

## Brief Communications

# Anatomic assessment of hand circulation in harvesting the radial artery

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**F**or the radial artery (RA) to be harvested safely, a careful assessment of the adequacy of the remaining blood supply of the hand is essential. The modified Allen test and Doppler ultrasound are the two tests commonly used for this purpose. The modified Allen test involves assessing the perfusion of the hand and fingers before and after occluding the RA and the ulnar artery 1 to 2 cm proximal to the wrist. However, alternative channels may still perfuse the hand and fingers. Two anatomic variations in which this may occur are (1) a superficial dorsal branch of the RA and (2) a persistent median artery as a branch derived from the ulnar artery (or even the RA) proximally. Noninvasive tests such as the Allen test and ultrasound may produce a false negative result in the presence of these variations.

### Anatomic Variations

**Superficial dorsal branch of the radial artery.** In this variation the RA divides into two branches about 7 cm proximal to the wrist (Figure 1). One runs in the normal position of the RA lateral to the tendon of the flexor carpi radialis. The other branch (the superficial dorsal branch of the RA) runs toward the dorsal aspect of the forearm and terminates by following the normal dorsal course of the RA but superficial to the extensor tendons. This artery then gives off branches to supply the thumb and forms the deep palmar arch with the ulnar artery. In this case, the RA gives off a small superficial palmar branch that does not communicate with the ulnar artery. The superficial palmar branch of the ulnar artery supplies the thumb and anastomoses with the RA on the dorsum of the hand. The superficial dorsal branch of the RA is present in about 3% of cases. It also may originate in the mid or proximal parts of the forearm.<sup>1</sup>

**Persistent median artery.** The persistent median artery is an embryonic remnant of the axial artery of the upper limb. In general it derives from the ulnar artery (usually via the anterior interosseous artery) and occurs in 8% of cases.<sup>2</sup> It is rare for the median artery to originate from the RA.<sup>1,3</sup> The median artery accompanies the median nerve, which is located between the radial and the ulnar arteries. It may terminate at the wrist or may contribute to the superficial palmar arch (Figure 2). The contribution of the median artery to the superficial palmar arch has been stated as ranging from 1.1% to 16.1%.<sup>4-6</sup>

### Clinical Implications

Generally, the testing procedures for assessing the hand collateral circulation involve examining the blood supply of the hand while the RA is occluded above the wrist. The position of occlusion is important, as in some cases RA removal may result in hand ischemia despite a normal Allen or Doppler ultrasound test. If a superficial dorsal branch of the RA is present, it will not be compressed during a standard preoperative assessment of hand collateral circulation. Accordingly, the test is likely to yield normal results given that this branch provides an alternative supply to the deep palmar arch. However, if the RA is harvested and this branch sacrificed, the blood supply to the hand may be compromised.

To identify this variation, we recommend using ultrasound to scan the entire length of the RA. When performing the modified Allen test, the examiner should adopt a modification we term the Allen-LEC (local extra compression) procedure (Figure 3, A and B). This involves

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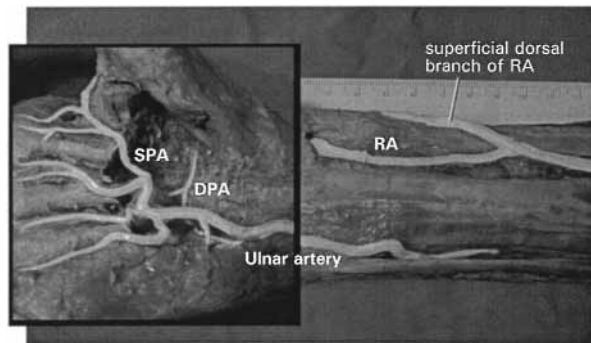
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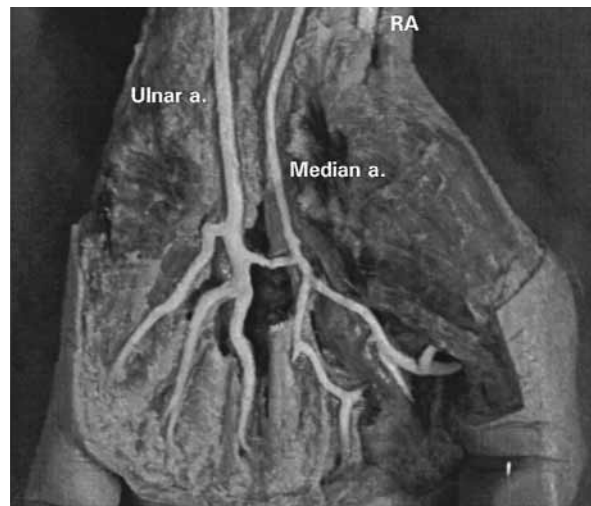
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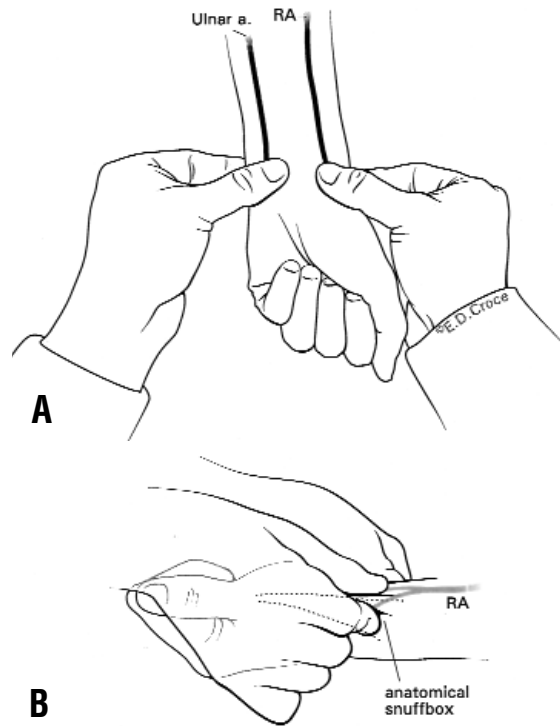
**Figure 1. Superficial dorsal branch of the radial artery. SPA, superficial palmar arch; DPA, deep palmar arch; RA, radial artery.**



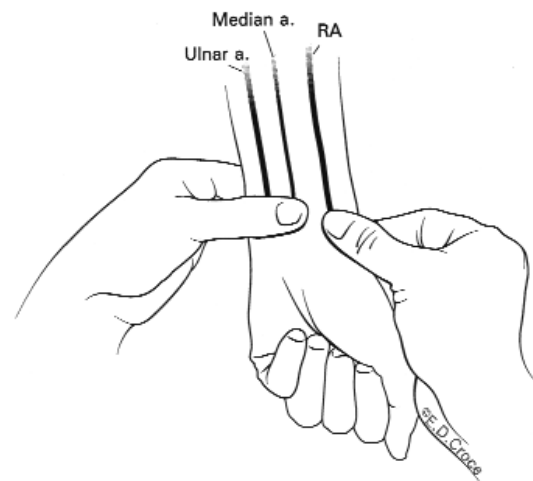
**Figure 2. Persistent median artery. RA, Radial artery.**

simultaneously compressing the RA at the usual position ventrally (with, for example, the thumb) and the anatomic snuffbox dorsally (with, for example, the index finger). Both the superficial palmar branch and the superficial dorsal branch of the RA (if present) will therefore be compressed, avoiding a false negative result.

When a persistent median artery is present, the RA can still be safely harvested if the Doppler ultrasound demonstrates an adequate blood supply to the hand. This is because the median artery will still be intact after the RA harvesting. However, when the modified Allen test is used, it may give a false negative result. If the median artery is not compressed in addition to the ulnar artery during the test, the hand will become flushed after it is opened despite the ulnar artery not being released. This highlights the need for careful observation of the returned color and pattern of the reperfusion when opening the hand. If the hand becomes flushed after being opened, it is our recommendation that additional pressure be applied over the median nerve at the wrist either by the thumb or by using an assistant (Figure 4). A persistent median artery is less important than a superficial dorsal branch of the RA because the median artery usually originates from the ulnar artery



**Figure 3. Diagram of Allen-LEC procedure. A, Anterior view. B, Lateral view. RA, Radial artery.**



**Figure 4. Diagram of Allen-LEC procedure showing compression of the median artery. RA, Radial artery.**

and is therefore not affected by the operation (except in the rare case in which a median artery originates from the RA distal to the harvested RA).

**Conclusion**

Preoperative testing of the hand collateral circulation must be interpreted carefully and must take into account anatomic varia-

tions of the branches of the radial artery such as the superficial dorsal branch of the RA and the median artery.

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