

Thoracodorsal artery perforator (TDAP) flap in immediate breast reconstruction and the role of preoperative mapping: a clinical experience

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Abstract

Background Oncoplastic approach to reconstruct partial breast resection is always challenging. Nowadays, pedicle perforator flaps have been described for partial breast mastectomy reconstruction

Methods The study comprised all patients who received partial breast resection due to external quadrant breast cancers and who were reconstructed with thoracodorsal perforator flap between August 2010 and August 2011. Twenty-two patients received the thoracodorsal artery perforator (TDAP) for breast reconstruction. The mean surgical time (including oncology resection and reconstruction) was 160 min. Eleven patients (50 %) underwent Doppler and Computed tomographic angiography (AngioCT) presurgical planning, the rest Doppler alone.

Results The mean stay was 3.27 days. Seroma formation in the donor site was found in five cases. No flap failures were detected. No breast size changes were observed after surgical and radiotherapy treatment.

Conclusions We conclude that TDAP flap is suitable for partial breast reconstruction (quadrantectomy) in moderate breast cancer.

Level of Evidence: Level IV, therapeutic study.

Keywords Breast immediate reconstruction · TDAP flap · Quadrantectomy reconstruction

Introduction

Breast conservation therapy is a popular treatment option for women with breast cancer. The rate of its use as an alternative to mastectomy has increased from 40 % in 1991 to 60 % in 2002, and the trend continues to rise [1]. The reason for this change could be due to the refinement in the reconstruction techniques.

Nowadays, pedicle perforator flaps have been described for partial breast mastectomy reconstruction [2]. These are skin and fat flaps that are based on perforators arising from a deep vascular system through the underlying muscles or intermuscular septa. Harvesting the flap without sacrificing the muscle or the nerve is the essence of this technique, which keeps donor site morbidity to a minimum [3].

To the best of the authors' knowledge, Hamdi et al. [4] were the first ones in reporting the use of thoracodorsal artery perforator (TDAP) flap for immediate breast reconstruction. This study describes author's clinical experience with the use of pedicled perforator flaps for immediate breast reconstruction and presents their indications for the use of TDAP flap and preoperative mapping.

Material and methods

The study included all patients who had partial breast resection for external quadrant breast cancer and who were reconstructed with a thoracodorsal perforator flap between August 2010 and August 2011.

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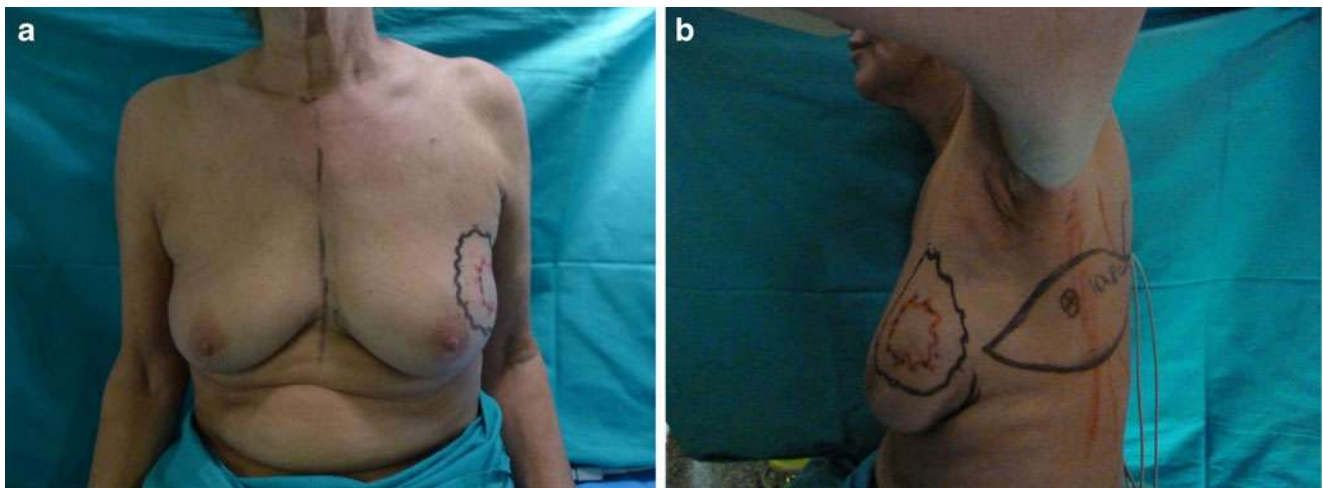


Fig. 1 **a** Presurgical tumor resection design. **b** Presurgical flap design based in thoracodorsal perforator after Doppler

Preoperative and surgery assessment

The patients underwent angioCT for a week to indicate the best perforator. On the day of surgery, breast size, tumor size

and location, and the estimated defect were recorded. Excess skin and fat on the back was determined by the pinch test. The patient was then anesthetized. The tumor resection was performed and the patient was then placed in a lateral



Fig. 2 Surgical findings; **a** flap harvested, **b** perforator detail, **c** flap deepithelization, **d** final surgical result

position. The arm was abducted 90°, as in the harvesting of a classical latissimus dorsi (LD) flap. The potential perforators were located using Doppler, whereupon the flap was designed. The flap elevation proceeded from distal to proximal and from medial to lateral at the level just above the LD muscle fascia until the perforator identified by the Doppler, or until a good size perforator was found as in the procedure reported by Hamdi et al. Preoperative and surgery assessment are shown in Figs. 1 and 2.

Description of the angioCT technique and presurgical plan

Our multidetector computed tomography studies were performed using a 64-detector-row CTscanner (Lightspeed; GE Medical Systems, Waukesha, WI, USA). The X-ray tube potential was 100 kVp for all scans and the tube current ranged from 414 to 600 mA with a fifty 180–240 field of view. All scanning was performed via intravenous (IV) administration of 120 ml of nonionic iodinated contrast medium at a concentration of 300 mgI/ml (Iopamiro, Iopamidol 300; Bracco Imaging, Milan Italy). The contrast material was injected mechanically with an Ohio Tandem injector (Ulrich Medical, Ulm, Germany) at a rate of 4 ml/s through an 18-gauge IV catheter inserted into an antecubital vein. The patient was placed in the supine position on a CT table. Sections were obtained from the cervical area to the diaphragm. Automated bolus detection and scan triggering were used for timing. No complications arose from the use of multidetector row CT angiography.

Image interpretation

Vascular maps were obtained by using volume rendering and maximum intensity projections and were generated by two radiologists with 3 and 7 years of experience in

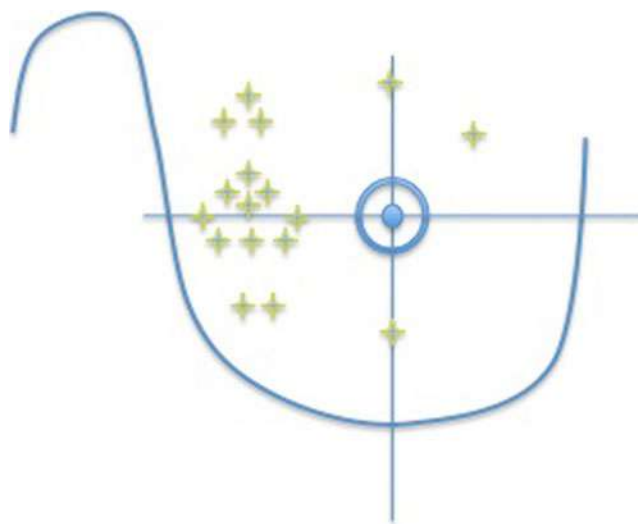


Fig. 3 Tumor location

Table 1 Patients data

Parameter	Result
Age	44.23 (28–63)
BMI	23.87 (19.5–29)
Co-Morbidities	Smoking 5/22=23 % Hypertension 3/22=14 % Hypothyroidism 2/22=9 % Diabetes mellitus 1/22=4.5 %
Breast size (before–after surgery)	Cup A: (3–3) B: (12–12) C: (9–9) D: 0
Tumor pTNM	Tx: 2/22 Tis: 2/22 T1: 7/22 T2: 10/22
Localization	Figure 6
Axillary disease	Lymphadenectomy: 6 Axillary sample: 15
Histology	CDI: 12/22 CID: 2/22 CDI + IS: 6/22 CLI: 1/22
Neoadjuvant chemotherapy	10/22
Tumor size	32 mm (0–80)
Complementary treatment	RT: 4 RT+QT: 4 RT+HT: 3 RT+QT+HT: 10

three-dimensional reconstruction, respectively on an independent workstation (Advantage Windows; GE Medical Systems, Milwaukee, WI, USA) in all cases. Scans were

Table 2 Patient results

Parameter	Result
Hospitalization days	3.27 (0–6)
Surgical procedure time (flap harvesting)	72'
Presurgical planning	Doppler 11/22, 50 % Doppler+AngioTAC 11/22, 50 %
Resection size	101.5×91×40.5 mm
Resection weight	146 g (45–300)
Skin island flap needed	5/22=23 %
Free margins resection	21/22=94.5 %
Complications	Dehiscence 1/22 Seroma 5/22



Fig. 4 **a** Presurgical view. **b, c** Results after 6 months in frontal and lateral view

assessed for the depiction of the major arteries of the axilla, including the thoracodorsal, subscapular, and serratus arteries. With the aid of the multiplanar localization program and once in the axial plane, the highest caliber artery perforator was located. The program automatically provided its location in the volume rendering and therefore showing where the surgeon should dissect, assessing whether the route to the perforator should be intramuscular or interfacial. The exit of the perforator in the subcutaneous tissue and the distance in the coronal plane from established landmarks were recorded. The reference was taken from the medial axillar line and the

distance was measured in millimeters. The perforator was marked in the operating room with the indications made by the angioradiologist. This labeling was found with the help of the Doppler probe.

Results

Twenty-two patients (mean age, 44; mean BMI, 23.87) received TDAP flap for breast reconstruction. The characteristics of the patients and the flaps are summarized in Fig. 3 and Tables 1 and 2. The mean resection size

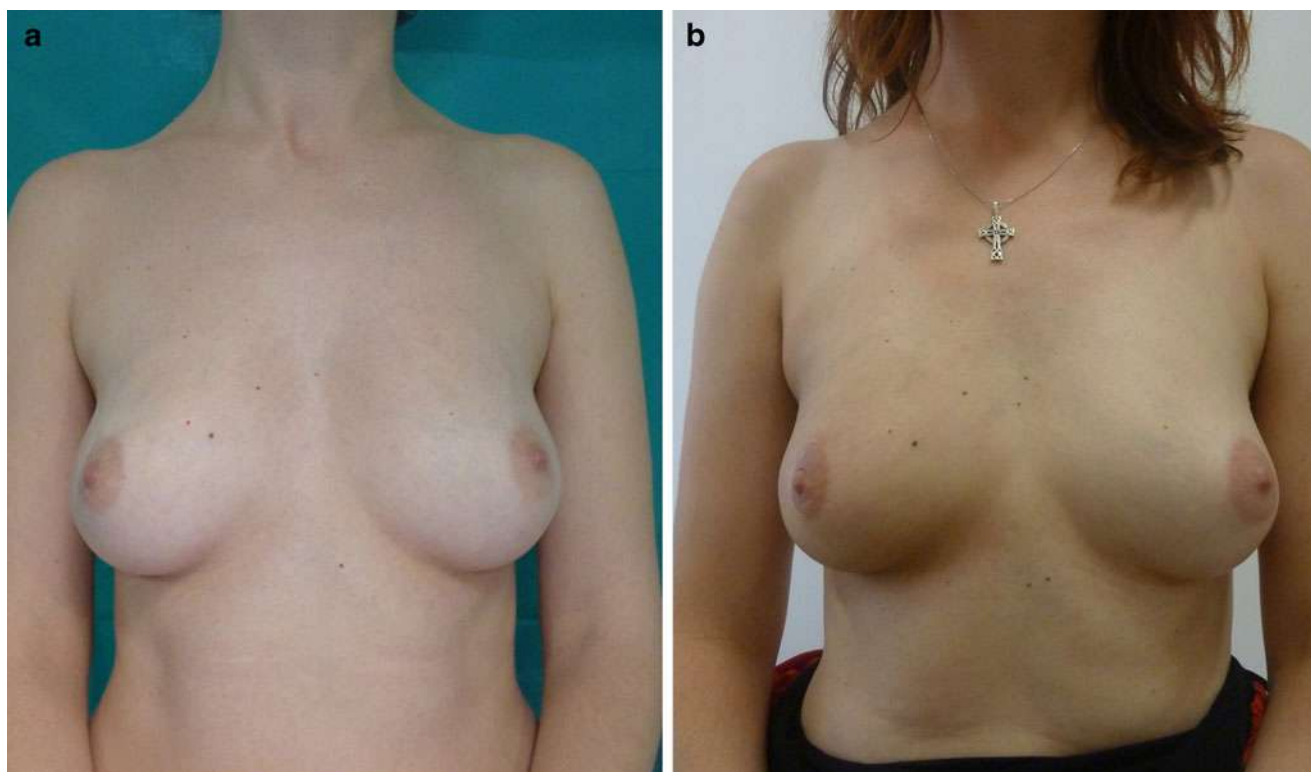


Fig. 5 **a** Presurgical view. **b** Results 6 months after radiotherapy

was 10×9 cm in a moderate size breast (B cup). Three of the patients had intercostal perforators. A small piece of LD was incorporated in the flap (MS-LD I) in two cases to protect its viability. In only one case was impossible to find a perforator and a LD was harvested. Skin island flap was used in five cases. Mean surgical time (including oncology resection and reconstruction) was 160 min. Eleven patients (50 %) underwent Doppler and angioCT presurgical planning, the rest only Doppler. The mean stay was 3.27 days. Seroma formation in the donor site was found in five cases. Probably, the cause of these seromas was the association in the same surgery with lymph node axillary dissection although this situation did not change their hospital stay. No flap failures were detected. No breast size changes were observed after surgical and radiotherapy treatment (Figs. 4 and 5).

Discussion

The TDAP flap was described for the first time by Angrigiani [5]. It represented a step forward in breast reconstruction because it allowed us to use as the LD flap without the use of the muscle. The thickness of the flap is reduced and the functional alterations in the donor site are kept to a minimum [6–8]. The TDAP flap has a reliable blood supply and its size can be as large as 10×25 cm [9, 10].

In authors' experience, TDAP flap is a good flap for volume replacement in breast cancer quadrantectomy in the lateral, superolateral, and central regions and it provides a good skin paddle. Needless to say, unlike TDAP flap, a denervated and radiated latissimus dorsi will undergo post-operative atrophy. To compensate for the expected loss in muscle volume, a flap much larger than the defect should be harvested, possibly preserving the sub-Scarpa's fat on the muscle. However, the effects of radiation therapy on perforator flaps remain unclear; some authors do not report alterations after radiotherapy [11]. For all these reasons, TDAP flap is nowadays a good tool in breast reconstruction.

For all these reasons, this flap is a good tool in breast reconstruction. Nevertheless, its use is not widely accepted due to its tedious and difficult dissection and its unpredictable results [12]. The possibility of performing pre-operative perforator mapping using a handheld Doppler flowmeter is an important step forward. However, although more accessible and less costly, this device generates more false-positive and false-negative signals and provides less detailed information on anatomical and functional vessels. The dominant TD perforator can also be visualized by AngioCT, which could make the harvest technique easier [13, 14]. In fact, its utility

in the case of other flaps is already well known [15, 16]. The application of angioTC as showed in this study and compared to the report by Mun et al. [17], varies only in 16 for 64 slice multidetector row computed tomography scanner. This should be an advantage with improved sensitivity; however, prospective studies would be needed. Recent reports have presented good results with the use of TDAP flap for reconstruction with implants or expanders [17].

Conclusions

TDAP flap is suitable for partial breast reconstruction (quadrantectomy) in moderate breast cancer. The results are excellent and no serious complications are found at the donor site. Further studies in presurgical planning with angioCT should be performed.

Conflicts of interest None.

References

1. Jemal A, Ward E, Thun MJ (2007) Recent trends in breast cancer incidence rates by age and tumour characteristics among U.S. women Breast Cancer Research 9:R28
2. Losken A, Hamdi M (2008) Partial Breast reconstruction: current perspectives. *Plast Reconstr Surg* 124(3):722–736
3. Schwabegger AH, Bodner G, Ninkovic M (2002) Thoracodorsal artery perforator (TAP) flap: report of our experience and review of the literature. *Br J Plast Surg* 55:390–395
4. Hamdi M, Van Landuyt K, Monstrey S, Blondeel P (2004) Pedicle perforator flaps in breast reconstruction: a new concept. *Br J Plast Surg* 57:531–539
5. Angrigiani C, Grilli D, Siebert J (1995) Latissimus dorsi musculocutaneous flap without muscle. *Plast Reconstr Surg* 96:1608–1614
6. Laredo Ortiz, C; Marquez Mendoza, M., Navarro Sempere, L; Salvador Sanz, J, Novo Torres, A, Lorda Barraquer, E. Versatility of the pedicle thoracodorsal Artery perforator (TDAP) flap in soft tissue reconstruction. *Ann Plast Surg* 58, 3: 315- 320
7. Adams WP Jr, Lipschitz AH, Ansari M et al (2004) Functional donor site morbidity following latissimus dorsi muscle flap transfer. *Ann Plast Surg* 53:6–11
8. Salmi A, Tuominen R, Tukianinen E et al (1995) Morbidity of donor and recipient sites after free flap surgery. A prospective study. *Scand J Plast Reconstr Surg Hand Surg* 29:337–341
9. Koshima; I. Saisho, H, Kawada, S. Hamanka, T., Umeda, N and Moriguchi, t. Flow-through thin latissimus dorsi perforator flap for repair of soft-tissue defects in the legs. *Plast. Reconstr. Surg.* 1999. 103: 1483
10. Heitmann, C; Guerra, A., Metzinger, S. W., Levin, S. L., and Allen, R. J. the thoracodorsal artery perforator flpa: anatomical basis and clinical application. *Ann. Plast. Surg.* 2003. 51: 23
11. Hamdi M, Van Landuyt K, Hijawi JB, et al. In: Spear SL, Willey SC, Robb GL, Hammond DC, Nahabedian MY, eds. *Surgery of the breast: principles and Art.* Philadelphia: lippicott Williams and Wilkins. 2006: 833-846

12. Spinelli HM, Fink JA, Muzaffar AR (2001) The latissimus dorsi perforator-based fasciocutaneous flap. *Ann Plast Surg* 107:374–382
13. Hamdi, M, Van Landuyt, K., Van HEdent, E. Duyck, P. Advances in autogenous breast reconstruction: the role of preoperative perforator mapping. *Ann Plast Surg* 58: 1 18–126
14. Mun GH, Kim HJ, Cha MK, Kim WY (2008) Impact of perforator mapping using multidetector-row computed tomographic angiography on free thoracodorsal artery perforator flap transfer. *Plast Reconstr Surg* 122(4):1079–1088
15. Higuera Suñé MC, López Ojeda A, Narváez García JA, De Albert De Las Vigo M, Roca Mas O, Perez Sidelnikova D, Carrasco López C, Palacin Porte JA (2011) Use of angioscanning in the surgical planning of perforator flaps in the lower extremities. *J Plast Reconstr Aesthet Surg* 64(9):1207–1213
16. Rozen WM, Ribuffo D, Atzeni M et al (2009) Current state of the art in perforator flap imaging with computed tomographic angiography. *Surg Radiol Anat* 31(8):631–639
17. Hamdi, M; Salgarello, M, Barone-adesi, L, Van Landuyt, K. Use of the thoracodorsal artery perforator flap with implant in breast reconstruction. *Ann Plast Surg* 61, 2:143–146