

# Extended Posterior Interosseous Artery Flap: Anatomical and Clinical Study

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### Disclosures for this Article

#### Editors

Jennifer Moriatis Wolf, MD, has no relevant conflicts of interest to disclose.

#### Authors

All authors of this journal-based CME activity have no relevant conflicts of interest to disclose. In the printed or PDF version of this article, author affiliations can be found at the bottom of the first page.

#### Planners

Jennifer Moriatis Wolf, MD, has no relevant conflicts of interest to disclose. The editorial and education staff involved with this journal-based CME activity has no relevant conflicts of interest to disclose.

### Learning Objectives

Upon completion of this CME activity, the learner should achieve an understanding of:

- The anatomy of the reverse-flow pedicled posterior interosseous artery (PIA) flap
- The consistency of a connection between the PIA and the dorsal intercarpal arch (DIA)
- Potential clinical applications of an extended pedicle-length PIA flap.

**Deadline:** Each examination purchased in 2017 must be completed by January 31, 2018, to be eligible for CME. A certificate will be issued upon completion of the activity. Estimated time to complete each JHS CME activity is up to one hour.

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**Purpose** A reverse-flow pedicled flap from the posterior interosseous artery (PIA) has been used to cover defects on the dorsal and volar aspects of the hand. However, the original description of this flap does not reach further than the metacarpophalangeal joints of the 4 ulnar digits. In the present study, we describe a distal variant (type 2) of the PIA flap, which changes the pivot point of the classic variant (type 1) and which can provide full coverage of single or multiple digits in the entire dorsum and palmar surface of the fingers.

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**Methods** An anatomical study was performed on 26 cadaveric specimens to assess the presence of the anastomosis between the PIA and the dorsal intercarpal arch (DIA). In addition, the gain in pedicle length using the DIA anastomosis as a pivot point was compared with the classic pivot point at the anterior interosseous artery. A clinical study in 19 patients with soft tissue defects distal to the proximal interphalangeal joint of the fingers was also performed to assess the viability and clinical outcomes of the new variant of the PIA flap.

**Results** The PIA was identified reaching the dorsal carpal arch in all anatomical specimens. The mean pedicle length of the fifth extensor compartment artery was 4.8 cm (range, 4.1–5.3 cm). The mean arterial diameter was 0.8 mm (range, 0.6–1.2 mm). In the clinical study, 17 flap reconstructions were done for posttraumatic lesions and 2 postburn contractures. All extended PIA flap procedures were performed successfully without loss of the flap or significant partial necrosis. We had only 1 superficial infection. There was no need for revision of the flap in any case.

**Conclusions** By extending the pivot point of the PIA flap through the DIA, instead of the anastomosis with the anterior interosseous artery, the flap distance can be increased by about 8.5 cm, allowing complete coverage of the fingers. (*J Hand Surg Am.* 2017;42(3):182–189. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)

**Type of study/level of evidence** Therapeutic IV.

**Key words** PIA anatomy, posterior interosseous artery pedicled flap, fifth ECA, finger defect, microsurgery.

THE REVERSE-FLOW PEDICLED FLAP from the posterior interosseous artery (PIA) was described by Zancolli and Angrigiani.<sup>1,2</sup> It has proven most useful for coverage of soft tissue defects on the dorsum of the hand. This flap has gained popularity owing to its reproducible and reliable technique that does not sacrifice the major forearm arteries.<sup>3–5</sup> However, the PIA flap is limited by its pivot point, which is located at the anastomosis between the anterior interosseous artery (AIA) and the PIA, proximal to the distal radioulnar joint (DRUJ). This anatomical characteristic makes the PIA flap unsuitable for coverage of soft tissue defects distal to the proximal interphalangeal (PIP) joints of the 4 ulnar digits.<sup>6,7</sup>

A well-known anastomosis is typically present between the PIA and the dorsal intercarpal arch (DIA), through the fifth extensor compartment artery (fifth ECA) (Fig. 1).<sup>8,9</sup> We hypothesized that using this anastomosis at the DIA as a pivot point would extend the length of the pedicle, allowing the PIA flap to provide coverage up to the fingertips.

The purpose of this study was to analyze the anatomical feasibility of the reverse PIA flap using the DIA as the pivot point, to extend the distal reach of this flap to the fingertips, and to assess the outcomes of a series of patients treated with this novel surgical technique.

## MATERIALS AND METHODS

First, an anatomical study was performed with 26 frozen cadaveric upper limbs from both sexes (14 female and 12 male) aged from 44 to 83 years (mean,

61.3 years). After preparation and cannulation of the axillary artery, red or black latex solution was injected into each specimen. The cannulas were sealed and the cadavers were preserved using a mixture of formaldehyde and phenolic acid according to the Cozzi technique, which allowed the injected latex to solidify evenly.<sup>10</sup> In all of the specimens, a dissection of the dorsal arteries of the forearm and hand was carried out under 3.5 times magnification.

We analyzed the frequency of the anastomosis between the PIA and the DIA through the fifth ECA. Then, we measured the distance and the diameter of the fifth ECA present between the AIA and the DIA.

A clinical study was developed with the approval of our institutional review board. We retrospectively analyzed a series of patients with soft tissue defects on the hand, treated with the extended PIA flap variant using the DIA anastomosis as a pivot point. The main indications for the procedure were defects distal to the PIP joint of the 4 ulnar fingers.

## Surgical technique

All surgeries were performed by the senior author (C.R.Z.). In all patients, a regional axillary or brachial plexus block was performed and a pneumatic tourniquet cuff was insufflated without exsanguination of the limb. The affected area underwent debridement and a template of the soft tissue defect was made. The flap was then designed according to the original description. A line that corresponds to the flap axis was drawn from the lateral epicondyle to the DRUJ.

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