaft of the fibula was carefully sectioned into two segments, leaving the bridging periosteum and the peroneal vessels intact. The lateral and medial foot arches were reconstructed with the fibula, from the talus to the first metatarsal bone and to the fifth metatarsal bone separately. The peroneal vessels were anastomosed in an end-to-end fashion with the dorsalis pedis artery and saphenous vein. Fixation of the fibular grafts was achieved with two intramedullary retrograde K-wires.

Histopathological evaluation of the resected specimen resulted in the diagnosis of monophasic synovial sarcoma with tumour-free margins. The patient was administered chemotherapy postoperatively.

The foot was immobilized in a short leg cast for four months (Fig. 3). The K-wires were removed after 12 weeks. After removal of the cast, the patient was mobilized with a University of California Berkeley Orthosis (UCBL). He was mobilized with two crutches and partial weight bearing. Full weight bearing was allowed after 7 months. At the fourth-month follow-up, radiographs revealed full union and cortical bone enlargement (Fig. 4). At the last follow-up visit at 14 months, the ankle range of motion was 15° dorsiflexion and 5° plantar flexion (Fig. 5). Foot pedobarography was performed at the last follow-up (Fig. 6).

## DISCUSSION

Musculoskeletal sarcomas are rarely encountered, and the foot is an uncommon location of malignant sarcomas, with an incidence below 1% (*1,3,7,12,17*). The foremost goal of the treatment is to achieve local control of the disease.

Historically, amputation was the most common treatment modality. Advances in imaging techniques, medical and radiotherapeutic treatment protocols, made it possible to achieve tumor-free margins with more conservative surgical techniques. Limb salvage, which is based on achieving tumour-free margins while preserving function of the extremity, became more popular (*6*).

The midfoot serves as a stiff and stable platform with minimal motion to allow body weight transfer from hindfoot to forefoot through the medial and lateral longitudinal arches (*2,10,15*). For this reason, the midfoot plays a key role in foot function (*2,10,15*).

***Fig. 4.*** — AP and lateral foot radiographs taken four months postoperatively, after removal of the cast. Radiographs show full union and cortical bone enlargement.

***Fig. 5.*** — Ankle dorsiflexion and plantar flexion at clinical examination

Midfoot reconstruction must be performed meticulously after wide resections to achieve a functional foot.

After high-energy trauma or tumour surgery, substantial defects are commonly encountered (*2,8,10,15*). In the literature, few reconstruction techniques have been described. These include the use of external fixators, temporary plating, iliac crest autografting, vascularized fibula and vascularized osteocutaneous fibula graft (*2,5,8-11,15,16*). Reconstruction with a free vascularized fibular transfer is a difficult technique, but has distinct advantages over other methods for such bone defects. It was first described by Taylor *et al* and became one of the most popular treatment modalities in tumour or trauma surgery (*2,4,11,14,15*). The fibula has advantages compared with the iliac crest for the reconstruction of large defects in the midfoot because it is similar in shape and diameter to the metatarsals, is easily accessible, and has low donor-site morbidity. Also because the fibula is highly vascularized and composed primarily of cortical bone, it can easily adapt to the stresses of weight bearing (*2,4,8,11,15*).

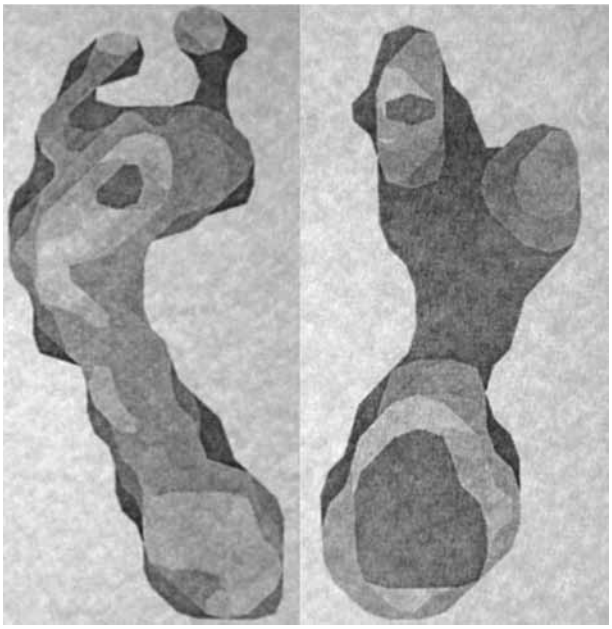

***Fig. 6.*** — Foot pedobarography shows pressure distribution. The latter is almost similar to the unaffected side.

Toma *et al*. reported that the use of free vascularized myocutaneous fibular grafts following midfoot resection offers an alternative to ablative surgery (*15*). In their series, all patients had partial midfoot defects. Lykoudis *et al* also reported use of this technique for substantial midfoot defects after blast injury (*8*). In the literature, there are no papers on vascularized free fibula, osteotomized in a V-shape to restore medial and lateral arches in substantial midfoot defects after malignant tumour resection. With this surgical technique, we were able to provide a plantigrade and painless foot for the patient. The use of a vascularized graft facilitated complication-free, early union.

In conclusion, wide resection of malignant tumours of the foot is considered difficult because of the technical problems. We believe that the use of a vascularized free fibula, osteotomized in a V-shape, is a good choice for midfoot reconstruction after wide resection of malignant tumours.

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