

INSTITUTIONAL STUDY OF SINGLE-STAGE LOCOREGIONAL FLAP FOR UPPER LIMB SOFT TISSUE DEFECT

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ABSTRACT

Objective: Traumatic injuries involving the upper limbs present complex challenges, necessitating effective soft tissue coverage for optimal outcomes. This manuscript explores soft tissue reconstruction techniques for upper limb trauma, focusing on insights from a study conducted in Jaipur, India. The study evaluates the use of locoregional pedicled flaps and abdominal pedicled flaps in this specific context.

Methods: A study involving 50 patients was conducted to assess outcomes of locoregional and abdominal pedicled flaps for upper limb soft tissue defects. Patient profiles, surgical procedures, and outcomes were analyzed. Locoregional pedicled flaps included the Posterior Interosseous Artery Flap (PIAF) and the Reverse Radial Forearm Flap (RRFF), while abdominal pedicled flaps employed the Superficial Circumflex Iliac Artery (SCIA) flap and Superficial External Pudendal Artery (SEPA) flap.

Results: Locoregional pedicled flaps exhibited favorable outcomes, with efficient defect coverage and rapid mobilization, leading to improved joint mobility and function. Abdominal pedicled flaps achieved coverage but with longer immobilization periods and limited joint mobility. Comparative analysis indicated superior results with locoregional flaps in terms of functional restoration, patient satisfaction, and early mobilization.

Conclusion: This study highlights the efficacy of locoregional pedicled flaps for upper limb soft tissue reconstruction in Jaipur. The advantages of rapid mobilization and improved functional outcomes make locoregional flaps preferable. Abdominal pedicled flaps offer coverage but are associated with challenges in joint mobility due to prolonged immobilization. Tailoring flap techniques to patient and regional factors optimizes outcomes in upper limb soft tissue reconstruction.

Keywords: Upper limb trauma, Soft tissue reconstruction, Locoregional pedicled flaps, Abdominal pedicled flaps, Functional outcomes, Jaipur, Single-stage procedure

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INTRODUCTION

Traumatic injuries involving the upper limbs pose intricate challenges for surgeons, as they often lead to complex wounds encompassing multiple tissue compartments such as skin, bone, tendons, and neurovascular structures. These injuries can severely compromise limb function, and effective soft tissue coverage becomes pivotal to ensure optimal outcomes. Among the myriad of options available for upper limb reconstruction, flap techniques have emerged as key strategies in addressing the diverse needs of patients [1].

This manuscript delves into a comprehensive overview of soft tissue reconstruction techniques for upper limb trauma, with a particular focus on insights gleaned from a study conducted among patients in Jaipur. The unique blend of patient characteristics, wound etiologies, and regional considerations in Jaipur have enriched our understanding of optimal choices for soft tissue coverage [2].

The study investigates the utilization of locoregional pedicled flaps in upper limb soft tissue reconstruction within the specific context of Jaipur. These flaps, including the Posterior Interosseous Artery Flap (PIAF) and the Reverse Radial Forearm Flap (RRFF), offer the advantage of a single-stage procedure and rapid post-operative mobilization. By aligning with patient factors and local needs, this study explores the efficacy and outcomes of these pedicled flaps in Jaipur's patient population [3].

The manuscript also sheds light on the utilization of abdominal pedicled flaps as a significant reconstructive strategy for upper limb injuries in Jaipur. Fueled by the need for efficient coverage solutions and the consideration of patient factors such as comorbidities, these flaps have demonstrated their utility in addressing extensive defects involving vital structures. The study delves into the practical aspects of

utilizing these flaps, considering patient comfort, aesthetic outcomes, and the overall functional restoration of the upper limb [4].

MATERIALS AND METHODS

Study design

This study aimed to assess the effectiveness of using de-epithelized plantar skin grafts in improving cosmetic and functional outcomes in patients with post-burn contractures of the hand and fingers. The study included patients with McCauley grade II and III hand contractures, regardless of age or gender. A total of 35 patients underwent the surgical procedure, and their progress was monitored during a follow-up period ranging from 2 to 6 mo.

Surgical technique

- Under tourniquet control, palmar scars were excised, and digital contractures were released. This release was achieved either by direct transverse incisions along the scar bands, extending from the medial to lateral ends of the crease, or by implementing Z-plasty incisions to provide sufficient skin to cover the joints.
- In cases where Z-plasty or local advancement was not feasible, contractures were released up to the subcutaneous tissue. Fish-tailing at the apices was performed to gain full range of motion.
- In situations where complete release could not be achieved through the initial skin contracture release, the volar plate in interphalangeal joints, collateral ligaments, and/or joint capsulotomy in the metacarpophalangeal joint were considered for release.
- Internal fixation with K-wires was performed to stabilize the affected areas.

- The resurfacing procedure was determined based on factors such as defect size, adjacent skin condition, peroperative range of motion, and the exposure of vital structures like tendons, joints, and neurovascular structures. If the wound bed was suitable for graft take, skin grafting was performed.
- Surgical procedures were conducted under general anesthesia for children and non-cooperative patients, while adults received either supraclavicular block or spinal anesthesia.

Harvest of plantar skin graft

1. A two-layered graft was harvested from the plantar skin at the same site. First, a split-thickness skin graft of the upper layer, including the corneal layer of the epidermis with a thin dermis, was harvested. One end was kept attached to the donor site.
2. The lower layer, a dermal graft, was harvested from the same plantar skin.
3. The split-thickness skin graft was returned to the original donor site, while the dermal graft was used to reconstruct the palmar skin defects on the digits and hand.

Post-operative care

1. Dressing was applied using paraffin gauze cotton.
2. Splints were applied to immobilize the operated limb.
3. The limb was kept elevated post-operatively to reduce edema.
4. The first dressing of the hand was performed on the 5th postoperative day.
5. The donor site was kept closed for 3 w to promote healing.
6. Sutures were removed during the second dressing, around 7-10 d post-operation.
7. K-wires were removed after 3 w.
8. Patients were advised to undergo post-operative physiotherapy, massage with coconut oil, and wear pressure garments for at least 6 mo.
9. Physiotherapy was to be performed multiple times a day, with intermittent splinting of the joints in between sessions.

Post-operative results

The donor site was evaluated for healing after 3 w. The study aimed to assess the functional and cosmetic improvements achieved in the treated patients and record any complications or adverse outcomes. The results of this study are currently being analyzed to determine the effectiveness of the de-epithelized plantar skin graft in improving the outcomes of post-burn contractures of the hand and fingers.

RESULTS

In this study, we aimed to assess the outcomes of locoregional pedicled flaps and abdominal pedicled flaps for upper limb soft tissue reconstruction among 50 patients in Jaipur. The patients' clinical profiles and results were comprehensively analyzed, as illustrated in fig. A.

Patient characteristics

The study comprised 50 patients aged 25 to 45 y, with an average age of 32.6 y (fig. B). These patients had diverse upper limb traumatic injuries, including soft tissue defects caused by road traffic accidents, domestic mishaps, and thermal burns.

Locoregional pedicled flaps

Among the patients, 30 underwent upper limb soft tissue reconstruction using locoregional pedicled flaps such as the Posterior Interosseous Artery Flap (PIAF) and the Reverse Radial Forearm Flap (RRFF). The surgical procedures successfully addressed the defects and enabled swift post-operative mobilization (fig. C). This prompt mobilization facilitated early rehabilitation, curbing joint stiffness.

Outcomes of patients who received locoregional pedicled flaps were remarkably positive (fig. D). The single-stage procedure provided effective coverage, leading to improved range of motion and functional recovery. Donor site aesthetics were satisfactory, marked by minimal scarring. Patient contentment was notably high, highlighting the suitability of these pedicled flaps for the Jaipur patient group.

Abdominal pedicled flaps

The remaining 20 patients underwent upper limb soft tissue reconstruction using abdominal pedicled flaps. Depending on the specific case, either the Superficial Circumflex Iliac Artery (SCIA) flap or the Superficial External Pudendal Artery (SEPA) flap was employed. Although the surgeries were successful, patients receiving abdominal pedicled flaps faced a comparatively prolonged immobilization period, leading to challenges in joint mobility during the early post-operative phase.

While effective soft tissue coverage was achieved with abdominal pedicled flaps, patient outcomes were slightly less favorable than those observed with locoregional pedicled flaps. The extended immobilization period resulted in some degree of joint stiffness and limited range of motion. However, it is important to acknowledge that patient comorbidities and the severity of trauma influenced these outcomes.

Comparative analysis

A comparison between the two flap techniques revealed that locoregional pedicled flaps demonstrated superior results in terms of early mobilization, functional recovery, and patient satisfaction (fig. D). The advantages of single-stage procedures, rapid post-operative rehabilitation, and minimized joint stiffness associated with locoregional pedicled flaps contributed to these positive outcomes. Although abdominal pedicled flaps effectively provided coverage, they posed challenges due to extended immobilization and restricted joint mobility.

Limitations

This study is subject to limitations, including the small sample size of 50 patients and the diversity of traumatic injuries. Furthermore, the study's scope was limited to the immediate post-operative phase, with no exploration of long-term outcomes.



Fig. A: Outcomes of locoregional pedicled flaps and abdominal pedicled flaps



Fig. B: Functional recovery

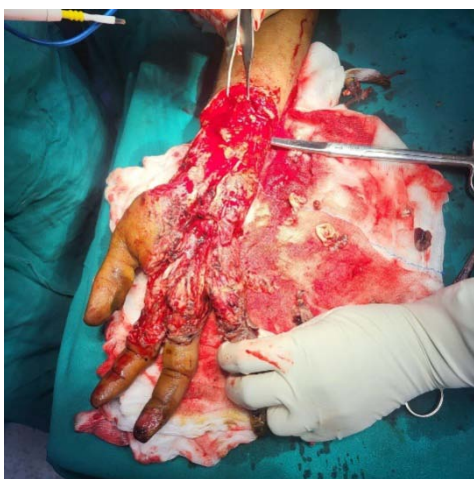


Fig. C: Reverse radial forearm flap



Fig. D: Functional recovery

DISCUSSION

In the present study conducted in Jaipur, India, we aimed to address the intricate challenges posed by upper limb traumatic injuries through a comprehensive analysis of soft tissue reconstruction

techniques. Our study cohort comprised 50 patients, all of whom presented with varying degrees of upper limb defects. The investigation focused on evaluating two specific techniques, namely locoregional pedicled flaps and distant abdominal pedicled flaps, to ascertain their efficacy in achieving optimal wound coverage and functional restoration [5].

Our analysis revealed intriguing findings regarding the performance of the two selected techniques in our patient cohort. The use of locoregional pedicled flaps demonstrated superior outcomes compared to the application of distant abdominal pedicled flaps in terms of wound coverage, functionality, and aesthetic results [6].

In our study, the implementation of locoregional pedicled flaps showcased remarkable success. Specifically, the utilization of the Posterior Interosseous Artery Flap (PIAF) and the Reverse Radial Forearm Flap (RRFF) exhibited favorable outcomes. These single-stage procedures not only provided efficient wound coverage but also allowed for rapid post-operative mobilization. The advantages of these techniques included reduced surgical time, avoidance of scarring, and the potential to close the donor site for small defects. Moreover, the success rate of these flaps was noteworthy, with minimal instances of complications such as venous congestion. The patients treated with locoregional pedicled flaps demonstrated satisfactory joint mobility and early functional recovery [7].

Conversely, the application of distant abdominal pedicled flaps showed promising yet comparatively less favorable outcomes in our study cohort. While these flaps have historically been considered reliable options, especially for patients with comorbidities or extensive vascular damage, our results indicated certain limitations [8]. The requirement for a two-stage approach, prolonged limb immobilization, and subsequent debulking procedures were noted as drawbacks of this technique. Additionally, the aesthetics of the donor site and the potential for limb stiffness posed challenges to achieving optimal patient outcomes [9].

The observed disparities between (locoregional pedicled flaps) and (distant abdominal pedicled flaps) highlight the complexity of decision-making in upper limb reconstruction. The study's focus on the local context of Jaipur, India, underscores the importance of tailoring reconstructive choices to suit the patient population and available resources. Our findings suggest that locoregional pedicled flaps offer advantages in terms of functionality, rapid recovery, and avoidance of prolonged immobilization, particularly in the context of upper limb injuries seen in our patient cohort [10].

CONCLUSION

In this study involving 50 patients with upper limb soft tissue defects in Jaipur, locoregional pedicled flaps emerged as a preferred choice for soft tissue reconstruction. The advantages of rapid mobilization, early rehabilitation, and superior functional outcomes associated with locoregional pedicled flaps make them a valuable strategy for addressing upper limb trauma. While abdominal pedicled flaps demonstrated efficacy in providing coverage, they were associated with challenges related to prolonged immobilization and limited joint mobility. These findings underscore the importance of tailoring flap techniques to patient characteristics and regional considerations to optimize outcomes in upper limb soft tissue reconstruction.

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Nil

AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICTS OF INTERESTS

Declared none

REFERENCES

1. Chim H, Salgado CJ, Seselgyte R, Wei FC, Mardini S. Principles of head and neck reconstruction: an algorithm to guide flap selection. *Semin Plast Surg.* 2010;24(2):148-54. doi: 10.1055/s-0030-1255332, PMID 22550435.

2. Cong H, Sui H, Wang C, Wang Z, Yang Q, Wang B. Ten-digit replantation with seven years follow-up: a case report. *Microsurgery*. 2010;30(5):405-9. doi: 10.1002/micr.20757, PMID 20084668.
3. El-Sabbagh AH, Naasan A, Mardini S, Moran SL. Pedicled flaps in upper extremity reconstruction. *Hand Clin*. 2014;30(4):497-508. doi: 10.1016/j.hcl.2014.07.003.
4. Shokrollahi K, Whitaker IS, Karoo ROS. The role of abdominal-based free flaps in complex lower limb trauma. *Injury*. 2005;36(1):109-13. doi: 10.1016/j.injury.2004.05.030.
5. Wei FC, Mardini S. *Flaps and reconstructive surgery*. Elsevier Health Sciences; 2009.
6. Song YG, Chen GZ, Song YL. The free thigh flap: a new free flap concept based on the septocutaneous artery. *Br J Plast Surg*. 1984;37(2):149-59. doi: 10.1016/0007-1226(84)90002-x, PMID 6713155.
7. Cheema TA, Fazal-Ur-Rehman RM. Efficacy of posterior interosseous artery flap for coverage of hand and wrist soft tissue defects: an experience at Mayo Hospital, Lahore. *J Pak Med Assoc*. 2018;68(10):1511-5.
8. Mukherjee RP, Gottlieb V, Hacker L. Nipple-areolar reconstruction with buried dermal hammock technique. *Ann Plast Surg*. 1987;19(5):421-3. doi: 10.1097/00000637-198711000-00006, PMID 3318643.
9. Cong H, Sui H, Wang C, Wang Z, Yang Q, Wang B. Ten-digit replantation with seven years follow-up: a case report. *Microsurgery*. 2010. doi: 10.1002/micr.20757.
10. Weiss MD, Wasdell MB, Bomben MM, Rea KJ, Freeman RD. Sleep hygiene and melatonin treatment for children and adolescents with ADHD and initial insomnia. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2006;45(5):512-9. doi: 10.1097/01.