

Management of Soft Tissue Defects of Hand with Local (Posterior Interosseous) Flaps

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Design:-Observational case series study **Objective:** - To evaluate the role of Local Flaps in the management of the soft tissue injuries of hand. **Suit & Period:** -. Study was conducted at BV Hospital, Bahawalpur from June 2002 to May 2003.

Material & Method: - In this study, we selected cases in which direct skin closure was not possible due to large defect or skin grafting was contraindicated for example in cases where bones and tendons were exposed, or in certain conditions where some secondary procedures may have to be carried out like tendon repair, tendon grafting nerve repair or fixation of fracture. Patients with severely crushed, non-salvageable hands, manageable with primary suturing & skin grafts & Patients with peripheral vascular disease, Elderly diabetic & Patients medically unfit for anesthesia. **Results:** A total of 10 patients were treated between June 2002 and May 2003. There were 8 males and 2 females (male to female ratio 4:1). Mean age of the patients was 26.26 years with range between 10 and 60 years. Most common cause of skin defects was agriculture machine injury (6 cases) followed by roadside accidents (2 cases), blast injury (1 cases), and electric burn (1 cases). In 7 patients there was an uneventful recovery. One flap was lost completely, partial flap loss occurred in one case, marginal necrosis and infection noted in one case. **Conclusion:** -Local (posterior interosseous island) flaps are useful for coverage of the skin defects over the hand when applied with proper indications.

Key words: -Posterior interosseous flap, Local flap

Hand is an organ exceptionally important for our everyday relationships. The hand collaborates with the eyes to gain knowledge of the external world. It can even substitute for the eyes in the exploration of a hidden area or, in the extremes case in blindness. It is also our agent for a great variety of activities.

Yet lying at the centre of every action, the hand, more than any other part of the body, is constantly exposed to trauma of all sorts. Hand injury is the most common injury and it represents one-third of all cases of trauma¹. Hand injury is the most common injury in both civilian and industrial life and a slightest break in the skin covering of the hand is a potential portal of infection, edema and trophic changes, which may rapidly spread and cause irreversible damage to its normal physiological function.

When feasible, suturing of the cutaneous wounds is always preferred over all other methods of closure. Small skin defects especially over the dorsal aspect of the hand can often be closed by direct approximation and suturing, while the skin defects over the fingers, the palm, and large defects over the dorsum of the hand are difficult to manage and often require some plastic surgical procedure which may range from skin graft to flap coverage.

In the hand, the contribution of plastic and reconstructive surgery has been mainly in the selection of skin coverage by grafts or flaps. The use of the simplest means of cover the skin grafting is not always suitable for restoration of skin loss because the other damaged components like bone and tendons may require subsequent procedures for their associated injuries. A number of other factors are important for selection of the reparative procedure and include the site and extent of the lesion, the nature of the tissue deficit, age, sex patients occupation

and cosmetic problems which need more extensive though reliable procedure – the flap coverage.

The posterior interosseous flap is a fasciocutaneous flap supplied by the posterior interosseous artery. Zancolli and Angrigiani² (1986,1988) concluded that the posterior interosseous flap can be raised from the skin of the dorsal aspect of the forearm and reliably be transferred to different skin defects of the hand such as those created by correction of an adduction contracture of the first web space, or on the back or front of the wrists level.

Groin flap is an axial pattern fasciocutaneous flap based on the superficial circumflex iliac artery and its venae comitantes. In 1972 McGregor IA and Jackson IT gave the original description³ of the groin flap.

Hypogastric flap is an axial pattern fasciocutaneous flap based on the superficial inferior epigastric artery and its venae comitantes. In 1944, Shaw described the anatomical details and results⁴ of his study regarding the use of hypogastric flap for coverage of surface defects of upper extremity including the hand and forearm.

Post-operative care is carried out considering the comfort of both patient and flap. Patient should be up and about as soon as possible. Kinks in the flap pedicle are avoided by correct positioning of the involved upper extremity and of the patient. **Flap Assessment** is done by the color & temperature of the flap, refill after blanching. Detection of kinks in the pedicle and their elimination, Signs of Hematoma & Evaluation of the patient's general condition (Hypotension, cardiopulmonary impairment anaemia, or a low circulating volume) may all affect oxygenation of the flap. **Postoperative complications** expected may be **Immediate** (Compression, Post-operative

hemorrhage, Oedema, Post-operative pain), **Early** (Marginal Necrosis leading to incomplete coverage, Wound breakdown, Gangrene of flap) & **Late** (Joint stiffness, Contractures, Sensitivity to cold, Cosmetic problems & Impaired functions of the hand)

Material and method:

Design: - This was Case series study.

Suit & Period: - Study was done from June 2002 to May 2003 in Orthopaedic complex B.V. Hospital Bahawalpur.

Material (the Patients): - In this study, we selected cases in which direct skin closure was not possible due to large defect or skin grafting was contraindicated for example in cases where bones and tendons were exposed, or in certain conditions where some secondary procedures may have to be carried out like tendon repair, tendon grafting nerve repair or fixation of fracture,

In this study of 10 cases we used posterior interosseous flap for different types of injuries or hand, in different locations on hand, for proper coverage and for the maximum functional restoration of the hand, which is the main purpose and goal of the management of the hand injuries.

Patient's Selection: -

Inclusion Criteria:

In our study the inclusion criteria was

1. Subjects regardless of age and gender.
2. Patients with soft tissue defects due to any cause. (roadside accidents, agriculture machine injuries, blast injuries, chemical burn, thermal burn, electric burn)
3. Patients with soft tissue defects of hand after release of congenital Contractures & release of post-burn contracture.

Exclusion Criteria:

Exclusion criteria in case of our study was:

1. Patients with severely crushed and non-salvageable hands.
2. Patients with skin defects manageable with primary suturing & skin grafts.
3. Patients with peripheral vascular disease.
4. Elderly diabetic patients.
5. Patients medically unfit for anesthesia.

Statistical Method: - Patient's preoperative, operative & postoperative details were recorded and processed by SPSS computer program. Procedural outcome were critically assessed by **Evaluation Criteria** considering the variables as given below:

Manifestations	Out Come
No complications	Excellent
Epidermolysis / Marginal necrosis	Good
25% flap loss	Fair
50% flap loss / complete failure	Poor

All the patients were advised exercises to bring the hand and remaining joints of the extremity in maximum

functional position. All the patients were advised to attend the outpatient department for follow-up.

Test of Significance: - As this was a case series study so no test was applied.

Results:

A total of 10 patients were treated between June 2002 and May 2003. There were 8 males and 2 females (male to female ratio 4:1). Mean age of the patients was 26.26 years with range between 10 and 60 years. Most common cause of skin defects was agriculture machine injury (6 cases) followed by roadside accidents (2 cases), blast injury (1 cases), and electric burn (1 cases). Right hand was injured in 7 patients while left hand in remaining 3. Three patients with agriculture machine (toka) injury presented with hands amputated through metacarpals.

Posterior interosseous flaps were performed in different conditions in 10 cases. In most of the cases with agriculture machine and all with blast injury, debridement was done in emergency. Few patients were initially treated somewhere else and operated on our department as elective cases. All the patients were operated on elective lists for flap elevation and application. Stitches were removed on an average of 14 days.

Posterior Interosseous Flaps was performed in 10 patients. In 7 patients there was no complication. In one patient in which graft was applied over the open stump at metacarpal level totally failed due to ischemic necrosis and complicated with postoperative infection. Subsequent debridements were done and after granulation tissue appeared, both recipient and donor areas were covered with skin grafts.

In another patient with open stump at the metacarpal level a small area over the recipient site remained uncovered due to partial flap loss, which was nicely covered by undermining the flap margin after about 4 weeks of the flap application without further complications. In another patient flap was complicated by marginal necrosis and infection, which was successfully treated by repeated antiseptic dressing and proper antibiotic. **Donor site coverage** was done with skin grafts. Data of posterior interosseous flap results are shown in Table 1.

Table I Complications with posterior interosseous flap

Complication	Male	Female	Total	%Age
No Complication	06	01	07	70%
Marginal Necrosis & Infection	01	00	01	10%
Partial Necrosis	00	01	01	10%
Complete Loss	01	00	01	10%
Total complication	02	01	03	30%
Success Rate	07	02	09	90%

Discussion:

Hand injury is the most common injury in both civilian and industrial life and a slightest break in the skin covering

of the hand is a potential portal of infection, edema, and trophic changes, which may rapidly spread and cause irreversible damage to its normal function.

When feasible, suturing of the cutaneous wounds is always preferred and considered as method of choice. Small skin defects especially over the dorsal aspect of hand can often be closed by direct approximation and suturing because of relatively lax and mobile skin over this region, while the skin defects over the fingers, the joints, the palm, and large defects over the dorsum of the hand are difficult to manage and often require some plastic surgical procedure.

The various options of soft tissue coverage of hand include split thickness skin grafting, rotation pedicle flap, local island pedicle flap, distant pedicle flap and free flap. The drawbacks of split thickness skin grafting are poor quality coverage for exposed tendons, nerves and bones along with restriction to secondary reconstructive procedures at the same site.

In case of free flaps, their transfer demands highly skilled surgeon and the specified instrumentation and the procedures themselves are lengthy, difficult, and tedious and post-operative complications are more and overall risk of free flap failure compared to conventional techniques is greater⁵.

Different pedicle flaps, both local and distant, can overcome the above-mentioned problems. The local pedicle flap like posterior interosseous island fasciocutaneous flap can provide soft tissue for coverage of the defects over the hand with advantage of local availability but it has the limitations of its smaller size and applications up to the specific sites only, where as the distant pedicle flaps like groin and hypogastric flaps can cover relatively larger wounds with minimum donor site morbidity.

We have used local (posterior interosseous island fasciocutaneous) flaps for soft tissue coverage of hand in our study.

Posterior Interosseous Island Fasciocutaneous Flap

Zancolli and Angrigiani operated 25 patients between 1984 and 1987.² 22 patients had severe adduction contracture of the first web space. Three had defects over the dorsal aspect of the metacarpal area of the hand and 1 had a skin defect over the palm.

None of the cases had any loss of circulation of the flap following the surgical procedure. Thumb function improved in all cases. The final appearance of the hand with dorsal skin defects was very acceptable because of thinness of the flap.

In our study of 10 cases we had 3 patients with open stumps through the metacarpal level, 3 cases with skin defect over the dorsal aspect of hand, 2 cases with post traumatic Contractures of the 1st web, 1 case with defect over palmer area and remaining one with defect over the thumb subsequent to road-side accident. One flap completely failed and complicated with post-operative

infection. In another patient the applied flap proved a bit shorter than the recipient area. Undermining the adjacent flap margins 4 weeks later covered the residual bare area. Skin grafting was done to cover donor area in all cases. Excellent results were obtained in rest of the 8 cases.

Buchler and Frey (1991)⁶ reported 36 distally based posterior interosseous island flap procedures. Flap sizes were variable according to the recipient area. Partial necrosis occurred in 7 flaps; four required additional local or distant flaps. Otherwise the flaps performed adapted well to the recipient site and had excellent texture and color match.

In our study of 8 cases, only two patients suffered additional procedures. In one with flap undermining and coverage of the residual naked area and other by split skin grafting over the open stump for complete flap failure due to ischemic necrosis. Otherwise patients found satisfied regarding the texture and color match.

In 2000, Amin M⁷ reported 7 cases treated with distally based posterior interosseous flaps. 3 patients had skin defects over dorsum of hand, one patient with defect over the ulnar border of hand, one with defect over 1st web, one with skin defect over volar aspect of the wrist and another patient with post-acid burn hypertrophic scar over the metacarpo phalangeal joints. The results were good in all patients except one in which tip necrosis of the flap occurred. Success rate remained 85%.

In our study of 10 cases, only one flap was lost completely while in another the residual uncovered area was covered by undermining the adjacent margin of the same flap, otherwise this as well as remaining 8 flaps proved excellent regarding the results. Success rate remained 90%

Conclusion:

Considering the clear concepts of indications and limitations for application regarding the above-discussed flaps, the experienced surgeon can cover the soft tissue defects of hand using these flaps with good results. These flaps can be performed with good cosmesis, maximum functional restoration of hand, and their well acceptability by the patients and early return to their jobs.^{2,4,7}

So the posterior interosseous island flap, groin flap and abdominal (hypogastric) flap are recommended for management of the soft tissue coverage defects of the hand in appropriate settings on case-to-case demand basis.
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