

Our Experience with Anterolateral Thigh Flap in Public Sector Tertiary Care Hospital.



Medical Science

KEYWORDS : anterolateral thigh flap, perforators, pedicled flap, free flap.

*** Dr. Gurram. Rangaswamy**

Assistant Professor, Department of Plastic Surgery, Gandhi Medical College, Secunderabad * Corresponding authors

Dr. Arige. Subodh kumar

Associate Professor, Department Plastic Surgery. Gandhi Medical College, Secunderabad

Dr. Gurram. Manjula

Ex - resident of Apollo hospital, Basavataraka cancer hospital, LV Prasad Eye Hospital, Hyderabad

Dr. Pokkula. Ramesh

Assistant Professor, Department of Plastic Surgery, Gandhi Medical College, Secunderabad.

ABSTRACT

Introduction: Some of the compound skin defects need free flap cover. Anterolateral thigh flap can be used either as a pedicled or a free flap. Free flap surgery is difficult in a Public sector hospital with constraints of resources.

Aims: To study the perforator type, the types of the flap used and the feasibility in public sector hospital.

Materials and Methods: 25 patients with compound defects were given cover with anterolateral thigh flap in Gandhi Hospital between 2005 and 2008. **Results:** Perforator was single in 72%, correlated with the Doppler finding in 68% and was musculocutaneous in 64%. 60% were raised as faciocutaneous, size between 8 X 7 cm and 25 x 12cm, with pedicle length between 6 and 8.5cm. success rate 88%.

Conclusion: Anterolateral thigh flap is versatile flap can be used with as free flap pedicled flap, as a faciocutaneous or musculocutaneous flap. Persistence, determination, perseverance, can definitely lead to success of flap and is feasible in public sector hospitals

Introduction:-

Compound skin defects need skin cover and are to be managed by following the reconstructive ladder, which begins with a direct closure to increasing complex options such as free flap tissue. Free tissue transfers are an option when pedicled flaps are not available. Microsurgery has changed the scope of surgical reconstruction.

The Anterolateral thigh flap first described by Song et al in 1984 has gained popularity in soft-tissue reconstruction. It has advantages in having a long pedicle with a suitable vessel diameter, the availability of large amount of skin, with the option of tailoring of thickness of the flap, and of making it a sensate flap. The operation can be performed by two teams working simultaneously, and the operating time can be reduced considerably.

Pedicled Anterolateral thigh flap has been successfully used to reconstruct the compound defects on lower abdominal wall, the suprapubic area, the circumference of the penis, the ischium, the trochanter and the lateral gluteal region. The dimensions of the flap range between 5 X 8 cm and 22 X 32 cm.

No major artery of the thigh is sacrificed. The flap may be harvested as faciocutaneous, fascial, or musculocutaneous and as pedicled and free flap. The flap can be combined with other free flaps using the chimeric or mosaic principle.

Our department is a public sector tertiary care center in the state, has constraints of human resources, infrastructure, with limited operating hours, and is burdened with cases from burns and other departments. This flap surgery was taken with the sole aim of exposing the post graduates to technique of free flap surgery, to improve the skills of the teaching faculty, and to avoid the referral to other institutes for the defects that needed free flap cover.

Aim

To study the perforator, its variations, the types of harvest of the flap, its dimensions and the feasibility in a public sector hospital.

Methods and material:-

Twenty five patients admitted in the Department of Plastic and Reconstructive Surgery, Gandhi Hospital between August 2005 to 2008 with various Compound defects from head to toe of varied etiology, were given cover with Anterolateral thigh flap.

Exclusion criteria

1. Cardiovascular disease and Diabetes
2. Pregnancy
3. Irradiation

Methodology: The patient's particulars were obtained defect and the donor area were examined. Routine surgical profile and other necessary investigations were done to assess the feasibility to tolerate the prolonged surgery. Hemoglobin levels were raised to 12gm% prior to surgery. Smokers were made to abstain for two weeks before the procedure.

All the patients were informed in detail prior to the surgery about the problem, the procedure, the likely complications including the possibility of repeat surgeries, the likely death of flap etc, and the consent was taken.

Entire department staffs were informed one day prior to the procedure. The recipient vessels and donor perforator vessels were evaluated with hand held Doppler machine and marking was done for perforators and dimensions of the flap. Templates of appropriate dimensions of the defect were cut and sent for sterilization. Pre operatively, two grams of Ceftriaxone was given.

All patients were operated under either General anesthesia, epidural or spinal. Marking of the perforator and the flap on the donor site shown in (figure -1).

The irrigation solution constituted 500 ml of normal saline +1cc heparin, 30ml of 2 % Xylocaine and 30 ml of the Dilator fluid 2.

Two team approach was adopted, One for flap harvest and the second team for the recipient area preparation and dissection of donor vessel.

FLAP DISSECTION:-

Elevation of a Faciocutaneous Flap

The axis of the flap is marked by a line connecting the anterior superior iliac spine and the supero lateral patella and the perforator is marked over the 3cm radius of the midpoint of this axis as described by McCarthy and Lambert³ Flap is harvested from the contralateral Thigh. The perforator is marked with the hand held Doppler. Then the size of the flap is marked after redefining the size of the defect following debridement.

The skin is incised down to the fasciae, and it is included in the flap. The cutaneous vessel is traced down noting whether it is septocutaneous or musculocutaneous and whether it is from the lateral circumflex femoral artery. The Tensor fascia lata perforator can be a life boat in the rare circumstance when the distal perforators are of poor quality or injured during dissection. Xylocaine known for its antispasmodic effect along with Saline were used to keep the field moist.

Elevation of a Musculocutaneous Flap

In the initial surgeries, all the muscle fibers were dissected off the perforator, coagulating the branches, but later, to lessen the time of dissection, a portion of the vastus lateralis muscle cuff was included around the perforator.

The vascular pedicle is carefully dissected from the femoral nerve branches to the vastus lateralis which lie lateral to the vessels.

Once vessel is dissected to its origin, the flap was incised on all the sides up to deep fascia and the pedicle was elevated including the perforator. Dilator solutions were sprayed on the perforator and the donor vessel.

Donor-Site Management

Defects less than 6 to 9cm in width were closed primarily. Large defects required skin grafting.

Dissection technique:

Flap harvest, dissection of the recipient and donor vessels was done using 4 x Carl- Zeiss loops⁴ and microsurgical instruments⁵ taking care that the pedicle reaches the recipient vessels without tension. Precaution was taken to avoid twist of the vascular pedicle.

Preparation of the vessels of the donor area and the recipient vessels and anastomosis were done under Operative microscope (Mohlerweidel)⁶.

Anticoagulant therapy consisted of heparin⁷ at a dosage of 60-70 mg / kg, administered intra-operatively just before the arterial clamps were released.

Patency of the anastomosis was tested, using either "Uplift test" or "Empty and refill test". Post-operative monitoring of the flap was done by the resident, through either clinical observation, testing the skin temperature⁸, pin-prick test, flap stabbing with #11 surgical blade or a combination of the above. Flaps were monitored hourly for the first 48 hours, then every 2 hours for the next 48 hours, then every

4 hours for the next 48 hours. The rest of the staff was available for any re-exploration if needed.

During the early part of the series, low-molecular-weight dextran⁹ (dextran 40) was given postoperatively for five days, but now Aspirin¹⁰ at a dose of 2.5-3 mg/kg is administered for five days.

If vascular thrombosis or extensive clot was noted in the lumen, systemic heparin was administered, thrombectomy and thrombolysis were performed. The anastomotic site was excised and re anastomosis done.

Results

SEX DISTRIBUTION: Table 1

Males were 84 % and females amounted to 26 %

AGE DISTRIBUTION – Table 2

The age group ranged from 7 to 65 years. Commonest age group involved was 26-30 years and amounted to 24%. The youngest patient was 8 years old.

ETIOLOGY: - Table 3

Trauma constituted the commonest indication of the flap and it was 76%. Congenital anomaly and malignancy were at 4% each.

ANATOMICAL DISTRIBUTION: – Table 4

Foot defects were given the flap cover in 52% of the patients. Flap was used for leg in 20%, both leg and foot in 12%, head and neck in 8%, and genitalia in 8%.

DONOR THIGH:–Table 5

The Flap in the majority was harvested from the left Thigh

PERFORATOR LOCATION: - graph 1 In 80% of the cases, it was in the lower and outer quadrant of the circle drawn with 3 cm radius from the midpoint of the imaginary line joining the anterosuperior iliac spine to the superolateral pole of Patella. . It was seen in other three quadrants in 12 %. It was seen outside the circle in 8% of the patients.

LOCATION OF THE PERFORATOR AND THE CORRELATION WITH DOPPLER:-graph:-2

The Doppler located the perforator in the lower and outer quadrants of the circle around the midpoint of the imaginary line between anterosuperior iliac spine and the superolateral pole of the Patella, and the perforator on dissection correlated with the Doppler finding in 68% of those cases.

NUMBER OF PERFORATORS FOR EACH FLAP:-Table 6

In 72% of the patients, there was a single perforator, and the rest, had two perforators.

TYPE OF PERFORATORS: - graph 3

64% of the patients had Musculocutaneous perforator and the rest had Septocutaneous perforator.

TYPE OF FLAP HARVEST:-Table 7

Flap was harvested as a Facio-cutaneous perforator flap in 60 % of the patients, and in 32% of the patients, it was with inclusion of a cuff of vastus lateralis muscle. Tensor fascia lata was done in 4% of the cases. Thinning of the flap was done in 8% of the patients.

PEDICLE LENGTH: - graph 4.

It was 8 cm in 41% of the patients, 7.5cm in 27%. Shortest was 6cm in 8%.

RECIPIENT VESSEL:-Table 8

Anterior Tibial vessels were used in 60% of the patients, facial vessels in 12% and Posterior tibial vessels in 7%.

PEDICLED VS FREE FLAPS: - The flap was used as a pedicled flap in 12% of the patients and the indications were for the reconstruction of Penis in two patients and for exposed femoral vessels in the groin in one.

In the rest of the patients, the flap was used as a free flap with microvascular anastomosis.

COMPLICATIONS OF DONOR SITE: - Table 9 Weakness of the quadriceps was noted in 20% of the patients, graft adhesions and unsatisfactory scar in 12 % each, Infection in 8%, while Seroma formed in 4%.

RE-EXPLORATION:- Table 10 The re-exploration was done in 48% of the patients for reasons which included venous thrombosis in 20%, arterial thrombosis in 8%, bleeding from drain site, bleeding from minor vessels, twisting of pedicle, cross anastomosis in 4 % each.

The flap salvage rate was 90 percent, after re-exploration. 90% of the flaps survived in this series.

DISCUSSION

In large compound skin defects, instead of staged pedicled flaps, Anterolateral thigh flap has gained popularity for use either as pedicled or free flap, as it offers a large amount of skin on a reliable perforator with a concealable grafted skin on the donor thigh.

In our study, majority of the flap recipients were males, were in the age group between 26 and 30 years, and the defects were post traumatic foot and leg defects.

The flap in most cases was harvested from the left thigh, as the right thigh was injured, in the accidents with the vehicles coming from the opposite direction.

Majority had single perforator, in the lower and outer quadrant of the circle drawn with 3 cm radius from the midpoint of the imaginary line between anterior superior iliac spine and the supero-lateral pole of the Patella, its location correlated with the marking done by the hand held Doppler.

In the majority, the perforator was musculocutaneous, the flap was harvested as Faciocutaneous, and in a few it was harvested along with a cuff of vastus lateralis muscle.

The flap can be harvested along with fascia lata strip¹¹ and it used in one patient, to get Oral continence, for deficit of Orbicularis oris muscle which resulted after resection of the tumor.

Large skin with dimensions up to 15 X 11 cm with the option of thinning has enabled it to be folded upon itself to reconstruct two layers, to do phalloplasty^{12,13} and urethroplasty in patients with near total loss of the penis following electrocution and traumatic amputation respectively. Initially lengthening of the penile stump was done to get a stump length of 4.5 cm by dividing the suspensory ligaments, advancing the corporal body and covering the defect with skin graft. The dimension of the reconstructed penis was 9 cm.

Long pedicle up to 8 cm has enabled us to use it in a patient after total Parotidectomy for post electrical burn Parotid fistula with exposed Mandible¹⁴.

The inclusion of viable muscle cuff¹⁵ along with the flap has enabled us to use it for vascularization of the bone, in a patient with post electrical burn middle third leg defect with exposed tibia.

The highly variable nature of this artery hindered the flap's popularity for more than a decade after the initial description by Song et al. Kimata et al. Classification of branching patterns of the lateral circumflex femoral system has since proved reliable and helpful, aiding surgeons in the dissection. The lateral circumflex femoral artery arises from the Profunda femoris either as a common trunk or as separate ascending, transverse, and descending branches. Occasionally, one of these branches may arise directly from the femoral artery.

One of the causes of flap failure was the twisting of the pedicle¹⁶ This complication can be prevented by including a small muscle or fascia cuff at the entrance of the skin vessels to the flap, by paying attention during the inset of the flap or by inclusion of more than one perforator.

In almost all cases the donor area¹⁷ was grafted with Split thickness skin graft.

Flap loss was seen in 12% of the patients, 4% had small and thin perforator and in 8%, infection was present.

The mean follow up was only three months as most of patients did not come beyond that period. In 12% of the patients, the mean follow up was up to one year. The overall success rate was 88%.

The flap was used as a pedicled flap in 12 % of the cases, for the reconstruction of penis and on the groin. The rest of the cases mandated it to be used as a free flap.

The anterolateral thigh flap has rapidly gained popularity in recent years.

CONCLUSION

The ratio of males to female in whom the flap was done was 3.2:1

Traumatic defects were the commonest indication for the flap and amongst them the foot defects predominated.

Right thigh was used as a donor in 60% of cases.

In 80 % the perforator was located in lower and outer quadrant

Hand held Doppler was able to identify the perforators with accuracy in 68% of the cases.

Majority were harvested on single perforator and most of them were musculocutaneous.

The longest pedicle was 8.5cm and the shortest was 6cm. The pedicle length in most cases was 7.5cm.

The largest dimension of the flap was 25 x 12cm and the smallest was 8 x 7cm.

Most of flaps were harvested as faciocutaneous flaps and a few were with muscle cuff.

Most of donor sites were skin grafted.

There were only minor donor complications.

Success in our study was approximately 88 %.

Finally antero lateral thigh flap with its long pedicle though has variable perforator can be used to cover compound defects from head to toe .It is used both as pedicled and free flap. Hard work, team work, patience and perseverance is needed and is feasible even in public sector hospitals.

Acknowledgement:

I thank Dr. Mohana Krishna,Dr. P. Siril Satyanandam, retired Professors and former heads of the Department of Burns and Plastic Surgery at Gandhi Hospital, Dr.N.Nagaprasad, present Professor and head of the Department of Plastic Surgery, Osmania General Hospital, Dr. E. Mahender, tutor in Plastic surgery at Gandhi Hospital, Dr. Chandralekha, Postgraduate in the department of Plastic Surgery at Gandhi Hospital who have helped me during the study by allowing me to observe the findings in the patients admitted under them and operated in their units.

Table one:-. Genderdistribution

Sex	Number of cases	Percentage
Male	21	84
Female	4	16

Table two: - Age wise distributions:-

Age	Number of patients	Percentage
0 - 5	0	0
6 - 10	2	8
11 -15	2	8
16 - 20	2	8
21 - 25	4	16
26 – 30	6	24
31 – 35	1	4
36 – 40	3	12
41 - 45	3	12
>45	1	4

Table Three: - Etiology

Cause	Number of cases	Percentage
Congenital	1	4
Post Traumatic	19	76
Post Burn	4	16
Malignant	1	4

Table four:-Anatomical site

Anatomical site	No: of cases	Percentage
Head and neck	2	8
Genitourinary	1	4
Leg	6	24
Foot	13	52
Both leg and foot	3	12

Donor Thigh: – Table five

Donor thigh	Number of cases	Percentage
Right	10	40
Left	15	60

Number of perforators for flap; - table six

Number of perforator for each flap	Number of cases	Percentage
Single	18	72
Double	6	24

Type of flap harvest: - table seven

Type of flap harvest	No: of cases	percentage
Alt perforator flap	13	60
Alt with vascularized tensor fascia	1	4
Alt myocutaneous flap with vastus lateralis cuff	7	32
Thinning of Alt	1	4

Table eight: - RECIPIENT VESSEL

Recipient vessel	No cases	Percentage
Anterior tibial	13	60
Posterior tibial	5	22
Facial vessels	3	14
Dorsalis pedis	1	4

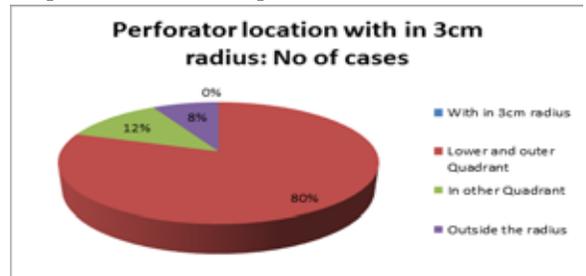
Donor Complications: table 9

complication	Number of cases	Percentage
infection	2	8
Seroma	1	4
Weakness of quadriceps	5	20
Contour deformity	2	8
Graft adhesions	3	12
Unsatisfactory scar appearance	3	12

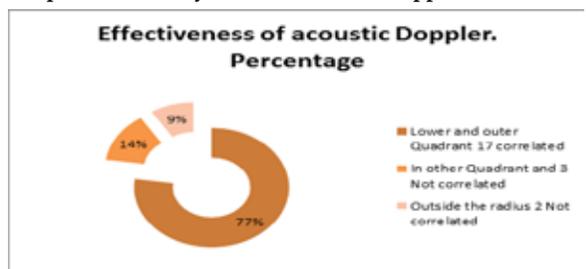
Re-exploration: table 10

Findings on reexploration	Number of cases	Percentage
Venous thrombosis	5	20
Arterial thrombosis	2	8
Bleeding from drain site	1	4
Bleeding from minor branch vessel	1	4
Twisting of pedicle	1	4
Cross anastomosis	1	4
Skin perforator thrombosis	1	4

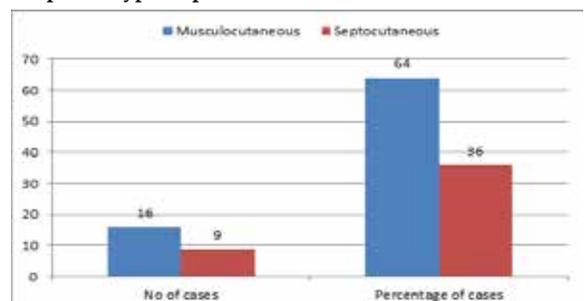
Graph:-1 Location of the perforator



Graph:-2 Reliability of the hand held Doppler



Graph: -3 Type of perforators



Graph:-4 Pedicle length

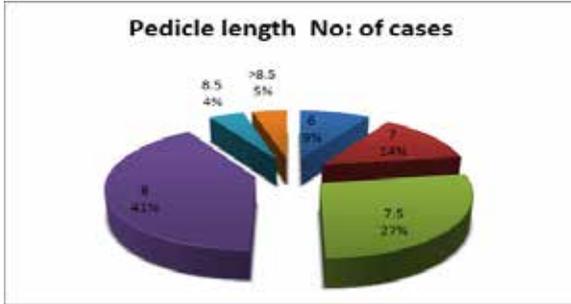


Figure :1 marking of the alt flap

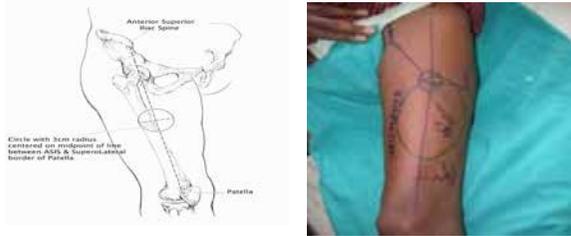


Figure 2:- . Verrucous Carcinoma of lower Lip



Growth over lower lip Two weeks after flap inset

Figure :-3 PEB defect of Rt. Cheek



PEB defect of Rt. Cheek with exposed mandible Flap after 3 months

Figure :- 4



Lower third defect in the leg 5 days after flap cover

Figure:-5 Heel pad defect



Heel pad defect preoperative Post operative flap cover

Figure:- 6 Penis reconstruction



The Penile stump – 2.5 cm after Electro trauma
Post operative appearance of Neo-Phallus

Figure :- 7 POST ELECTRICAL BURN CONTRACTURE



POST BURN CONTRACTURE OF DORSUM OF FOOT
2 WEEKS AFTER FLAP COVER

References

1. Song YG, Chen GZ, Song YL: The free thigh flap: a new free flap concept based on the septocutaneous artery. Br J Plast Surg 37:149, 1984.
2. Ohta I et al: Topical use of Xylocaine for relieving vasospasm: effect of concentration. J Reconstr Microsurgery 7:205, 1991.
3. Arterial anatomy of skin flaps: George C. Cormack and B.GeorgeH. Lamberty.2nd edition: Chap 7;366-67.
4. Shenaq SM, Klebuc MJA, VargoD; Free – tissue transfer with the aid of loupe magnification; experience with 251 procedures .Plas Reconstr Surg 95:261,1995.
5. Acland RD : Instrumentation for microsurgery.Orthop Clin North Am 8:281,1977.
6. HoerenzP: The operating microscope II. Accessories J. Microsurg2:22,1985.
7. Ritter, E. F., Cronan, J. C., Rudner, A. M., Serafin, D., and Klitzman, B. Improved microsurgical anastomotic patency with low molecular weight heparin. J. Reconstr. Microsurgery. 14:331, 1998.
8. Neligan, P. C. Monitoring techniques for the detection flow failure in the postoperative period. Microsurgery 14: 162,
9. Sun, T. B., Chien, S. H., Lee, J., et al. Is dextran infusion as an anti-thrombotic agent necessary in microvascular reconstruction of the upper aero digestive tract? J. Reconstr. Microsurg.19: 463, 2003.
10. Peter, F. W., Franken, R. J., and Wang, W. Z. Effect of low dose aspirin on thrombus formation at arterial and venous micro anastomoses and on the tissue microcirculation. Plast.Reconstr. Surg. 99: 1112, 1997.
11. Yildirim, Serkan MD; Taylan, Gaye MD; Akoz, Tayfun MD. Use of Fascia Component of the Anterolateral Thigh Flap for Different Reconstructive Purposes. Annals of Plastic Surgery. 55(5):479-484, November 2005.
12. Zhe Y, Yangqun L, Yong T, Muxin Z, Wen C, Ning M, Weixin W.The

- pedicledanterolateral thigh flap for penile reconstruction Zhonghua Zheng Xing Wai KeZaZhi. 2015 Nov;31(6):406-10.
13. Morrison SD1, Son J, Song J, Berger A, Kirby J, Ahdoot M, Lee GK.Modification of the tube-in-tube pedicled anterolateral thigh flap for total phalloplasty: the mushroom flap. *Ann Plast Surg.* 2014 May;72 Suppl 1:S22-6.
 14. Demirkan, Ferit M.D. 1; Unal, Sakir M.D. 1; Arslan, Emrah M.D. 1; Gurbuz, Onur M.D.Versatile Anterolateral Thigh Perforator Flap: Case of Tailored Reconstruction for a Large Temporal and Parotidectomy Defect. *Journal of Reconstructive Microsurgery.* 19(4):221-224, 2003.
 15. Chin-Ho Wong, MBBS, MRCS, MMed, Huang-Kai Kao, et al, A Cautionary Point in the Harvest of the Anterolateral Thigh Myocutaneous Flap, *Annals of Plastic Surgery* Volume 62, Number 6, June 2009.
 16. . Celik, Naci M.D.; Wei, Fu-chan M.D.et al, Technique and Strategy in Anterolateral Thigh Perforator Flap Surgery, Based on an Analysis of 15 Complete and Partial Failures in 439 Cases. *Plastic and Reconstructive Surgery*:Volume 109(7)June 2002pp 2211-2216
 17. . Lipa, Joan E. M.D., M.Sc., FRCS(C) 1; Novak, Christine B. P.T., M.Sc. 1; Binhammer, Paul A. M.D., FRCS(C) 2 Patient-Reported Donor-Site Morbidity Following Anterolateral Thigh Free Flaps. *Journal of Reconstructive Microsurgery.* 21(6):365-370, August 2005.
 18. *Urol. Clin. North Am.*21: 487, 1994. Free Flap Reexploration: Indications, Treatment, and Outcomes in 1193 Free Flaps.