



Original Article

A Study on the use of Abdominal Flaps to Reconstruct Upper Limb Defects

Authors

Dr Rohit Munot, Dr Maksud Devale*, Dr Amarnath Munoli

Dept of Plastic Surgery, LTMG Hospital, Sion, Mumbai-22, India

*Corresponding Author

Dr Maksud Devale

Additional Professor, Dept of Plastic Surgery, LTMG Hospital Sion, Mumbai-22., India

P:-9833288913/ 02224043141, Email: maksuddevale@yahoo.co.in

Introduction

Upper limb injury is one of the most common forms of trauma presenting to any major tertiary care center. These patients usually young and are in their productive years of life. Appropriate and long lasting cover is most important factor for recovery and functional rehabilitation of injured upper limbs¹ Despite an increasing number of free flaps being used for reconstruction, abdominal flaps still have maintained their place and are commonly employed for reconstruction of these defects. Various abdominal flaps which are used for reconstruction of upper limb defects include groin flap, paraumbilical perforator flap, hypogastric flap, SEPA flap, or combination of above flaps. This study attempts to emphasis varsatality of various abdominal flaps performed. for reconstruction of upper limb defects of various sizes and shapes. This study discusses indications, planning and outcomes of these flaps peformed at our institute. We would also like to highlight secondary surgeries performed after abdominal flaps.

Material and Methods

A retrospective study of 55 patients who underwent an abdominal flap surgery for reconstruction of upper limb defects was conducted from August 2016 to July 2018 after obtaining well informed written consent. Data regarding age, sex, cause and characteristics of the defect, type of abdominal flap done, complications, secondary surgeries undertaken was collected and evaluated. All patients were followed up for a minimum period of 6 months. Patients whose demographic data were not available or did not follow up were excluded.

Results

We have evaluated results under various demographic and clinical parameters. 78% of our patients were male. Mean age was 27 yrs with youngest patient was 3 yrs. Dominant upper limb was most commonly involved in 70% patients. Most common cause of defect over upper limb in our series was road trauma or railway trauma (69%). There were other causes which include defects after surgical release of post burn hand

deformities, acute hand burn, post infective defects.

Sex

Male	Female
43(78.1%)	12 (11.9%)

Age

Youngest	Oldest	Mean
3	70	27.05

Involvement of dominant upper limb

Dominant upper limb involved	Number	Percentage
yes	39	70.9
no	16	29.1

We usually undertake reconstruction of upper limb defects secondarily after one setting of debridement. Only 8 about of 55 cases we had done flaps primarily after trauma. Paraumbilical perforator and groin flaps are our workhorse flap for upper limb reconstruction. An abdominal pouch procedure was done in 2 patients one having degloving injury of the entire hand and circumferential degloving of the right middle finger in the other. This procedure is useful for defects which require large amount of skin for circumferential defects. Hand is the most common area injured in our series followed by fingers. We are able to close donor area primarily in 54% of patients. Remaining 25 patients required skin graft for donor area out of which nine patient required re-grafting.

Complications of abdominal flap surgeries faced in our series include partial or complete necrosis of flap, requirement for re-insetting of flap, donor site skin graft loss. Tendon reconstruction, flap syndactyly release and debulking of flap are most common secondary procedure performed after abdominal flap.

Brief Anatomy of abdominal flap

Paraumbilical flap is based on perforators which are arising from deep inferior epigastric artery and concentrated around umbilicus. This flap can be harvested with long horizontal or oblique axis extending upto posterior axillary line.². Main

disadvantage of flap is very conspicuous scar which does not look aesthetic.

Groin flap is based on the Superficial Circumflex Iliac Artery (SCIA) arising from the femoral artery around 2 cm below inguinal ligament or from common trunk along with the superficial inferior epigastric artery. Thin pliable flaps can be raised. Donor sites can be closed primarily and are hidden. Hypogastric flap is based on the Superficial Inferior Epigastric Artery (SIEA). The artery arises from the femoral artery just below the inguinal ligament and passes superficial to ligament within 2.5 cm of midinguinal point. It becomes superficial after piercing the Scarpa’s fascia.³

SEPA Flap is based on the Superficial External Pudental Artery (SEPA) arising from the femoral artery. The artery passes medially toward the pubic tubercle and ascends toward the umbilicus. The SEPA flap is designed along a line drawn from the umbilicus to the pubic tubercle.⁴



Fig1 Defects over dorsum of fingers



Fig 2 Louvre flap for multiple fingers



Defect over lower forearm



Marking of flap



Paraumbilical flap elevated



Well settled flap



Marking of a large abdominal flap based on all three vessels SCIA, SEIA, SEPA



Right forearm defect covered with flap



Degloved middle finger



Groin flap marked



Groin flap inset done



Groin flap settled



Defect over dorsum of left hand



Syndactylization of finger



Flap inset



Well settled hypogastric flap

Complications



Partial loss of paraumbilical flap

Secondary procedures



Syndactyly release

Discussion

Soft tissue reconstruction of the upper limbs remains a challenge and has come a long way since McGregor and Jackson described the pedicled groin flap in 1972⁶McGregor I, Jackson I. Skin defects may be covered by local, regional or distant flaps. Other than pedicled flaps, free flap is major option for reconstruction of these defects. There are some advantages of abdominal flap over free flaps as it does not require microvascular expertise and major infrastructure⁶ These procedure are relatively easy to perform against free microvascular tissue transfer so can be done in emergency set up. It does not require intensive post operative care. Abdominal flap is a workhorse flap for patient having major vascular injury as it doesn't require vessel for reconstruction. It can be used as a lifeboat for failed free flaps for upper limb defects.

These flaps are designed depending on the defect size and location. Upper limb defects usually require one sitting of debridement before definitive flap surgery. Abdominal flaps are planned in reverse, upper limb with defect is placed in position of comfort and adequate size of flap is marked by using cloth piece or other pliable material. Adequate length of pedicle of flap allows mobilization of the hand which allow better outcome of these injury. Narrowing of base of flap allows better inset of flap. Most of these flaps may require delay before division depending on extent of inset. All flaps in our series were divided after surgical delay at 18-21 days.

The versatility of abdominal flaps can be appreciated by their ability in covering any defect of the forearm and hand. Paraumbilical flaps are useful for coverage of defects on the volar aspect of the forearm, the hypogastric flaps for defects on the dorsum of the hand and forearm. Groin flaps are versatile flaps useful for defects over the fingers, hand and forearm. There are some disadvantages of pedicled abdominal flap like long hospital stay, stiffness of hand, bulk of the flap and inability to reconstruct injured underlying structures primarily. Some of these

difficulties can managed by thin flap with mobilization of fingers while flap in situ. The donor sites of all groin flaps were closed primarily. Out of 19 paraumbilical flaps 9 donor sites had to be grafted, while in hypogastric flaps the donor sites were grafted in 15 of 16 flaps. Primary closure of the donor site is preferred. Split thickness skin grafts (STSG), if placed, may undergo partial loss and may need re-grafting (36% in our series). Loss of STSG was observed in the larger flaps. This increases hospital stay duration and adds another procedure.

Complications: Partial loss of flap was the most common complication which was usually treated conservatively. Ten out of all 55 patients in our series developed partial necrosis which required re-setting of flap or grafting.

Secondary surgeries: Debulking of flap was the most common procedure done. A thinner flap is cosmetically more acceptable to the patient^{7,8}. Tendon reconstruction was done in 4 patients and subsequent follow ups showed good results in range of movements of the affected fingers.

Some representative clinical cases-

Louvre flaps (multiple Paraumbilical perforator flaps) for multiple small defects on dorsum of fingers.

Conclusion

In the current period of increasing microvascular surgeries, abdominal flaps still play a major role in reconstruction of upper limb defects. Proper choice of flap, refinement in technique and post-operative care result in successful outcomes, reduced complications and increased patient comfort.

If manuscript presented as part at a meeting:

Presented as E-Poster in APSICON 2018 Lucknow

Conflict of interest- None

References

1. Eberlin KR, Chang J, Curtin CM, et al. Soft-tissue coverage of the hand: a case-based approach. *Plast Reconstr Surg* 2014;133(1):91–101
2. Gutwein L, Merrell G, Knox K. Paraumbilical Perforator Flap for Soft Tissue Reconstruction of the Forearm. *The Journal of Hand Surgery*. 2015;40(3):586-592. 16.
3. Li YY, Wang JL, Lu Y, Huang J. Resurfacing deep wound of upper extremities with pedicled groin flaps. *Burns*. 2000;26:283–288.
4. Patil U, Dias A, Thatte R. The anatomical basis of the SEPA flap. *British Journal of Plastic Surgery*. 1987;40(4):342-347.
5. McGregor I, Jackson I. The groin flap. *British Journal of Plastic Surgery*. 1972;25:3-16
6. Sabapathy S, Bajantri B. Indications, Selection, and Use of Distant Pedicled Flap for Upper Limb Reconstruction. *Hand Clinics*. 2014;30(2):185-199..
7. Karthikeyan G, Krishnamoorthy R. Degloving injuries of the hand. *Indian Journal of Plastic Surgery*. 2011;44(2):227
8. Colson P, Houot R, Gongolphe M, et al. Use of thinned flaps (flap grafts) in reparative hand surgery. *Ann Chir Plast* 1967;12:298–310.