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PEDICLED THORACOUMBILICAL FLAP FOR FOREARM AND ELBOW DEFECTS

Plastic Surgery

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ABSTRACT

AIM : Upper limb injuries are invariably associated with significant soft tissue loss, often requiring flap cover. For forearm and elbow defects reconstructive options should ensure coverage of larger defects and be less cumbersome for the patient. In this study, the aim is to study the application of pedicled thoracoumbilical flap for forearm and elbow defects and its outcome.

MATERIALS AND METHODS : Between June 2015 and June 2018, 20 cases of pedicled thoracoumbilical flaps were performed. All patients were males. Age group ranged from 6 years to 56 years. Defect size varied from 20 sq cms to 350 sq cms. Paraumbilical perforators from the deep inferior epigastric vessels supplies the skin island of the flap. All patients underwent flap division and inset at 3 weeks. Followup period ranges from 4 months to 3 years.

RESULTS : All flaps survived completely, except one which had marginal necrosis and managed with split skin grafting. Donor site was closed primarily in 8 patients and with split skin grafting in 4 patients. All donor sites healed well. Scar assessment was done with observer and patient scale, being on an average of 24 and 20.5 respectively.

CONCLUSION : The thoracoumbilical flap is a safe and a reliable option for large and complex defects of forearm and elbow. It has the capacity to transfer a large amount of tissue, allowing the damaged limb, during the attached period, to be elevated and hence minimises edema and congestion and also to receive physiotherapy. Although the working portion of the flap uses the thin, hairless skin over the lateral ribs, the base of the flap is thick and difficult to tube in all but the thinnest of individuals. The donor scar is much more conspicuous than that of a groin flap. This procedure can be done, even in centres where microsurgical facilities or expertise is less and can become workhorse flap for proximal forearm and elbow defects.

KEYWORDS

Forearm And Elbow Soft Tissue Defects; Thoraco-umbilical Flap; Periumbilical Perforators; Deep Inferior Epigastric Artery

INTRODUCTION

Forearm and elbow injuries always remain a challenge for reconstruction. Many times they require flap cover from a distant region. Pedicled distant flaps still have a place in the soft tissue reconstruction of the elbow and forearm, even in the present era of micro surgery.

In the years gone by, the abdominal skin was used based on random blood supply, and the flap size was restricted by the length to breadth ratio. The description of the axial groin flap revolutionized the management of hand injuries [1] and has remained a workhorse for management of hand injuries. However, this flap has some limitations; mainly the dependent position of the limb that leads to flap oedema. The groin flap may be insufficient if elbow and large areas of adjacent forearm need to be covered. The coverage of elbow defects with this flap can be quite cumbersome for the patient. Hence a flap that had consistent anatomy, providing cover to elbow and forearm defects, which was easier to harvest and with less postoperative oedema was looked upon.

Taylor and Boyd[2] in 1975 described the vascular territory of the deep inferior epigastric artery and suggested the use of the flap based upon these vessels. As the predominant vascular connections were oriented upward and laterally, they suggested that a thoracoumbilical axis of the flap is the most suitable.[3] The flap has been used as both pedicled and free flap under varied clinical situations. It has been used for upper limb and groin reconstruction as a pedicled flap.[4-13] Although a simple and versatile flap, it has been relegated to the category of 'second choice flaps' as there have been only a few reports in the literature regarding its usefulness in clinical setting.[10,13] This paper describes our experience with pedicled thoraco-umbilical flap for elbow and forearm defects.

MATERIAL AND METHODS

This flap has been used in 20 patients. The demographic details are given in Table 1. The defect size varied from 20 cm2 to 350 cm2 [Table 1]. All patients remained under clinical observation for a minimum period of 3 weeks. Immediate and early complications including flap loss, marginal necrosis, infection, dehiscence, etc were noted. Patients were also assessed at 3-month follow up visit when delayed complications such as complications of immobilization e.g. stiffness, pressure ulcers etc. were noted. Donor site complications were also recorded including donor site infection, dehiscence, unsightly scar and donor site hernia. At 3-month follow up visit, donor site scar was assessed using patient and observer scar assessment scale.

Vascular Anatomy of the Flap

The vascular anatomy of the paraumbilical region is well known.[3-10] The skin island of the thoraco-umbilical flap is supplied by paraumbilical perforators from the deep inferior epigastic vessels. The largest perforator is located at approximately 2 cm from the umbilicus, and directs toward the inferior angle of the scapula, anastomoses with the posterior intercostal artery and angulates 45° with the midline.[10] In a recent microdissection study, El- Mrakby et al.[11] investigated the course of paraumbilical perforator vessels. They followed the course of the musculocutaneous perforator vessels in the deep subcutaneous fat and then superficial to the Scarpa fascia until their final destination. It was demonstrated that superficial to the Scarpa fascia, the direct perforators turn to take a course parallel to the skin, where they started to divide for forming subdermal plexus. These perforators were also found to be anastomosing with the superficial vessels in the abdominal wall.

Operative Technique

Procedures were done under either general anaesthesia or spinal anaesthesia and supraclavicular block. A sand bag is placed under the lower ribs on the same side. The axis of the flap is marked as a line extending superiorly and laterally from the umbilicus to the tip of the scapula [Figure 1]. The mid and posterior axillary lines are marked. Pinching the skin assesses the elasticity of the skin and hence the width of the flap. The flap is raised from distal (lateral) to proximal (medial). It is elevated just superficial to the underlying musculature, to include not only the subdermal plexus but also the less important vessels within the fat and the flimsy fascia overlying the abdominal muscles. The dissection ceases about 2-3 cm medial to the lateral border of the rectus muscle or at any point of time if the flap is found to be adequate in length [Figure 2]. However, if more length of the flap is required, then the dissection continues medially, the rectus muscle is divided and the flap is thus based on the inferior epigastric artery only. The surrounding tissues are undermined and the donor site is closed primarily. The arm is immobilized on the patient's side with the help of adhesives and a pillow is placed beneath the elbow [Figure 3]. The flap division and final inset are performed 3 weeks later. The planning and execution of the flaps are shown in figures 5 and 6.

RESULTS

This flap was done in 20 patients. All patients were males. The age group was 6-56 years. Aetiology of injury included vehicular accidents in 12 patients, industrial accidents in 6 patients and electrical burns in 2 patients. The flap was elevated till the mid-axillary line in 18 patients. In 2 patients, it was raised till the posterior axillary line [Table 2]. The location of the defect included forearm and the elbow region [Figure 4].

During initial post-operative, assessment wound cover was found to be satisfactory in all cases. Marginal necrosis in one case, which was managed with flap advancement. Recipient site was closed primarily in 16 cases and with ssg in 4 cases.

Joint stiffness occurred in all cases but resolved with post-operative physiotherapy. Abdominal wall hernia was not seen in any patient.

The flap was technically easy to execute at every step - identification of its anatomical landmarks, identification of the sub-fascial plane and draping the contours of the injured upper limb. The flap was not bulky in most of the patients. Fortunately, all patients were male labourers and were quite skinny.

Scar assessment was done at a follow-up period of 3 months using the observer scar assessment scale (Table 3).

On observer scale, the total score ranged from 21 to 35, with average being 24. On patient scar assessment, the average score was 20.5 (range 16-32).

DISCUSSION

An axial flap is one containing a known vessel oriented along the axis of the flap. When the skin is supplied by vessels radiating from a single source rather than by an even distribution of direct musculocutaneous perforators, then a degree of 'axiality' is imparted to any flap containing such a radiating vessel in its long axis.[12]

The basis for the thoraco-umbilical flap is the radiating nature of the dominant periumbilical perforators originating from the deep inferior epigastric artery. It would seem logical that if a flap was designed with its base in the umbilical region and its axis orientated along the major interconnections with the intercostal system, it would behave as an axial flap, allowing an advantageous length-to-breadth ratio and would provide the means of covering soft tissue defects in the upper extremity.

The thoraco-umbilical flap was first described by Taylor and Boyd.[4] They deduced that a large flap could be designed in many directions along axes that radiate from the umbilicus. The best flap appeared to be one planned along the axis between the umbilicus and the inferior angle of the scapula, running parallel to the ribs. By including a disc of anterior rectus sheath together with underlying muscle, the para umbilical perforators could be preserved. Dissection of the vascular pedicle toward the groin, with or without the rectus muscle, permitted the skin flap to rotate through a wide arc. In 1984, Taylor et al.[5] described their clinical experience with 18 patients treated with various combinations of deep inferior epigastric (thoraco-umbilical) flap. There were 20 male patients in our study. This is in contrast with the previous study by Yilmaz et al.[13] wherein majority of the patients were females (72.7%). We believe that there are only males in our study is because of the fact that males are more exposed to the upper limb trauma in our scenario. The operative technique is easily learned with well-defined anatomical landmarks and requires average skill for raising the flap.

It is simple, speedy and safe. All the flaps had a large length to breadth ratio, and all were elevated at least to the mid-axillary line. Out of the 2 patients whose flaps were elevated till posterior axillary line, 1 had marginal necrosis involving the distal portions.

This flap is in fact a 'perforator plus' flap and the base of the flap contains perforators from the deep inferior epigastric artery that are centered around the periumbilical region. The distal part of the flap is from the thin and pliable thoracic skin and appears extremely suitable for coverage of upper-limb defects. The proximal part of the flap is rather bulky but tends to settle with time after final inset in most of the patients. We incorporate the subcutaneous fat and fascia to ensure that the vessels are included. Post-operatively, upper limb with the attached flap could be maintained at a reasonably elevated level and did not require strict positioning. The arm rests in a comfortable natural position. It also helps in preventing oedema and facilitates physiotherapy. Patients can also wear their clothes comfortably as compared to the groin flap.

In our study, 95% of the flaps were successful and were able to cover the intended areas. Because the pedicle of the flap could neither be tubed nor grafted, discharge from this site was common.

Out of 2 flaps that were elevated beyond mid-axillary line, 1 developed marginal necrosis and partial flap dehiscence. This was readvanced and was able to provide stable coverage.The first harvest acted as a delay and we were able to recruit the adjoining angiosomes by delay.

The donor site closure was not difficult and we were able to close the donor site primarily in 16 cases. Four patients required split skin grafting.

An unsightly scar has been suggested as the main drawback of this flap. In our study, however, none of the patients had any complaints about the scar.

On objective parameters, however, observers assessing the scar quality were more critical of it than the patients themselves. The observer assessment is similar to the ones reported earlier.[6,13] Patients were generally unwilling to undergo further surgical procedure for scar revision, as it could be well concealed in clothing.

The flap fares quite well as compared to the commonly used groin flap. The groin flap based on the superficial circumflex iliac artery is a very useful flap for hand defects, but it is difficult to use this flap for extensive forearm defects because of the inferior and uncomfortable position of the flap. Moreover, the dependant position of the hand harnessed in a groin flap makes it oedematous, and the post operative physiotherapy more cumbersome.

The narrow pedicled of the thoraco-umbilical flap enables a significant comfort for the patient in terms of upper-extremity movements. During the waiting period of 3 weeks for flap detachment, the hand and forearm are in a better physiologic condition than with the groin flap, and early mobilization of the hand is possible with the use of this flap.

CONCLUSION

The thoraco-umbilical flap is a very useful flap for the coverage of upper-limb defects. A fairly large flap can be harvested and the donor site can be closed primarily in majority of the patients. There is no need to isolate the vascular pedicle, and the dissection is quick and systematic. The flap remains in an elevated position postoperatively and there is minimal oedema and congestion. Although the donor site scar is not concealed as in groin flap, majority of our patients accepted the donor scar because our traditional dresses conceal it anyway. This flap can become our workhorse for upper extremity defects, especially in an emergency setting, where defect size is large and/or emergency free flap is not feasible. It can be raised with ease and speed, and is a reliable flap.

TABLES TABLE 1: Defect Size And Demographic Details

AGE		SEX		DEFECT SIZE		
<40 YRS	>40 YRS	MALE	FEMALE	<100cm^2	101-300	>300cm^2
16	4	20	0	8	10	2

TABLE 2: Flap Extent

FLAP SIZE	EXTENT	NUMBER
<100 cm^2	Ant. Axillary line	8
100-300 cm^2	Mid axillary line	10
>300 cm^2	Post axillary line	2

TABLE 3: Scar Assessment

CRITERIA	SCORE
Is the colour of scar different?	4.1
Is the thickness of scar different?	4.4
Is the scar more stiff?	4.2
Is the scar irregular?	5.7
TOTAL SCORE	18.2

FIGURES

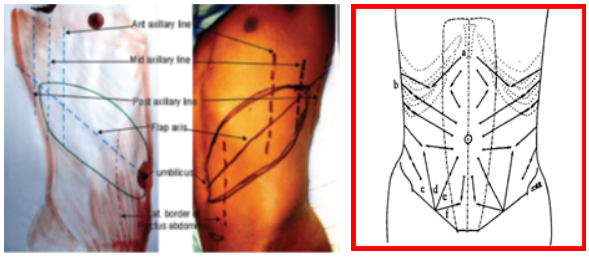

FIGURE 1 : Flap Axis

FIGURE 2: Vascular Pattern And Flap Limit

FIGURE 3: Immobilisation

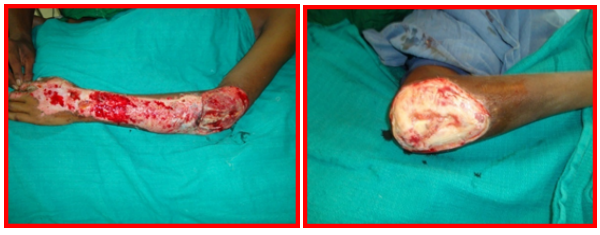

FIGURE 4: Defects

FIGURE 5: Case 1

REFERENCES

1. McGregor IA, Jackson IT. The groin flap. Br J Plast Surg 1972;25:3-16.
2. Taylor GI, Daniel RK. The anatomy of several free flap donor sites. Plast Reconstr Surg 1975;56:243-53.
3. Boyd JB, Taylor GI, Corlett R. The vascular territories of the superior epigastric and deep inferior epigastric system. Plast Reconstr Surg 1984;73:1-14.
4. Taylor GI, Corlett R, Boyd JB. The extended deep inferior epigastric flap: A clinical technique. Plast Reconstr Surg 1983;72:751-64.
5. Taylor GI, Corlett RJ, Boyd JB. The versatile deep inferior epigastric flap. Br J Plast Surg 1984;37:330-50.
6. Boyd JB, Mackinnon SE. An evaluation of pedicled thoraco umbilical flap in upper extremity reconstruction. Ann Plast Surg 1989;22:236-42.
7. Fan QS. The anatomy and application of the thoracoumbilical flap. Chin J Microsurg 1987;10:129-32.
8. Fan QS. The thoraco-umbilical flap for a large skin defect on hand and forearm. Chin J Hand Surg 1992;8:21-4.
9. Fan QS. The anatomy and application of the thoracoumbilical flap. Chin J Microsurg 1987;10:129-32.
10. Zhang XQ, Wang SD, Fan QY, Mao BA, Zhou Y, Zhang MH. Thoracoumbilical flap: experience with 33 flaps. J Reconstr Microsurg 2004;20:133-7.
11. El-Mrakby HH, Milner RH. The suprafascial course of the direct paraumbilical perforators vessels. Plast Reconstr Surg 2002;109:1766-8.
12. Cormack GC, Lamberty BG. Cadaver studies of correlation between vessel size and anatomical territory of cutaneous
13. Yilmaz S, Saydam M, Seven E, Ercocen AR. Paraumbilical perforator-based pedicled abdominal flap for extensive softtissue deficiencies of the forearm and hand. Ann Plast Surg 2005;54:365-8.
14. Rensis L. A Technique for the Measurement of Attitudes. Archives of Psychology 1932;140:1-55.