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ORIGINAL ARTICLE

Coronary angiography safety between radial and femoral access

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Abstract One of the major criticisms of the radial approach is that it takes longer overall procedure and fluoroscopy time, which means not only more staff will be exposed during the procedures, but they will also stand close to the patient where rates of radiation scattered by the patient are higher. The aim of this study was to evaluate the safety of the radial versus femoral artery approach in our institution's routine coronary angiography practice.

Methods: All cases of diagnostic coronary angiography (CA) over a 23 month period at a tertiary care hospital were reviewed for this analysis. Procedure duration was calculated as a total in laboratory catheter time. Contrast volume and fluoroscopy time were recorded, as it is correlated to catheter manipulation.

Results: Eight hundred patients who underwent a diagnostic CA were included in this study. The radial approach was used in 586 patients (73.25%) and the femoral approach in 214 patients (26.75%). Comparing the radial and femoral approaches, fluoroscopy and procedure times were not significantly different (3.43 ± 1.19 vs 3.86 ± 1.49 min, $P = 0.215$ and 31.87 ± 9.61 vs 33.24 ± 10.33 min, $P = 0.170$, respectively). While contrast utilization during the procedure was significantly lower in the radial than the femoral approach (67.63 ± 25.49 vs 81.53 ± 24.80 mL respectively, $P = 0.03$).

Conclusion: Transradial coronary angiography can be safely performed for the patient and the professional staff members as the transfemoral approach.

1. Introduction

The hand receives a dual arterial supply from the radial and ulnar arteries, which come together to form deep and superficial palmar arches. The radial artery – unlike the femoral or brachial artery – is therefore not an end artery, and in the presence of a satisfactory ulnar collateral supply, its occlusion does not compromise the vascular supply to the hand. Furthermore, the superficial course of the distal radial artery provides for

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easy compression of the artery, so that patients can mobilize as soon as the arterial sheath is removed on completion of the procedure.[1] Recent technological advances have enabled the miniaturization of diagnostic catheters as well as the equipment for percutaneous transluminal coronary angioplasty. Owing to this miniaturization, the percutaneous arm approach via the radial artery is becoming more popular throughout the world as an alternative to the femoral artery technique.[2–12] Advantages of this approach include a lower incidence of access site complications, earlier patient ambulation, improved patient satisfaction, and lower cost.[2–4,7,11–13] Transradial procedures may be performed by cannulation of either the right or the left radial artery. At present, the choice for the right radial or the left radial approach largely depends on the operator's preference. Most of the studies of the transradial approach have been performed through right radial artery probably because of the familiarity in performing the study from the patient's right side as commonly used in the femoral approach.[2] One of the major criticisms of the radial approach is that it takes longer overall procedure and fluoroscopy time, which means not only more staff (interventionists, radiographers, nurses, and anesthetists if needed clinically) will be exposed during the procedures, but they will also stand close to the patient where rates of radiation scattered by the patient are higher.[14] The American Heart Association/American College of Cardiology clearly state that "the responsibility of all physicians is to reduce the radiation injury hazard to their patients, to their professional staff and to themselves".[15] So, the aim of this study was to evaluate the safety of the radial versus femoral artery approach in our institution's routine coronary angiography practice.

2. Methods

All cases of diagnostic coronary angiography (CA) over a 23 month period (starting from March 2007 till the end of January 2009) at a tertiary care hospital (Cardiothoracic department, Spedali Civili, Brescia University, Italy) were retrospectively reviewed for this analysis. All the data were entered into a database after the end of each procedure, detailing arterial access route, crossover from one access to other approach, contrast amount, overall procedure time and fluoroscopy time.

The choice between femoral or radial artery access was left to the discretion of the operator. The right radial approach is the default strategy at the Brescia catheterization laboratory-Spedali Civili. In accordance with institutional policy, the femoral approach was favored for patients with negative findings on the Allen test,[16,17] and for patients with coronary artery bypass grafts (CABG). Radial arterial access was achieved in a standard fashion using commercial micropuncture kits. After sheath insertion, 5000 U of unfractionated heparin was injected directly into the radial artery through the sheath; also intra arterial nitroglycerine (200 mcg) was used as the primary antispasmodic. CA was performed using 6 Fr diagnostic catheters. At procedure completion, the sheath was removed immediately and a compression by hemostatic band was installed for 3 h, patients were allowed to walk around immediately after the end of the procedure. Femoral procedures were done using vascular sheaths, which placed using Seldinger's technique. CA was performed using 6 Fr diagnostic catheters. After the end of the procedure, the sheath was removed in the catheter laboratory and manual compression was performed for a minimum of 15 min or until satisfactory hemostasis had been achieved. This was followed by placement of a compressive bandage for 6 h. Closure devices were not used.

Study population was stratified according to arterial access used to perform the procedure into two groups; radial group and femoral group. Access crossover was recorded and stratified based on the first route of access attempted. Crossover to femoral was defined as the need to shift to the transfemoral approach and was left to the operator's discretion. Crossover to the femoral approach was classified into the following three groups: puncture failure (lack of radial cannulation), radial and brachial failure (severe spasm, tortuosity, loops, remnant, or other anomalies), and epiaortic failure (severe subclavian or aortic tortuosity).[18]

Procedure duration was calculated as the time between the patient entering and leaving the catheter laboratory. Fluoroscopy time is recorded, as it is correlated to catheter manipulation, whereas the fluorography time is not included in our study, as it is independent from catheter manipulation and is associated with the cineangiography recording. Contrast injection was performed using an automatic power injection device that allows for online control of contrast injection rate and volume.[19] In our institution, coronary angiography and subsequent coronary intervention – when necessary – are performed in a single session in order to optimize patient health and comfort. All diagnostic coronary angiography which were followed by percutaneous coronary intervention (PCI) were excluded, as we were not measuring and recording into the data base the contrast amount, fluoroscopy and procedure times of the diagnostic coronary angiography independently from PCI procedures of the same case.

2.1. Statistical analysis

The data were coded and computed on a statistical package for social sciences SPSS version 17 for windows for statistical analysis. Continuous data were analyzed using student's t test and presented as mean ± SD. Categorical data are presented as a percentage, and were analyzed using a chi squared analysis. Times measured were analyzed and reported in minutes. Significance was defined as $P < 0.05$.

3. Results

A retrospectively collected catheterization laboratory database of consecutive patients who underwent a diagnostic coronary angiography over a 23 month period (starting from March 2007 till the end of January 2009) at a tertiary care hospital (Cardiothoracic department, Spedali Civili, Brescia University, Italy) was reviewed for this analysis. Eight hundred patients who underwent a diagnostic CA, which was done by the authors were included in this study. The radial approach was used in 586 patients (73.25%) and the femoral approach in 214 patients (26.75%).

The baseline characteristics of the patients are summarized in Table 1, which were similar in both groups except for age which is significantly higher in the femoral than radial group, representing older population in this group (72.36 ± 18.20 vs 66.47 ± 10.22 years respectively, $P = 0.00$). Also according