doi: 10.48095/ccachp20236

Prospective observational study of clinical outcomes in using posterior interosseous free flap for finger defects

M. K. Kumaraswamy[1], S. Chethan[2], K. S. Shanthakumar[3], K. Kamal[2]

[1] Department of Plastic Surgery, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, India
[2] Department of Plastic Surgery, Rajarajeshwari Medical College, Bangalore, India
[3] Department of Plastic Surgery, Ramaiah Medical College, Bangalore, India

Summary

Finger injuries are common in hand and plastic surgery practice. There are various options for reconstructing finger defects. Moderate sized skin defects of the fingers which need flaps are commonly covered using various abdominal flaps. These conventional workhorse flaps are thick, need two-staged procedures and require the hand to be kept in a cumbersome position. The radial artery or the ulnar artery flap need sacrifice a major vessel. To address the above, we have used the posterior interosseous artery free flap to cover finger defects. This was a prospective observational clinical study done on 15 patients admitted to a tertiary level hospital from July 2017 to July 2021. These patients had accidental industrial injuries with a loss of soft tissue on the fingers. There were finger fractures in 6 cases. These patients underwent posterior interosseous artery free flap cover. The flap size ranged from 6 × 3 cm to 10 × 4 cm. We had to cover the donor defects with skin graft in all our cases. Fourteen out of 15 flaps survived, with loss of one flap due to venous congestion. The mean two-point discrimination was 7.8 mm, with a total active motion percentage of more than 70% in 11 out of 15 cases. The posterior interosseous artery flap is a thin and pliable one stage flap, and may not need further flap thinning either, thereby establishing itself as a single stage procedure and moreover not requiring sacrifice a major vessel.

Key words

posterior interosseous artery free flap – finger defects – thin free flap

Kumaraswamy MK, Chethan S, Shanthakumar KS, Kamal K. Prospective observational study of clinical outcomes in using posterior interosseous free flap for finger defects. Acta Chir Plast 2023; 65(1): 6–12.

Introduction

Hand injuries are common workplace accidents presenting to the hospitals [1]. The usual modes of presentations seen are finger-tip injuries, crush, degloving and amputations. While simple defects can be treated with homodigital or heterodigital flaps, complex injuries need a flap cover commonly from a distant region. The choice of flap depends on the size of the defect, availability of the donor, micro-surgical expertise and instruments. For moderate sized defects of the fingers, the local flaps are insufficient. There are many distant flaps to be chosen from. Of them, the abdominal flap has been the workhorse flap for reconstruction. It does not need microinstruments and the reconstruction is also easier than a free flap [2]. The abdominal flap is a staged procedure compared to one stage free flap and needs the hand to be kept in a cumbersome position, besides being bulky and possibly requiring further thinning procedures [3]. Although we have free flaps such as radial and ulnar artery flaps to address these disadvantages, but these need to sacrifice of a major vessel. We studied the use of the free posterior interosseous artery (PIA) flap to cover moderate sized finger defects.

Materials and methods

This was a prospective study on 15 patients between July 2017 to July 2021, who underwent posterior interosseous free flap for reconstruction of their finger defects. Patients aged more than 18 years, who were admitted to the hospital with finger defects of more than 6 × 3 cm and consented for the PIA free flap were included in the study. Patients who were deemed not fit for free flap or those who did not consent for the procedure were excluded. Informed consent was taken from all the patients. The age, etiology, size of the flap, number of perforators, recipient fingers, flap success, complications, range of movements were recorded, and the results were analyzed using the JMP Pro 16 software.

Procedure

Supraclavicular blocks were given to all patients who underwent the surgery. The recipient site was debrided, and the

Fig. 1. (A) Marking of the flap; (B,C) flap after being harvested.

fractures were fixed using a K-wire. The digital vessel was selected proximal to the zone of the trauma and adequate blood flow was confirmed beforehand. Then the dorsal digital vein was dissected for venous anastomosis.

Flap harvest: the upper limb was flexed to 90° at the elbow, the forearm fully pronated and placed over the chest. The axis of the flap was marked along the line joining the lateral epicondyle and the wrist (head of the ulna) on the dorsum (Fig. 1). The perforators were marked in the middle third using a handheld doppler. The flap was harvested under a tourniquet with the use of magnification loupes as a free style flap. An ulnar exploratory incision parallel to the axis of the flap was used. The perforators were found in the septum between the extensor carpi ulnaris and the extensor digiti minimi, on the ulnar side and the extensor digitorum communis and extensor carpi radialis on the radial side. The cutaneous perforators were followed to the posterior interosseous vessels. The posterior interosseous vessels and the nerve are in proximity. The posterior interosseous nerve was identified from distal to proximal, and carefully dissected off the vessels. After dissecting the vessels and the perforators, our flap marking was revised and customized as necessary to accommodate possible inclusion of multiple perforators. The flap was then islanded over the perforators and the posterior interosseous vessels (Fig. 2). The vessel dissection was stopped at the distal margin of the supinator muscle. The flap was harvested after ligating and dividing the proximal and the distal ends of the posterior interosseous vessels.

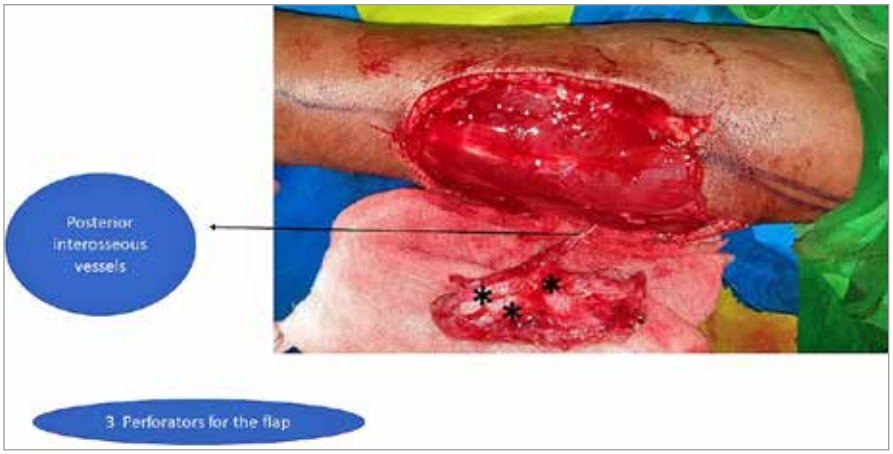

Fig. 2. The posterior interosseous flap is harvested. The posterior interosseous vessel is indicated by the arrow and the perforators are indicated by asterisks.

The posterior interosseous vessels were anastomosed end to end to the recipient digital vessels and flap inset was given. The fingers were immobilized for 3 weeks. Regular postoperative monitoring was done as per the institutional protocol for free flap monitoring. Patients were advised physiotherapy after 3 weeks following the surgery. They were followed up in the outpatient clinic at regular intervals of up to 6 months. At the end of 6 months, two-point discrimination (2PD) and the movements of the hand were measured using a goniometer. The percentage of total active motion was calculated using the following formula: total active motion (TAM) = flexion of the involved finger (metacarpophangeal joint (MCP) + PIP (proximal interphalangeal joint) + distal interphalangeal joint (DIP)) – extensor lag/ flexion of the involved finger (MCP + PIP + DIP) – extensor lag × 100.

Results

All our 15 patients were males aged 20–50 years with an average of 29.2 years. There was no specific motive for all study participants to be males. The industrial zone served by the hospital could be the reason, as all our patients had workplace injuries. The index and the middle fingers were the most involved fingers. The size of the flap harvested ranged from 6 × 3 cm to 10 × 4.5 cm (Tab. 1) with a mean flap size

of 30.4 cm^3. During our initial cases, the dorsal digital vein of the same digit was used (Fig. 3), but later we opted to use the digital vein of the other uninjured fingers. The posterior interosseous vessels were anastomosed end to end to the recipient digital vessels and a flap inset was given. In one case, an interposition vein graft was used between the common digital artery and the posterior interosseous artery (Fig. 4). The diameter of the pedicle was 1–1.2 mm. Each of our flaps had two or more perforators except one case where we had to base our flap on a large branch of the posterior interosseous artery (Fig. 5).

The fingers were immobilized for 3 weeks. Initially, we used a below elbow plaster of Paris slab to immobilize the hand. Later, we started placing a K-wire across the metacarpophalangeal joint of the involved finger (Fig. 6), along with the plaster of Paris below the elbow splints. Regular postoperative monitoring was done as per the institutional protocol for free flap monitoring. The average length of postoperative in-patient stay was 10 days. The patients were advised hand therapy after 3 weeks of surgery. They were followed up in the outpatient clinic at regular intervals for up to 6 months. At the end of the 6 months, 2PD and the range of motion of the hand were measured using a goniometer. The percentage of total active motion (Tab. 2) was calculated using the following formula: total active motion (TAM) = flexion of the involved finger (MCP + PIP + DIP) – extensor lag/flexion of the involved finger (MCP + PIP + DIP) – extensor lag ×100. The results were statistically analyzed using the JMP Pro 16 software.

One flap was lost due to venous congestion and the operative success rate was 93%. The mean 2PD recorded over the flap was 7.8 mm with a range of 7–10 mm. The mean percentage of the total active motion was 79.2 with a range of 49–93%. Eleven out of 15 patients had more than 70% of total active motion.

Tab. 1. Details of the cases.

Case number	Age/ sex	Finger and extent	Number of perforators	Flap size (cm)	Complications
1	24/M	index – distal, middle	3	8 × 5	none
2	45/M	middle - distal, middle	3	10 × 4.5	flap loss – venous congestion
3	31/M	little - proximal	2	7 × 3	none
4	24/M	ring – distal, middle	2	9 × 5	none
5	21/M	index –proximal, middle, distal	2	10 × 3	none
6	25/M	middle – distal, middle	2	7.5 × 3	none
7	32/m	thumb – distal, proximal	2	6 × 3	none
8	24/M	index – distal, middle	3	8.5 × 4	none
9	28/M	index – distal, middle	2	8 × 3	none
10	26/M	middle – distal, middle	3	10 × 4	none
11	24/M	ring – middle, distal	2	9 × 3	none
12	25/M	middle – proximal, middle, distal	2	10 × 3.5	none
13	33/M	index – distal, middle	1	7 × 3	none
14	42/M	middle – distal, middle	2	8.5 × 4	none
15	34/M	ring – distal, middle	2	6.5 × 3	none

M – male

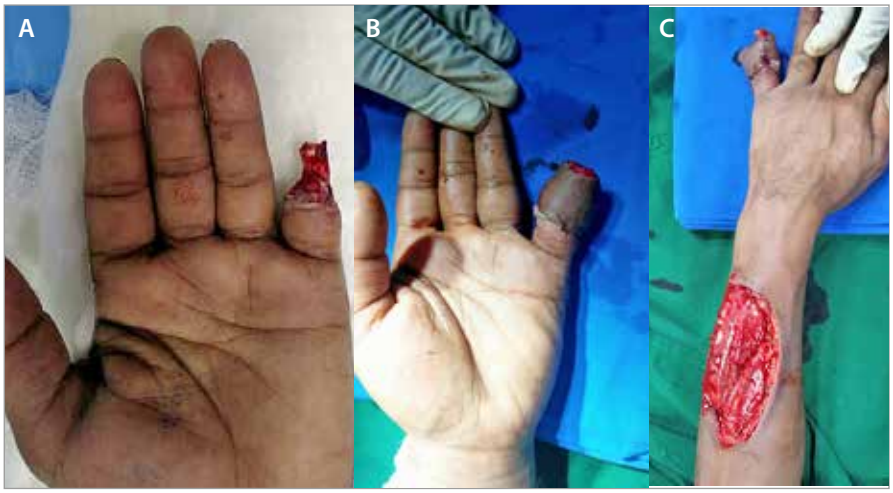

Fig. 3. (A) Defect over the middle phalanx with amputation of the distal phalanx. (B) Immediate post-operative picture after inset; (C) immediate post-operative picture of the donor site, the dorsal digital vein of the same digit was used.

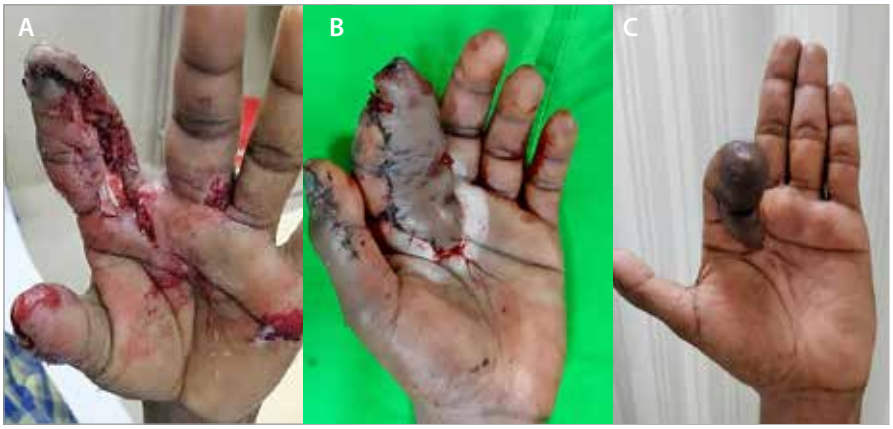

Fig. 4. (A) Crush injury of the index finger with soft tissue loss over the distal, middle and the proximal phalanx with flexor tendons exposed; (B) posterior interosseous flap inset, an interposition vein graft was used and anastomosed to the common digital vessel; (C) late postoperative picture of 6 months.

Discussion

Smaller finger defects which need a flap can be covered by local flaps [4], V-Y flaps, advancement flaps, distal based finger flaps, bilobed flaps, propeller flaps, cross finger flaps [5], thenar flaps, homo-digital flaps [6], and toe free flaps. The bigger complex defects, for which the above flaps cannot provide sufficient cover, can be chosen from radial artery perforator flaps, ulnar artery perforator flaps, abdominal flaps, free fascio-cutaneous flaps like the free groin flap, anterolateral thigh flaps, dorsalis pedis artery flap and posterior interosseous artery flap, to name a few. The posterior interosseous flap is thin and supple with minimal fat which improves the function, movement and esthetics of the fingers. The abdominal flaps which are the most commonly used flaps for reconstruction of such defects are bulky and they require staged procedures. Also, the bulky flaps are difficult to inset. They may not turn out to be the best esthetically, and need further procedures to thin the flaps [7]. The hand needs to be kept in a cumbersome position as well. Modifications of the abdominal flaps give us thinner options, but the skin tends to be thick. Superthin or ultrathin abdominal flaps have been described to harvest a very thin flap, but it would be a staged procedure. The skin on the dorsum of the forearm is thin and pliable. Among free flaps, the groin flap is also common in reconstruction. However, we found the PIA flap to be thin and supple more consistently than the groin free flap. Besides, PIA was a better match for the digital vessels.

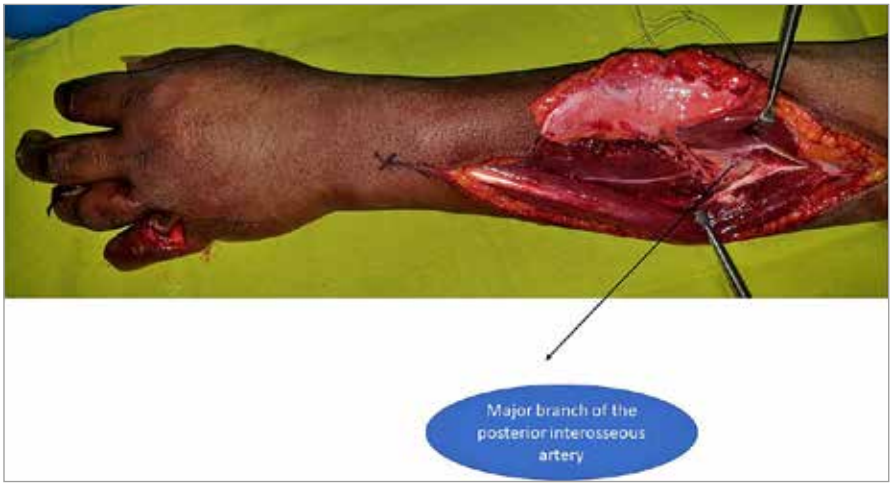

Fig. 5. Posterior interosseous flap has been harvested on a major branch of the posterior interosseous vessels. The arrow shows the main posterior interosseous vessel before giving the branch.

The posterior interosseous flap is commonly used as a pedicled flap [8]. The posterior interosseous artery territory in the dorsal forearm extends from the elbow to the wrist [9], and is based on the communication between the anterior interosseous and the posterior interosseous vessels at the wrist [10]. Hence, defects up to the metacarpophalangeal joints can be covered using this flap. The knowledge of this anatomy also allows it to be used for elbow cover based on the antegrade flow of the posterior interosseous vessels. When based on the communication of the posterior interosseous vessels with the dorsal intercarpal arch, the pedicled posterior interosseous flap has been able to reach the distal to proximal interphalangeal joints [11]. The flaps can be used as fascio-cutaneous flaps, sensate flaps, fascial flaps, and osteo-fascio-cutaneous flaps.

The posterior interosseous artery arises from the common interosseous artery, which is a branch of the ulnar artery. The posterior interosseous vessels pierce the interosseous membrane and enter the dorsal compartment at about 8 cm distally to the lateral epicondyle of the humerus. Multiple perforators are given to the dorsum of the forearm. The artery is accompanied by the posterior interosseous nerve. The diameter of the vessel distally to the supinator muscle is 1.1–1.2 mm and it decreases in size as it flows distally, but proximally to its anastomosis with the anterior interosseous vessels, it is relatively big in size. If the posterior interosseous vessels are dissected proximally under the supinator muscle, the diameter of the vessel can be about 2.2 mm and we may also get 3–4 cm of additional pedicle length [12].

In our present study, we restricted our dissection to the distal border of the supinator muscle, and the diameter of the pedicle was 1–1.2 mm. This diameter was comparable to the digital vessels.

The posterior interosseous nerve gives a branch to the extensor carpi ulnaris. This branch crosses the posterior interosseous vessels. We have been able to safely dissect the flap by restricting our dissection to the distal border of the supinator muscle. Prior identification of perforators with a doppler makes the free style flap dissection easier. In one of our cases in the present series, we harvested a flap on a larger proximal branch of the posterior interosseous vessels. Here, the vessel diameter was 1 mm. The continuation of the posterior interosseous artery was smaller, and it descended along with the nerve.

The axis of the flap is centered between the extensor digiti minimi and the extensor carpi ulnaris in full pronation. This axis includes the maximum number of perforators arising from the posterior interosseous vessels. There are clusters of perforators located at the middle third and the distal third aspects of the flap axis [13]. In our study, most of our flaps had two or more than two perforators included, except one where we had to harvest on one of the major

Tab. 2. Active and passive range of movements of the involved fingers.

Case number	Range of passive motion (MCP + PIP + DIP)	Active range of motion (MCP + PIP + DIP)	TAM in %
1	98 + 88 + 84	110 + 100 + 80	93
2	84 + 90 + 80	96 + 96 + 87	91
3	85	92	
4	89 + 84 + 78	92 + 87 + 85	93
5	96 + 89 + 75	100 + 97 + 81	91
6	93 + 87 + 78	95 + 100 + 96	89
7	38 + 75	40 + 90	87
8	88 + 74 + 54	103 + 100 + 73	74
9	75 + 68 + 43	86 + 100 + 80	67
10	82 + 64 + 43	98 + 94 + 90	65
11	82 + 70 + 41	92 + 94 + 86	49
12	86 + 70 + 60	90 + 98 + 88	78
13	94 + 80 + 52	90 + 106 + 84	81
14	85 + 66 + 54	98 + 96 + 88	73
15	85 + 75 + 48	90 + 91 + 82	79

DIP – distal interphalangeal joint, MCP – metacarpophalangeal joint, PIP– proximal interphalangeal joint, TAM – total active motion = flexion of the involved finger (MCP + PIP + DIP) – extensor lag/flexion of the involved finger (MCP + PIP + DIP) – extensor lag × 100.

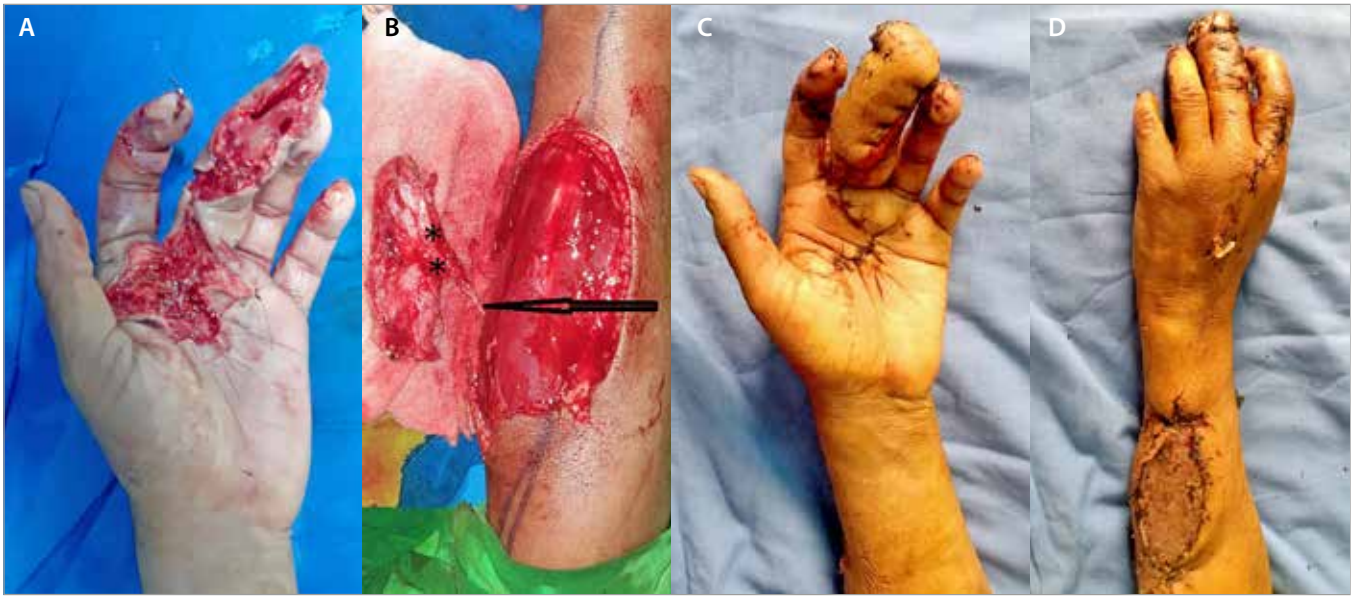

Fig. 6. (A) Defect over the middle finger, over the distal and the middle phalanx, the recipient vessels have been dissected; (B) flap harvested from the forearm with the attached pedicle; (C) post-operative picture one week after flap inset; (D) post-operative picture one week after flap inset, donor site. K-wire for immobilisation of the metacarpophalangeal joint, the dorsal digital vein was dissected from the index finger.

branches of the posterior interosseous artery. We revised the flap length based on the location of the perforators, probable length of the pedicle required and the recipient vessel position. We had to revise the flap marked in four of our cases since we found that the doppler marked perforator was not present or insufficient. Since our study included only finger defects, the length of the flap and minimal changes in the width of the flap could be altered easily. We believe that a medial exploratory incision with the patients forearm on the chest with elbow flexed helps in easy identification of the perforators, and this would help in revising the width of the flap if necessary. The maximum width of our flaps was 5 cm. We found that dissection after a medial exploratory incision helps us to identify the relevant perforators, the posterior interosseous vessels and the accompanying posterior interosseous nerve comfortably. When the flap is harvested by a lateral exploratory incision, we encounter other perforators before we reach the septum. This may make the dissection difficult.

The digital artery was identified for anastomosis. Choice of the digital artery was made based on a simple rationale that the side which was crushed or cut distally should be used. This would safeguard the vascularity of the finger. The digital vessel was dissected proximally to a healthy non-traumatic zone. In all our cases, we found that the vessels had good flow at the web space or proximal to the proximal-most dorsal digital branches. Distal to the proximal dorsal branch, the digital vessel decreased in size and may be more sensitive to spasm. Although we used topical drugs like lignocaine and papaverine [14] to relieve spasm of the vessels, we could not successfully relieve the spasm. It has been well documented that the spasm of the vessels can be reversed by using topical lignocaine or papaverine [14]. We assumed that effect of trauma, sensitivity to spasm and resistance to topical drugs dictated on using the vessel proximal to the proximal dorsal digital branch. At this level, we observed a favorable increase in the size of the donor artery which was comparable to the posterior interosseous vessels. In one of our cases, we had to move proximally to the common digital vessels to get a good flow. Our pedicle length was not sufficient, hence an interposition vein graft harvested from the forearm was used.

The dorsal digital vein was used in all our cases. Initially, in our cases we used the same digit dorsal digital vein, later we used the adjacent digit dorsal digital vein. The same digit vein, being more likely in the zone of trauma, decreased our chances of harvesting a long digital vein. We were able to dissect a sufficiently long vein that could be brought through the web space to reach the digital vessel. The metacarpophalangeal joint was immobilized in flexion of 30–45° after the anastomosis. In view of the postoperative movement of the finger that could jeopardize the flap by stretching of the vein, we harvested a sufficiently long vein and fixed the metacarpophalangeal joint with K-wires for 3 weeks.

The flap was thin enough and pliable, and it did not restrict finger flexion. The total range of motion of the fingers were adequate to perform routine functions. The deep fascia that was harvested in the flap allowed good gliding of the underlying tendons. We have used the percentage of the total active motion of the fingers to evaluate the function of the reconstructed digit. The total active motion in 11 out of 15 patients was > 70%. None of our cases needed tendon reconstruction; however, there were fractures in 6 cases. As per the American society of hand surgeons, > 75% of total active motion is considered excellent [15]. In cases with fracture involving the joints, we had a lower total active motion percentage.

The radial artery or ulnar artery fasciocutaneous flap can be used as a pedicled flap and can cover the fingers up to the tip. These can be used as a thin fascial flap with a skin graft. The major disadvantage is that these flaps require sacrifice of a major vessel [16,17]. The use of posterior interosseous artery flap does not sacrifice a major vessel of the hand. We will not have a bridge of tissue across the hand as in case of pedicled radial or ulnar fascio-cutaneous flaps.

The posterior interosseous flap has been used as a multi paddle flap based on multiple perforators. This design has been used to cover the defects over multiple fingers. Usami et al [7] have used the posterior interosseous flap as a bi-paddle or tri-paddle flaps for simultaneous cover of multiple fingers. They have reported to have reduced the donor site morbidity, being able to close the defects primarily. If the harvested flap width is < 4 cm, the donor defect may be closed primarily. However, we found that primary closure of a flap donor defect of ≥ 3 cm could not be closed primarily. All our cases had skin graft for the donor site. The patients accepted the skin graft scar and none of them asked for a skin graft revision. There are ways to easily manage the donor cosmesis if the patient wishes, either by scar revision or skin graft excision and closure. Also, serial excision and using the tissue expander may also be used in cases where the grafted area is large for one sitting.

All the flaps were harvested as insensate flaps. None of the patients developed fingertip ulcers during the study period. All patients developed protective sensations. Jeong et al have used a posterior interosseous flap and have recorded a 2PD of 6–9 mm [12]. Our findings are comparable to other literature with an insensate flap. The posterior interosseous flap can be made a sensate flap if the antebrachial cutaneous nerve is included [18]. The sensate flaps can help improve the 2PD and hence improve protection, especially when used on the palmar defects. The posterior antebrachial nerve of the forearm is a sensory nerve and is in the superficial plane

above the fascia. The nerve can be dissected proximally to get the length. The nerve size is comparable to that of the digital nerve and can be co-opted. In the present series, all our cases were insensate flaps, but we were able to achieve a mean of 7.8 mm protective 2PD sensation. Satoshi et al have also recorded that the 2PD and the total active movement of the hand was acceptable compared to the other hand [7].

The advantage of using the posterior interosseous flap for the finger defects is that it can be harvested from the same limb, under a brachial plexus block. This is a single staged procedure. The flap is thin and supple, which would not need a flap thinning and hence esthetically better. The deep fascia would help in the gliding of the underlying tendons which is functionally better. A sensate flap can be harvested with the antebrachial nerve.

The flap on the dorsum of the forearm is hirsute skin, hence hair growth is a problem. This may need regular hair clippings or laser hair removal. The vessels are small, causing difficulty in anastomosis.

Conclusion

The posterior interosseous free flap is a thin, supple flap which can be harvested from the same limb under single limb anesthesia. It may not need flap thinning. Flap dissection limited to the distal border of the supinator muscle helps in decreasing the injury to the branches of the posterior interosseous nerve.

Disclosure: The authors have no conflicts of interest to disclose. The authors declare that this study has received no financial support. All procedures performed in this study involving human participants were in accordance with ethical standards of the institutional research committee (Ramaiah Medical College) and with the Helsinki Declaration and its later amendments or comparable ethical standards.

Roles of authors

Mohan Kumar Kumaraswamy – conception of the work, acquisition, analysis, interpretation, drafting, interpretation of data;
Satish Chethan – interpretation of data, drafting;
Shivalingappa Shanthakumar – conception of the work, acquisition, analysis, interpretation, drafting, interpretation of data;
Kumar Kamal – interpretation of data, drafting.

References

1. Gupta A., Gupta AK., Uppal SK., et al. Demographic profile of hand injuries in an industrial town of north India: a review of 436 patients. *Indian J Surg.* 2013, 75(6): 454–461.
2. Sabapathy SR., Bajantri B. Indications, selection, and use of distant pedicled flap for upper limb reconstruction. *Hand Clin.* 2014, 30(2): 185–199.
3. Al-Qattan MM., Alammar AK., Alfaqeeh FA., et al. Pedicled abdominal flaps for hand reconstruction in adults: physiotherapy of the attached hand. *Plast Reconstr Surg Glob Open.* 2021, 9(3): e3474.
4. Foucher G., Delaere O., Citron N., et al. Long-term outcome of neurovascular palmar advancement flaps for distal thumb injuries. *Br J Plast Surg.* 1999, 52(1): 64–68.
5. Li YF., Cui SS. Innervated reverse island flap based on the end dorsal branch of the digital artery: surgical technique. *J Hand Surg Am.* 2005, 30(6): 1305–1309.
6. Kappel DA., Burech JG. The cross-finger flap. An established reconstructive procedure. *Hand Clin.* 1985, 1(4): 677–683.
7. Usami S., Okazaki M. Fingertip reconstruction with a posterior interosseous artery perforator flap: a minimally invasive procedure for donor and recipient sites. *J Plast Reconstr Aesthet Surg.* 2017, 70(2): 166–172.
8. Zancolli EA., Argrigiani C. Posterior interosseous island forearm flap. *J Hand Surg Br.* 1988, 13(2): 130–135.
9. Cormack GC., Lamberty BGH. The arterial anatomy of skin flaps. *Churchill Livingstone: Edinburgh.* 1986, 113–256.
10. Zancolli EA., Angergiani C. Dorsal forearm island flaps. In: Abstacts of the 3rd congress of the international federation of societies for surgery of the hand. *Tokyo: Japan*. 1986.
11. Zaidenberg EE., Farias-Cisneros E., Pastrana MJ., et al. Extended posterior interosseous artery flap: anatomical and clinical study. *J Hand Surg Am.* 2017, 42(3): 182–189.
12. Park JJ., Kim, JS., Chung JI. Posterior interosseous free flap: various types. *Plast Reconstr Surg.* 1997, 100(5): 1186–1197.
13. Sun C., Wang YL., Ding ZH., et al. Anatomical basis of a proximal fasciocutaneous extension of the distal-based posterior interosseous flap that allows exclusion of the proximal posterior interosseous artery. *J Plast Reconstr Aesthet Surg.* 2015, 68(1): 17–25.
14. Egozi D., Fodor L., Ullmann Y. Salvage of compromised free flaps in trauma cases with combined modalities. *Microsurgery.* 2011, 31(2): 109–115.
15. Magnani PE., Ferreira AM., da Silva Rodrigues EK., et al. Is there a correlation between patient-reported outcome assessed by the Disabilities of the Arm, Shoulder and Hand Questionnaire and total active motion after flexor tendon repair? *Hand Ther.* 2012, 17(2): 37–41.
16. Shibata M., Iwabuchi Y., Kubota S., et al. Comparison of free and reversed pedicled posterior interosseous cutaneous flaps. *Plast Reconstr Surg.* 1997, 99(3): 791–802.
17. Liu Y., Jiao H., Ji X., et al. A comparative study of four types of free flaps from the ipsilateral extremity for finger reconstruction. *PLoS One.* 2014, 9(8): e104014.
18. Ishiko T., Nakaima N., Suzuki S. Free posterior interosseous artery perforator flap for finger reconstruction. *J Plast Reconstr Aesthet Surg.* 2009, 62(7): e211–e215.

Assoc. Prof. Mohan Kumar Kumaraswamy
Department of Plastic Surgery,
Sapthagiri Institute of Medical Sciences
and Research Centre
Bangalore, India
e-mail : drmks2001@gmail.com

Submitted: 13. 9. 2022
Accepted: 21. 3. 2023