

Original Research Article

Reverse dorsal metacarpal artery flap to cover skin and soft tissue defects over fingers proximal to distal interphalangeal joint

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ABSTRACT

Background: Finger injuries with soft-tissue loss and exposure of tendons, joints, or bones require stable and durable vascularized flap coverage to preserve hand function. The aim of the study was to evaluate the clinical outcomes of reverse dorsal metacarpal artery flap reconstruction for covering skin and soft-tissue defects of the fingers proximal to the distal interphalangeal joint.

Methods: This descriptive observational study was conducted at the Department of Plastic Surgery and 100-Bed Burn Unit, Dhaka Medical College and Hospital (DMCH), Dhaka, Bangladesh, from February 2016 to January 2017. 50 (fifty) patients were included with finger skin and soft-tissue defects proximal to the distal interphalangeal joints. Reconstruction was done by Reverse dorsal metacarpal artery flap. Flap survival, donor-site morbidity, and joint function were assessed. Data were analyzed using SPSS after obtaining informed consent.

Results: Among 50 patients, most were male (42, 84.0%) and aged 25-35 years (27, 54.0%). Index-finger defects (24, 48.0%) and electric burns (31, 62.0%) predominated. Complete flap survival occurred in 39 patients (78.0%), with no donor-site morbidity in 43 (86.0%). Full MCP and PIP movement was achieved in 39 (78.0%) and 45 (90.0%) patients, respectively.

Conclusions: The reverse dorsal metacarpal artery flap is a simple, reliable, single-stage option for skin and soft-tissue reconstruction of fingers proximal to the distal interphalangeal joint, with minimal donor-site morbidity and early functional recovery.

Keywords: Reverse dorsal metacarpal artery flap, Soft-tissue defects, Finger reconstruction, Distal interphalangeal joint, Flap survival

INTRODUCTION

Finger injuries can compromise the function of the entire upper limb. Soft-tissue defects of the fingers with exposure of tendons, joints, or bones require stable vascularized flap coverage. The causes of finger injuries include machine crushing, electric burns, flame burns. Sometime after release of flexion contractures of fingers joint, bone, tendon, vessel and nerve may exposed. Skin and soft tissue defects in some areas of the digits are difficult to

reconstruct, such as the ulnar aspect of the little and ring fingers, radial aspect of the index finger, dorsal or volar aspects of the fingers with exposed proximal interphalangeal or metacarpophalangeal joint and the proximal phalanx of the thumb.^{1,2} Surgical options for finger injuries include local, regional, and distant flaps. The use of local flaps, including transposition and advancement flaps with random vascularity, is restricted because of their limited range of mobility. The cross-finger flap is a staged operation requiring skin grafting of the

donor site, prolonged operative time, and prolonged immobilization, with the risk of subsequent joint stiffness.³ Distant flaps, such as abdominal and groin flaps, are also staged procedures and have disadvantages including differences in skin texture, color, and thickness compared with finger skin, flap bulkiness, and prolonged immobilization.

The reverse dorsal metacarpal artery flap has several advantages, including a reliable axial blood supply, simple dissection, minimal postoperative care, a thin flap with good elasticity and durability, avoidance of immobilization of unaffected digits, primary closure of the donor site, and early return to work. However, skin grafting may be required at the donor site if the flap width exceeds 3.5 cm. Other disadvantages include a long linear scar on donor site, lack of sensation, and possible absence of the fourth dorsometacarpal artery in 10-20% of the population.

The reverse dorsal metacarpal flap was first reported in 1990 by Lu et al in China and by Quaba et al and Mayuyama et al in the English literature.¹⁻³ Since its introduction, this flap has attracted considerable interest among plastic and hand surgeons because it provides an excellent and reliable method for covering skin defects over the fingers.

The dorsal metacarpal arteries (DMAs) are relatively constant arteries that course between the extensor tendons and dorsal interossei.^{1,4} The dominant sources of the DMAs arise from the deep palmar arterial arch, and each DMA has communications with the dorsal arterial network of the wrist.⁵ The DMA lies on the surface of the epimysium of the dorsal interosseous muscle between two adjacent metacarpals. Approximately 1.5 cm proximal to the leading edge of the web space, the DMA anastomoses with the common or proper palmar digital artery. This anastomosis forms the anatomical basis of the reverse dorsal metacarpal flap. Each DMA is accompanied by two venae comitantes measuring approximately 0.2-0.3 mm in diameter, which provide venous drainage for the flap.⁶⁻⁸ The reverse dorsal metacarpal flap is designed according to the selected DMA. For example, to cover a skin defect over the middle finger, the second or third DMA can be selected as the pedicle. The axis of the flap lies along the midline between adjacent metacarpals, and the pivot point is located approximately 1.5 cm proximal to the leading edge of the web space. The skin paddle is dissected between the fascia and extensor paratenon, while the pedicle is dissected beneath the epimysium of the dorsal interosseous muscle. The reverse dorsal metacarpal flap can be performed under brachial plexus block or local anesthesia at the wrist. Under tourniquet control without exsanguination, the radial edge of the planned flap is incised to the extensor paratenon, and the skin is undermined toward the DMA beneath the fascia.⁹

Given its reliable vascularity, relatively simple dissection, favorable tissue characteristics, and potential for primary

donor-site closure, the reverse dorsal metacarpal artery flap represents an important option for reconstruction of skin and soft-tissue defects of the fingers proximal to the distal interphalangeal joint.

Objective

The objective of this study was to evaluate the clinical outcomes of the reverse dorsal metacarpal artery flap for coverage of skin and soft-tissue defects over the fingers proximal to the distal interphalangeal joint.

METHODS

This descriptive observational study was conducted at the Department of Plastic Surgery and 100-Bed Burn Unit, Dhaka Medical College and Hospital (DMCH), Dhaka, Bangladesh, between February 2016 and January 2017. A total of 50 patients with skin and soft-tissue defects over the fingers proximal to the distal interphalangeal (DIP) joints were included based on predefined inclusion and exclusion criteria to evaluate the clinical outcomes of reverse dorsal metacarpal artery flap reconstruction.

Inclusion criteria

Soft-tissue defect of a finger proximal to the DIP joint, measuring at least 1.0 cm in the greater dimension and soft-tissue defect with exposure of bone, tendon, or joint were included.

Exclusion criteria

Soft-tissue defect distal to the DIP joint; injury involving the course of the dorsal metacarpal artery; soft-tissue defect measuring less than 1.0 cm in the greater dimension without exposure of bone, tendon, or joint and patients unwilling to participate in the study were excluded.

Surgical procedure and outcome assessment

Based on the location of the skin defect, an appropriate dorsal metacarpal artery (DMA) was selected as the pedicle of the reverse dorsal metacarpal flap. The flap was designed according to the selected DMA, with its axis aligned along the midline between adjacent metacarpals. The pivotal point was located 1.5 cm proximal to the leading edge of the web space. The pedicle location was identified and marked using a handheld vascular Doppler. Wound and flap dimensions were measured in centimeters using a measuring scale. The dissection plane of the skin paddle was located between the fascia and the extensor paratenon, while the pedicle was dissected beneath the epimysium of the dorsal interosseous muscle.¹⁰⁻¹²

The reverse dorsal metacarpal flap was performed under brachial plexus block or local anesthesia at the wrist. Under tourniquet control without exsanguination, the radial edge of the planned flap was incised down to the extensor paratenon, and the skin was undermined toward

the DMA beneath the fascia. As the DMA lies on the surface of the epimysium of the dorsal interosseous muscle, the artery was dissected beneath the epimysium to preserve the DMA and its venae comitantes. The epidermal and dermal layers over the pedicle were then incised, while the surrounding adipose tissue was preserved with the DMA. During pedicle dissection, the superficial veins from the dorsum of the adjacent fingers were ligated, as these veins could contribute to venous drainage following flap elevation.¹³ The pedicle was dissected until the predetermined pivotal point was reached. The opposite edge of the flap was then incised down to the extensor paratenon and undermined toward the DMA to complete flap elevation. The flap was subsequently transferred to the recipient site.

Donor-site defects measuring less than 3.5 cm could be closed primarily. The width of the skin paddle was therefore maintained below 3.5 cm to avoid the need for split-thickness skin grafting over the dorsum of the hand.¹⁴⁻¹⁶ Postoperative outcomes were assessed in terms of flap survival, degree of flap loss, donor-site morbidity, and functional outcomes. The range of motion of the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints was measured using a goniometer. Clinical photographs were obtained using a digital camera. Postoperative outcomes were assessed in terms of flap survival, degree of flap loss, donor-site morbidity, and functional outcomes. The range of motion of the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints was measured using a goniometer and compared with the preoperative condition. Clinical photographs were obtained using a digital camera.

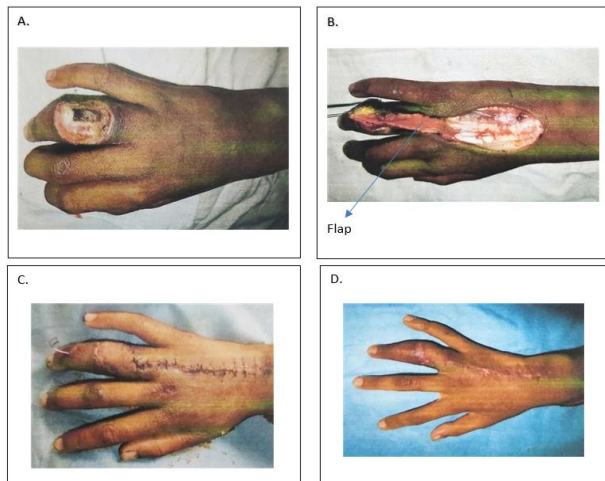


Figure 1: Reverse dorsal metacarpal artery flap for reconstruction of a dorsal ring finger defect (A) preoperative soft tissue wound over the dorsum of the ring finger; (B) intraoperative flap elevation on the dorsum of the hand; (C) postoperative appearance at 2 weeks showing successful flap integration; and (D) final clinical result at 6 months showing a mature scar and stable contour.

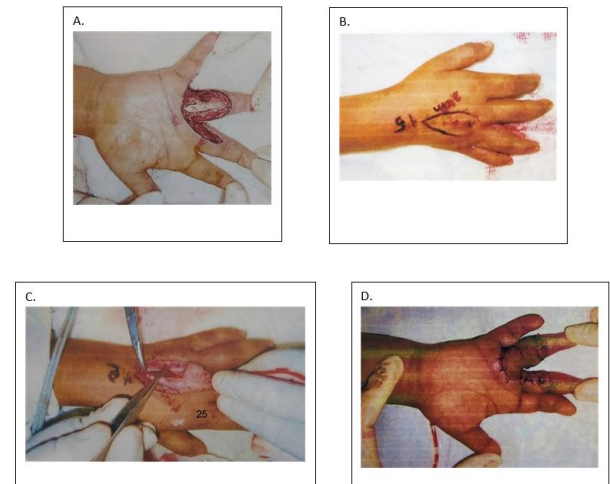


Figure 2: Intraoperative planning, elevation, and inset of reverse dorsal metacarpal artery flap for volar surface defect (A) preoperative soft tissue defect over the volar surface of the middle and ring finger web space; (B) preoperative design and axial marking of the flap on the dorsum of the hand; (C) intraoperative flap elevation and pedicle skeletonization; and (D) immediate postoperative inset of the flap into the volar recipient site.

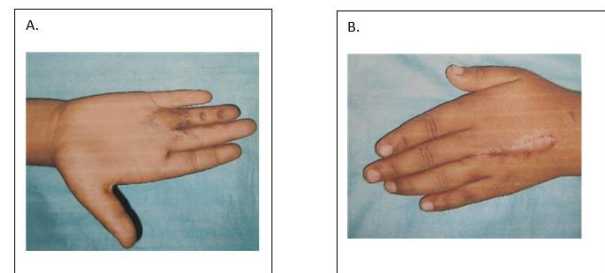


Figure 3: Long-term clinical and donor site outcomes at 6 months follow-up (A) volar view at 6 months showing complete flap survival, contracture free fingers and web space, and preserved function; and (B) dorsal view at 6 months demonstrating a well-healed donor site scar with minimal aesthetic defect.

Data collection and analysis

Data were collected through face-to-face interviews, clinical examinations, and a structured questionnaire containing sociodemographic and relevant clinical information.

The general medical condition of the patients was assessed through history, physical examination, and relevant investigations. Postoperative follow-up findings and surgical outcomes were recorded systematically.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), while Microsoft Excel 2007 was

used for data organization and tabulation. Results were presented as frequencies and percentages, as appropriate.

Ethical considerations and quality control

Written informed consent was obtained from the patients or their parents/attendants before the procedure. Participants were informed about the study objectives, procedures, confidentiality, and their right to withdraw from the study at any time. All surgical procedures were performed under the supervision of the study supervisor by trained medical professionals. Systematic data collection and postoperative assessment were performed to ensure data quality and consistency.

RESULTS

The majority of patients were aged 25-35 years (27 patients, 54.0%), with a mean age of 24.02 ± 6.8 years. Male patients predominated (42 patients, 84.0%). Factory workers constituted the largest occupational group (24 patients, 48.0%), followed by garments workers (11 patients, 22.0%). Overall, 35 patients (70.0%) were workers (Table 1).

The index finger was the most commonly affected site (24 patients, 48.0%). Electric burn was the predominant cause of wound (31 patients, 62.0%), followed by machinery injury (18 patients, 36.0%) (Table 2).

The wound dimensions ranged from 1.5×1.0 cm to 6.5×3.0 cm, with the most common size range being 3.5×2.5 to 4.5×3.0 cm (28 patients, 56.0%). Flap dimensions ranged from 2.0×1.5 cm to 7.0×3.5 cm, with the most common

size range being 4.0×3.0 to 5.0×3.5 cm (28 patients, 56.0%). In all patients, the flap was designed approximately 5 mm larger in both length and width than the corresponding wound (Table 3).

The 2nd dorsal metacarpal artery (DMA) was the most frequently used pedicle (27 patients, 54.0%), followed by the 3rd DMA (21 patients, 42.0%) and the 4th DMA (2 patients, 4.0%) (Table 4).

Complete flap survival was observed in the majority of patients (39 patients, 78.0%). Near-total to complete flap loss of 91-100% occurred in 4 patients (8.0%) (Table 5).

No donor-site morbidity was present in the majority of patients (43 patients, 86.0%). Donor-site scar was observed in 6 patients (12.0%), while donor-site infection occurred in 1 patient (2.0%) (Figure 4).

Full range of movement was possible in 39 patients (78.0%) at the MCP joint and 45 patients (90.0%) at the PIP joint. At the MCP joint, 6 patients (12.0%) had 5-10° restriction, 4 patients (8.0%) had 10-20° restriction, and 1 patient (2.0%) had no movement.

At the PIP joint, 5 patients (10.0%) had 5-10° restriction. Functional outcomes were assessed using a goniometer (Table 5). Full range of movement was possible in 39 patients (78.0%) at the MCP joint and 45 patients (90.0%) at the PIP joint. At the MCP joint, 6 patients (12.0%) had 5-10° restriction, 4 patients (8.0%) had 10-20° restriction, and 1 patient (2.0%) had no movement. At the PIP joint, 5 patients (10.0%) had 5-10° restriction. Functional outcomes were assessed using a goniometer.

Table 1: Demographic characteristics of the study participants (n=50).

Category	Characteristics	Frequency (N)	Percentage (%)
Age group (years)	5-14	4	8.0
	15-24	19	38.0
	25-35	27	54.0
Sex	Male	42	84.0
	Female	8	16.0
Occupation	Factory worker	24	48.0
	Garments worker	11	22.0
	Service holder	7	14.0
	Student	6	12.0
	Housewife	2	4.0

Table 2: Clinical characteristics of the wound according to location and cause (n=50)

Category	Characteristic	Frequency (N)	Percentage (%)
Location of wound	Index finger	24	48.0
	Middle finger	19	38.0
	Ring finger	6	12.0
	Little finger	1	2.0
Cause of wound	Electric burn	31	62.0
	Machinery injury	18	36.0
	Contracture	1	2.0

Table 3: Wound and flap dimensions among the study participants (n=50).

Category	Dimension range (cm)	Frequency (N)	Percentage (%)
Wound dimensions	1.5×1.0 to 3.0×2.5	18	36.0
	3.5×2.5 to 4.5×3.0	28	56.0
	5.1×3.0 to 6.5×3.0	4	8.0
Flap dimensions	2.0×1.5 to 3.5×3.0	18	36.0
	4.0×3.0 to 5.0×3.5	28	56.0
	5.5×3.5 to 7.0×3.5	4	8.0

Table 4: Distribution according to dorsal metacarpal artery used for flap (n=50).

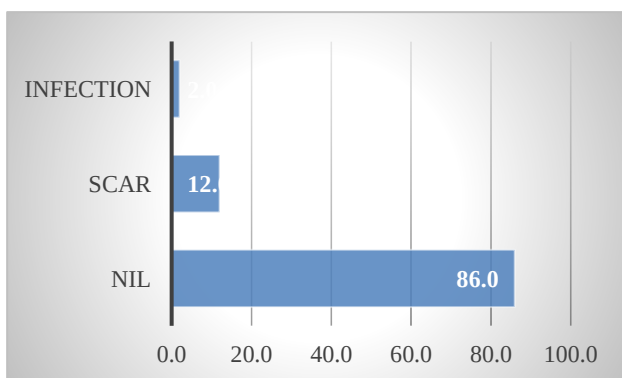
Dorsal metacarpal artery	Number of cases	Percentage (%)
2nd DMA	27	54.0
3rd DMA	21	42.0
4th DMA	2	4.0
Total	50	100.0

Table 5: Flap survival and degree of flap loss among the study participants (n=50).

Category	Outcome	Frequency (N)	Percentage (%)
Flap survival	Complete survival	39	78.0
Partial flap loss	1-10% loss	3	6.0
	11-20% loss	3	6.0
	21-30% loss	1	2.0
Near-total/complete flap loss	91-100% loss	4	8.0

Table 6: Functional outcomes of the MCP and PIP joints (n=50)

Category	Range of movement	Frequency (N)	Percentage (%)
MCP joint	Full range of movement	39	78.0
	5-10° restricted	6	12.0
	10-20° restricted	4	8.0
	No movement	1	2.0
PIP joint	Full range of movement	45	90.0
	5-10° restricted	5	10.0

**Figure 4: Distribution of donor-site morbidity after flap harvest (n=50).**

DISCUSSION

The reverse dorsal metacarpal artery flap is a reliable and effective method for covering skin and soft tissue defects over injured fingers, with the advantages of providing skin with a similar color, texture, and thickness. The fingers

that can be covered by this flap include the index, middle, ring, and little fingers. The distal limit of coverage extends up to the distal interphalangeal (DIP) joint, both the palmar and dorsal aspects of the finger. In most cases, sufficient laxity of the dorsal skin permits linear closure of the donor-site defect. When the flap is used to cover a skin defect over the middle phalanx with intact skin over the proximal phalanx, an incision is extended over the skin of the proximal phalanx to facilitate the flap transfer to the defect. For avoiding this, other methods can be preferred, such as the cross-finger flap, which requires a secondary procedure.

In this study, 50 reverse dorsal metacarpal artery flaps were performed in 50 patients.

Sebastin et al reported a study in which 58 dorsal metacarpal artery perforator flaps were performed to resurface soft-tissue defects proximal to the fingertip in 56 patients.¹⁷ Among them, 52 were male patients (93%) and 4 were female patients. Lai-Jin et al conducted a study of 153 cases, including 112 male and 41 female patients.¹⁸ Chang et al reported 14 cases, comprising 11 male and 3

female patients.¹² In the present study, 42 patients (84%) were male and 8 (16%) were female, demonstrating a marked male predominance. This sex distribution is comparable to that reported in previous studies. The predominance of male patients may be related to their greater exposure to occupational and traumatic hand injuries.

Sebastin et al studied a population of 56 patients with an age range of 18-62 years.¹⁰ Lai-Jin et al reported 153 cases with an age range of 6-69 years.¹⁸ In the series of Chang et al the age range was 10-44 years.¹⁹ Thus, these studies included patients ranging from childhood to middle age. In the present study, the age ranged from 5 to 35 years, with a mean age of 24.02 ± 6.8 years. The relatively young age of the study population may reflect the higher risk of traumatic finger injuries among younger and economically active individuals.

Most of the patients in the present study were manual workers (35 patients, 70.0%). This finding is comparable to the study by Sebastin et al in which 79% of the patients were manual workers who sustained injuries at work.¹⁷ Similarly, Balan et al reported that 8 of 14 patients had workplace-related injuries, further supporting the association between occupational exposure and traumatic finger defects.¹ In the present study, electric burns were the most common cause of injury (31 cases, 62.0%), followed by machinery injuries (18 cases, 36.0%) and contracture (1 case, 2.0%). Thus, the predominance of occupationally exposed patients in the present series may partly explain the high frequency of electric and machinery-related injuries.

In the series of Sebastin et al 21 cases involved the index finger (35%), 16 involved the long finger (27%), 12 involved the ring finger (20%), and 9 involved the small finger (15%).¹⁰ In the series reported by Lai-Jin et al, the sites of skin defects included the index finger (n=74), middle finger (n=45), ring finger (n=25), little finger (n=7), and finger stump (n=2).¹⁸ Dautel et al reported 7 cases in which reverse metacarpal flaps were used, including 2 index-finger injuries, 2 middle-finger injuries, and 3 little-finger injuries.²⁰ Chang et al reported 14 cases, including 4 thumb injuries, 3 index-finger injuries, 1 middle-finger injury, 2 ring-finger injuries, 1 little-finger injury, and 3 cases of web-space contracture release.¹⁹ Balan et al reported 14 patients undergoing reverse dorsal metacarpal artery flap reconstruction, with involvement of the little finger in 4 cases (28.6%), ring finger in 4 cases (28.6%), middle finger in 3 cases (21.4%), and index finger in 3 cases (21.4%).¹ In the present study, the index finger was involved in 24 cases (48.0%), followed by the middle finger in 19 cases (38.0%), the ring finger in 6 cases (12.0%), and the little finger in 1 case (2.0%). Thumb and web-space injuries were not included in the present series. The predominance of index- and middle-finger involvement in the present study differs from the more evenly distributed pattern reported by Balan et al but is consistent with the predominance of index- and middle-

finger involvement observed in several other previous series.¹

The second, third, and fourth DMAs can be selected as pedicles for the reverse dorsal metacarpal artery flap. The choice of pedicle depends on the location of the injured finger, anatomical considerations, and clinical requirements. Wang et al reported 14 patients treated with reverse second and third dorsal metacarpal artery fasciocutaneous flaps for distal- and middle-segment finger soft-tissue defects, with flap dimensions ranging from 2.0×4.5 cm to 3.0×7.0 cm, and all flaps survived.²¹ Their findings demonstrate the clinical feasibility of using both the second and third DMAs for reverse-flow reconstruction. In the present study, the 2nd DMA was used in 27 cases (54.0%), the 3rd DMA in 21 cases (42.0%), and the 4th DMA in 2 cases (4.0%), with the 2nd and 3rd DMAs together accounting for 96.0% of cases. In the study by Lai-Jin et al, the 2nd DMA was used in 117 cases, the 3rd DMA in 29 cases, and the 4th DMA in 7 cases.¹⁸ Sebastin et al reported the use of the 2nd DMA in 34 cases, the 3rd DMA in 14 cases, and the 4th DMA in 10 cases.¹⁷ Similarly, Duman et al reported reverse-flow DMA flaps, including 7 based on the 2nd DMA, 7 on the 3rd DMA, 2 on the 4th DMA, and 2 on the 1st DMA, further demonstrating the frequent use of the 2nd and 3rd DMAs and the relatively limited use of the 4th DMA.²² Anatomical findings by Omokawa et al provide further support for this clinical pattern.²² In their cadaveric study, the mean diameters of the 2nd, 3rd, and 4th DMAs were 0.8 mm, 0.5 mm, and 0.4 mm, respectively, while reliable connections with the palmar arterial system were observed for the 1st through 3rd DMAs but in only 65% of specimens for the 4th DMA.²³ These anatomical characteristics may explain the greater clinical preference for the 2nd and 3rd DMAs compared with the 4th DMA. Thus, the predominance of the 2nd and 3rd DMAs in the present series is consistent with both previous clinical experience and anatomical evidence. Among the 27 cases in which the 2nd DMA was used, partial flap loss occurred in 3 cases and complete flap loss occurred in 1 case.

In most previous studies, post-traumatic wounds were the predominant indication for reconstruction. In contrast, electric burns were the most common cause in the present study (31 cases, 62.0%), followed by machinery injuries (18 cases, 36.0%). This difference may reflect variations in the occupational and environmental patterns of hand injuries among the study populations.

Cedidi et al reported a study in which tendon reconstruction was performed along with DMA flap coverage.²⁴ In the present study, tendon and bony injuries were excluded, and reconstruction was limited to skin and soft-tissue defects. This difference in patient selection may partly account for variations in functional outcomes between the present study and studies involving associated tendon injuries.

In the study by Sebastin et al the defect size ranged from 1.5×1.0 cm to 6.0×2.0 cm.¹⁰ The smallest flap measured 2.0×1.5 cm and the largest measured 6.0×4.0 cm. Chang et al reported flap sizes ranging from 1.8×2.4 cm to 1.8×6.5 cm.¹⁹ Lai-Jin et al reported skin defects ranging from 3.0×2.0 cm to 8.0×3.0 cm, with reverse dorsal metacarpal artery flap sizes ranging from 3.5×2.5 cm to 9.0×3.0 cm.¹⁸ A prospective observational study from Dhaka Medical College Hospital involving 30 patients undergoing reverse dorsal metacarpal artery flap reconstruction reported flap sizes ranging from 2.5×1.5 cm to 5.5×3.5 cm.²⁵ The upper range of flap dimensions in that series is comparable to the larger flap sizes observed in the present study. In the present study, the defect size ranged from 1.5×1.0 cm to 6.5×3.0 cm, while flap size ranged from 2.0×1.5 cm to 7.0×3.5 cm. These findings are broadly comparable with those of previous studies and further support the clinical feasibility of relatively large reverse dorsal metacarpal artery flaps for finger reconstruction. The flap was consistently designed slightly larger than the defect; in the present study, the flap dimensions were approximately 5 mm greater in both length and width than the corresponding wound dimensions.

In the present study, 39 flaps survived completely (78.0%), partial flap loss occurred in 7 cases (14.0%), and near-total to complete flap loss occurred in 4 cases (8.0%). In the series of Lai-Jin et al 143 of 153 flaps survived uneventfully.¹⁸ Venous congestion occurred in 8 cases and resulted in partial epidermal necrosis, while 2 cases failed completely because of pedicle injury.¹⁸ Sebastin et al reported that among 60 flaps, total flap loss occurred in 3 cases and marginal flap necrosis occurred in 1 case, while the remaining flaps survived completely.¹⁷ Dautel et al reported complete survival of all 7 flaps.²⁰ The flap survival and loss rates in the present study were broadly comparable with those reported in previous studies, supporting the reliability of the reverse dorsal metacarpal artery flap for soft-tissue reconstruction of the fingers.

In most series, donor-site defects measuring less than 3.5 cm can be closed primarily. Chang et al reported that the donor site was closed primarily in 13 of 14 patients, while 1 patient required a split-thickness skin graft.¹⁹ Skin necrosis developed at the donor site in 1 patient because of hematoma and excessive suture tension, and the wound healed spontaneously by secondary intention.¹² In the series of Sebastin et al 6 donor sites were covered with full-thickness skin grafts, while the remaining 52 donor sites were closed primarily.¹⁷ In the present study, the donor-site width was 3.5 cm in 14 cases, and all donor sites were closed primarily. Donor-site morbidity was minimal, with 43 cases (86.0%) having no significant donor-site morbidity, while a scar was observed in 6 cases (12.0%) and infection occurred in 1 case (2.0%). The infection was confirmed by clinical examination and culture and sensitivity testing, and appropriate treatment was administered, following which the wound healed without surgical intervention.

Among the 50 patients in the present series, 39 flaps survived completely, while 1-10% flap loss occurred in 3 cases, 11-20% loss in 3 cases, 21-30% loss in 1 case, and 91-100% loss in 4 cases. The present study provides a more detailed categorization of the extent of partial flap loss, whereas other authors generally reported only the number of complete or partial flap losses without specifying the percentage of tissue loss.

In the present study, the functional outcomes of the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints were assessed using a goniometer. At the MCP joint, 39 patients (78.0%) had full range of movement, while 6 patients (12.0%) had 5-10° restriction, 4 patients (8.0%) had 10-20° restriction, and 1 patient (2.0%) had no movement. At the PIP joint, 45 patients (90.0%) had full range of movement, while 5 patients (10.0%) had 5-10° restriction. Other studies did not specifically report functional outcomes of the fingers, except in cases in which tendon repair or tendon grafting was performed along with flap coverage. The relatively favorable functional outcomes observed in the present study may be partly related to the exclusion of patients with associated tendon and bony injuries.

Preoperative Doppler examination is particularly useful when considering a third or fourth reverse dorsal metacarpal artery flap. In the present study, Doppler examination was performed before application of the tourniquet to assess the vascular anatomy.

Dautel et al reported the use of a tourniquet without exsanguination of the limb, allowing the pedicle to remain clearly visible during flap elevation.¹³ A similar technique was used in the present study.

In the present study, the tourniquet was released with the flap in its native position, and the flap was allowed to perfuse for 10-15 minutes before being rotated into the defect. It was then loosely anchored to the edges of the defect with the PIP and MCP joints maintained in extension. A volar or dorsal splint was applied for 1 week to maintain finger extension and wrist extension, and the limb was kept elevated. Range-of-motion exercises were initiated after 1 week. Sutures were removed after 2 weeks, and patients were subsequently allowed to resume normal activities. These postoperative management measures were broadly similar to those described in other studies.

Limitations

There were some limitations in this study: (a) the sample size was small and may not be representative of the wider population; (b) the follow-up period was limited; the study was descriptive in nature. A comparative study could have provided stronger and more direct evidence; and (d) this was a single-center study.

CONCLUSION

The reverse dorsal metacarpal artery flap is a reasonable and reliable option for skin and soft-tissue reconstruction of the digits proximal to the distal interphalangeal joint. It is a single-stage procedure with simple dissection and easy flap elevation. Primary closure of the donor site is possible, and the procedure requires minimal postoperative care while allowing early return to work.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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