



ERGONOMICS OF PERFORATOR/ PROPELLAR FLAPS IN LOWER LIMB

**Dr.J.Romul
Dhayan Raja**

MS (general Surgery), M.Ch (Plastic surgery) Senior Civil Surgeon Government District Headquarters hospital Krishnagiri

ABSTRACT

INTRODUCTION: Tissue defects in lower limb still present a challenge for the reconstructive Surgeon. Various types of flaps have been used in order to cover them. Perforator/propeller flap represent the latest milestone in the evolution of reconstructive surgery in the armamentarium of local flaps. This perforator flap are upgraded version of musculocutaneous flaps with complete sparing of muscles and reduced local morbidity and functional disabilities. Aim of study is to ascertain the usefulness of these flaps in planning reconstructive surgery and to improve aesthetic and functional outcome and reducing local morbidity. **MATERIALS AND METHODS:** The study was conducted in the Dept. of Plastic Reconstructive & Maxillofacial surgery. Rajiv Gandhi Government General Hospital, and Madras Medical College over a period of 18 months. All patients with small to large sized soft tissue defects affecting Lower limb except plantar defects were included in the study. The proposed procedure was explained to the patient in detail including its merits and demerits. Informed and written consent was obtained from the patient. The proforma was submitted before the Institution Ethical committee and approval obtained. **OBSERVATION & RESULTS:** Perforator/propeller flaps for reconstruction of soft tissue defects over the lower limb was done in 40 patients (30 males and 10 females). The age of patients ranged from 20 yrs to 63 yrs. Post traumatic soft tissue defects of Knee, Lower 1/3 leg, Ankle and foot 34 patients, 4 patients were paraplegic with sacral pressure sore and 2 patient were paraplegic with trochantric pressure sore. Among 40 patients, 3 patients were diabetic, 4 patients had the habit of Smoking. Perforator Characteristics: 1. Average size of perforator was 1.5mm. Average distance between perforator and wound margin was 2cms. **CONCLUSION:** The perforator/propeller flap in lower limb is a truly versatile flap that is safe, reliable, quick to perform and with standard periperforator dissection, gives a good aesthetic result. The single best perforator contributes to increased influx of blood flow with recruitment of adjacent perforosomes by opening the linking vessels and larger flap harvest with 95% success rate of flap survival. The ability to base a flap on any perforator found in the vicinity of a wound to be reconstructed gives the surgeon unparalleled freedom when designing local flaps.

KEYWORDS : Perforator flap, lower limb**INTRODUCTION**

Tissue defects in lower limb still present a challenge for the reconstructive Surgeon. Perforator/propeller flap represent the latest milestone in the evolution of reconstructive surgery in the armamentarium of local flaps¹. This perforator flap are upgraded version of musculocutaneous flaps with complete sparing of muscles and reduced local morbidity and functional disabilities. Even more beneficial and exciting development has been the possibility of using tissue close to or adjacent to the defect as a local perforator/propeller flap. This technique not only provides a simpler and more expeditious repair, but arguably a superior aesthetic result because of better tissue match².

To select the perforator flap, factors like dimensions of the defect, surrounding structures involvement, morbidity, functional and aesthetic aspects of the procedures should be considered in each case. Perforator flaps³ have advantage over free flaps reconstruction in lower limb with ease to perform, single team approach reduced operating time and morbidity⁴. Based on this aim of study is to ascertain the usefulness of these flaps in planning reconstructive surgery and to improve aesthetic and functional outcome and reducing local morbidity.

MATERIALS AND METHODS

The study was conducted in the Dept. of Plastic Reconstructive & Maxillofacial surgery, Rajiv Gandhi Government General Hospital, and Madras Medical College over a period of 18 months. All patients with small to large sized soft tissue defects affecting Lower limb except plantar defects were included in the study. Whereas patients with peripheral vascular diseases. Gustilo grade IIIC injuries in lower limb. Advancement, transposition perforator flap and Free style free flap were excluded. All the details of the patient, regarding preoperative, surgical, and postoperative and follow up periods were collected and analyzed.

The patients were explained about the nature of the defect and the various flap options available. Informed and written consent was obtained from the patient. The proforma was submitted before the Institution Ethical committee and approval obtained. A hand held Doppler ultrasound with 8 to 10 Mhz frequency probe is used to mark the dominant perforator artery near the defect in our study. Perforator markings of the following flaps are done with a hand held Doppler⁵.

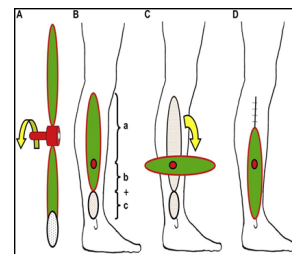


Figure 1: (A) The propeller flap concept, (B) Marking of the flap, (C) Flap elevation and clockwise rotation, (D) Flap inset.

RESULTS:

The outcomes of flaps were critically analyzed at periodic intervals and at the end of study. Perforator/propeller flaps for reconstruction of soft tissue defects over the lower limb was done in 40 patients (30 males and 10 females). The age of patients ranged from 20 yrs to 63 yrs. (Table.2)

Post traumatic soft tissue defects of Knee, Lower 1/3 leg, Ankle and foot 34 patients, 4 patients were paraplegic with sacral pressure sore and 2 patient were paraplegic with trochantric pressure sore. Among 40 patients, 3 patients were diabetic, 4 patients had the habit of Smoking.

PERFORATOR CHARACTERISTICS

Average size of perforator was 1.5mm. Average distance between perforator and wound margin was 2cms. In our study Perforator/Propeller flaps were done from 14 source vessel in 40 patients (Table4). The defect size that were covered ranged from 3 x 3 cm to 18 x 8cm. Skin flap ranges from 5 x 4 to 22 x 9

Table 1- Type of flap^{6, 7}

S. No	Name of Flap	Total No. of Flaps	Source Vessel	Average Perforator Size in mm	Max. Flap Dimension in cms	Max. Degree of Rotation In degree	Average Duration of Surgery in minute
1	SGAP-gm	2	Superior Gluteal Artery	1.35	15x8	180	110

2	IGAP - gm	2	Inferior Gluteal Artery	1.8	22x9	180	120
3	LCFA P -tfl	1	Lateral Circum Flex Femoral Artery	1.2	9x5	180	90
4	DGAP	2	Descending Genicular Artery	1.4	16x8	180	100
5	ATRA P	1	Anterior Tibial Recurrent Artery	2.2	6x3.2	100	90
6	SAP	2	Saphenous Artery	1.2	9x4.8	100	90
7	ATAP	4	Anterior Tibial Artery	1.7	15x6	160	110
8	SPNA P	2	Superficial Peroneal	1.5	10x6.5	160	100
9	PTAP	10	Posterior Tibial Artery	1.7	20x8	180	110
10	PNAP	6	Peroneal Artery	1.8	20x8	160	100
11	RFAP	3	Ramus Performance Artery	1.8	13x5.1	100	90
12	LCAP	3	Lateral Calcaneal Artery	1.2	5x4	140	90
13	AAP	1	Arcuate Artery	1.7	9x4	100	90
14	FDMA P	1	First Dorsal Metatarsal Artery	1.0	6x3.4	180	90

COMPLICATIONS

Two PTAP flaps and one SGAP flap had venous congestion and alternate sutures released, flap settled well. One SGAP flap developed haematoma, which was evacuated and flap settled well. One ATAP flap and one PNAP flap patient developed infection with partial loss of graft over the donor site. One ATAP flap and a SPNA flap in which patient was a smoker had 1 cm superficial dermal necrosis of the flap. Once the scab was removed the underlying flap was healthy that healed by secondary intention with spontaneous epithelialization⁸. One PTA Flap developed wound dehiscence, secondary suturing done. One AAP flap and an ATRA flap had partial flap necrosis, was managed with bedside debridement and SSG.

DISCUSSION

The ultimate aim of our reconstruction is to design various flaps based on perforators/propeller flaps in the lower limb and to improve aesthetic and functional outcome by reducing local morbidity. Muscle flaps fill complex three-dimensional defects and provide well-vascularised tissue that may have the advantage of controlling bacterial inoculation in heavily contaminated or chronically infected wounds⁹. Fasciocutaneous flaps are indicated to cover shallow wounds and when based on a single perforator, may have enhanced perfusion properties and can restore contour that may be advantageous in controlling local bacterial load¹⁰.

In sacral and trochantric pressure sore propeller flaps cover the defect without tension and secondary defect closed primarily. Soft tissue defects in the proximal two thirds of the leg are often covered with local muscle flaps; the distal third is often reconstructed with free microsurgical transfers.

The advent of perforator flap surgery has created new awareness for the potential of local flaps based on perforator vessels from regional vessels. Propeller perforator flaps in distal lower leg provide a good option in the reconstructive armamentarium because flap harvest is

relatively quick and easy without sacrificing the under lying muscle. Besides the reconstruction can replace like-with-like tissues of similar texture, thickness, pliability, and color, this method also avoids multiple surgical sites and reduce morbidity of the donor site, because the scars are limited to only one region. For defects, <6 cm wide, the donor site closed primarily⁴⁸, but larger defects can be partially closed and skin grafted area minimised.

The flap may be rotated through up to 180°, and the distal perforators in particular can be used for coverage of defects around the ankle and distal two thirds of the tibia, where there have previously been few reliable local flap options. In our study the median angle of rotation of the flap about the perforator was 160° (range, 90 to 180 degree) and the average size of perforator was 1.5mm and average operative time is 90-120 minutes. The distance between wound margin and perforator was 2cms.

The reliability of these flaps was proved by the clinical case studies. The flaps were found to be safe and reliable in both young and old patients and in both sexes. Also the flap survival was not significantly compromised by co morbidities like Diabetes Mellitus once they were treated or brought under control. The flaps were also found to be safe irrespective of the etiological factors. Also these flaps have a good contour and natural appearance and avoid the dog ear problems of the classical flaps.

The unique design of the propeller flap, pivoted around a single cleanly dissected perforator, allows the importation of truly undamaged tissue into a defect for easy closure without tension. In the lower limb this is a luxury afforded to few. Thus the patient satisfaction was much better with less postoperative pain and early recovery.

CONCLUSION

The perforator/propeller flap in lower limb is a truly versatile flap that is safe, reliable, quick to perform and with standard periperforator dissection, gives a good aesthetic result. The single best perforator contributes to increased influx of blood flow with recruitment of adjacent perforosomes by opening the linking vessels and larger flap harvest with 95% success rate of flap survival.

REFERENCES:

1. Taylor GI, Daniel RK. The free flap: composite tissue transfer by vascular anastomosis. *Aust N Z J Surg* 1973;43(1):1-3.
2. Orticochea M. The musculocutaneous flap method as a substitute for the method of delayed transfer. Report on a discovery. *Acta Chir Plast* 1983;25(1):6-13.
3. Hyakusoku H, Yamamoto T, Fumiiri M. The propeller flap method. *Br J Plast Surg* 1991;44:53-4.
4. Teo TC. Reconstruccion de la extremidad inferior con colgajos de perforantes locales [Perforator local flaps in lower limb reconstruction]. *Cir Plas Iberolatinoam* 2006;32(4):287-92.
5. The "Gent" consensus on perforator flap terminology: Preliminary definitions; Blondeel, P. N., Van Landuyt, K. H. I., Monstrey, S. J. M., et al; *Plast Reconstr Surg*. 112: 1378, 2003.
6. Geddes CR, Morris SF, Neligan PC. Perforator flaps: Evolution, classification, and applications. *Ann Plast Surg* 50:90-99, 2003.
7. Bravo FG, Schwarze HP. Free-style local perforator flaps: concept and classification system. *J Plast Reconstr Aesthet Surg* 2009;62(5):602-
8. Jakubietz RG, Jakubietz MG, Gruenert JG, et al. The 180-degree perforator-based propeller flap for soft tissue coverage of the distal, lower extremity: a new method to achieve reliable coverage of the distal lower extremity with a local, fasciocutaneous perforator flap. *Ann Plast Surg* 2007;59:667-71.
9. Guerra AB, Gill PS, Trahan CG, et al. Comparison of bacterial inoculation and transcutaneous oxygen tension in the rabbit S1 perforator and latissimus dorsi musculocutaneous flaps. *J Reconstr Microsurg*. 2005;21:137-143.
10. Gravvanis A, Tsoutsos D, Karakitsos D, Iconomou T, Papadopoulos O. Blood perfusion of the free anterolateral thigh perforator flap: Its beneficial effect in the reconstruction of infected wounds in the lower extremity. *World J Surg*. 2007; 31:11-18.