

ABDOMINAL FLAPS IN THE MANAGEMENT OF UPPER LIMB DEFECT- OUR EXPERIENCEAnil R¹, Avinash Prabhu², Niranjana Kumar³¹Assistant Professor, Department of Plastic Surgery, SDM College of Medical Sciences and Hospital, Sattur, Dharwad.²Associate Professor, Department of Plastic Surgery, SDM College of Medical Sciences and Hospital, Sattur, Dharwad.³Professor and HOD, Department of Plastic Surgery, SDM College of Medical Sciences and Hospital, Sattur, Dharwad.**ABSTRACT****BACKGROUND**

Soft tissue defects in upper limb are commonly seen as a sequel to trauma and burns, leading to exposure of important structures such as vessels, nerves, tendons and bone. These structures require primary cover at the earliest. Although, in the present era of microvascular reconstruction locoregional pedicled flaps are fading, abdominal flaps prove to be handy in reconstruction of upper limb soft tissue defects.

The aim of this retrospective descriptive study is to prove the versatility and simplicity of abdominal flap in reconstruction of upper limb defects.

MATERIALS AND METHODS

Our retrospective descriptive study involves 30 patients who had post-traumatic soft tissue defect and post-burn contractures in the upper limb. Detailed history was obtained, thorough clinical examination performed, necessary pre-operative investigations done and abdominal skin flap cover given.

RESULTS

All the patients selected in the study group underwent abdominal flap cover in a satisfactory way. Majority of the patients were discharged with no complications and a minor group of them with minimal complications.

CONCLUSION

Abdominal flap is a simple procedure, which can be practiced by most of the surgeons to cover even extensive defects of upper limb and thereby decreasing the morbidity of the patients. The operative technique is easily learned with no rigid anatomical landmarks to be followed strictly and requires average skill for raising the flap.

KEYWORDS

Abdominal Flap, Upper Limb Reconstruction.

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BACKGROUND

Soft tissue defects in the upper limb are commonly seen consequent to trauma and post-burns contracture release. These defects often result in the exposure of important structures such as vessels, nerves, tendons and bone and definitely require primary cover at the earliest in order to reduce the chances of infection, to reduce patient morbidity and to obtain a useful working upper limb. Considered options of reconstruction in managing soft tissue defects of upper limb are locoregional flaps, pedicled abdomen or groin flaps and free flaps. Locoregional flaps and pedicled groin flap is limited in its usage due to its small size, which is tough in covering large defects.

During the period of 1970s - 1980s pedicled flaps from abdomen and groin were the workhorses in upper limb reconstruction with huge series of publications sailing from across the world.¹⁻⁴

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Although, the chief indication for employing pedicled abdominal flap in upper limb reconstruction is lack of microsurgical expertise, these flaps have always an important place in centres with microsurgical expertise.⁵ This study which was performed in our centre is an example for later.

Abdominal flap is a cutaneous random pattern flap. In trauma involving the upper limb with extensive tissue loss, abdominal flap reconstruction proves to be a simple, easy and versatile distant flap that has taken a great place in the era of reconstructive surgery. The aim of this retrospective descriptive is to prove the versatility and simplicity of abdominal flap in reconstruction of upper limb trauma.

MATERIALS AND METHODS

This retrospective descriptive study includes 30 patients with post-traumatic soft tissue loss with fracture bones in a few cases involving the upper limbs who were treated at Department of Plastic Surgery, SDM College of Medical Sciences and Hospital over a period of 10 years from January 2004 till December 2013.

Details like age, sex, aetiology, site of the defect, dimensions of defects, exposure of the bone, tendon, wrist or elbow joint, fracture site and history of chronic illness if any were noted from patients' medical records (Table 1). All the patients underwent radiographs.

Culture and sensitivity was sent for appropriate cases. Injection Cefotaxime intravenous 12th hourly was started empirically and was continued or changed according to

culture and sensitivity report for 7 - 10 days. We analysed the flap outcome in the post-operative and the complications were noted. Patient's followup was between one to three years. In our study, patients with post-traumatic soft tissue defects of upper limb and post-burn contracture of upper limb were included. Patients with polytrauma were excluded.

Vascular Anatomy of Abdomen

In 1979, Huger described the cutaneous blood supply to the abdomen and this theory was supported by anatomical studies of Taylor. Huger's zone I is located medially and Zone II includes the lower lateral abdomen, which is supplied by the external iliac system comprising of the superficial inferior epigastric artery and the superficial and deep circumflex iliac arteries. Zone III is lateral, this is supplied by the intercostals and subcostal arteries.⁶ These three zones have a rich arcade of anastomosis and choke vessels (Figure 1).

The deep inferior epigastric artery (DIEA) is a branch of the external iliac artery. As the DIEA approaches the arcuate line, it divides into a medial and lateral branch. The medial and lateral branches of the DIEA give off perforating vessels to the fasciocutaneous tissue overlying the midabdomen. There are between four and seven perforators in a given individual, usually clustered in the periumbilical region.⁷

The superficial inferior epigastric artery (SIEA) is a branch of the proximal femoral artery arising 2 - 3 cm below the inguinal ligament. The vessel travels from its origin supero-laterally and pierces Scarpa's fascia 0.5 to 4 cm above the inguinal ligament midway between the ASIS and the pubic tubercle. It travels just superficial to the fascia as it branches medially and laterally to supply the lower hemi-abdominal skin.⁸



Figure 1. Vascular Anatomy of Anterior Abdominal Wall⁷

Flap Anatomy

Abdominal flap is a random pattern skin flap. Here abdominal skin and subcutaneous tissue is raised based on unnamed vessels. Random pattern flap is raised with 1: 1 length to breadth ratio. The flap is based on subdermal random blood supply, which are unnamed perforators of abdominal vasculature system (Figure 1).

Surgical Procedure

All patients were operated under GA. Cases were operated in supine position. The recipient site was debrided, edges were freshened. In case of chronic exposure of the bone, debridement was carried out until healthy bleeding from the bone noted. Dimension of the defects were measured. Planning in reverse performed. Random pattern abdominal skin flap was raised. This flap included skin and subcutaneous fat of the trunk. In setting of the flap with non-absorbable sutures with half buried mattress technique was performed prior to which secondary donor defect was either closed primarily or by SSG cover based on the size of the donor defect (Figure 2 - 7). Following the inset of the flap, operated limb was immobilised using elastoplast dressing so that abdominal flap is not under tension.

Flap was inspected on every post-operative day. We monitored the flap clinically based on skin colour, temperature, skin turgor and capillary refill. The pedicled flap was dressed after 3 days postoperatively. All the flaps were divided after 21 days under local anaesthesia (Figure 8). The first in setting sutures were removed and new sutures were taken at the site of divided flap (Figure 9). Active physiotherapy was initiated once the flap was divided and final inset given.

RESULTS

In our retrospective descriptive study with a sample size of 30 patients, age group of the patients varied from 18 years to 58 years. Maximum number of patients being in the age group between 20 - 30 years, forming 50% (n= 15) of total patients. Majority of the patients were males forming 76.6% (n= 23) of total patients and females formed the remaining 23.3% (n= 7). Most of our patients had traumatic aetiology, who constituted 70% (n= 21) of the group. Remaining 30% (n= 9) had post-burn contracture; 66.6% (n= 20) of our patients had soft tissue defect in the hand, whereas 26.6% (n= 8) of patients had defect in the forearm and 6.6% (n= 2) of patients had soft tissue defect in the arm. The size of defects ranged from a minimum of 5 x 7 and a maximum of 12 x 14 centimetres. There were no surgical complications in 93.3% (n= 28) of the patients. Two flaps had distal necrosis involving one-two centimetres that needed debridement and re-suture to the edge of the defect (Figure 12 and 13). Complication rate was found to be minimal. All patients presented in this series had early recovery after flap procedure. Early union of fracture segments due to coverage of viable tissue. The above-mentioned factors prove the versatility of the flap.

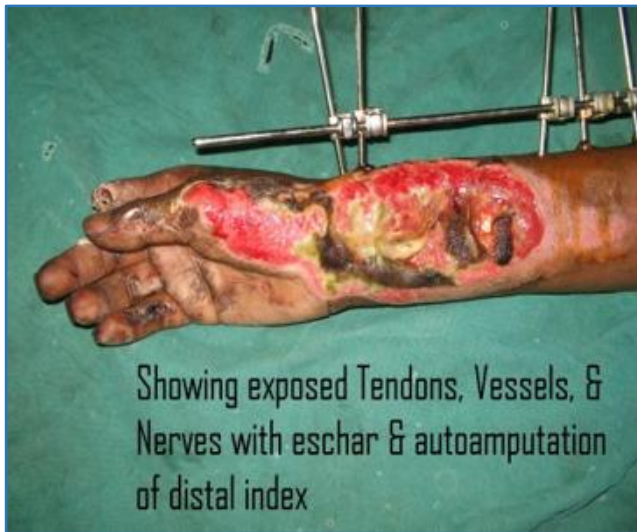


Figure 2. Post-traumatic Defect of Right Upper Extremity with Exposed Vital Structures. External Fixation done to Align Fractured Radius



Figure 5. Elevation of Superiorly based Abdominal Flap



Figure 3. The same Injured Right Upper Extremity following Debridement and the Bed is ready for Flap Cover



Figure 6. Inset of Abdominal Skin Flap



Figure 4. Planning in Reverse Performed



Figure 7. Closure of Donor Defect by Skin Graft



Figure 8. Division of Abdominal Flap on 21st Post-Operative Day



Figure 11. Post-Operative Followup



Figure 9. Final Inset of the Divided Abdominal Flap



Figure 12. Marginal Necrosis of the Flap



Figure 10. Post-Operative Followup



Figure 13. Necrosed Segment of Flap Debrided and Final Inset Given

Sl. No.	Age	Sex	Aetiology	Defect Site	Flap Dimensions (In cms)
1	22	M	RTA	Hand	6x7
2	31	M	RTA	Hand	8x8
3	35	M	Machinery injury	Forearm	12x14
4	18	F	RTA	Hand	8x7
5	22	M	RTA	Arm	5x7
6	19	M	PBC	Hand	10x9
7	20	M	RTA	Hand	8x6
8	43	M	RTA	Arm	6x6
9	19	F	RTA	Hand	9x8
10	24	M	RTA	Hand	10x6
11	27	M	PBC	Forearm	8x5
12	29	F	RTA	Forearm	5x7
13	30	M	RTA	Hand	10x12
14	26	M	Machinery injury	Hand	6x7
15	38	M	PBC	Hand	8x9
16	27	M	RTA	Forearm	10x12
17	58	M	RTA	Hand	6x7
18	29	F	PBC	Forearm	9x10
19	25	M	Machinery injury	Forearm	8x8
20	34	F	RTA	Hand	6x7
21	28	M	RTA	Hand	7x7
22	26	M	PBC	Forearm	9x8
23	24	F	PBC	Hand	10x9
24	49	M	RTA	Hand	10x10
25	19	M	Machinery injury	Forearm	9x10
26	28	F	PBC	Hand	8x10
27	36	M	RTA	Hand	7x9
28	41	M	PBC	Hand	9x12
29	22	M	PBC	Hand	5x7
30	21	M	PBC	Hand	6x7

Table 1

DISCUSSION

Soft tissue defects in upper limb often result in the exposure of vital structures. These defects should be covered as early as possible to prevent infection, to hasten the wound healing and to decrease patient's morbidity. Numerous techniques to reconstruct upper limb defects have previously been described which includes locoregional flaps,^{9,10} distant flaps^{1,11} and free tissue transfer.^{1,9,12-15} Each reconstructive option depends on the institution and is individualised to the patient and type of defect.¹⁶ Size of the defect, arc of rotation and amount of available surrounding tissue, which can be compromised in a severely traumatised limb are the serious limitations in considering locoregional flaps as reconstructive options. At present day scenario, free tissue transfer is considered gold standard in reconstructing large defects of upper limb. Microsurgical expertise and equipment are prerequisites for microsurgical free flap reconstruction and they might not be easily available. In addition, financial constraints of the patient, condition of donor vessels play a major role in decision making. Co-morbidities of patient can preclude prolonged anaesthesia time and the use of free flap transfer.

In these cases, pedicled distant flap reconstruction might very well offer a satisfactory option for upper extremity limb salvage. Conventionally, groin flaps¹ and abdominal flaps¹⁷ have been the most reliable distant pedicled flaps in extremity reconstruction. Pedicled groin flap is limited in its usage due to its small size, which is not easy in covering large defects. Vascularity of groin flap beyond anterior superior iliac spine is not assured and need for delay may arise on occasions. Soft tissue defects of proximal forearm, elbow and arm are not possible to reconstruct using groin flap.

Abdominal flap is a random pattern skin flap. Here, abdominal skin and subcutaneous tissue is raised based on unnamed vessels. In the year 1898, Biggs MD of Boston, described abdominal flap to reconstruct a contracted palmar burn scar of the left hand.¹⁸ Abdominal flap is a bulky and versatile skin flap. Vascularity of the flap is reliable when length-to-breadth ratio is maintained. Large soft tissue defects of upper limb can be easily covered by employing abdominal flap. This flap proves to be an effective life boat even in cases with failed microvascular surgery, which is employed in free tissue transfer. These flaps are easy to perform and are quickly done. Chances of complete necrosis of the flap are quite uncommon. This proves the versatility of the flap. Although, there are few disadvantages of pedicled abdominal flaps like discomfort of the patient, increased hospital stay, staged procedures and not possible to elevate the involved hand, still the advantages of performing abdominal flap outweigh the shortcomings.

In our study, most of the operated patients were males forming 76.6% of the total study group. This is in difference with previous studies done by Yilmaz et al,¹⁹ wherein majority of the patients were females which formed 72.7% of that respective study. Male preponderance in our study is because of the fact that males are more exposed to the upper limb trauma in our scenario. Trauma constituted the aetiological factor for majority of our cases, which involved 70% of the group. This is similar to other studies reported in the literature, where trauma was the aetiological factor in 70% - 90% of the cases.²⁰

Our complication rate was 6.6%. Out of 30 cases operated, 2 patients had marginal necrosis of the flap (Figure 12). One case was a case of Volkmann's ischaemic contracture of left forearm. In this case, more than 65% of the circumference of forearm was reconstructed by abdominal flap; 2 cms of skin and subcutaneous tissue was found necrosed on division of flap. Wound debridement was performed, necrosed tissue excised and re-inset was performed as additional procedure (Figure 13) and patient had no other issues. Other case was of severe post-burn contracture involving hand and wrist. Post-contracture release defect was reconstructed by pedicled abdominal flap; 1.5 cms of marginal necrosis was noted on division of flap. Case was similarly managed as mentioned above. Probable cause for partial necrosis of flap is poor compliance of the patient to maintain the upper limb postoperatively. Performing the abdominal flap procedure is a simple surgical manoeuvre, which requires less expertise which proves its simplicity.

Abdominal flap is a simple procedure, which can be practiced by most of the surgeons to cover even extensive defects of upper limb and thereby decreasing the morbidity of patients. Although, in the present era of microvascular reconstruction locoregional pedicled flaps are fading,

abdominal flaps prove to be handy in reconstruction of upper limb soft tissue defects. The operative technique is easily learned with no rigid anatomical landmarks to be followed strictly and requires average skill for raising the flap. It is simple, speedy and safe.

CONCLUSION

Abdominal flap is a simple procedure which can be practiced by most of the surgeons to cover even extensive defects of upper limb and thereby decreasing the morbidity of the patients. The operative technique is easily learned with no rigid anatomical landmarks to be followed strictly and requires average skill for raising the flap.

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