Absence of Ulnar Artery Inflow Detected by Allen’s Test Prior to Radial Forearm Free Flap

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Summary: Radial forearm free flaps are commonly used for soft-tissue reconstruction after resection of head and neck cancer. It is perfused by the radial artery, leaving the ulnar artery for perfusion of the hand and digits. The absence of distal ulnar artery and associated superficial palmar arch, however, has not been reported in cadaveric dissection. We report a case of unilateral ulnar artery flow absence, detected by Allen’s test, during preoperative preparation for a radial forearm free flap. Based on the simplicity, safety, and ease, we recommend Allen’s test to be performed preoperatively on every patient for whom such a flap is a consideration.

(Radial forearm free flaps (RFFFs) are commonly used for soft-tissue reconstruction after resection of head and neck cancer. The RFFF is a fasciocutaneous flap perfused by the radial artery and drained via the venae comitantes or cephalic vein.

Consistent and predictable vascular anatomy allows for harvest of the radial artery with the flap, leaving the ulnar artery for perfusion of the hand and digits. In an anatomical study of 750 cadavers, McCormack et al.1 found anomalies of the radial and brachial arteries in 15% of cases. The absence of distal ulnar artery and associated superficial palmar arch, however, has not been reported in cadaveric dissection2 and exists as only 2 case reports in the literature.3,4

The clinical significance of such a finding is great, as the harvest of RFFF in case of absent ulnar artery could result in ischemia and subsequent loss of the hand if not urgently addressed.

We report a case of unilateral ulnar artery flow absence, detected by Allen’s test, during preoperative preparation for a RFFF. The principles outlined in the Declaration of Helsinki have been followed.

CASE REPORT

A 62-year-old man was treated 15 years previously with a radical neck dissection and external beam radiation for squamous cell carcinoma of right pharyngeal wall, subsequently developed osteoradionecrosis of the mandible complicated by bone exposure. Due to patient comorbidities and wishes, soft tissue, rather than bony reconstruction, was planned to reconstruct the anticipated mandibulectomy defect. The RFFF was chosen, and routine preoperative testing was performed. This included a bilateral Allen’s test to assess for radial and ulnar arterial flow to the hand. The Allen’s test showed radial artery dominance with no clinical perfusion through the ulnar artery, bilaterally.

This finding was further investigated with a CT angiogram, which demonstrated a narrowed ulnar artery proximally and complete flow absence at the level of the wrist on the left side (Fig. 1). Unfortunately, the right arm was not assessed in the scan. Due to the findings on the left and concerning Allen’s test on the right, a pedicled supraclavicular flap was chosen to reconstruct the defect.

Postoperatively, a duplex Doppler was performed to evaluate the contralateral wrist, which showed a similarly narrowed, but patent, right ulnar artery.

The patient was admitted postoperatively for 10 days and subsequently discharged without complication. A written informed consent was obtained from the patient for publication of this case report.

DISCUSSION

The RFFF is a frequently called upon tool in the head and neck surgeons’ reconstructive armamentarium. The success of this free tissue transfer relies on patency of the radial artery system for the flap, and the remaining ulnar artery and associated palmar arch to
perfuse the hand. The reliability of the ulnar artery is such that preoperative imaging is not routinely performed.

To date, 2 case reports have described the clinical discovery of absent ulnar arteries. Lee et al. described a case, wherein bilateral ulnar artery absence was detected preoperatively with Allen’s test in preparation for a RFFF. Zhao et al. described incidental discovery of unilateral ulnar artery absence after exploratory surgery for management of a forearm laceration. Based on the knowledge from cadaveric dissection, the absence of an ulnar artery is exceptionally rare, estimated at less than 0.015%. This flow absence we are reporting could be related to arterial agenesis or secondary to peripheral artery disease.

Allen’s test is a simple bedside test used to assess blood flow to the hand, first described by Edgar B. Allen in 1929. In this test, both radial and ulnar arteries are occluded at the wrist; the subject is then asked to make a firm fist, allowing the palmar surface of the hand to blanch. By releasing the pressure on 1 artery, its patency, and that of the superficial palmar arch, is confirmed as the color of the hand returns. The goal of this test is to ensure adequate collateral supply to the hand, before sacrificing 1 of the 2 major arterial suppliers of the hand.

The specificity and sensitivity of Allen’s test are 54.5% and 91.7%, respectively. The validity and accuracy of the Allen’s test have been disputed in cardiac literature as the radial artery is frequently cannulated for access to the thoracic aorta for coronary angiography or percutaneous coronary intervention. Although Allen’s test is still regularly used in practice, Shah et al. suggest that this test is often misleading and an inaccurate measure of contralateral blood supply to the hand. This is supported by Valgimigli et al., who demonstrated no local hemodynamic compromise or change in hand lactate levels in patients with an abnormal Allen’s test who subsequently underwent radial artery cannulation for PCI.

The use of Allen’s test in preoperative evaluation for candidacy of RFFF harvest is less complicated, however. Despite the poor specificity of the test, it offers excellent sensitivity for the presence of a patent ulnar artery system. Any abnormalities can then be further evaluated using more sophisticated imaging modalities. In our institution, we use CT angiography (CTA) for patients planned to have fibula free flap, so it might not be unreasonable to consider imaging...
like ultrasound or even CTA for RFFF, especially if there is a concern from Allen’s test. In a study conducted to evaluate forearm arterial system for percutaneous coronary interventions, ultrasound imaging was able to identify 100% forearm vascular anomaly (high origin of superficial palmer branch from radial artery), which was confirmed by angiography. This anomaly represented 2.7% of their cases.10 Additional benefits have also been postulated, including identification of asymptomatic radial artery occlusion, potentially preventing early flap failure.11

**CONCLUSIONS**

Based on the simplicity, safety, and ease, we recommend Allen’s test to be performed preoperatively on every patient for whom a RFFF is a consideration. Also to consider imaging studies for abnormal Allen’s test.

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