Performing Allen’s test in immobile hand: The Esmarch bandage method

Nebil Yesiloglu, Gokhan Temiz, Hakan Sirinoglu, Murat Sarici

ABSTRACT
In this study, an alternative method of assessing hand vascular flow using a modification of Allen’s test is presented. This technique may be helpful for patients who have immobile hands due to severe trauma, patients scheduled for free tissue transfer reconstruction, patients under general anesthesia in intensive care units that require serial arterial blood gas analyses, and emergency coronary by-pass candidates who decided to receive radial arterial grafts.

Key words: Allen’s test, ulnar artery, radial artery, hand vasculature, capillary refill, Esmarch bandage

Introduction
The upper extremity has an important role in reconstructive surgery as a flap donor and recipient site [1]. Both radial and ulnar arteries are candidates as recipients or flap pedicles for such reconstruction options [2]. The patency of both arteries is also important for cardiac by-pass surgery, which requires the use of the radial artery as an arterial graft, for puncturing of the radial artery for serial arterial blood gas detection in patients in the intensive care unit who are under general anesthesia, and for both diagnostic and interventional coronary procedures [3].

Technique
Patients with mutilated hands that need a free tissue transfer for major reconstruction of the hand, patients under general anesthesia in need of arterial blood sampling who are unable to flex their hands, and patients at risk of insufficient blood supply due to sacrificing of a major artery of the forearm, have the potential for compromised distal nourishment to the hand. However, the patency of both arteries and their ability to supply the whole hand is essential for the surgeon when the classical Allen’s test is not possible.

In this study, a simple alternative method to performing the Allen’s test on immobile hands due to the abovementioned causes is presented. An Esmarch bandage was wrapped in the distal to proximal direction up to the elbow, followed by releasing the bandage in the same direction until two to three loops re-
mained (Figure 1). Next, both ulnar and radial arteries were compressed by the surgeon and the remainder of the bandage released (Figure 2). By releasing the ulnar artery, the return of capillary refill is examined (Figure 3). The same steps may be used for the examination of blood flow through the radial artery.

**Discussion**

The exsanguination of the upper extremity is the key point of the technique; therefore, other alternatives for the exsanguination of the upper extremities, like the Urias bag, the Pomidor roll-cuff, the Northwick Park exsanguinator, or the Rhys-Davies exsanguinator, may be used for such a test [4]. The Esmarch bandage has been used for over a hundred years for acute hemostasis and as a device for exsanguination in hand surgery [5].

Although some false positive and false negative results were reported due to anatomical variations, like median arteries, dorsal superficial branches or other congenital anomalies of the vasculature, the Allen's test is still a rapid, non-invasive, and practical method for such an assessment [6]. A preoperative Doppler ultrasonography may support the results obtained with the Allen's test. In our clinic, a hand-held Doppler device is also used during the procedure to assess the inflow of palmar vascular arches.

**Conclusions**

Although a detailed clinical study was not performed, the Esmarch bandage method was used for the assessment of hand nourishment in over a hundred patients without any complications. In the emergency department or intensive care unit, it may provide a safe and practical method for the rapid assessment of vascular nourishment of immobile hands.
Conflict of interest statement
The authors have no conflicts of interest to declare.

References
1. Kayiran O, Cihandide E. Enhancement of palmar advancement flap: A simple modification. Hand Microsurg 2014;3:33-8.
2. Evinc R, Kopal C, Bek D, Durmus M. Reconstruction of multiple metacarpal bone defect using segmentated free fibular bone flap: Case report. Hand Microsurg 2014;3:29-32.
3. Oertel BG, Vermehren J, Zimmermann M. Necessity and risks of arterial blood sampling in healthy volunteer studies. Clin Pharmacokinet 2012;51:629-38.
4. Iyer S, Pabari A, Branford OA. Refinement of a simple technique with new relevance for exsanguination of the upper limb. Tech Hand Up Extrem Surg 2011;15:82-3.
5. Shteinle AV. [Esmarch's tourniquet: 135 years in use]. [Article in Russian]. Angiol Sosud Khir 2009;15:122-6.
6. Agrifoglio M, Dainese L, Pasotti S, Galanti A, Cannata A, Roberto M, et al. Preoperative assessment of the radial artery for coronary artery bypass grafting: is the clinical Allen test adequate? Ann Thorac Surg 2005;79:570-2.