

# Anterolateral Leg Soft Tissue Reconstruction with Pedicled Hemisoleus Muscle Flap Post Low Grade Malignant Peripheral Nerve Sheath Tumour Excision - A Case Report

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## Abstract

A flap is indicated to cover any exposed vital structures such as bones, joints, tendons, or hardware. In the leg, various flaps can be designed to cover such defects which can be divided mainly into local and free flaps. Local flaps can further be subdivided into a random pattern or axial pattern flaps. Pedicled hemisoleus muscle flap is one example of an axial pattern local flap that is commonly used to cover a defect that is located at the middle third of leg. We describe a case of exposed middle one third of tibia following wide local excision of a low grade malignant peripheral nerve sheath tumour. He was successfully treated with pedicled hemisoleus flap and split thickness skin graft.

**Keywords:** Pedicled hemisoleus flap; Malignant peripheral nerve sheath tumour; Lower extremity reconstruction

**Abbreviations:** MPNST: Malignant Peripheral Nerve Sheath Tumours

## Introduction

Primary malignant tumours of the lower limbs will almost always require surgical treatment. The main aim of the surgery is to remove the tumour by performing wide local excision with a margin that is free of any malignant growth or by a radical removal of the affected limb depending on the severity and extend of the tumour spread. Following the removal of tumour, the next goal is to reconstruct the resulting defect for optimal function

and cosmesis. Limb amputation has been the mainstay of treatment of extensive malignancy concerning the lower limbs for centuries, however, with the advancement in knowledge and surgical techniques, limb salvage procedures by extended or local regional excision followed by reconstruction is the more preferred option both by the surgeon and patient.

## Case Report

Madam P is a 68 years old Malay lady with an underlying hypertension, diabetes mellitus and a history of transient ischaemic attack in 2015. On a visit to Melaka General

Hospital for a routine check-up, she complained to the attending doctor that she has a growth at the right lateral leg. The swelling has been there for the past 3 years but it has never caused her any pain, numbness or weakness. She did not complain of any loss of appetite, loss of weight or general malaise. The lesion has been gradually increasing in size and because of that, she became concerned if it's going to cause her any problem in the future. She was then scheduled for an MRI of the right tibia in Melaka General Hospital which was reported as "superficial soft tissue tumour at the right distal leg measuring 4.9cm (AP) x 3.6 cm (W) x 6.3 cm (CC) with local mass effect and heterogenous pattern of enhancement. However, no infiltration to surrounding structures. Soft tissue sarcoma has to be considered. Other possibility is organizing hematoma mimicking tumor, however it is indistinguishable with sarcoma. Suggest HPE correlation".

Based on the MRI, she was referred to the orthopaedic tumour team in HKL and she was admitted for further investigations. An incisional biopsy was done and the HPE was reported as "right skin soft tissue mass: consistent with a low grade malignant peripheral nerve sheath tumour". Subsequently, the patient was planned for wide local excision by the orthopaedic tumour team and plastic & reconstructive surgery team was referred for the soft tissue reconstruction of the leg to be done in the same setting.

She underwent "wide local excision of right lateral leg low grade malignant peripheral nerve sheath tumour, and soft tissue coverage with pedicled medial hemisoleus flap & split thickness skin graft" on the 1<sup>st</sup> November 2017. Following wide local excision, the resulting defect was 13 cm x 8.5 cm exposing the anterior compartment muscle and a portion of the tibial bone measuring 9 cm x 2 cm. Right pedicled hemisoleus flap was raised based on the proximal blood supply from the tibioperoneal trunk and the distal end of the muscle was divided to cover the exposed tibia bone. Split thickness skin graft was harvested from the left lateral thigh and meshed with 1.5:1 ratio. The harvested SSG was then laid onto the resulting wound and finally dressing was done with bactigrass, Flavin cotton, gauze and sponge. The right lower limb was then immobilised with an above knee back slab. Wound inspection at the recipient site was done at day 5 post operatively and every other day following that. Patient was safely discharged at 14 days post operation after the wound inspection showed the skin graft to have 100% take and no other complications had occurred (Figure 1-5).



Figure 1: The tumour at the anterolateral aspect of right leg prior to surgical excision.



Figure 2: Resulting wound post wide local excision of the tumour. Size of the defect is 13 cm (L) x 8.5 cm (W), with part of the tibia bone exposed measuring 9 cm (L) x 2 cm (W).



Figure 3: Right medial hemisoleus flap is raised and rotated to cover the exposed tibia.



Figure 4: Split thickness skin graft is harvested and laid onto the muscle at the wound and anchored with a surgical stapler.



Figure 5: 2 weeks post soft tissue coverage with pedicled hemi-soleus flap and split thickness skin grafting.

## Discussion

Malignant peripheral nerve sheath tumours (MPNST) are biologically aggressive soft tissue sarcomas that are believed to derive from peripheral nerves or demonstrate peripheral nerve differentiation. In other words, for a diagnosis of MPNST to be made, there must be a demonstrable evidence of Schwannian differentiation [1]. They are an uncommon entity and may arise sporadically,

following radiation therapy and also may occur in the context of neurofibromatosis type 1, characterized by loss of function or mutations to the tumour suppressor neurofibromin. MPNST is associated with poor prognosis with high relapse rate following multimodality therapy in early stage of the disease, and low response rate to cytotoxic chemotherapy in advanced disease [2].

The term MPNST does not include tumours arising from the epineurium or the vasculature of peripheral nerves, but it has substituted previous less well defined term of neurogenic sarcoma, malignant schwannoma and neurofibrosarcoma [2]. In general, MPNST constitutes approximately 2% of all sarcomas diagnosed globally and thus affect on average 5 people per million per year [3]. They may occur at any age and has no gender predilection. The median age for sporadic MPNST is thought to be between the third and sixth decades of life, and that for NF1-associated disease is between 20 and 40 years [4]. Patients diagnosed with MPNST typically complain of a rapidly enlarging mass that can either be painful or which that causes local neurological symptoms such as paraesthesia or weakness, which is interestingly absent in this patient. Nerve roots and bundles in the extremities and pelvis are the most common sites of involvement, particularly the sciatic nerve [1]. For surgical planning purposes, magnetic resonance imaging is considered to be the most useful imaging modality in order to determine the anatomical extent of the tumour.

In the setting of localized disease, the treatment of choice is to perform a complete surgical excision with a clear margin. Adjuvant radiation is recommended for large (>5cm), high-grade MPNST in order to reduce risk of local recurrence, which is typically seen in most cases of high-grade limb sarcomas. To date, there are no randomized data specifically examining adjuvant chemotherapy in MPNST, however, there are data from meta-analyses in histologically unselected populations of soft tissue sarcomas that proposes marginal survival benefit [5].

Following wide resection of the tumour, the conundrum that will ultimately arise is the method to cover any exposed vital structures such as bones, joints, or tendons that are laid bare following the removal of the tumour. Historically, surgeons dealt with extensive tumours of the extremities by performing radical amputations of the limbs. However, thanks to the advancement in applied anatomy, wound and fracture management, the advent of sterile techniques as well as the introduction of anaesthesia and antibiotics, most surgeons have moved towards reconstructive surgery, therefore resulting in limbs salvage procedure [1].

It's extremely important to abide by the reconstructive ladder in approaching closure of any wounds which

typically progresses from secondary healing to primary closure, through the options of skin grafting before moving on to the more complex local, then distant, free tissue transfer. Nevertheless, the simplest option is not necessarily the best option when it comes to covering any defects or wounds. For this patient, after the tumour and its margin have been cleared, we decided to proceed with the soft tissue reconstruction using a pedicled hemisoleus muscle flap. It is an axial pattern flap and provides enough soft tissue to cover the exposed tibia following tumour excision. Generally, the use of an entire soleus muscle as a flap has a limited arc of rotation, therefore some difficulty will be met if the soft tissue defect is located at the junction of the middle and distal thirds of the leg. Moreover, plantar flexion of the foot may also be weakened if the whole muscle is sacrificed.

The bipenniform morphology of the soleus muscle and the independent neurovascular supply to each belly of the muscle are the critical features that allow a surgeon to split the muscle longitudinally along the muscle's raphe resulting in a muscle flap using only half of the muscle (hemisoleus) [6]. The most significant advantage of a hemisoleus muscle flap is that it permits the conservation of plantar flexion ability of the foot by the other half of the soleus muscle which was left in situ. Additionally, it also has a longer arc of rotation than a conventional soleus muscle flap.

Another way to approach wound coverage in this patient is to adopt a free tissue transfer. However, it is worth to note that not all hospitals or reconstructive surgeons are capable of performing microvascular free flap surgery and the postoperative flap monitoring that follows. Furthermore, free tissue transfer in this case may also be associated with undesired flap donor site morbidity that is very much distant from the site of the tumour leading to two complicated wounds to be managed at two different sites. Another problem that is usually associated with initial period of free tissue transfer is the bulkiness of the tissue which will require debulking at a much later stage [7].

## Conclusion

In a less extensive tibial wound located at the junction of the middle and distal third of the leg, a proximally based

medial hemisoleus flap can be used as reliable local soft tissue coverage with a desirable outcome and minimal morbidity. It may offer a cost-effective approach to managing an exposed hardware following wide-resection of tumour at the middle tibia and it can easily be carried out by most reconstructive surgeons, even in a hospital with limited settings. Precise knowledge of flap anatomy, meticulous flap dissection and the preservation of critical perforators from the distal tibial vessels to the flap are the keys to success.

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