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Determining Patency of Palmar Arches by Retrograde Radial Pulsation

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With the advent of modern methods for measurement of intra-arterial blood pressure and increasing use of arterial blood to monitor ventilation, cannulation of the radial artery has become common practice. Occasionally, thrombosis of the radial artery may lead to gangrene of the extremity if collateral circulation is inadequate.¹ Allen, in 1929, devised a test to confirm the patency of the palmar arch in patients with occlusive arterial disease.² This test is used today to assess the advisability of radial-artery cannulation. The limitations of this so-called Allen test are: 1) it requires patient cooperation and, therefore, cannot be used if the subject is anesthetized; 2) it may be impossible to perform in patients with extensive palmar burns; 3) it is inconclusive when palmar blushing is delayed more than 15 seconds;³ 4) false-positives are obtained if the hand is

completely extended with the fingers separated when palmar blushing is sought.³

We have noticed that pulsation of the radial artery persists distal to the point of digital occlusion in patients with competent palmar arches. This pulsation disappears consistently when the ulnar artery is occluded simultaneously with the radial artery.

We have therefore devised a test for patency of the palmar arch based on palpation of retrograde radial pulsation at a point distal to complete digital compression of that vessel. The method is simple, efficient, and useful in all situations where a radial artery can be palpated.

METHOD

The right radial artery of a consenting patient about to undergo a splenorenal shunt was cannulated with an 18-gauge Longdwell catheter§ for continuous monitoring of arterial blood pressure and blood-gas tensions. Pulse waveforms were monitored with a Statham model P 23Db arterial transducer, displayed on an Electronics for Medicine IR4 oscilloscope screen pressure module type

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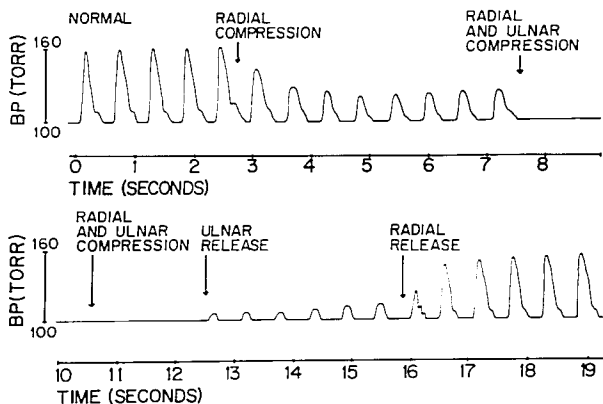


FIG. 1. Upper, radial-artery tracings before and after proximal occlusion of that vessel and after simultaneous ulnar-artery compression. Lower, restoration of radial pulsation following decompression of ulnar, and later radial, arteries.

PMI, and recorded. The radial artery was digitally occluded proximal to the catheter tip; simultaneous compression of the ulnar artery was then applied. Pulsation of the radial artery was also sought distal to the point of digital occlusion without and with simultaneous compression of the right ulnar artery.

Twenty awake healthy volunteers were tested for persistence of radial pulsation distal to digital compression and disappearance of this pulsation following simultaneous ulnar occlusion. The maneuver was performed as follows: The proximal portion of the radial artery was occluded with the index finger of one hand and distal pulsation felt with the middle finger of the same hand. The ulnar artery was occluded with a finger of the other hand. The Allen test was also carried out on all these individuals.

RESULTS

The palpated pulsation in the anesthetized patient became noticeably weaker following proximal occlusion of the radial artery and disappeared when simultaneous ulnar-artery occlusion was added. Similarly, the pulse

waveform, after total occlusion of the radial artery (fig. 1), became gradually attenuated, and disappeared with simultaneous ulnar-artery compression. When ulnar pressure was released, retrograde pulsations returned. The original waveform rapidly reappeared after radial-artery decompression.

Nineteen of the 20 volunteers studied had negative Allen's tests. In each of these 19 subjects, retrograde radial-artery pulsation was easily felt. In the single subject who had a positive Allen's test, retrograde pulsation could not be discerned.

DISCUSSION

The palmar arches (fig. 2) are formed by the anastomosis of the superficial palmar branch of the radial artery with the terminal branch of the ulnar artery (superficial arch), and by the anastomosis of the deep branch of the ulnar artery with the termination of the radial artery after it emerges between the two heads of the adductor pollicis (deep arch). Both arches lie behind the palmar fascia and are compressed by it against the deep structures of the palm when it is tensed by extension of the hand with the fingers wide

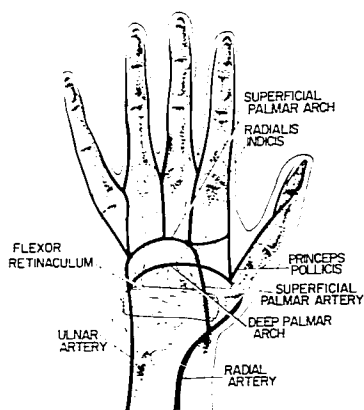


FIG. 2. Anatomy of the palmar arches.

apart. This brief anatomic description illustrates how the patency of these arches can easily be ascertained by the palpation of retrograde radial-artery pulsation following digital compression. This test should be done with all muscles in the limb relaxed, the hand slightly flexed, and the fingers kept close together to avoid compression of the arches by tensing the palmar fascia and the adductor pollicis muscle, through which the termination of the radial artery emerges into the palm. The extended arm should be placed on a flat surface.

Incomplete radial-artery occlusion will result in persistence of retrograde pulsation. This occurs, ulnar-artery compression will not eliminate it, thus ruling out false-negative tests.

While one volunteer in 20 was found to have an incomplete arch, this should not be interpreted as suggesting that 5 percent of the population has similar anatomical aberrations.

SUMMARY

The patency of palmar arches must be ascertained before radial-artery cannulation is performed. A simple test in which digital pulsation is felt after proximal occlusion of the radial artery has been devised for this purpose.

The method is reliable, does not require active patient cooperation, and can be carried out in all clinical situations where the radial artery can be felt.

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Alterations in Ventricular Fluid Pressure during Ketamine Anesthesia in Hydrocephalic Children

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Dissociative anesthesia with ketamine hydrochloride has been recommended for neurosurgical and neuroradiologic procedures in children. However, there are reports

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