Catheterization of the Dorsalis Pedis Artery

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The radial artery is usually selected for arterial catheterization because puncture is easy and collateral flow is available. Often overlooked is the dorsalis pedis artery, which has the same advantages. This report reviews clinically relevant facts about catheterization of the dorsalis pedis artery. This route is especially useful when immobilization of a patient's hand is undesirable or when both radial arteries are inaccessible (extensive burns or trauma, damage from numerous previous catheterizations, etc.). Rapid flushing of radial-artery cannulae may cause embolization of clots or air bubbles to the brain[1] and prolonged wrist dorsiflexion may damage the median nerve. Both problems are avoided by catheterizing the dorsalis pedis artery.

The dorsalis pedis artery is the continuation of the anterior tibial artery extending from the ankle to the great toe. It lies subcutaneously on the dorsum of the foot, parallel and lateral to the extensor hallucis longus tendon (fig. 1). The other major artery supplying the foot is the lateral plantar artery, which is the dominant terminal branch of the posterior tibial artery. The main arterial arch of the foot (plantar artery) is supplied by the dorsalis pedis and lateral plantar arteries, analogous to the radioulnar communication in the volar arch of the hand. Thus, should the dorsalis pedis artery be damaged following lengthy cannulation, collateral flow is available.

To check for collateral flow, place the patient supine, occlude the dorsalis pedis artery with external pressure, blanche the great toe by compressing the toenail, then release the nail and observe flushing as blood returns. Rapid return of color indicates adequate lateral plantar flow. However, flushing may be difficult to see if the feet are allowed to cool. Both feet should be examined to determine the more suitable since the arterial supply is usually not symmetrical.[2] Barnhorst and Barnor found bilaterally non-palpable dorsalis pedis pulses in 5.3 per cent of 1,000 children.[3] We could not cannulate the dorsalis pedis artery in five of 26 patients. We have found 20-gauge catheters most suitable.

Arterial pulse contour changes as the pulse moves to the periphery. Ascending aortic pulses have a broad systolic crest with a sharp incisure. Moving peripherally, the systolic peak becomes progressively narrower and higher, the downstroke drops to a lower pressure, and the incisure is lost. These changes are due to decreased compliance of peripheral arteries and reflections of previous waves.[4,5] Although there is little difference between brachial and femoral arterial pressures,[6] radial and dorsalis pedis arterial pulses are affected (fig. 2). The dorsalis pedis pulse arrives later and peaks higher than the radial pulse. Using a Doppler technique, Yao *et al.* found the ratio of pedal to arm systolic blood pressures to be 1.0–1.3 in 25 healthy supine adults.[7] In three catheterized subjects, we have observed the dorsalis pedis pulse to peak 5–20 torr higher than the radial pulse. The effects of shock on peripheral systolic amplification are not known. Arterial stenosis in the legs does not reduce resting blood flow or distal pressures until a critical degree of stenosis is reached. When this critical stenosis (80–90 per cent arterial occlusion in the lower extremities) is reached, further relatively small increases in the stenosis cause significant decreases in flow and pressure.[8] With severe occlusive vascular disease, arterial pressures in the foot decrease to below those obtained from a brachial artery.[9]

With increasing use of invasive arterial techniques, the dorsalis pedis artery provides a safe, reliable and usually available alternative to the radial artery. Studies comparing morbidity using the two arterial sites are not yet available, but several hazards unique to the radial artery are avoided in selecting the foot.

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FIG. 1. 20-gauge catheter in the dorsalis pedis artery, illustrating relationship to surrounding ligaments. The catheter is secured with Steri-drape. Splinting is not needed.

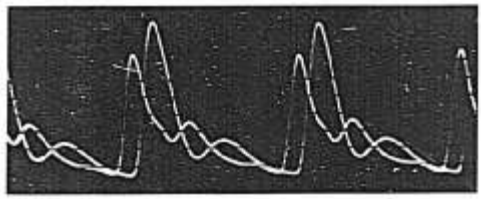

FIG. 2. Simultaneous display of radial and dorsalis pedis arterial pressure traces. The dorsalis pedis pulse is delayed 0.1 sec and has a peak pressure 17 torr greater.

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