

Research Article

Unveiling the Versatility of Pedicled Thoracodorsal Artery Perforator Flap with a Modified Surgical Technique for Excellent Outcome

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Abstract

Background: The thoracodorsal artery perforator (TDAP) flap has attracted considerable interest in reconstructive surgery owing to its reliable vascular supply and adaptability. It is an excellent fasciocutaneous flap but hasn't gain much acceptance due to variable outcome.

Objective: The aim of the study is to analyze the use of the pedicled thoracodorsal artery perforator flap with description of an easy and reproducible technique of flap raising with good outcome.

Methodology: This case series was conducted at Plastic Surgery Department, Mayo Hospital Lahore / King Edward Medical University from November, 2022 to November, 2023. Patients requiring coverage of defects on back, shoulder, axilla and chest were included. The antigrade approach was adopted to raise the flap and cover the defect. The patients' demographics, defect characteristics, surgical details, and postoperative outcomes were systematically analyzed. The primary outcomes included flap survival, donor site scarring and functional outcomes of latissimus dorsi muscle.

Results: Total 30 patients were included in the study. 5 cases were of inframammary fold contracture, 9 cases of axillary fold contracture, 5 cases were post tumour resection defect tumor and 1 had post traumatic soft tissue defect. Complete flap survival was noted in 29 cases, with partial necrosis in one flap due to venous congestion secondary to hematoma formation. None of the patients developed any scar related complication at donor site. None of the patients developed functional compromise of LD muscle.

Conclusion: The antegrade approach is an easy and reproducible technique to raise TDAP flap to reconstruct wide range of defects.

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Introduction

The use of pedicled thoracodorsal artery perforator flap (TDAP flap) has been well documented in literature for the reconstruction of axillary, breast and back defects. Its advantages include long vascular pedicle, constant flap thickness, wide arc of rotation and minimum donor site morbidity.^{1,2,3}

Thoracodorsal artery perforator flap was first documented by Angrigiana et al. as "latissimus dorsi musculocutaneous flap without muscle" in 1995.⁴ He along with

Heitmann et al described the anatomical landmarks that were helpful in identifying the perforators.⁵

Preoperative perforator mapping with hand-held Doppler or computed tomography scan can help in locating perforator on which the flap can be islanded.^{6,7} however, when more than one perforator is encountered or if there are only minor perforators, then islanding the flap over a single perforator can result in partial flap loss or venous congestion.^{7,8} The retrograde approach is also difficult if a small perforator is encountered due

to its oblique course within the muscle and the accompanying nerve, which gives many branches.⁹ As computed tomography scan is not feasible in a resource scarce setup to map perforators pre-operatively, so it is safe to adopt a way to address the problem intra operatively by adopting an appropriate surgical technique to prevent such complications.^{10,11,12} Hence, there was a need for a better surgical technique to raise this flap safely without much pre-operative planning and with good viability.

The aim of this article is to share our surgical technique which utilizes antegrade dissection to safely raise the thoracodorsal artery perforator flap with functional preservation of latissimus Dorsi.

Methodology

This case series was done at Mayo burn and reconstructive surgery department from November 2022 to November, 2023. After informed consent, patients with either gender between 2 to 60 years of age, who presented with post burn contractures of axilla or inframammary fold, post traumatic defects and defects after resection of malignancy of axilla, anterior or posterior chest wall, scapular and shoulder region, all amenable to reconstruction with TDAP flap were included. Patients with scarring over posterior axillary fold or in whom surgery was done around thoracodorsal arteries and those with uncontrolled co morbidities were excluded. The antegrade approach was adopted to raise the flap and cover the defect. The patients' demographics, defect characteristics, procedural details, and postoperative outcomes were systematically analyzed. The primary outcome measures included flap survival, scar complication, and functional outcome in terms of power of adduction.

Surgical technique:

Marking of flap was done preoperatively and perforators were marked with the help of hand Held Doppler in sitting position. They were in an area 8 to 12 cm below the axilla and 2 cm medial to the anterior border of latissimus dorsi. Anterior incision was first given, and skin elevated to assess the perforators. After that antegrade dissection was done, thoracodorsal pedicle and nerve were identified and followed by dividing branch to serratus anterior. Source vessels were approached laterally from where they entered the muscle. Muscle was split over the pedicle to identify and isolate the descending and transverse branch of thoracodorsal artery, the latter was ligated and divided. The nerve

accompanying the transverse branch was spared. The descending branch was isolated by further splitting the muscle on over its lateral border until the origin of perforator on which the fascio-cutaneous flap was based.

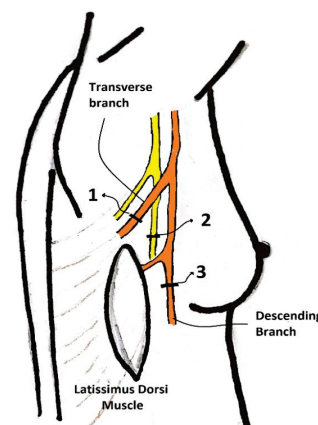


Figure 1: Diagrammatic presentation of the surgical technique. **1:** division of the transverse branch of thoracodorsal arteries. **2:** division of the nerve accompanying the descending branch. **3:** division of the descending branch and accompanying nerve after origin of the perforator.

The descending branch was divided and ligated distal to the origin of the perforator along with the nerve. A small cuff of muscle was also taken along with the perforator, allowing the capture of arborizing vessels for maximum flow. Branch of thoracodorsal nerve accompanying transverse vessels, was spared for preservation of latissimus dorsi function, while the other branch was divided proximally too, to free the source vessel. The flap was then raised from the remaining muscle and donor site is closed primarily in 2 layers. No dissection was done to free the nerve from the perforator, or the portion of descending branch which was taken with the flap. In case if small multiple perforators were encountered, a wider cuff of muscle was taken without further deroofting the perforators. Figure 1 and 2 shows the technique of raising the flap in antegrade fashion.

Results

A total of 30 patients were treated with the pedicled thoracodorsal artery perforator flap. The mean age was 25 ± 1.5 years. Majority of the patients were female. There were 15 cases of inframammary fold contracture, 9 cases of axillary fold contracture, 5 underwent soft tissue reconstruction after tumor resection and 1 had post traumatic soft tissue defect reconstructed with TDAP flap (table no.1).

There was complete flap survival in 29 out of 30 (96.7%) cases. There was partial necrosis in one flap due to de-

layed detection of venous congestion, secondary to hematoma formation over the excised scapular border. Stitches were opened and hematoma was evacuated. 60% of the flap was salvaged and rest of the wound was covered with split thickness skin graft after granulation tissue formation. In 23 (76.7%) cases, the flap was islanded on a single perforator, while in 7 (23.3%) cases multiple perforators were found. Mean follow-up period was 7.2 ± 1.2 months. Donor sites were closed primarily in all cases and none of the patients reported hypertrophic scarring or widening of the scar. Latissimus dorsi was found to be functional in all cases, with mean power of adduction 4.6 ± 0.1 according to medical research council (MRC) scale for muscle strength.

Table 1: patient demographics & indications of TDAP flap

| Patient Demographics: | |
|--|--------------------|
| Total Patients | 30 |
| Mean Age | 25 ± 1.5 years |
| Gender | Cases: |
| Male | 9 |
| Female | 21 |
| Indications for TDAP flap: | |
| Inframammary Fold Contractures | 15 |
| Axillary Fold Contractures. | 9 |
| Soft Tissue Reconstruction after Tumor Resection | 5 |
| Post traumatic Tissue defect. | 1 |

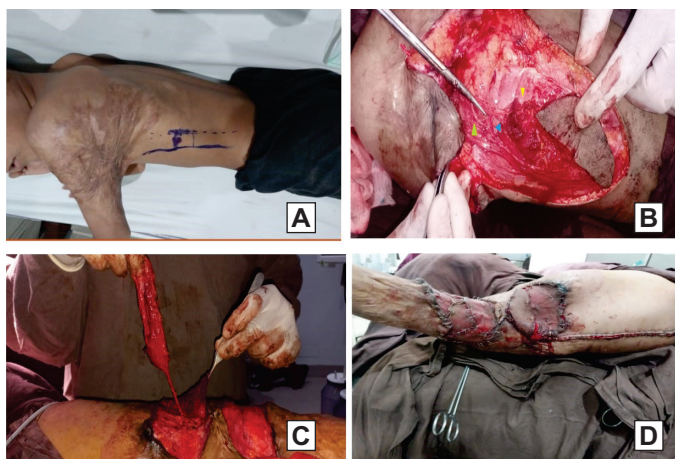


Figure2: TDAP flap for reconstruction of soft tissue defect after axillary contracture release. **A)** Marking of the perforators **B)** Dissection through border of trapezius after locating the perforator. Green arrow: Intact nerve along the transverse branch Yellow arrow: Perforator deroofed through the muscle in continuation of the vertical branch Blue arrow: transverse branch White star: divided nerve along the vertical branch of the pedicle. **C)** Fasciocutaneous flap raised **D)** Flap used to cover the roof of axilla along with split thickness skin graft.

Discussion

Pedicled thoracodorsal artery perforator flap has recently gained popularity in reconstructive surgery. As a pedicled flap it has a wide arc of rotation due to long pedicle to cover regional defects and a thin pliable tissue that matches colors and texture of regional skin.¹³ Li et al studied the efficacy of TDAP flap in breast conserving reconstruction of patient with T2 Breast cancer in East Asian population. The authors reported no seroma formation or scar complication and acceptable survival rate, but adopted retrograde dissection aided by pre-operative imaging.¹⁴ They reported wide arc of rotation as we also noted in our case series, allowing breast reconstruction even on the medial pole of the breast. Another article reported good contour formation of the breast after lumpectomy but adopted retrograde approach and raised flaps on single dominant perforators. No detail was provided for raising flaps if multiple perforators were encountered.¹⁵ Nizamoglu et al shared his experience of using TDAP flap salvage surgery in patients going autologous and implant-based breast reconstruction in a single stage procedure¹⁶. However he emphasized on performing CT angiogram for successful identification of perforator using the retrograde approach which is inconsistent with our experience. Sui et al used TDAP flap for extremity reconstruction and similarly depended on pre-operative CT scans for planning.¹⁷ Thomsen et al described pivot flaps based on thoracodorsal artery for breast reconstruction.¹⁸ They mentioned increased excision of distal 5cm or more of the flap due to inadequate perfusion. Our technique utilizes multiple perforators if a single dominant one is not present, resulting in good outcome. Scafati et al adopted antegrade approach but stressed the identification and islanding of the flap over single perforator.¹⁹ They too stated the occasional absence of a single large perforator but didn't describe improvisation of their technique to solve the issue of multiple small perforators. They utilized preoperative identification of perforators with handheld ultrasound but found that their technique had a steeper learning curve as it required isolation of pedicle from the nerve and its branches.⁹ They only described their technique but didn't show the clinical cases to assess the functional outcome of latissimus dorsi flap. We have described the easy antegrade approach with technique to go about the presence of multiple small perforators and shown the clinical outcome with retention of the muscle function in our case series. The perforator-based flap was also shown to be a safe option

with previous history of axillary radiation²⁰. To prevent venous congestion, a small cuff of muscle around the perforator was preserved, along with the arborizing vessels, similar to La Padula's technique. However, instead of using a strip of fat tissue for padding, our approach employed a muscle cuff for added protection.²¹

Our study describes an easy and safe method to raise the TDAP flap in 30 patients, yet there are some limitations. The cases were performed by a single author thus the resulting in consistency in the outcome. We selected cases with no scarring over the site of the flap, but in case of supple scar the reliability of the flap is yet to be established. We have taken a vertical skin paddle, but in cases of aesthetically demanding patients a transverse of oblique design is favored. This leaves less room for exploratory technique as we have described. Hence otherwise a safe and easy technique, it is yet to be verified by other surgeons and in other scenarios to cement its utility.

Conclusion

Antegrade dissection provides a reliable method to raise TDAP flap to cover wide range of defects around axilla. Our improvisation of the technique provides a solution to the presence of multiple minor perforators rather than a single dominant one, when angiography facility is not available.

Conflict of Interest: None

Source of funding: None

Author's Contribution

Dr. Muhammad Omar Afzal: Conception and design of the study, data analysis and interpretation, agreement to be accountable for all aspects of the work & final approval of the version to be published.

Dr. Sadia Hussain: Data analysis, Critical revision of the article, conception and design of the study and final approval of the study.

Dr. Umer Nazir: Substantial contribution to acquisition of data, concept and design and final approval of the version to be published.

Dr. Arooba Iqbal: Interpretation of data, Critical revision of the article and final approval of the study.

Dr. Umer Asif: Interpretation of data Critical, revision of the article and final approval of the study.

Dr. Hafsa Khalid: Data analysis and interpretation, concept and design and final approval of the version to be published.

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