



Abdominal Flaps in Coverage of Forearm and Hand Defects

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Abstract

Background: The management of upper extremity trauma has evolved since the First World War and especially over the last three decades to the point that many extremities that would have required amputation are now routinely salvaged. **Objectives:** To evaluate aetiology of acquired hand and forearm defects and to evaluate the role of abdominal flaps for coverage of hand and forearm defects. **Materials and Methods:** The present study entails 50 patients having been diagnosed with forearm and hand defects needing reconstruction by flap coverage admitted to Government Medical College Jammu (J&K) over a period with effect from 1st April 2018 to 31st August 2019. All patients having sustained hand or forearm defects needing flap coverage were included. **Results:** All of our patients had restoration of anatomy and normal function after reconstructive procedures, with 86% (n=43) patients having no complications. No major complication was encountered during intra operative or postoperative period. Minor complications (marginal necrosis, infection, donor site graft loss, hypertrophic scarring) were seen in 14% (n=7) patients, which settled with dressing and debridement. **Conclusion:** In conclusion, we recommend the usage of abdominal flaps for coverage of hand and forearm defects as a safe, durable, technically less demanding and cost-effective treatment modality.

Key Words

Forearm, Hand, Defects, Abdominal flap coverage

Introduction

The upper extremity defects needing reconstruction are on the rise owing to the increased use of machines, high incidence of automobile accidents and conflicts with increased use of arms and explosives. Injury to the forearm and hand may lead to exposure of vital structures such as tendons, bones, vessels and nerves requiring a suitable coverage. Conditions such as diabetes, cellulitis and burns result in soft tissue defects in hand and forearm, needing adequate coverage.

Desiccation of vital structures can be prevented by providing coverage with a suitably designed flap (1). The umbilical region (supplied by the paraumbilical perforators of DIEA) and the infraumbilical region (supplied by the

SCIA, SEPA, SIEA) along with the lateral aspect of the trunk (supplied by perforators of intercostal vessels and lumbar arteries) serve as common donors of pedicled flaps (2).

Superficial Inferior Epigastric Artery flap (SIEA) can be raised as vertical pedicle or horizontal pedicle as long as the base of the flap contains the superficial inferior epigastric artery (3,4). Superficial Circumflex Iliac Artery flap (SCIA/GROIN FLAP) was a milestone in the journey of reconstruction of soft tissue defects of hand (5).

Thoracolumbar flap (TA Flap) is based on the paraumbilical perforators of the deep inferior epigastric artery, the largest perforator being located at

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approximately 2 cm from the umbilicus and directs towards the inferior angle of scapula anastomosing with the posterior intercostal artery (6). The superficial external pudendal artery (SEPA FLAP) is simple and straightforward (7). The lateral border of the flap is 2.5cm from the pubic tubercle and the medial margin is midline in unilateral SEPA flap.

In this study, we attempt to describe the role of abdominal flaps for reconstruction of forearm and hand defects along with an evaluation of various reconstructive modalities in providing normal activity of the limb. Objectives were to evaluate aetiology of acquired hand and forearm defects and to evaluate the role of abdominal flaps for coverage of hand and forearm defects.

Material and Methods

The study entailed 50 patients with forearm and hand defects needing reconstruction by flap coverage admitted to Government Medical College Jammu (J&K) over a period with effect from 1st April 2018 to 31st August 2019. The requisite ethical clearance for the study was taken from Institutional Ethics Committee. Demographic data of the patients was noted. Detailed history regarding the aetiology, mode of injury, symptoms of the patient, associated trauma, alcohol or drug abuse, systemic illness, medication and allergies were taken.

Examination included analysis of the defect in terms of its situation, structures exposed (bone, tendons, vessels and nerves), degree of contamination, condition of surrounding skin, bones and joints and neurovascular status of the extremity. Posteroanterior and oblique plain roentgenograms were taken to rule out associated bone or joint injury. All routine investigations were sent. A wound swab was taken from patients with discharging wounds and subjected to bacteriologic culture and sensitivity testing.

Inclusion Criteria: All patients having sustained hand or forearm defects needing flap coverage.

Exclusion Criteria: i) Patients with abdominal incision in the territory of axial vessels or perforators; ii) Patients with previous history of abdominoplasty; and iii) Patients with comorbid conditions and not fit for general anaesthesia.

Majority of the patients were operated under general anaesthesia. Flap delays and divisions were performed under sedation or local anaesthesia. Post-operative position of the patient following flap coverage was maintained with the help of elastic adhesive bandage for one week followed by loose dressing with bandage for

the remaining two weeks.

Post-operative flap monitoring was done clinically on the basis of skin colour, temperature, turgor, capillary refill and colour of blood on pin prick of flap. Pedicle division



Figure 1: Right Thumb Avulsion (Domestic Injury)



Figure 2: Elevation of Right Groin Flap



Figure 3: Flap Inset



Figure 4: Post-Operative Photograph at 3 Months



Figure 7: Louvre Flap for Digital Defects on Left Side of Abdomen



Figure 5: Electric Burn Wound Over Left Hand and Forearm



Figure 8: Combined Flap Inset



Figure 6: Right Thoracolumbar Flap Elevation with Primary Closure of Secondary Defect



Figure 9: Post-Operative Photograph at 2 Months



of the flaps was done in a staged manner after 3 weeks with a gap of 3 days between the stages and inset done.

All the patients were followed weekly after discharge for a month and then monthly afterwards for 3 months to check for any complication in the form of infection, necrosis or flap loss.

Results

Out of a total of 50 patients, the maximum number of cases were in the range of 21-30 years (40%) (Table 1). Mean age of the patients was 29.28 years. Youngest patient was 9 years old and the oldest patient was 53 years old. There were 42 males (84.0 % cases) and 8 females (16.0 % cases) in our study. The male to female ratio was approximately 5:1.

Most of the affected patients were labourers/farmers (56 cases). Students constituted the next most affected group (24 % cases). In-service class and house wives accounted for the rest of the cases (12% and 8% cases respectively). Cause of defect shown in Table 2.

Right upper limb was involved in the majority of patients (72%), whereas the left upper limb was injured in the rest of the cases (28%). Maximum number of defects needing coverage involved hand (60%) followed by defects of forearm (28%). Combined hand and forearm defects accounted for 12% of cases.

68% of the patients in the study group underwent flap coverage after a period of more than 1 week owing

Table 1- Age Distribution of Patients

Age Group	No. of Patients	Percentage (%)
<10 years	2	4
11-20 years	8	16
21-30 years	20	40
31-40 years	14	28
41-50 years	4	8
51-60 years	2	4
Total	50	100

Table 2- Cause of Defect

Cause of Defect	No. of Patients	Percentage (%)
Machine Injuries	16	32
Burn Wounds	12	24
Road Accidents	8	16
Domestic Injuries	6	12
Chemotherapy Extravasation	4	8
Animal Bites	4	8
Total	50	100

Table 3- Flap Coverage and Cause of Defect

Procedure and Cause of Defect	No. of Cases
SIEA Flap	20
Crush Injury of Hand	6
Degloving Injury of Forearm	8
Animal Bite of Hand	4
Electric Burn of Hand	2
Groin Flap	12
Thumb Avulsion (Domestic)	6
Crush Injury of Hand	4
Chemotherapy Extravasation	2
Thoracoubilical Flap	8
Degloving Injury of Forearm	6
Chemotherapy Extravasation	2
SEPA Flap	4
Electrical Burn of Digits	4
Combined Flaps (Thoracoubilical + Louvre Flap)	6
Electrical Burn	6

to the contamination and wound infection. 32% of the patients underwent the coverage within one week of sustaining the defect.

SIEA flap (Superficial Inferior Epigastric artery flap) was the mode of coverage in 40% of cases; Groin flap in 24% of cases; Thoracoubilical flap in 16% of cases and SEPA flap (Superficial External Pudendal artery flap) in 8% of cases. Combined flaps were employed in 12% of cases with defects involving both hand and forearm (Table 3).

Flap infection was observed in 2 cases, one involving the thoracoubilical flap and other of a louvre flap. Both settled with repeated dressings. Marginal necrosis was seen in one case of groin flap and one case of thoracoubilical flap. Partial donor site graft loss occurred in 1 case of SIEA flap. Hypertrophy of the donor site occurred in one case of SIEA flap and one case of thoracoubilical flap.

Discussion

The defects of the hand and forearm arise out of a variety of causes like entrapment in machines, burns, trauma, infection, release of contracture or exposed prosthesis.

In our study, 50 cases of hand and forearm defects needing abdominal flaps were included. Age group of 21 to 30 years of age accounted for 40% of the cases. Mean age of patients in our study was 29.28 years. The relationship between age and upper limb defects is well



established in other studies (8-10). Males in our study accounted for 84.0% whereas females contributed 16.0 % of the total cases. This finding goes well with other studies (11,12).

In our study, incidence of forearm and hand defect was found to be highest among labourers/ farmers (56.0 %) whereas students constituted the second largest group (20%). Bernard and Boudreaux (13) in their study on hand injuries observed that such injuries are more commonly seen in men who work with moving machinery. Machine injury accounted for most of the defects (32%), whereas burn injury and road traffic accidents accounted for 24% and 16% respectively all requiring coverage with abdominal flaps. Indications of abdominal flaps for coverage of hand and forearm defects have been noted in other studies (11,12,14).

Right upper limb was more frequently injured (72 % cases) and this has been observed in other studies too (11). In the study entailed, 68% of the patients underwent flap coverage of the injured hand/ forearm after a period of more than one week owing to the contamination / infection of the defect. Various authors advocate the delayed primary coverage of defects following complete removal of all the non-viable tissue (15).

SIEA flap was employed in coverage of 8 cases of degloving injury of forearm by us, out of which minor complications were noticed in 2 cases which were managed conservatively. Similar findings have been reported by other authors employing SIEA flap for the coverage of forearm and hand defects (16,17).

In our study, a total of 12 Groin flaps were used to cover the defects of hand out of which 6 were cases of thumb avulsion with exposed bone/ tendon and 6 cases of hand defects were secondary to machine injury (n=4) and chemotherapy extravasation (n=2). We encountered no complication in any of our Groin flaps. Many authors have reported the usage of Groin flap for coverage of hand defects and its outcome (18,19).

We used thoracumbilical flap for coverage of 6 forearm defects arising out of RTA/ machine injury and 2 hand defects secondary to chemotherapy extravasation. Out of the four flaps employed, 1 flap showed marginal necrosis which was managed with debridement and advancement. 1 flap got infected during the 1st postoperative week but settled before flap division. Another case showed hypertrophy of donor site in the post discharge follow up and was managed with silicon cream and sheet. Thoracumbilical flap has been described as a successful coverage modality for forearm

and hand defects by various authors (20,21).

SEPA flap was used in the coverage of 2 finger defects with exposed tendon secondary to electric burns by us. Both the flaps survived well with no complications. SEPA flap has been used by other authors for soft tissue defects of hand and fingers (7).

In our study, 6 combined flaps were used to provide soft tissue coverage to defects involving both forearm and the fingers secondary to electric burn, thoracumbilical flap for forearm defects and louvre flap for finger defects. Out of the 6 cases, 1 case developed infection of the louvre flap in the postoperative period which settled by the time of inset at 4 weeks. The combined use of these flaps allowed stable coverage of the widely separated defects in one setting. Flap combinations have been well documented for coverage of degloving injuries of the hand and distal forearm (22,23).

Conclusion

In conclusion, we recommend the usage of abdominal flaps for coverage of hand and forearm defects as a safe, durable, technically less demanding and cost-effective treatment modality.

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Conflicts of Interest

There are no conflicts of interest.

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