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TERTIARY HOSPITAL IN SUB-SAHARAN AFRICA**

REVERSE POSTERIOR INTEROSSEOUS ARTERY FLAP: EARLY EXPERIENCE IN A TERTIARY HOSPITAL IN SUB-SAHARAN AFRICA

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ABSTRACT

Introduction

The reverse posterior interosseous artery (rPIA) perforator flap is a well-established option for the reconstruction of hand defects proximal to and involving the metacarpophalangeal joints (MCPJs). Its ease of dissection, reliability, single-stage reconstruction, versatility, and facilitation of early functional rehabilitation have made it an attractive reconstructive option. We report our early experience with the rPIA perforator flap in the reconstruction of hand defects in a tertiary hospital in sub-Saharan Africa.

Methods

Demographic and relevant clinical data were retrieved retrospectively from the case records of patients who underwent reconstruction using the rPIA flap between June 2019 and May 2024. Data are presented as a case series.

Results

Four patients aged 30–45 years underwent reconstruction of various hand defects using the reverse posterior interosseous artery perforator flap over the five-year study period. Three patients were male and one was female. All defects in the male patients resulted from trauma, whereas the female patient presented with a neglected diabetic hand infection. All flaps survived, although one patient developed marginal distal flap necrosis that healed without additional

surgery. No patient required secondary reconstructive procedures.

Conclusion

The reverse posterior interosseous artery flap is a feasible, reliable, and effective reconstructive option for appropriately selected hand defects in our environment. Careful patient selection, meticulous flap planning, and precise surgical dissection are essential for achieving favourable outcomes.

Keywords: Reverse posterior interosseous artery flap; posterior interosseous artery; perforator flap; hand reconstruction; soft-tissue defects; sub-Saharan Africa.

INTRODUCTION

Reconstruction of complex soft-tissue defects of the hand advanced considerably following the description of the reverse posterior interosseous artery (rPIA) flap by Pentead *et al.* in 1986,¹ and subsequently by Zancolli and Angrigiani in 1988.² The flap is a distally based, retrograde-flow island flap that offers a versatile reconstructive option for soft-tissue defects involving both the dorsal and volar aspects of the hand, including the metacarpophalangeal joints, first web space, and thumb.

The flap derives its vascular supply from the relatively constant anastomosis between the anterior interosseous artery (AIA) and

posterior interosseous artery (PIA), located approximately 2–3 cm proximal to the ulnar styloid process.^{2,3} The posterior interosseous artery supplies the extensor aspect of the forearm through four to eight septocutaneous perforators, two to four of which are usually located in the middle third of the forearm.^(2,4) Some perforators, together with the parent posterior interosseous artery, are accompanied by venae comitantes that establish communication between the superficial and deep venous systems.^{1,3}

According to the Lamberty and Cormack classification, the reverse posterior interosseous artery flap is a Type B fasciocutaneous flap.⁵ Its anatomical basis, flap design, dimensions, and clinical applications have been extensively described.^{1,3,6–9}

In many resource-limited centres in sub-Saharan Africa, pedicled groin, abdominal, and hypogastric flaps remain the principal reconstructive options for deep soft-tissue defects of the hand. These two-stage procedures are associated with prolonged immobilisation, delayed commencement of physiotherapy, longer hospital stay, and patient discomfort due to temporary attachment of the hand to the trunk. In contrast, the reverse posterior interosseous artery flap provides thin, pliable tissue in a single-stage procedure, allowing earlier rehabilitation and improved aesthetic outcomes.^{8,10}

Despite more than three decades of clinical use, published reports on the application of the reverse posterior interosseous artery flap from sub-Saharan Africa remain scarce. We therefore present our early experience with this flap in a tertiary hospital, highlighting its indications, technical considerations, challenges encountered, and clinical outcomes.

METHODS

This retrospective case series included four patients with complex soft-tissue defects of the hand who underwent reconstruction with a reverse posterior interosseous artery flap between June 2019 and May 2024 at Federal Teaching Hospital, Ido-Ekiti, Nigeria. Written informed consent was obtained from all patients before surgery. Demographic and relevant clinical information were retrieved from their medical records.

Operative Technique

Although the anatomical landmarks and operative technique for harvesting the reverse posterior interosseous artery flap have been comprehensively described,^{1,2,9,11,12} the technique adopted in our unit is briefly outlined below.

All procedures were performed under **general anaesthesia** with endotracheal intubation. A handheld Doppler ultrasound was used preoperatively to identify the septocutaneous perforators within the middle third of the forearm and to confirm the vascular anastomosis at the pivot point.

With the patient in the supine position and the forearm fully pronated on a hand table, the lateral epicondyle and ulnar styloid were identified and connected by a line representing the flap axis. The remaining surface markings were completed according to the standard technique.^{4,9}

The skin paddle was designed proximally, ensuring that its upper limit did not extend beyond the junction of the proximal first and second quarters of the line joining the lateral epicondyle and the ulnar styloid. This region corresponds to the vascular territory of the interosseous recurrent artery, inclusion of which may predispose to distal flap necrosis.

The distance between the pivot point and the recipient defect was measured to ensure adequate pedicle length. Following routine antiseptic skin preparation and draping, the

limb was exsanguinated and a pneumatic tourniquet applied.

Under loupe magnification, flap elevation commenced proximally on the ulnar aspect of the forearm. The **extensor carpi ulnaris (ECU)** and **extensor digiti minimi (EDM)** muscles were identified, and the intermuscular septum between them exposed. Care was taken to distinguish the **extensor digitorum communis (EDC)** from the extensor digiti minimi.

The posterior interosseous artery was identified within the septum and carefully dissected proximally to preserve at least two septocutaneous perforators supplying the skin paddle. The posterior interosseous nerve was identified during proximal dissection and preserved throughout the procedure.

The posterior interosseous artery was then divided proximally, allowing elevation of the fasciocutaneous flap. The intermuscular septum containing the vascular pedicle was carefully dissected distally to the pivot point. After release of the tourniquet, flap perfusion was confirmed and meticulous haemostasis achieved.

The flap was inset into the prepared recipient site, while the donor site and exposed pedicle were covered with a split-thickness skin graft.

RESULTS

The demographic and clinical characteristics of the patients are summarised in **Table 1**. Four patients underwent reconstruction using the reverse posterior interosseous artery (rPIA) flap during the study period. All flaps survived; however, the first patient developed marginal distal flap necrosis following postoperative venous congestion. The necrotic area healed with conservative management, and no secondary reconstructive procedure was required.

Flap dimensions ranged from **6 × 6 cm to 8 × 12 cm**. Flap viability was assessed clinically

by monitoring colour, capillary refill, temperature, and tissue turgor throughout the postoperative period. Venous congestion was observed in the first patient on the second postoperative day before the development of distal flap necrosis.

All patients achieved stable and durable soft-tissue coverage of their defects. Donor sites healed satisfactorily following split-thickness skin grafting. The duration of postoperative outpatient follow-up ranged from **1 to 8 months**.

CLINICAL CASES

Case 1

A 30-year-old right-handed man presented with a **10-day history** of a neglected human bite involving the left first web space, with ulceration extending over the thumb metacarpophalangeal joint and adjacent dorsum of the hand. Initial management consisted of wound debridement followed by definitive intravenous antibiotic therapy. After satisfactory wound preparation, the residual soft-tissue defect was reconstructed using a reverse posterior interosseous artery flap.

Venous congestion developed on the **second postoperative day**, followed by marginal distal flap necrosis on postoperative day five. The necrotic tissue was managed conservatively after limited debridement, and no additional reconstructive procedure was required. The flap ultimately provided durable and pliable soft-tissue coverage while preserving mobility of the thumb metacarpophalangeal joint and first web space.

Case 2

A **45-year-old right-handed woman** with known diabetes mellitus presented with a **three-week history** of progressive swelling of the left hand and purulent discharge from an ulcer located within the second web space.

Table 1: Demographic and clinical profiles of the cases

	CASE 1	CASE 2	CASE 3	CASE 4
Age	30 years	45 years	30 years	32 years
Sex	Male	Female	Male	Male
Address	Ekiti	Ekiti	Ekiti	Ekiti
Occupation	Farmer	Teacher	Hunter	Student
Handedness	Right-handed	Right-handed	Right-handed	Right-handed
Site of defect	1 st web space and MCPJ region of left hand	Dorsum of the hand	Dorsum of the right hand	Post amputation defect of the right thumb
Aetiology	Human bite	Diabetic hand infection	Gunshot	Gunshot
Duration before presentation	10 days	21 days	5 days	28 days
Duration before flap coverage	7 days	21 days	5 days	2 days
Commencement of physiotherapy post-operatively	12 days	13 days	12 days	7 days
Length of stay post-surgery	10 days	20 days	14 days	5 days
Complications	Distal Necrosis	nil	nil	nil

Clinical examination revealed a middle-aged woman in painful distress with diffuse swelling of the left hand, which was maintained in a position of comfort. A sloping ulcer containing necrotic tissue involved the dorsal aspect of the second web space. Plain radiographs demonstrated no underlying osseous involvement.

A diagnosis of neglected diabetic hand infection was made. The patient received definitive intravenous antibiotic therapy, tetanus prophylaxis, and serial surgical debridement with regular wound dressing. Glycaemic control was optimised in collaboration with the endocrinology team.

Following complete resolution of infection and satisfactory glycaemic control, the residual dorsal hand defect was reconstructed using a reverse posterior interosseous artery

flap. The postoperative course was uneventful, and the patient was discharged **20 days after flap reconstruction.**

Case 3

A **30-year-old right-handed hunter** sustained a blast injury to the right hand while handling locally prepared gunpowder. Clinical examination and plain radiography demonstrated extensive soft-tissue loss without associated fractures.

The patient underwent wound debridement, tetanus prophylaxis, intravenous antibiotic therapy, and serial wound dressings. Once a healthy wound bed had been established, the residual defect was reconstructed with a reverse posterior interosseous artery flap.

The postoperative course was uneventful, and the flap healed satisfactorily. Unfortunately,

the patient was subsequently lost to follow-up.

Case 4

A 32-year-old right-handed undergraduate sustained a gunshot injury to the right hand resulting in complete traumatic amputation of the thumb at the level of the metacarpophalangeal joint.

Initial wound debridement was performed at a peripheral hospital before referral for

definitive reconstruction. Following serial wound dressings and optimisation of the wound bed, a reverse posterior interosseous artery flap was used to reconstruct the residual first web space and thumb defects, providing stable and durable soft-tissue coverage.

Six months after reconstruction, the patient successfully underwent prosthetic thumb rehabilitation. Toe-to-thumb transfer remains a future reconstructive option should microsurgical facilities become available.



Figure 1: (A) Soft-tissue defect involving the first web space and thumb metacarpophalangeal joint following a human bite. (B) Clinical appearance four years after reconstruction with a reverse posterior interosseous artery flap (photograph provided by the patient).



Figure 2: (A) Dorsal aspect of the left hand at presentation with diabetic hand infection. (B) Volar aspect of the hand. (C) Residual dorsal soft-tissue defect following infection control. (D) Intraoperative appearance after wound excision. (E) Reverse posterior interosseous artery flap inset. (F) Six-month postoperative appearance.



Figure 3: Clinical appearance two weeks after reconstruction of a dorsal right hand defect with a reverse posterior interosseous artery flap following a gunshot injury. (Preoperative photograph unavailable.)



Figure 4: (A) Right hand following gunshot injury with traumatic thumb amputation. (B) Intraoperative elevation of the reverse posterior interosseous artery flap. (C) Six-month postoperative appearance. (D) Healed donor site following secondary closure. (E) Volar view after prosthetic thumb rehabilitation. (F) Dorsal view after prosthetic thumb rehabilitation.

DISCUSSION

The four cases presented in this series demonstrate the usefulness of the reverse posterior interosseous artery (rPIA) flap for reconstruction of small- to moderate-sized complex soft-tissue defects of the hand. The rPIA flap has gained widespread acceptance among plastic and reconstructive surgeons as a reliable option for hand resurfacing.¹³ As an islanded perforator flap, it may be harvested as a fasciocutaneous, adipofascial, osteofasciocutaneous, or free flap, thereby offering considerable reconstructive versatility.¹⁴

One of the principal advantages of the rPIA flap is preservation of the radial and ulnar arteries, thereby maintaining the major arterial supply to the hand. In addition, it is a single-stage procedure that provides durable, pliable tissue with satisfactory functional and aesthetic outcomes. Successful flap elevation, however, requires meticulous preoperative planning, intraoperative Doppler localisation of perforators, loupe magnification, and careful microsurgical dissection.^{9,12,15} These facilities and technical expertise are not routinely available in many resource-limited tertiary hospitals in sub-Saharan Africa.

The patients included in this series were carefully selected based on defect

characteristics and timing of reconstruction, contributing to the favourable surgical outcomes observed. Flap elevation required approximately 1.5–2 hours under tourniquet control, and the posterior interosseous artery was consistently identified within the intermuscular septum. Although anatomical variations, including absence of the posterior interosseous artery and variable septocutaneous perforators, have been described,^{6,7} no such variations were encountered in the present series.

The first patient sustained a human bite involving the first web space and thumb metacarpophalangeal joint. Reconstruction with the rPIA flap provided supple, durable soft-tissue coverage that prevented first web space adduction contracture and preserved thumb mobility. Postoperative venous congestion resulted in marginal distal flap necrosis, most likely due to injury to the venous drainage system. Venous congestion remains the commonest complication associated with this flap.^(11,12) Kelada *et al.* reported a 10% incidence of venous congestion in a series of 20 patients.⁴ Preservation of the venae comitantes and the venous network accompanying the posterior cutaneous nerve of the forearm has been shown to reduce this complication.¹⁵ In our patient, the marginal necrosis healed without additional reconstructive surgery, further demonstrating the resilience and reliability of the rPIA flap.

The second patient developed a dorsal hand defect following a neglected diabetic hand infection, a condition that remains relatively common in our environment.¹⁷ Although split-thickness skin grafting could have achieved wound closure, it would likely have resulted in poor durability, restricted joint mobility, and an inferior cosmetic outcome. Reconstruction with the rPIA flap provided stable soft-tissue coverage while preserving hand function. In appropriately selected patients without advanced diabetic microangiopathy, the rPIA flap may therefore

represent a superior alternative to skin grafts and distant pedicled flaps. Although free tissue transfer remains the preferred reconstructive option in many well-resourced centres, prolonged operative time, intensive postoperative monitoring, and delayed contour refinement may favour regional pedicled flaps in resource-constrained settings.¹⁸

The remaining two patients sustained firearm-related injuries. Although road traffic crashes remain the leading cause of hand injuries in many low- and middle-income countries,^{19–21} increasing regional insecurity has contributed to a growing burden of firearm-related trauma in parts of sub-Saharan Africa. One patient sustained an accidental blast injury while loading a locally fabricated Dane gun with gunpowder. Similar injuries have previously been reported by Babalola *et al.*,²² who emphasised the importance of prompt hand salvage and public education. Successful reconstruction with the rPIA flap facilitated early functional rehabilitation in this patient. In the fourth patient, stable first web space reconstruction enabled subsequent prosthetic thumb rehabilitation. Toe-to-thumb transfer remains a potential future reconstructive option should microsurgical facilities become available.

Despite its advantages, the reverse posterior interosseous artery flap has recognised limitations. Flap elevation is technically demanding and requires meticulous dissection comparable to that of free flap surgery, resulting in a relatively steep learning curve. Das De *et al.* classified the procedure among flaps of moderate technical difficulty.²³ Furthermore, the flap may not be suitable in patients with extensive locoregional soft-tissue destruction or vascular injury,²⁴ and donor-site closure usually requires split-thickness skin grafting, which may compromise cosmetic appearance. Harvesting the flap as an adipofascial flap may improve donor-site aesthetics.¹⁵

Several authors have highlighted the challenges facing reconstructive surgery in sub-Saharan Africa, including inadequate specialist training, limited infrastructure, and insufficient funding.^{25,26} These factors probably contribute to the relatively limited use of the reverse posterior interosseous artery flap in the region. Greater investment in reconstructive surgical services, microsurgical training, and institutional capacity building would facilitate wider adoption of this valuable reconstructive technique.

CONCLUSION

The reverse posterior interosseous artery flap is a safe, reliable, and versatile option for reconstruction of appropriately selected soft-tissue defects of the hand in resource-limited settings. This case series demonstrates its successful application in four diverse clinical scenarios and highlights its value in preserving hand function while avoiding sacrifice of the major arterial supply to the hand. Increased institutional capacity, specialised surgical training, and wider adoption of this technique are recommended to improve reconstructive hand surgery practice in sub-Saharan Africa.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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