



## 360° of Freedom in Chimeric Pedicled Vastus Lateralis-ALT Perforator Flap for Reconstruction in Patients with Advanced or Recurrent Malignancies

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### Abstract

**Introduction:** Defects following resections of advanced malignancies and particularly sarcomas are often challenging from functional and reconstructive point of view. In recent years, a chimeric vastus-lateralis-fascio-cutaneous ALT was described, allowing greater versatility and more sophisticated reconstructions. We report our experience with pedicled chimeric vastus-lateralis muscle-fasciocutaneous ALT pedicled flap for reconstruction following resection of sarcomas and advanced melanomas or complications of sarcoma resections in a large tertiary cancer centre with the longest ever follow up published so far.

**Methods:** From 2009 to 2016, 29 pedicled perforator chimeric vastuslateralis muscle-fasciocutaneous ALT flaps were used to reconstruct defects following primary and recurrent sarcomas and advanced melanomas in 29 patients. Data on tumor type, defect and vascular anatomy, number of perforators used for the flap, arc of rotation, comorbidities, complications, donor site morbidity and long term outcomes were collected prospectively and analyzed.

**Results:** Defects involved pubic and suprapubic areas, lower abdomen, vulvar region, peritrochanteric area, groin, supra-patellar, upper and lower thigh and lateral aspect of knee joint. All 29 flaps completely survived in all patients. All donor sites healed primarily. There were no local recurrences. Patients (7) developed metastasis within 2 years from resection and reconstruction and all of them were dead within 1 year from the date metastatic spread was diagnosed. Remaining patients on long-term follow up continue to have excellent functional and aesthetic outcome.

**Conclusion:** We suggest pedicled chimeric vastuslateralis-ALT flap as an excellent option for reconstruction of defects following removal of advanced or recurrent malignancies in elderly patients.

### Introduction

Defects following curative resections of advanced malignancies and particularly soft-tissue and bony sarcomas are often challenging from the functional and reconstructive point of view. This is even more true in frail and elderly population we often treat in tertiary Cancer Centre setting. Serious comorbidities and, not infrequently, relatively high local recurrence rates for some sarcoma subtypes, make the use of free tissue transfers in this subgroup of patients a less desirable option. Vastus lateralis flap and its most popular variant- ALT (antero-lateral thigh perforator flap) have, since its description by Song [1], gained a great popularity as a free or pedicled flaps. In recent years, a chimeric vastus-lateralis-fascio-cutaneous ALT was described, predominantly as a free flap [2], allowing greater versatility and more sophisticated reconstructions. We report our experience with pedicled chimeric vastus-lateralis muscle-fasciocutaneous ALT pedicled flap for reconstruction following resection of sarcomas and advanced melanomas or complications of sarcoma resections in a large tertiary cancer centre with the longest ever follow up published so far.

### Patients and Methods

From June 2009 to August 2016 29 pedicled perforator chimeric vastus lateralis muscle-fasciocutaneous anterolateral thigh flaps were used to reconstruct defects following primary and recurrent sarcomas and advanced melanomas in 29 patients (all unilateral cases). Data on tumor type, anatomy of the defect, vascular anatomy and number of perforators used for the flap, arc of

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**Figure 1:** Recurrent DFSP (Dermatofibrosarcoma protuberans) affecting pubic and supra-pubic areas and extending into the vulva.



**Figure 2:** Extensive defect following resection.



**Figure 3:** Reconstruction with chimeric vastus lateralis-ALT pedicled flap.

rotation, comorbidities, complications, patient demographics, donor site morbidity and long term outcomes were collected prospectively and analyzed. Dominant skin perforator was located using usual anatomical landmarks and hand-held Doppler only in the first 10 cases, while CT-angiogram was used in the remaining 19 cases. Selection of perforators supplying the muscle component of the flap was performed intraoperatively, depending on their location, distance from the skin perforator and requirements of the defect. Dissection was performed from distal to proximal in all cases for the skin component while dissection of muscle perforators was performed from proximal (main pedicle) to distal, in order to maintain good control of haemostasis and avoid unnecessary damage to the muscle component of the flap.

### Results

24 patients underwent resection for sarcomas (18 primary and 6 recurrent), 4 patients had resection of advanced melanoma and one



**Figure 4:** A) and B) Stable result 3 years after reconstruction.



**Figure 5:** A) and B) Chronic Peri-trochanteric defect following sarcoma excision, infection with skin necrosis and wound breakdown.

patient had resection of metastatic SCC. In the sarcoma group there were 12 patients with DFSP (Dermatofibrosarcoma protuberans)- (Figures 1-4), 9 patients with leiomyosarcoma and 3 patients with osteosarcoma. Defects involved pubic and suprapubic areas, lower abdomen, vulvar region, peri-trochanteric area, groin, supra-patellar, upper and lower thigh and lateral aspect of knee joint (Table 1). There were 27 proximally based and 2 reversed flow-distally based flaps. All flaps were raised with a single separate perforator supplying skin-island and 2-4 separate perforators supplying the muscle component of the flap. 21 flaps were rotated clockwise and 8 were rotated anti-clockwise (Figures 5-8). Arc of rotation varied between 60° and 180°



**Figure 6:** A) and B) lower-most perforator chosen to supply skin island to allow greater reach.



**Figure 9:** Exposed hip-prostheses following infection and soft tissue necrosis after bony sarcoma resection.



**Figure 7:** Flap rotated anti-clockwise and tunneled into the defect.



**Figure 10:** Vastus-only pedicled flap reconstruction-skin island removed as not required.



**Figure 8:** Tension-free closure of both defect and donor-site.



**Figure 11:** Stable result 7 years post-operatively.

in both clockwise and anti-clockwise direction. One skin island was removed following harvest as muscle-only flap was sufficient for reconstruction under the directly closed skin edges (Figures 9-12). All 29 flaps completely survived in all patients. 1 patient developed local wound infection that was treated successfully with antibiotics only. All donor sites healed primarily. 14 Patients were classified as ASA score III, 5 as ASA IV, 4 as ASA II and 6 as ASA I, due to their comorbidities. Full range of motion in hip and knee joint was observed in all patients in the long term follow up, which varied from 31 to 98 months (average 64 months of follow up). Histopathological margins were clear following resection in all patients. There were no local recurrences. 7 patients developed metastasis within 2 years from resection and reconstruction and all of them were dead within 1 year from the date metastatic spread was diagnosed. Remaining patients on long-term follow up continue to have no surgery related issues with mobility and excellent functional and aesthetic outcome.

**Discussion**

Reconstruction of defects following resection of advanced and

recurrent malignancies in elderly patients is often limited by previous surgeries, scars, serious comorbidities and reduced mobility. Under these circumstances, there is a need for reliable, straightforward and not overly lengthy procedure with low donor site morbidity. Vastus lateralis flap and its fasciocutaneous counterpart- anterolateral thigh perforator (ALT) flap have been extensively utilized as free [3] or pedicled [4] flaps in reconstructing both traumatic and oncological defects. More recently, a chimeric version of these flaps have been used for head and neck [5], lower limb [6] and trunk, including lower abdomen, perineum [7] and vulvar area [8]. Separate blood supply to muscle part of the flap and skin component creates more degrees of freedom and customized flap design [9], often required in oncological

**Table 1:** Pedicled ALT Table.

No	Age	PMH	Diagnosis	Site	No. of Perforators	Defect size	Follow up and outcomes
1	84	ASA 3	Recurrent Leyomyosarcoma	Suprapubic and Right pubic region extending to vulval region.	<u>2 skin and 3 muscle perforators</u>	11 x 7 cm	31 months Uneventful healing, Full range of movement to thigh
2	53	ASA 4	Malignant Melanoma	Lateral aspect of lower Right thigh towards the knee joint.	<u>1 skin and 2 muscle perforator</u>	5 x 7 cm	35months uneventful healing, Full range of movement to low extremity No complications to Donor's site. 58 months follow up
3	55	ASA 1	Malignant Melanoma	Left distal lateral thigh towards patella	<u>1 skin and 2 muscle perforators</u>	5x6cm	Uneventful healing, Full range of movement to low extremity. No complications to Donor's site. 60 months follow up
4	41	ASA 1	Malignant Melanoma	Left lateral distal thigh	<u>1 skin and 2 muscle perforators</u>	5 x 7 cm	Uneventful healing, Full range of movement to low extremity No complications to Donor's site. 31 months follow up
5	66	ASA 2	Metastatic SCC to left inguinal nodes with overlying skin involvement.	Left inguinal region.	<u>2 skin and 4 muscle perforators</u>	10 x 7 cm	Uneventful healing, Full range of movement to low extremity No complications to Donor's site..
6	61	ASA 2	Recurrent DFSP	Right pubic area	<u>1 skin and 2 muscle perforators</u>	14 x 7 cm	90 months follow up, full range of motion in lower extremity, uneventful healing
7	65	ASA 3	DFSP	Lower abdomen and pubis	<u>2 skin and 2 muscle perforator</u>	25 x 12 cm	84 months, uneventful healing, full ROM
8	72	ASA 3	Osteosarcoma	Greater trochanter	<u>2 skin and 4 muscle perforators</u>	15 x 10 cm	31 months, skin island removed intra-operatively, uneventful healing but patient died of metastatic

reconstructions. On the other hand, simultaneous harvest of muscle component may make the blood supply to the skin island more robust and reliable [10]. In our experience, Skin Island can safely be raised on a single skin perforator regardless of the flap size even in elderly patients. On the other hand, we aimed to include at least two branches supplying the muscle component due to higher physiological demand and more difficult monitoring. Inclusion of muscle makes the reconstruction more reliable as it may serve as a back-up, should the skin component undergo necrosis. This is particularly useful in peri-trochanteric defects (Figure 9-11). In our experience, the arc of rotation covers 360° (180° clockwise and anti-clockwise). However, if flap is rotated anti-clockwise, the lowest-available perforator needs to be chosen for the skin-component (Figures 5-8). Additional benefit of raising the part of vastus lateralis is certainly easier closure of donor-site. We have not observed any significant weakness in leg extension following inclusion of vastus lateralis or its part in any of our reconstructions, which is in accordance with what has been reported previously. This is particularly important in frail and elderly group of patients that usually have some mobility issues; we commonly treat in tertiary cancer centre. Our series confirms these findings as all of our patients returned to their pre-operative range of motion. We have not observed any vascular/microvascular problems in our series which highlights the quality of blood supply to this flap and the fact that lateral circumflex femoral artery axis may indeed be less frequently affected by atherosclerotic changes even in elderly. Pedicled chimeric vastus lateralis-ALT flap should be in our opinion, considered a first-line option in oncological reconstruction for a variety of defects within the reach of LCFA (lateral circumflex femoral artery) axis, as it provides more degrees of freedom than any other flap. It is easy and relatively quick to harvest, has a robust reliable blood supply and no negative effects on post-operative mobility.

## Conclusion

We suggest pedicled chimeric vastus lateralis-ALT flap as a

first line option for reconstruction of defects following removal of advanced or recurrent malignancies in elderly patients due to its multiple qualities, low donor-site morbidity and no negative effects on patient mobility post-operatively.

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