Use of A Pedicled Flap for Reconstruction of Extensive Soft Tissue Defects Around Elbow

Yawar Sajjad, A. Hameed, Nauman Ahmad Gill and Abdul Waheed Bhutto

ABSTRACT

Objective: To determine the reliability of pedicled latissimus dorsi flap for reconstruction of extensive defects around the elbow in terms of flap survival and coverage of exposed bones, vessels or nerves.

Study Design: Case series.

Place and Duration of Study: Department of Plastic and Reconstructive Surgery at Shaikh Zayed Hospital, from February 2003 to January 2008.

Methodology: Patients with extensive traumatic wounds around the elbow and wounds secondary to release of postburn elbow contracture were included. Patients above 60 years of age with previous history of myocardial infarct, heart failure, chronic obstructive pulmonary disease or insulin dependent diabetes were excluded. Pedicled latissimus dorsi flap was used for defect reconstruction. Overall flap survival and postoperative complications were the outcome measures.

Results: There were 28 patients, including 20 males and 8 females, age ranging from 17 to 60 years. Evaluation of the defect considering extent of tissue loss, depth of the defect and exposed vital structure was done. Myocutaneous flap was used in 4 (14%) patients. Muscle only flap was used in 24 patients (86%). Twenty five (90%) flaps survived completely and 3 (10%) had partial loss. Other minor complications were partial graft loss seen in 3 (10%) patients and wound infection seen in 2 (7%) patient. There was no considerable morbidity at donor site and all patients had satisfactory healing.

Conclusion: Pedicled latissimus dorsi flap is a reliable and safe option for resurfacing extensive soft tissue defects of arm, elbow and forearm.

Key words: Tissue defects. Elbow. Flap cover. Pedicled latissimus dorsi flap.

INTRODUCTION

Extensive soft tissue defects around the elbow are difficult to reconstruct. These defects may result from trauma, tumour excision, infections and radiations.1 Various reconstructive options ranging from skin grafts, local flaps, distant pedicle flaps and free flaps are available.2 Local flaps like radial forearm, posterior interosseus (proximally based), lateral arm, brachioradialis and anconeus muscle flaps can be used for smaller defects whenever nerve, vessels, tendon, bone or joint are exposed.3-6 These flaps have the advantage of providing skin coverage with similar tissue texture. However, they are limited in size and availability of tissue and also inflict injury on the traumatized limb. Scapular and parascapular flaps have a limited arc of rotation.7 Parambilical perforator based abdominal flap is versatile for the coverage of large complex defects of the forearm and hand but not very useful for elbow defects.8 There is a paucity of expandable and large muscles in the upper limb which dictates the requirement of locoregional or distant flaps.9 For any moderate to extensive defect of upper extremity with exposed bone, nerves and joints, distant flap in the form of pedicled or free flap is a suitable option.10 Microvascular free tissue transfer needs a microvascular team, equipment and lengthy operating time.11 Pedicled latissimus dorsi flap provides excellent soft tissue coverage for extensive defects. The earliest description of this flap was by Vesalius in 16th century.12 Olivari and McGraw described its numerous applications in chest wall reconstruction, functional restoration of upper limbs and meningomyelocele closure.13,14 Since the early 19th century, the scope of pedicled latissimus dorsi flap has expanded in reconstruction of the forearm, elbow, upper arm and shoulder defects.15 The objective of the present study was to assess the reliability of pedicled latissimus dorsi flap for elbow reconstruction.

METHODOLOGY

The case series describes 28 patients admitted in Shaikh Zayed Hospital, Lahore, from February 2003 to January 2008 with extensive soft tissue defects around the elbow. Elderly patients with previous history of myocardial infarct, heart failure, chronic obstructive pulmonary disease or insulin dependent diabetes were...
excluded from the study. For each patient, complete history, general physical, local examination and photographic documentation was done. Laboratory investigations, complete blood count, wound swab for culture and sensitivity and X-rays were performed. Evaluation of the defect considered extent of tissue loss and depth of the defect.

Under general anaesthesia, the patients were placed in a lateral position. Wound debridement was done after stabilization of fractures. The extent of soft tissue defect was assessed. For smaller defects, musculocutaneous flaps were used and for larger defects muscle flaps were used. Wide undermining of skin was done for easy identification of surrounding muscle anatomy (Figure 1). The anterior border of the latissimus dorsi was identified. During muscle dissection, care was taken to separate the muscle from the superior surface of the scapula and its associated serratus anterior muscle. Whole latissimus dorsi muscle down to the iliac crest was raised and released. Intercostals and para-spinal perforators were carefully ligated. To increase the arc of rotation, insertion of the muscle was divided and the vessels were freed up to the origin. Flap was brought to the elbow through subcutaneous tunnel and after insetting, the flap suction drains were placed in the donor site and in the recipient area. Regarding the execution of the flap, it took about 60 minutes for elevation of the flap and another 45 minutes for flap insetting on average.

RESULTS

Between February 2003 to January 2008, 28 patients were managed. Twenty were males and 8 were females. Their age ranged from 17-60 years (mean 38.5 years). In 24 (86%) patients, the cause of defect was a road traffic accident. Four patients (14%) were operated for scarring of arm and elbow. The largest defect (20x42 cm) was covered with muscle only flaps and the smallest one with a size of 14x16 cm exposed bone was covered with musculocutaneous flap. The largest defect (20x42 cm) extended from the arm, elbow to forearm and the smallest one (16x14 cm) mainly involved the arm. Twenty flaps (71%) were used for traumatic loss of elbow skin and soft tissue with exposure of fracture site and joint. Four flaps (14%) were used for traumatic loss of arm skin and exposure of nerves. Four patients (14%) had extensive postburn scarring of the elbow and arm and the release of scarring required flap coverage. In 24 (86%) patients, defects were reconstructed with latissimus dorsi muscle using only flap. In 4 (14%) patients, musculocutaneous flap was used (Figure 2). The dimensions of the muscle only flap ranged from 15-34 cm in length and 14-16 cm in width. The outcome measure of flap survival and postoperative complications were assessed (Table I). The mean follow-up was for 6 months (range: 4-8 months). In all patients, the donor defect closed primarily. Overall flap survival and postoperative complications were used as outcome measures. Twenty five flaps (90%) survived completely, 3 (10%) cases had necrosis of the most distal part of the muscle which healed with secondary intention and finally reconstructive goal was achieved in all cases. Other minor complications were partial graft loss seen in 3 (10%) patients, which required regrafting. Wound infection was seen in 2 (7%) patients, who were treated successfully with conservative management.

Figure 1: Operative technique: (a) Marking for flap elevation, (b) Muscle flap mobilized, (c) Dissected pedicle.

Figure 2: Extensive soft tissue defect involving arm, elbow and forearm: (a) Extensive defect around elbow with exposed humerus, (b) Dissection of muscle flap, (c) Flap covering the exposed bone, (d) Grafting of muscle flap.
Donor site seroma formation was seen in 8 (28%) patients which was resolved with serial needle aspiration in all cases. There was no scar contracture seen at the donor site in any patient. No patient had any occupational problem related to shoulder disability.

### Table I: Outcome measures.

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>Number (n)</th>
<th>Percentage (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete graft survival</td>
<td>25</td>
<td>89.29</td>
<td>84.16-95.84</td>
</tr>
<tr>
<td>Partial necrosis</td>
<td>3</td>
<td>10.71</td>
<td>4.16-15.84</td>
</tr>
<tr>
<td>Partial graft loss</td>
<td>3</td>
<td>10.71</td>
<td>4.16-15.84</td>
</tr>
<tr>
<td>Wound infection</td>
<td>2</td>
<td>7.14</td>
<td>2.13-11.87</td>
</tr>
<tr>
<td>Seroma formation</td>
<td>8</td>
<td>28.57</td>
<td>19.46-36.54</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The reconstruction of extensive defects around the elbow are challenging for plastic surgeons. For such extensive defects of upper extremity, pedicled latissimus dorsi flap is a reliable and versatile option.  

Superficial defects without exposure of the vital structures can be resurfaced with skin grafts. Various local flaps have been used for reconstruction of the arm, elbow and proximal forearm defects. Proximally based posterior interosseous flap or radial forearm flap when rotated 90° to 180° can reach forearm and elbow defects. The radial forearm flap first described in 1981 is the most versatile providing a thin durable cover and protective sensation. The flap involves sacrificing a major artery which can lead to cold sensitivity of the hand. The proximally based posterior interosseous artery flap is good for smaller defects but demands tedious dissection involving fragile and anatomically variable vessels. The ulnar artery forearm flap has been used for elbow coverage. It involves sacrificing the ulnar artery which is a dominant vessel in 80% of cases. Reverse lateral arm flap may be elevated on the distal pedicle but cannot provide enough bulk to reconstruct larger defects around the elbow. The brachioradialis flap has been described in case studies for use of coverage around elbow. It is best suited to cover small defects along the anterolateral and posterolateral border of the distal arm and proximal forearm. Its use as a musculocutaneous flap results in a bulky disfigured appearance of the forearm and the muscle should not be sacrificed in the absence of elbow flexors.

Large defects up to 22 cm can be covered with distant pedicle flaps like the abdominal flap. It is a staged procedure and leads to dependency edema, poor mobilization and hygiene problems. Increased difficulties are seen with stiffness of shoulder, elbow, hand and poor rehabilitation.

Free flaps can be a good choice in difficult situations but in heavily traumatized limbs a healthy recipient vessel can be a major problem. Microvascular free tissue transfer demands expertise, instrumentation and lengthy operating time. Postoperative vascular complication may result in flap failure and donor site morbidity as well. Pedicled latissimus dorsi flap has been used for resurfacing defects in the upper arm, elbow and forearm. It is a large flap, has got a long pedicle and can be used as a muscle or musculocutaneous flap. A well vascularized flap improves circulation with increased resistance to infection and promotes fracture union. Functional transfer of latissimus dorsi muscle as a pedicled flap has been suggested by Thomas et al. for restoration of biceps muscle function. They described pedicled muscle flap as a valuable treatment not only for functional restoration of the elbow but also to provide coverage for soft tissue defects after major upper arm replantations. Latissimus dorsi was used for functional restoration of elbow extension and flexion as well as soft tissue coverage of upper arm and shoulder.

Stevanovic presented his experience of 16 patients with upper extremity soft tissue defects around elbow reconstructed with pedicled latissimus dorsi flap and recommended that the flap should be used to cover defects not more than 8 cm distal to the olecranon.

Choudry et al. in his study condemned the use of pedicled latissimus dorsi for defects distal to the olecranon. Distal defect coverage leads to increased risk of necrosis of the flap and he recommended use of free tissue transfer for coverage of elbow but in our experience, we resurfaced proximal forearm defects up to 15 cm distal to the olecranon with pedicled latissimus dorsi muscle flap and the increased reach was achieved by the release of total muscle from origin to insertion and release of vessel up to its origin.

Success rate in this study was 90% and the survival of flap was 100%, with partial flap loss (necrosis) in 10% of patients. Similarly, donor site morbidity (seroma formation) was seen in 8 patients (28%). The patients had minor functional deficit after muscle harvesting which was overcome by physiotherapy.

The procedure is safe and can be performed in a single stage with minimum donor site morbidity. The large size of the muscle is able to cover extensive defects involving the arm, elbow and forearm as well.

**CONCLUSION**

Pedicled latissimus dorsi flap is reliable, versatile, quick to execute and has a wide arc of rotation. We recommend it as a flap of choice for extensive soft tissue defects around the elbow.

**REFERENCES**


