SCIENTIFIC LETTER

Implementation of a diagnostic and interventional transradial programme: resource and organisational implications

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There is now convincing evidence that the radial artery is a very safe access site for cardiac procedures.[1] Additional benefits include improved patient comfort, reduced procedural costs, and rapid mobilisation.[2] Despite these advantages, many cardiologists continue to use the femoral artery for the majority of their procedures. This is because of a commonly held view that transradial procedures are technically challenging (and therefore often fail), time consuming, and involve excessive radiation exposure.

METHODS

A diagnostic and therapeutic transradial programme was instituted at the North Staffordshire Hospital in September 1998. The programme was initiated and supervised by an experienced transradial operator (JN). The workload consists of patients under the direct care of the supervising consultant, along with patients referred for transradial procedures because of arterial access problems. The radial artery was the access site of choice for all procedures performed or supervised by JN (including graft cases, where the left radial artery was employed when access to the left internal mammary artery was required). To minimise the risk of vascular complications in patients who had received thrombolytic treatment, the radial artery was employed for rescue angioplasty procedures. If arterial cannulation could not be supervised, the femoral access site was employed by trainees. All operators were fully trained in transfemoral procedures. The technique employed for transradial procedures has previously been described in detail[3] and utilises a specific transradial introducer (Arrow International, UK) and 6 French sheath system (Cook Cardiology, Letchworth, Hertfordshire, UK). Standard Judkins and pigtail catheters are used for diagnostic procedures. For interventional procedures, EBU, Amplatz or Judkins configuration catheters are employed in most patients. Fixed dose heparin (5 000 u for diagnostic procedures, 10 000 u for interventional procedures) is used for all cases. Before the procedure the collateral blood supply to the hand is assessed and an alternative access site chosen if the Allen test is negative. The radial sheath is removed at the end of the procedure, and haemostasis achieved with a unilateral pressure system (RADI Medical Systems, Godalming, Surrey, UK). Chronic oral anticoagulant treatment is continued without interruption for radial cases.

Data were prospectively collected on all diagnostic and interventional cases performed between 1 September 1998 and 31 March 2002. Procedure duration was defined as the time elapsed between entering the catheterisation laboratory and returning to the post-procedure suite (including time spent on patient preparation in the catheterisation laboratory, and subsequent transfer back to the post-procedure suite). The radial cases were ambulated in the catheterisation laboratory immediately after sheath removal and walked to the post-procedure suite where they required minimal nursing care. Femoral cases were transferred on a trolley before sheath removal followed by an obligatory period of bed rest.

RESULTS

During the study period, 1000 radial and 727 femoral cases were performed (1095 diagnostic, 632 angioplasties) (table 1). Intravenous glycoprotein IIb/IIIa usage for interventional procedures increased from 0% in the first third of the series, to > 80% in the final third. No femoral cases were performed in patients treated with anticoagulants or symptomatic peripheral vascular disease. In the radial group, 290 patients (29%) had symptomatic peripheral vascular disease, and 55 (5.5%) were receiving uninterrupted anticoagulant treatment (mean international normalised ratio (INR) 2.7 on day of procedure). Patient characteristics (including the proportion of graft cases) were otherwise similar in both groups. Seventy three (10%) of femoral cases were required because of failed radial access, with the remainder relating to operator supervision. The major cause of access failure in the radial group was the presence of a negative Allen test (5.1%). In patients with a positive Allen test, access failure rates were similar in both groups (2.4% in the radial group, 2.1% in the femoral group), and were related to problems with the vascular anatomy of the arm or pelvic vessels (excessive tortuosity or atheroma), puncture failure or inability to cannulate the coronary arteries. In the radial group, the only access site complications were three superficial infections, treated with oral antibiotics. In the femoral group 1.7% of patients required transfusion, vascular intervention or developed infection requiring intravenous antibiotics. Fluoroscopy time and procedure duration were similar in both groups. Case mix and major adverse cardiac event (MACE)-free outcomes were similar for radial and femoral interventions.

Table 1 Comparison of radial and femoral procedures

	Radial (n=1000)	Femoral (n=727)
Access failure (n (%))	73 (7.3)	15 (2.1)
Negative Allen	51	0
Vascular anatomy	6	9
Puncture failure	12	4
Coronary canulation failure	4	2
Vascular access site complications (n (%))	3 (0.3)	12 (1.7)
Transfusion	0	4
Vascular intervention	0	6
Infection	3	2
Mean (±SD) fluoroscopy time (mins)		
Diagnostic	6.1 ±4	5.5 ±5
Interventional	14.6 ±5	13.2 ±4
Mean (±SD) procedure duration (mins)		
Diagnostic	26 ±3	22 ±6
Interventional	48 ±20	51 ±23

DISCUSSION

This study demonstrates that, with appropriate supervision and training, a diagnostic and interventional transradial programme can be implemented with no adverse effect on catheter laboratory throughput, radiation exposure or procedural outcome. These excellent results were obtained despite a third of the radial patients having important extracardiac vascular disease or receiving uninterrupted anticoagulant treatment. Additionally, this series incorporates the transradial learning curve of five trainees. These factors may adversely affect the radial procedure duration and reduce the risk of vascular complications in the femoral group. The measured procedure duration does not incorporate the time required for sheath removal, haemostasis or bed rest in femoral patients. These components of a femoral procedure take up considerable additional time, require significant nursing or medical input, and have an adverse effect on patient quality of life and procedural cost. The results in this series reflect close supervision by a consultant with extensive previous transradial experience. New operators will inevitably experience more procedural failures related to the important learning curve. During the learning curve, procedure duration, equipment consumption, and radiation exposure will increase. For an experienced cardiologist, 100–200 procedures will be required to overcome this learning curve and replicate our results. The learning curve will be shorter for experienced operators with substantial previous experience of brachial procedures, and longer for trainees.

We used 6 French catheters for our procedures. For small individuals, 5 French catheters now offer a viable option for both diagnostic and interventional procedures. If a large calibre guiding catheter is required for a complex or device based procedure, a large proportion of individuals have a 7 or 8 French compatible radial artery. We routinely re-puncture the radial artery after diagnostic procedures, and repeated transradial procedural present no particular technical challenge.

A radial approach is contraindicated in around 5% of patients because of unsuitable arterial anatomy at the wrist, manifest in a negative Allen test. In the remaining patients, there is no increase in access failure rate compared to the femoral access site. In keeping with other studies, we have shown a clinically useful reduction in access site complication rates for the radial approach, even in this high risk population.[1] The use of the radial artery does not preclude subsequent use as a surgical arterial conduit. More than 97% of radial arteries remain patent after catheterisation. Even if occlusion occurs, it is usually localised, permitting the use of the majority of the remaining patent radial artery.

This study confirms that the excellent results reported in selected study populations can be replicated in routine clinical practice. A recently published study indicates that vascular complications occur in 7.4% of patients catheterised femorally in the presence of intravenous glycoprotein IIb/IIIa receptor blockade, despite the use of weight adjusted heparin, and small calibre catheters.[4] There is no convincing evidence that these complications can be prevented by vascular closure devices. Additionally, peripheral vascular disease prevents transfemoral access in some patients. Although experienced operators can overcome these problems and achieve excellent results utilising a surgical approach to the brachial artery, access to appropriate training is now limited.[5] There is now a convincing case for increasing the availability of training in this useful technique, and incorporating it into routine clinical practice.

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