Title : SAFETY OF BRACHIAL VS. RADIAL ARTERIAL CATHETERS

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Introduction. Numerous complications of the use of arterial catheters in the upper extremities have been reported. Since the study by Barnes et al,[1] arterial catheters placed by anesthesia department personnel have been almost exclusively brachial. However, during the period 1976-1978, arterial catheter complications seemed to occur with sufficient frequency and severity to cause concern. This study was designed to assess the subclinical and clinical sequelae of brachial and radial catheters with the use of Doppler flow studies.

Methods. Fifty-eight patients scheduled for elective thoracic-cardiovascular surgery were studied between September 1978 and March 1979. Preoperative physical and Doppler examinations of an upper extremity were performed. Doppler Allen tests of both radial and ulnar arteries defined the patency of the arterial palmar arch and/or arterial obstruction of the artery tested. Further evaluation of arterial obstruction was performed by Doppler measurement of the systolic pressures in the brachial, radial, and ulnar arteries. We defined arterial obstruction as present whenever the forearm pressures were less than the brachial pressure by a gradient of 10 mmHg or more. Patients with normal preoperative Doppler examinations were then randomly assigned into radial or brachial catheter groups to determine where the initial attempt at catheterization would be made. Prior to induction of anesthesia in the operating room, the arterial catheter site was prepared and draped with sterile technique, and a 20-G Teflon non-tapered B-D catheter was placed. The catheters were connected to transducers with a continuous heparin flush device. The catheters were used in the operating room and Intensive Care Unit to measure arterial pressure and to obtain blood samples. After discontinuance of the catheter, each patient underwent Doppler flow studies daily for 5 days and again at 6 weeks post-discharge from the hospital.

Results. Four patients (7%) had arterial obstruction preoperatively in one arm with no history of prior vascular disease or placement of arterial catheters. The alternate arm in each of these patients was normal on examination and was therefore used for catheter placement. Twenty-nine radial and 29 brachial arterial catheters were placed in 58 patients. Their mean age was 59.1 years, range 36-79. Average catheter duration was 1.10 days, range 1-3 days. There were no neurological deficits, signs or symptoms of ischemia, or catheter failures in either group. Only the postoperative abnormalities of arterial obstruction and altered Allen tests were considered as complications. Of the 29 patients with radial catheters, 5 patients (17%) had transient postoperative complications (see table). Radial arterial obstruction (by pressures) was present in all 5 cases, and radial Allen tests became abnormal in 4 cases. Of the 29 patients with brachial catheters, 12 patients (41%) had transient postoperative complication. Radial arterial obstruction (by pressures) occurred in 4 patients and ulnar arterial obstruction in 6. Radial Allen tests became abnormal 3 times and the ulnar Allen tests 5 times. The incidence of brachial complications (41%) was significantly greater than radial complications (17%), using a 2x2 contingency table and Fisher's exact test.

Discussion. We cannot explain the difference between our 41% brachial complication rate and that of Barnes (5.5%).[1] Our radial complications rate (17%) compares much more closely with Bedford's reported rate of 11%.[2] An unexpected finding was the 7% incidence of arterial obstruction detected preoperatively in patients without prior arterial catheterization or history of arterial disease in the upper extremities. This arterial obstruction was detectable with the Doppler BP examination but not with either a manual or Doppler Allen test. We conclude that:

1. Radial arterial catheters are as effective as and produce fewer complications than brachial arterial catheters when used for a short duration.
2. Further investigation is warranted to determine whether preoperative evaluation by the Allen test and the Doppler is superior to the Allen test alone in diagnosing unsuspected arterial vascular disease. Our study suggests that combining the tests is superior to the Allen test alone.

References.

1. Barnes RW, Boutros AR et al: Anesthesiology 44:260, 1976
2. Bedford RF: Crit Care Med 6:64, 1978

DISTRIBUTION OF 58 PATIENTS

Catheter Site	Number of Patients	Patients with Complications	
		Number	Percent
Radial artery	29	5	17
Brachial artery	29	12	41