

Evaluation of various options for resurfacing of soft-tissue defects of dorsum of hand and their outcome assessment



Sasanka Nath¹, Subhashis Karmakar², Dipankar Mukherjee³, Amitesh Kumar Jha⁴

¹Associate Professor, Department of General Surgery, R. G. Kar Medical College and Hospital, Kolkata, ²Associate Professor, Department of General Surgery, Tamralipto Government Medical College and Hospital, Purba Medinipur, ³Assistant Professor, ⁴Consultant Plastic Surgeon, Department of Plastic Surgery, Medical College, Kolkata, West Bengal, India

Submission: 22-10-2022

Revision: 28-10-2022

Publication: 01-12-2022

ABSTRACT

Background: Soft tissue defect of dorsum of hand is a difficult problem to deal with in reconstructive surgery. Various factors have to be considered for planning of the reconstruction. **Aims and Objectives:** To assess the overall incidence of soft tissue defect on dorsum of hand, evaluation of different options for coverage of soft tissue defect on dorsum of hand, assessment of outcome and complications (both primary and donor sites) of reconstructive procedures and coverage of defect with like for like tissue. **Materials and Methods:** We present our experience of resurfacing soft-tissue defects of dorsum of hand in 27 patients by split thickness skin grafting, local flaps, distant pedicled flaps, and free flaps. **Results:** Among total 27 patients, in whom resurfacing was done, distant pedicled flaps such as groin/abdominal flap were performed in 13 patients, regional flaps like posterior interosseous artery flap were done in seven patients, free flap like anterolateral thigh flap was the method in three patients, and skin grafting was used in two patients. Complications such as partial or complete flap necrosis were noted in one patient each of free and regional flap and none in distant pedicled flap. The operating time was relatively less in distant pedicled flaps. **Conclusion:** Skin grafting had limited use when underlying vital structures were exposed. Distant pedicled flaps such groin and abdominal flaps were very useful for resurfacing the defect especially in emergency situations. Regional and free flaps had limited indications.

Key words: Soft-tissue defect; Dorsum of hand; Various options

INTRODUCTION

Post-traumatic hand always represents a challenging problem in reconstructive surgery. The soft-tissue cover of dorsum of the hand is characterized by thin skin with poor subcutaneous tissue. Trauma frequently leads to loss of soft-tissue cover of the dorsum of hand with exposed bones and tendons. Such defects necessitate early flap coverage to protect underlying vital structures, preserve hand functions, and to allow for early rehabilitation.

Different reconstructive methods have been used to treat these defects considering the functional and cosmetic

aspects. Local flaps such as reverse radial forearm flaps require sacrificing a major vessel and are not suitable in many cases. However, they can be easily elevated even in emergency setup. The perforator based flaps avoid sacrificing major vessel. Other options such as distant pedicled flap (abdominal and groin flap) and free flaps have their own advantages and disadvantages.

We report our experience of resurfacing soft-tissue defects of dorsum of hand in 27 patients.

Aims and objectives

The aims of this study were as follows:

Access this article online

Website:

<http://nepjol.info/index.php/AJMS>

DOI: 10.3126/ajms.v13i12.47663

E-ISSN: 2091-0576

P-ISSN: 2467-9100

Copyright (c) 2022 Asian Journal of Medical Sciences



This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

Address for Correspondence:

Dr. Subhashis Karmakar, Associate Professor, Department of General Surgery, Tamralipto Government Medical College and Hospital, Purba Medinipur - 721 636, West Bengal, India. **Mobile:** +91-9830390574. **E-mail:** drsubhashis27@gmail.com

1. To assess the overall incidence of soft-tissue defect on dorsum of hand
2. Evaluation of different options for coverage of soft-tissue defect on dorsum of hand
3. Assessment of outcome and complications (both primary and donor sites) of reconstructive procedures
4. Coverage of defect with like for like tissue.

MATERIALS AND METHODS

1. Place of study – Department of Plastic and Reconstructive Surgery, Medical College, Kolkata
2. The study was pre-approved by the Institutional Ethics Committee (IEC) for the final permission
3. Type of study – prospective observational study
4. Time frame – from January 2017 to December 2018
5. Average follow-up period—6 months.

Inclusion criteria

The following criteria were included in the study:

1. All patients with soft-tissue defect on dorsum of hand presented at plastic surgery outpatient department/emergency
2. Patients willing to give consent for the study.

Exclusion criteria

Patients having major comorbidities such as uncontrolled DM and peripheral vascular disease were excluded from the study.

Study technique

All patients with soft-tissue defects of dorsum of hand were first stabilized hemodynamically and proper hemostasis was done. The wound was debrided and the resultant defect was resurfaced with skin graft or flap. The patients were selected on the basis of inclusion criteria. The choice between delayed and immediate coverage was decided on the local condition of the wound, exposure of the vital structures, and general condition of the patient. Plain radiographs of the hand were taken to note any fractures, any bony ankylosis, presence of chronic osteomyelitis, and any other skeletal defect. Exposed bone, tendon, or prosthesis was also noted. A hand held ultrasound Doppler scan was performed in all the cases to ensure the patency of the local artery.

Patients were operated under general or regional anesthesia. Template of the defect was taken with the help of lint-piece and flap was planned in reversed to mark the donor site within the previously Doppler marked area. Donor site was closed primarily in cases of small defect and skin grafting was done in cases of large defect. After inclusion in the study, resurfacing was planned according to the

standard treatment protocol of the institution from the following options (see Table 1)— (1) Regional pedicled flap include – the reverse radial forearm fasciocutaneous flap, the posterior interosseous artery (PIA) flap, (2) distant pedicled flap like the groin flap and abdominal flap, and (3) free flap – anterolateral thigh flap, latissimus dorsi myocutaneous flap.

Loco regional flaps were the method of choice when the donor area was healthy and well vascularized. The choice of flap depended on the site and size of the defect, availability, and quality of the donor tissue and reach of the flap to cover the defect. However, the areas covered by the loco regional flaps are overlapping and there is no strict limitation of their use.

Distant pedicled flaps were used for large defects and in patients where local donor tissue was not available. They were also be used in cases where the patients choose distant pedicled flaps for reconstruction. The free flaps were used in hemodynamically stable patients without medical comorbidities, where there was no suitable locoregional flap available as in case of mutilating trauma, large defect not manageable with local flaps, etc.

RESULTS

Out of 27 patients, 24 patients were male and three were female. Maximum numbers of patients were in age group (20–40) (see Graph 1). The size of defect varied from 16 cm² to 110 cm² (see Graph 2).

It is obvious from above table which is that dorsum of hand soft-tissue defect is most commonly seen in 20–40 years age group.

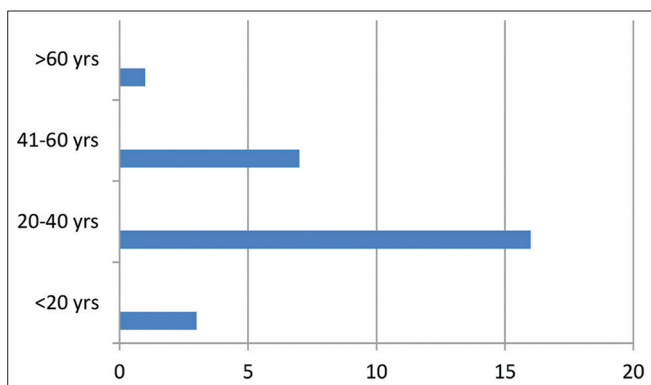
We encountered with mostly small to medium size wounds. Very large defect was present in two cases.

Before considering various reconstructive options for dorsum of hand soft-tissue defect coverage, certain *prerequisites* must be kept in mind, but these obviously vary from case to case basis. In nutshell, they are –

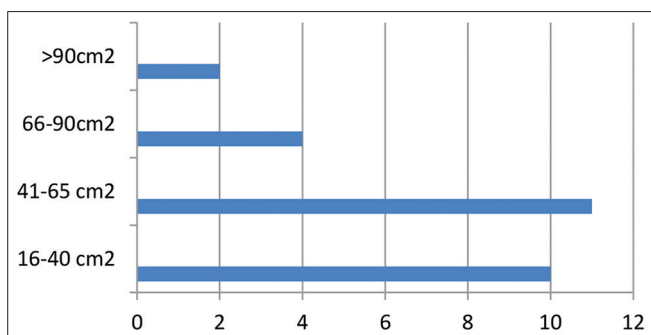
1. Availability of like for like tissue in the local area.
2. Healthy, scarless abdominal/groin area.
3. When considering free flap, availability of tissue at donor site, and good blood vessels at recipient site.
4. Consideration of nerve coaptation for making the flap sensate.
5. Patient's preference of reconstructive option.

Most of the patients (15 out of 27) underwent abdominal or groin flap for reconstruction (see Figures 2 and 5). They were having good outcome with least complications,

Table 1: Reconstructive options, duration of procedure and outcome (including complications)						
Type of flap	Number of patients	Necrosis-partial/complete	Operating time (minutes)	Hospital stay (days)	Patient acceptability (donor and recipient site)	
Skin grafting	2	-	45	5	50%	
Reverse radial forearm flap	3	-	150	6	67%	
Posterior interosseous artery flap	4	1	180	8	75%	
Abdominal flap	9	-	90	15	67%	
Groin flap	6	-	80	14	87%	
Free anterolateral thigh flap	3	1	330	9	67%	



Graph 1: Number of cases in different age groups



Graph 2: Number of cases with respect to wound size

short operation time, and technically easy to perform. Skin grafting (only 2 out of 27) is not a preferred option as it may develop adhesions later-on and hence mobility restriction (see Figure 1). PIA flap and free flaps are technically demanding and usually done in selected cases (see Figures 3 and 4).

DISCUSSION

Soft-tissue defects of dorsum of hand always present as a reconstructive challenge to plastic surgeons.^{1,2} The lack of adequate subcutaneous tissue frequently exposes the underlying tendons, bones, and nerves. Adani et al.,³ mention reconstruction of the dorsal surface of hand defects requires thin, pliable, and well-vascularized tissue with a gliding surface for the extensor tendon course. These defects are frequently not amenable to skin grafting thus requiring flap coverage. In our study, out of 27 patients only two patients



Figure 1: Seven months follow-up of skin grafting of soft-tissue defect of dorsum of hand



Figure 2: Six months follow-up of soft-tissue defect of dorsum of hand resurfaced by abdominal flap

could be treated with resurfacing by skin grafting as they had adequate subcutaneous tissue covering the tendons. Skin grafting is usually not an option in patients with dorsal soft-tissue defects as the skin with thin subcutaneous tissue in dorsum of hand is easily lost in trauma. This option should be reserved for patients having loss of only skin of dorsum of hand.⁴ The recipient site acceptability was not good in these patients as they frequently developed hyper/hypopigmentation of the site. Fifteen patients with soft-tissue defects of dorsum of hand were resurfaced by abdominal and groin flaps. These flaps required less operating time, minimal technical requirements and were very suitable for



Figure 3: Seven months follow-up of soft-tissue defect of dorsum of hand resurfaced by anterolateral thigh flap



Figure 4: Showing follow-up pictures of soft-tissue defect of dorsum of hand resurfaced by posterior interosseous artery flap



Figure 5: Soft-tissue defect on dorsum of hand resurfaced with groin flap

emergency situations. These flaps were also useful where the local tissue was not available as in extensive trauma involving

forearm. However, they require two stage procedures and are associated with increased patient morbidity and hospital stay. Another disadvantage is donor site scarring in some patients. They are recommended in emergency setup or when patient is not fit for free flap surgery and in patients requiring large area to be resurfaced (>100 cm²). However, they can also be used to resurface smaller defects. In their study, Ricardio et al.,⁵ mention that ultra-thin abdominal flap is safe, easy to harvest, has no donor site morbidity, and does not require a secondary debulking surgery. The recipient and donor site acceptability was high especially in patients treated with groin flap.⁶ Hassan,⁷ in their study, mention that in contrast to the complexity of free flaps, the pedicled groin flap is simple and easy to handle in emergencies. The locoregional flaps were technically demanding. They were suitable for smaller defects with trauma limited to dorsum of hand and wrist. Operating time was longer than abdominal flaps. However, advantage was that they required single stage procedure and were thin flaps. They are recommended for smaller defects in hemodynamically stable patients, where local tissue of forearm is available for reconstruction. They are also recommended when hospital stay is required to be short. Kaufman et al.,⁸ in their study, found the reverse radial forearm flap potentially offers thin, mobile skin with similar characteristics to the skin over the dorsum of the hand. The last group consisted of free flaps. They were technically highly demanding. The operating time was also long. Their advantage was that they could cover a large area. They were esthetically acceptable. They are indicated for large defects in hemodynamically stable patients and when sufficient technical support is available. However, in our study, there was loss of anterolateral flap in one patient. Thus, free flap should be done in patients after screening for co morbid conditions. The donor and recipient site acceptability was good in free flap patients. Meko et al.,⁹ in their study of resurfacing dorsal hand defects, found that one out of 12 patients developed full flap necrosis and two patients developed partial flap necrosis.^{10,11}

Limitations of the study

1. Our average follow-up period was 6 months, final functional and cosmetic outcome would have been better evaluated if the duration was more than one year.
2. Efficacy of different reconstructive options could be better documented if total no. of patients were more.

CONCLUSION

Abdominal flap and Groin flap are very useful in resurfacing soft-tissue defect of dorsum of hand especially in emergency situations. Other flaps such as PIA flap and free flaps are technically demanding and should be used

in hemodynamically stable patients with adequate technical support for the operation. Skin grafting has limited role due to frequently underlying vital structures being exposed.

ACKNOWLEDGMENT

We sincerely acknowledge the contribution of the study participants (patients), all operation theatre staffs, ward and OT nurses for their valuable support. We also acknowledge the support provided by all our colleagues, the hospital administration and Ethical committee for conducting this study.

REFERENCES

1. Wang HT, Fletcher JW, Erdmann D and Levin LS. Use of the anterolateral thigh free flap for upper extremity reconstruction. *J Hand Surg Am.* 2005;30:859-864.
<https://doi.org/10.1016/j.jhsa.2005.03.016>
2. Barun FM, Hoang P, Merle M, Van Genechten F and Foucher G. Technique and indications of the posterior interosseous flap in hand surgery. A report of thirty-three cases. *Ann Chir Main.* 1985;4(2):85-97.
[https://doi.org/10.1016/s0753-9053\(85\)80119-8](https://doi.org/10.1016/s0753-9053(85)80119-8)
3. Adani R, Marcoccio I and Tarallo L. Flap coverage of dorsum of hand associated with extensor tendons injuries: A completely vascularized single-stage reconstruction. *Microsurgery.* 2003;23(1):32-39.
<https://doi.org/10.1002/micr.10086>
4. Rachim SA and Chung KC. Local flaps of the hand. *Hand Clin.* 2014;30(2):137-151.
<https://doi.org/10.1016/j.hcl.2013.12.004>
5. Ricardo M, Damian G, Paul GO and Eilen M. Reconstruction of the hand defects by pedicled abdominal thin skin flaps. *JOJ Orthoped Ortho Surg.* 2017;1(1):20-23.
6. Lin SJ, Rable A and Yu P. Designing the antero-lateral thigh flap with preoperative Doppler or imaging. *J Reconstr Microsurg.* 2010;26:67-72.
<https://doi.org/10.1055/s-0029-1234023>
7. Hassan ML. Hand reconstruction by pedicled groin flap. *AAMJ.* 2011;9:1.
8. Kaufman MR and Jones NF. The reverse radial forearm flap for soft tissue reconstruction of the wrist and hand. *Tech Hand Up Extrem Surg.* 2005;9(1):47-51.
<https://doi.org/10.1097/01.bth.0000154479.20226.22>
9. Meko M, Safoury Y. Composite anterolateral thigh perforator flaps in the management of complex hand injuries. *Journal of Hand Surgery (European Volume).* 2013 May;38(4):366-70.
10. Bakri K. *Clinical Anatomy and Recipient Vessel Selection in the Upper Extremity.* Philadelphia: Saunders/Elsevier; 2009. p. 89-114.
11. Yamamoto Y, Igawa H, Minakawa H, Yoshida T, Sugihara T, Ohura T, et al. Reconstruction of iatrogenic dorsal skin defects of hands with reverse forearm flaps. *Eur J Plastic Surg.* 1994;17:104-105.

Authors Contribution:

SN and SK- Concept and design of the study, prepared first draft of manuscript; **SN and AKJ-** Reviewed the literature, and manuscript preparation; **SK and DM-** Concept, coordination, statistical analysis and interpretation, Interpreted the results; **AKJ and SK-** Revision of the manuscript.

Work attributed to:

Medical College and Hospital, Kolkata, West Bengal, India.

Orcid ID:

Sasanka Nath - <https://orcid.org/0000-0001-8308-573X>
 Subhashis Karmakar - <https://orcid.org/0000-0001-8079-7854>
 Amitesh Kumar Jha - <https://orcid.org/0000-0003-2196-8582>
 Dipankar Mukherjee- <https://orcid.org/0000-0003-3068-459x>

Source of Funding: None, **Conflicts of Interest:** None.