Original Research Article

Clinical study of reconstruction of devastating defects around the elbow region at a tertiary care hospital

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Abstract

Back ground: Devastating defects are those defects where the major structures like bones, joints, nerves, and blood vessels are exposed. These defects may be due to road traffic accidents, train traffic accidents, post burn scar contracture release raw area etc. Skin grafting or simple flaps may not help in these cases making reconstruction challenge. To study the various flap options for the coverage of the elbow defects and its outcomes.

Materials and methods: From the period of 2016 to 2017, all patients with elbow defects that required local or locoregional flaps were chosen for the study. Investigations included plain X-ray of the elbow. Hand held Doppler was done for patients in whom the perforator based flaps were selected for reconstruction.

Results: In our study (23 patients) were males and (4 patients) were females. The most common cause was the road traffic accident (18 patients). Two patients were due to a post burn contracture release raw area. One of the patients was due to a work place accidental injury. Six patients were due to train traffic accident and of which 5 patients presented with total amputation (stump raw area). The site of the wound played a major role in determining the flap selection. In our series, most of the patients presented with defects over lateral (6 patients) and posterior lateral (7patients) elbow region.

Conclusion: Meticulous planning for their construction of devastating elbow defects is necessary to achieve satisfactory results. The choice between different flaps depends on the nature of the defect, availability of donor tissues and the patient's needs.

Key words

Devastating defects, Elbow reconstruction, Stump raw area, Hand held Doppler.

Introduction

Devastating defects are those defects where the major structures like bones, joints, nerves, and blood vessels are exposed. These defects may be due to road traffic accidents, train traffic accidents, post burn scar contracture release raw area etc. Skin grafting or simple flaps may not help in these cases making reconstruction challenge [1]. The options available are distant and flaps. Distant flaps are staged procedures but they are demanding for larger and complex defects. Unfortunately, these major elbow defects are not proper recipient sites to accept a skin graft. In this study, five different techniques for reconstruction of defects in the elbow region were evaluated in twenty-seven patients, namely the Latissimus Dorsi musculocutaneous flap, the thoracic-umbilical perforator flap, distally based lateral arm flap, propeller flap around the elbow and the rotation flaps [2].

Materials and methods

The study was conducted for a period of one year from 2016-2017 at IRRH and Plastic surgery department of the government Stanley medical college, Chennai.

Inclusion criteria

All patients with defects around elbow region exposing vital structures. Elbow defects associated with defects of arm, forearm, and wrist. Scar contracture patients requiring release and flap cover.

Exclusion criteria

Small elbow defects which can be managed conservatively of by secondary suturing. Elbow defects which can be covered by skin graft Elbow effects that are managed by free flaps.

Operative technique

Surgery is done under the supra clavicular block and spinal anesthesia. A sand bag is placed under ipsilateral under the rib cage. (**Case – 1**)

Case – 1: Operative techniques for devastating defects around the elbow region.

Step 1: Soft tissue defect near the postero-lateral aspect of elbow

Step 2: A line is drawn from the umbilicus to the inferior angle of the scapula. This is the axis of the TUP flap. Mid axillary line is marked. Care must be taken not to extend the incision beyond the mid axillary line. Pinch test is done to assess the skin elasticity so that the width of the flap

can be drawn facilitating the primary closure of the donor site.

The flap is raised from distal to proximal. The plane of the flap elevation is superficial to the underlying muscle. The dissection is stopped 2 cm medial to the lateral border of the rectus.

Step 3: Flap insert is given to the defect around the elbow.

Contraindication

Paraplegics – may seriously weaken upper extremity function. Previous irradiation to chest/axilla. Previous axillary dissection – injury to the thoracodorsal artery. Previous neck dissection on the same side- injury to spinal accessory nerve (trapezius injury already was done) [5]

Case – 2: A case of below elbow amputation stump covered with TUP flap donor site grafted.

Step – 1: Case Of Below Elbow Amputation Stump

Step – 2: Stump Covered with Thoracoumbical Perforator Flap

Step – 3: Donor Site Covered with SSG (Split Skin Graft)

Results

The most common cause was the road traffic accident (18 patients). Two patients were due to a post burn contracture release raw area. One of the patients was due to a work place accidental injury. Six patients were due to train traffic accident and of which 5 patients presented with total amputation (stump raw area) as per **Graph - 1**.

The site of the wound played a major role in determining the flap selection. In our series, most of the patients presented with defects over lateral (6 patients) and posterior lateral (7 patients) elbow region. A number of patients presented with defects over medial side of elbow region was five and anterior elbow region was four (**Graph – 2**).

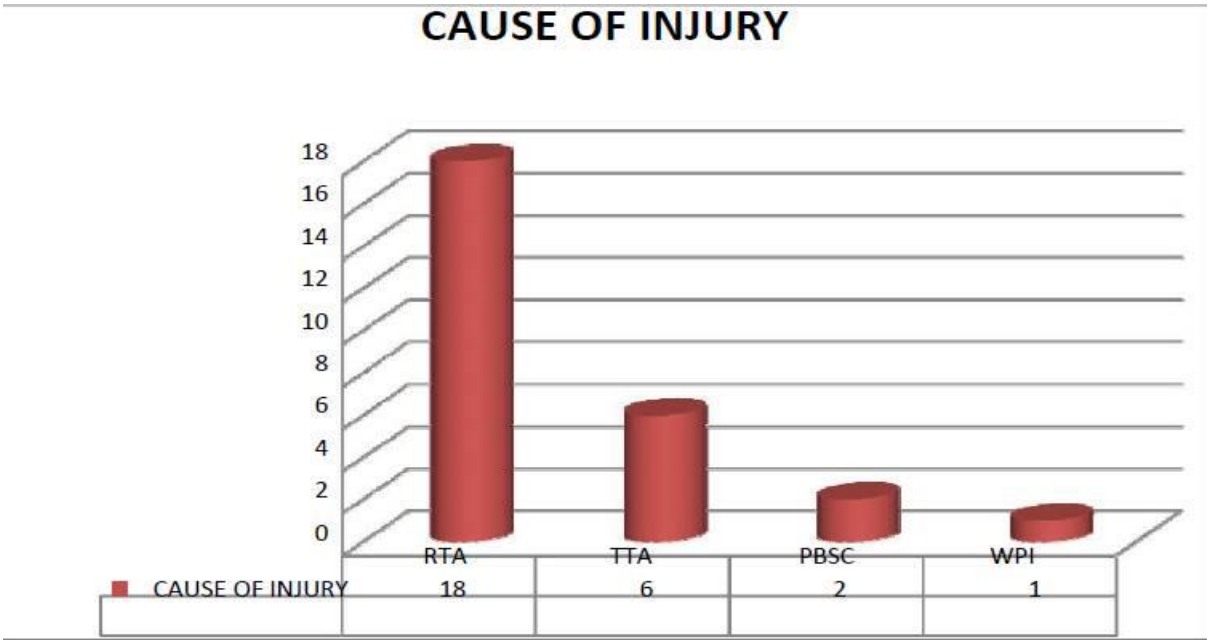
This bar diagram shows the relationship of a number of patients presented with total amputation around elbow region and the mode of injury. We find that patients who were injured by train traffic accidents presented more with total amputation (5 patients) around the elbow region. In all other modes of injury, no patients

presented with total amputation of the upper limb (**Graph – 3**).

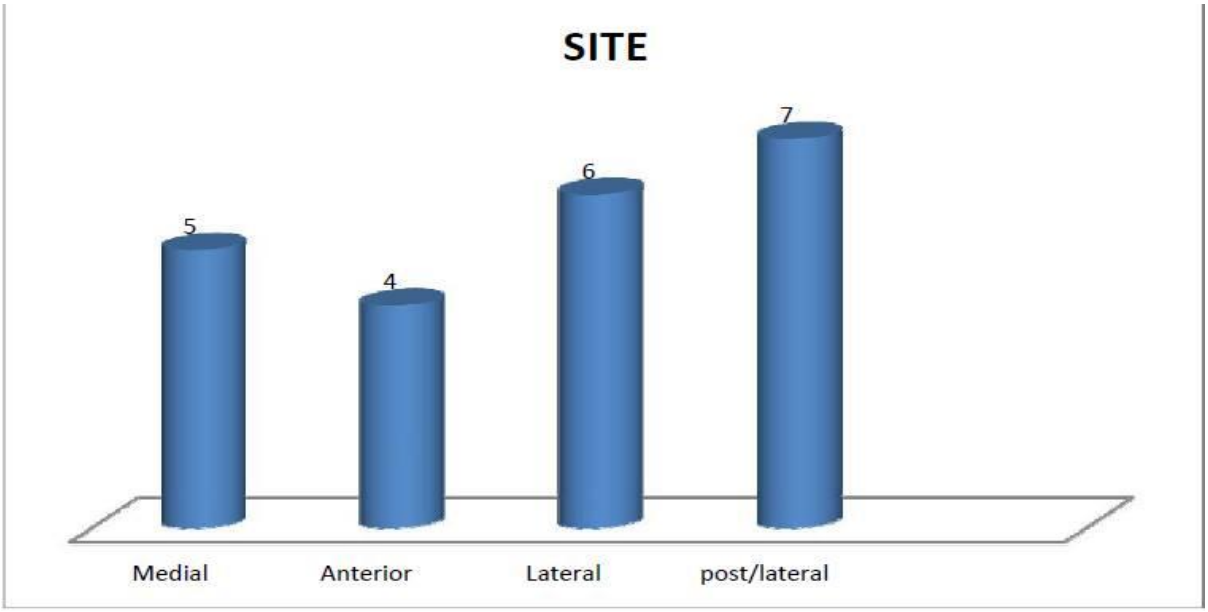
Immediate reconstruction was done only in 2 of the patients which were posted burn scar contracture release raw area. In all the other patients in our series, immediate reconstruction was not possible. In most of the patients, reconstruction was done within one week of the injury. In 8 patient's reconstruction was delayed after the first week which was due to other co-morbid conditions and delay in the aesthetic fitness (**Graph – 4**).

It is found that in all the cases of pedicled LD and rotation flaps the donor site was primarily closed. In patients with TUP flap if the defect size less than 7 cm the donor site was primarily closed. Similarly, in lateral arm flap if the defect size is less than 7 cm the donor site is primarily closed (**Graph – 5**).

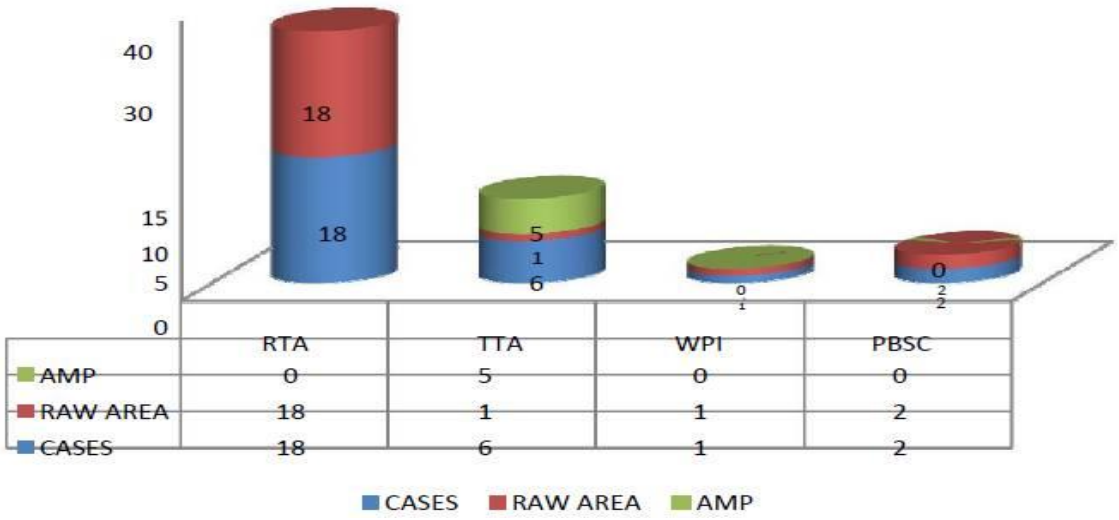
Graph – 1: Cause of injury among patient population.



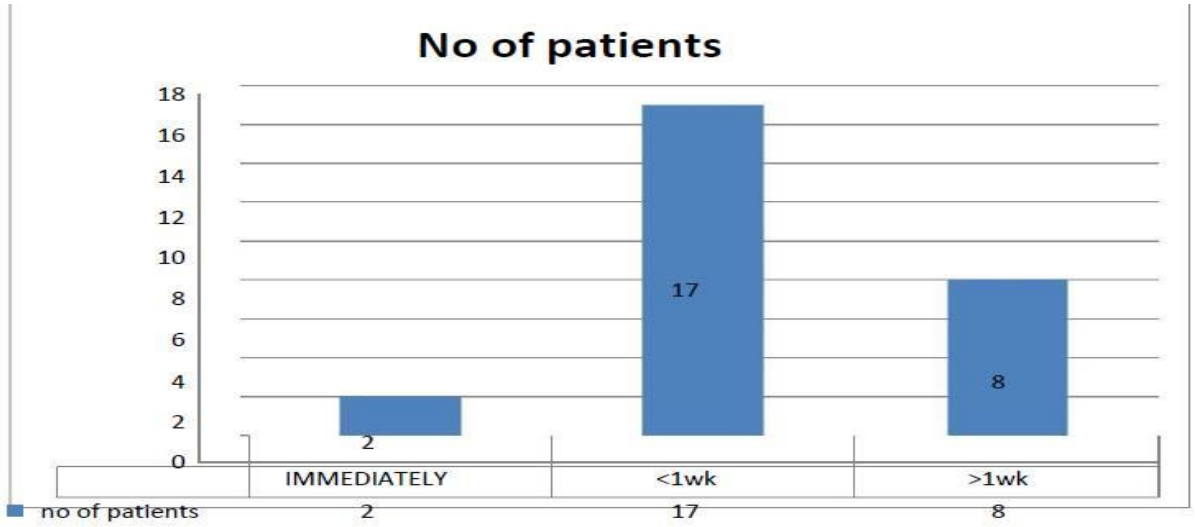
Graph – 2: Cause of injury among patient population wound location.



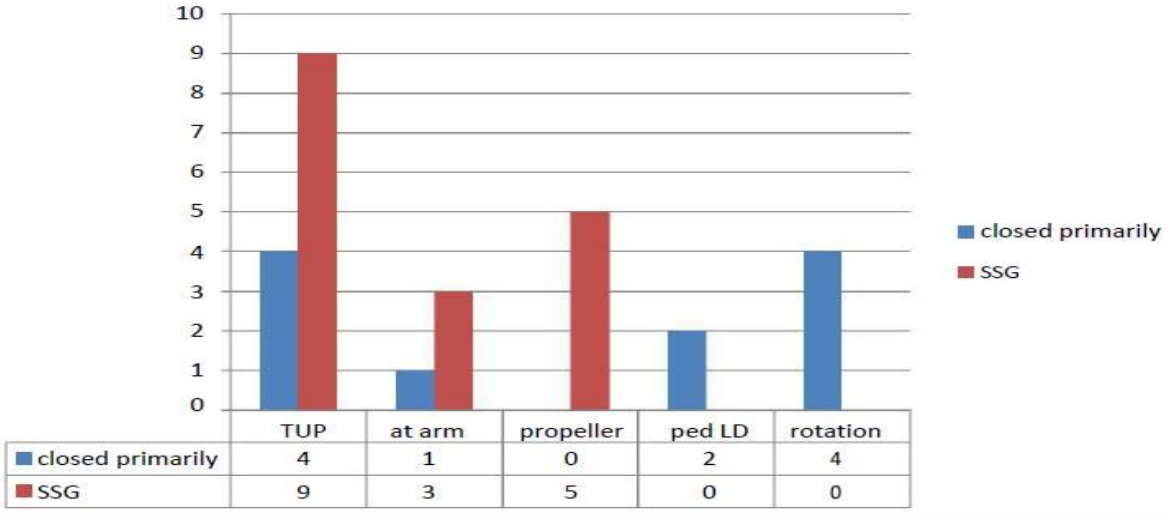
Graph – 3: Comparison of mode of injury and total amputations.



Graph – 4: Timing of reconstruction among patients.



Graph – 5: Relation of flaps to the primary closure of donor site.



Discussion

This flap is based on the perforators from the deep inferior epigastric artery which are more concentrated in the periumbilical region. It transfers a thin, pliable and a hairless skin. Even though the proximal part of the flap is a bit bulky it settles with time. The operative technique is easy to learn. It is simple, safe and speedy. All our flaps had a large length compared to the breadth [6]. All our flaps were elevated up to the midaxillary line and care was taken not to cross this line. Resting the arm with the pillow under the elbow reduced the incidence of edema [7]. This position was comfortable for the patient. Patients were able to do active mobilization of the forearm and hand preventing the stiffness of these joints. Patients were also able to wear their clothes comfortably. In our study, 95% of the flaps survived completely without complications. Discharge from the pedicle was a problem with this flap because the pedicle was left open [8]. Out of 13 flaps, 2developed marginal necrosis of 1-1.5cm. These were managed with flap advancement. There were no cases of complete flap failure. The donor site closure was not difficult and if the donor site was more the 7cm it mostly needed SSG. None of the patients had any complaints about the scar. Scar was well concealed in clothing [9]. The flap behaves quite well as compared to the commonly used groin flap. The narrow pedicle of the thoracic-umbilical flap enables a good range of movements and comfort for the patient. Pedicled Latissimus Dorsi mucocutaneous flaps were designed according to the defect area [10]. This muscle flap pivoting is used to repair a large area of skin defects. The length of the blood vessel from the axillary artery to the section where the thoracodorsal artery comes across into the muscle is 25-40 cm. Hence, the pedicled Latissimus dorsi mucocutaneous flap can be transferred to repair the wound at the upper 2/3 of the arm. This muscle flap has a good blood supply and hence a good resistance to infection and a high survival rate [11]. The function of the donor site is also less affected and it is from the back, a hidden region. Separate the point where the thoracodorsal artery enters into the muscle so that injury to the vascular pedicle can be prevented [12]. The flap should be harvested under the muscle sarcolemma and the flap should be flipped upward to prevent injury of vascular branches. Flap and the muscle should be anchored to prevent separation of skin and muscle end, which would affect blood circulation for the skin; and while transferring the flap, the pedicle of the flap should be kept open, relaxed and pressure-free; the angle of the proximal vascular pedicle should be large enough to avoid being folded or twisted. LD mucocutaneous was best suited for the above elbow amputations to give a stable cover for the functioning arm preserving the functional length [13]. Among local flaps, radial forearm flap can be rotated 90–180 degrees but involves sacrificing a major artery of the hand. Proximally based interosseous artery flap is good for smaller defects but involves tedious dissection. Ulnar artery forearm flap involves sacrificing ulnar artery which is a dominant vessel. Brachioradialis muscle flap is suited for small defects and should not be sacrificed in the absence of elbow flexors [14]. It has a consistent axial pedicle, with relatively easy dissection. There is no associated functional impairment and no major vessel is sacrificed. The flap is harvested in the supine position and does not require intraoperative repositioning. Finally, it has multiple design variations like V-Y advancement, rotation advancement, and complete island flap [15]. There are many reports of the usefulness of reverse lateral arm flap for elbow coverage. The flap can be used for medium sized defects. Skin grafts need to be placed above and below the flap to cover the whole defect. However, it still is beneficial to the joint area is covered with a flap. Immobilization only is required for healing of graft. Distally based lateral arm flaps were more suited for lateral defects and small to medium sized defects. All the flaps in our study survived completely without any complications. The propeller flaps done in our study was based on the perforators from the posterior radial collateral artery. The dissections were same as that of the

distally based lateral arm flap [16]. Donor sites were covered with the graft. The donor site was relatively inconspicuous. Rotation flaps were done in our patients for defects of smaller size over the medial aspect of the elbow region. Donor site was primarily closed which was the biggest advantage of this flap [17].

Conclusion

There were 27 patients of which 23 were male and 4 were female patients in our study. This may be due to the female having increased exposure to road traffic accidents. Age group ranged from 10-60 years in our study. 14 patients (51.8%) were in the age group of 10-30. Donor site was primarily closed in 11 patients (40.7%). Comparing the primary closure of the donor site with the size of the donor site, it was found the donor site defect <7 cm was easily closed primarily. Defects more the 7 cm needed an SSG. Only three patients (11.1%) had flap complications. Of which two patients had a flap marginal necrosis of 1-1.5 cm. Both of them were in TUP cases. In one part Donor site was primarily closed in 11 patients (40.7%). Comparing the primary closure of the donor site with the size of the donor site, it was found the donor site defect <7 cm was easily closed primarily. Defects more the 7cm needed an SSG.

Only three patients (11.1%) had flap complications. Of which two patients had a flap marginal necrosis of 1-1.5 cm. Both of them were in TUP cases. Follow-up of 6-12 months showed that the contour of the flap was aesthetic and the function of the limb was excellent.

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