TRANSRADIAL ACCESS FOR CORONARY ANGIOGRAPHY: A SINGLE OPERATOR'S EXPERIENCE OF 500 CASES

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ABSTRACT

Objective: The purpose of the present study was to assess the feasibility, success, and safety of the transradial approach (TRA) for diagnostic coronary angiography.

Design: Descriptive study.

Place and Duration of Study: The study was carried out in Armed Forces Institute of Cardiology–National Institute of Heart Diseases (AFIC-NIHD) over a period of ten months from June 2009 to March 2010.

Patients and Methods: We collected data of 500 consecutive patients who underwent coronary catheterization by the transradial approach. Transradial access was performed only if the Allen's test was normal (positive). Patients with previous CABG or requiring right heart catherization were excluded from this study. Study endpoints included procedure success rate, vascular complications at access site, and major adverse cardiac and cerebrovascular events during hospitalization.

Results: Mean age of the patients was 52 years (range 33-77 yrs) and 72.8% (n= 364) were men and 27.2% (n=136) were females. The vast majority of cases (98.4%) were elective. The right radial artery was used in 98% of cases. Procedural success was achieved in 90.6% cases (453/500). No case of vascular complications such as major access site bleeding, vascular perforation, radial artery occlusion, forearm ischemia, compartment syndrome or MACE was observed.

Conclusion: Transradial access for coronary angiography is a safe, effective and elegant alternative to transfemoral access.

Keywords: Transradial angiography, Allen's test, coronary angiography, transradial intervention.

INTRODUCTION

The usual site of vascular access for coronary angiography is through the femoral artery. The transfemoral route is popular, as puncturing the accessible and large caliber femoral arteries is relatively easy, however it is associated with a small but potentially serious incidence of vascular complications at the puncture site that may result in significant groin haematomas, blood transfusion or require surgical repair. A useful alternative approach is through the transradial access which involves a minimal vascular complication rate, eliminates the necessity for prolonged compression, and allows for earlier ambulation for the patient, rendering the radial approach more comfortable for the patient and one that decreases hospital costs and length of stay when compared to transfemoral access[1] . The transradial approach (TRA) for performing coronary angiography was initially proposed by Campeau in 1989[2], and in 1993, Kiemeneij reported his experience with coronary angioplasty through the radial route[3]. A meta-analysis that collected twelve randomized trials has shown that the transradial approach for coronary procedures is a highly safe and effective technique for both transcatheter diagnostic and therapeutic procedures[4] .

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PATIENTS AND MATHODS

A descriptive study was carried out in Armed Forces Institute of Cardiology – National Institute of Heart Diseases (AFIC-NIHD) spanning over a period of ten months from june 2009 to march 2010 involving 500 patients. Patients referred for coronary catheterization who had a normal radial pulse and a good collateral flow via the palmar arch as indicated by a normal Allen's test, were considered for transradial catheterization. Patients with previous CABG or requiring right heart catherization were excluded. Our preference was to use the right radial artery whenever possible as it was nearest to where

the operator stood while facing the cardiac monitors. The arm was abducted at 70° over an arm board and the wrist was sterilized and draped in the usual fashion. The skin was infiltrated with subcutaneous 5-8 ml of 1% lidocaine in front of the radial artery pulse at 1 cm proximal to the styloid process of the radius. The radial artery was punctured with a 21 gauge needle and was cannulated with a 45 cm, 0.019 inch straight wire. A 6 Fr radial sheath (11 cm) was then inserted into the artery using the Seldinger technique. All transradial angiograms were performed with intravenous administration of 5000 IU of unfractionated heparin in order to prevent radial artery occlusion. Intravenous verapamil 2.5 mg was given routinely and Adenosine and Glyceryl trinitrate(GTN) were kept in reserve for use only in case of arterial spasm. 6Fr diagnostic catheters, Judkins right 4 and Judkins left 3.5 were used in majority of the cases, but we also used catheters specially shaped for transradial approach, such as the Tiger catheter which was used to engage both left and right coronary arteries. A 260 cm long guide wire was used in catheter exchange to facilitate the procedure and minimize catheter manipulation into the aortic arch and ascending aorta. At the completion of the procedure, the sheath was immediately withdrawn and pressure was applied over the puncture site with a gauze roll and crape bandage dressing for approximately four hours to achieve haemostasis. The pressure dressing was then replaced by a light dressing after checking the capillary refill and the patient was allowed to be discharged the same day unless their clinical status dictated otherwise. Vascular complications such as forearm hematoma, radial artery occlusion, forearm ischemia and compartment syndrome were noted. Access site bleeding was defined as major if associated with haemoglobin loss of at least 2gm/dl, administration of blood transfusions, vascular repair or prolonged hospitalization and minor if bleeding at vascular access site only resulted in haematoma formation which did not require specific therapy. Any significant in-hospital major adverse cardiac events (MACE) were also noted.

Data Analysis

Data was analyzed using SPSS version 15.Descriptive statistics were used to describe the data i.e.mean and standard deviation (SD) for quantitative variables where as frequency and percentages for qualitative variables.

RESULTS

The baseline demographic and clinical characteristics of the patients are detailed in Table I. Mean age of the patients was 52 years (range 33-77 yrs) and 72.8% were men and 27.2% were females. Our main reason in choosing transradial access was due to operator preference (99.4%); otherwise they were performed mostly for failed transfemoral access. The vast majority of cases (98.4%) were elective. The right radial artery was used in 98% of cases, and a 6F sheath was most commonly used (97.6%). Judkins right and left diagnostic catheters were used in 357 (71.4%) patients, Tiger catheter was used in 140 (28%) patients. The success of the transradial procedure was defined as success in performing coronary angiography. Procedural success rate was 90.6%. Out of the 500 transradial cases; there were 30 (6%) cases of transradial intervention. In 47 (9.4%) patients, a transradial procedure was unsuccessful; the reasons can be classified into three categories. The first reason was failed radial puncture, which occurred in 28 (59.6%) patients. The second reason was the inability to advance the guide wire or coronary catheter to the ascending aorta, despite a successful radial puncture; this occurred in 11 (23.4 %) patients. This was due to an anomaly of the radial artery such as a radial loop, high take of radial artery or due to a small caliber vessel. The third reason was due to failed cannulation of the coronary arteries, in 08 (17%) patients. This was caused by either a right subclavian artery that was either tortuous or had an aberrant origin or dilated aortic root making it difficult to manipulate the catheter into the coronary ostium. The procedural characteristics are shown in Table-2. Coronary angioplasty and stenting was completed successfully in all 30 (100%) patients.

Radial artery spasm (relieved spontaneously or with vasodilators) occurred in

93 (18.6%) patients as shown in Table-3. Major vascular complications such as major access site bleeding, vascular perforation, forearm haematomas (requiring blood transfusion or surgical repair) radial artery occlusion, forearm ischemia or compartment syndrome peri or post-procedurally related to transradial access were not seen . There were 45 (9%) cases of minor bruising and 7 (1.4%) cases of minor forearm haematomas that occurred just after the completion of the procedure and settled with arm elevation and pressure. All patients had a palpable radial artery post procedure and no patient had symptoms or physical signs of hand ischemia.

DISCUSSION

Transfemoral approach carries the advantage of ease of access , but it can lead to numerous vascular complications, such as arteriovenous fistula, pseudo aneurysms, arterial occlusion and most seriously, retroperitoneal bleed. Large series involving the transfemoral approach have reported a significant rate of vascular complications (2.9–12.8%), including retroperitoneal bleeding (0.1–2.6%), need for transfusion (0.8–2.6%), and surgical repair (0.2–2.6%)[5-8]. Transradial access is an excellent alternative to femoral puncture[9]. The rationale for the transradial approach has been to attempt to reduce the incidence of bleeding complications at the vascular access site and the necessity for prolonged bed rest. The radial artery has a superficial course, and there are no nerves or veins of significant size near the usual site of puncture. The hand's dual arterial supply from the radial and the ulnar artery adds an extra level of safety to the arterial puncture. In critically ill patients in ITC who have prolonged cannulation of the radial artery, the incidence of ischaemic damage to the hand is minimal despite the frequent occurrence of arterial occlusion[10]. Before attempting transradial access, it is important to ascertain that the Allen's test is normal (positive), thus confirming an adequate collateral arterial supply from the ulnar artery. In a study by Benit et al in 1,000 patients undergoing cardiac catheterisation, 83% had a normal Allen's test[11]. In our study 95% patients had a positive Allen's test. For transradial access, the right radial approach is often preferred due to its more comfortable proximity to the operator. In our study right trans-radial approach was utilized in 490 patients (98%). Radial approach failure occurs in 1-9% of cases; the main causes are due to failed radial puncture, anatomic variations of the radial artery and small caliber vessels[12-16]. Procedural success rate was 90.6 % in our study which closely matches 94-97% success rates achieved in some other studies[17-18]. The reasons for a failed transradial procedure in our study can be classified into three categories. The first reason was failed radial puncture, which occurred in 28 patients (59.6%).The second reason was the inability to advance the guide wire or coronary catheter to the ascending aorta, despite a successful radial puncture; this occurred in 11 patients (23.4 %).This was due to an anomaly of the radial artery such as a radial loop, high take of radial artery or due to a small caliber vessel. The third reason was due to failed cannulation of the coronary arteries, in 08 patients (17%).This was caused by either a right subclavian artery that was either tortuous or had an aberrant origin or major aortic arch dilatation making it difficult to manipulate the catheter into the coronary ostium. Prevalence of an aberrant right subclavian artery anomaly (ARSA), has been reported as 0.4-2 %(19). In our study we encountered 2 patients (0.4%) who had an ARSA. Repeat transradial access is usually possible as is the use of a previously catheterized radial artery for a surgical conduit. Sakai et al carried out a study of repeated transradial cannulation in Japanese patients and found that transradial access in the same arm could be performed three to five times in most patients[20]. Vascular complication rates with transradial access are extremely low. In our study there were 45 cases (9.0 %) of minor bruising and 7 cases (1.4%) of minor forearm haematomas that occurred just after the completion of the procedure and settled with arm elevation and pressure bandage. There were no major vascular complications (major access site bleeding, vascular perforation, forearm haematomas requiring blood transfusion or surgical repair, radial artery

occlusion, forearm ischemia or compartment syndrome) or MACE. These findings are similar to published data by Kiemeneij et al[13]. In their study comparing percutaneous transluminal coronary angioplasty (PTCA) from various routes, they found a 2% incidence of major access site bleeding complications with the femoral approach and a 2.3% incidence with brachial access, whereas there was none encountered in the radial group. Transradial intervention (PCI) can be advantageous in patients with acute coronary syndrome (ACS) where aggressive antithrombotic and antiplatelet therapy is often instituted, leading to a higher potential for access site bleeding complications. Mann et al compared the use of radial and femoral access sites for PTCA in 142 patients with ACS, and found no access site bleeding complication in the radial group, as compared to the femoral group (4%)[21]. One of the main advantages of radial access over the femoral route is rapid mobilization of the patient and earlier discharge from hospital. In a randomized trial of transradial versus transfemoral diagnostic coronary angiography, hospital stay was significantly shorter (3.6 v 10.4 hours) in the radial group and day one and week one measures of bodily pain, back pain, and walking ability all favoured the radial group[22].

CONCLUSION

The radial artery is an excellent access site for coronary interventions and a safe alternative to femoral catheterization. Given the superficial course of the radial artery, the absence of major vascular structures in near vicinity of the radial artery and the dual blood supply of the hand, frequency of significant vascular complications is low, even when concomitant anticoagulants or antiplatelet agents are used. Not only patient comfort is increased with early ambulation but same-day home discharge (SDD) after transradial coronary angiography is cost-effective as compared to over night hospitalization (OH) required in case of transfemoral approach.

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Table-1: Baseline Clinical Characteristics (n= 500)

age (years)	52 ± 14.8
Gender	
Male	364 (72.8%)
Female	136 (27.2%)
Hypertension	373 (74.6%)
Diabetes Mellitus	197 (39.4%)
Dyslipidemia	409 (81.8%)
Smoking History	276 (55%)
Previous PCI	154 (30.8%)

PCI = Percutaneous coronary intervention

Table-2: Procedural Characteristics

	n= 500
Success of TR angiography	453 (90.6%)
TRA only	470 (94%)
TRA + TRI	30 (06%)
Reason for TR access	
Operator preference	497(99.4%)
Failed femoral access	03 (0.6%)
Site of attempted TR access	
Right radial artery	490 (98%)
Left radial artery	10 (02%)
Radial sheath size	
5 F	12(2.4%)
6 F	488(97.6%)
Contrast volume (ml)	90 ± 24

TR= Trans radial; TRA= Trans radial angiography
TRI= Trans radial intervention
LMS= Left main stem

Table-3: Procedural Characteristics -continued

	n= 500
Type of catheter's used	
Judkin R& L	357 (71.4%)
Tiger radial	140 (28%)
Amplatz / AL	2 (0.4%)
Multiporpose	1 (0.2%)
Tempo of case	
Elective	492 (98.4%)
Emergent	8 (1.6%)
Coronary artery lesions	
Normal	88(17.6%)
1-vessel disease	128(25.6%)
2-vessel disease	154(30.8%)
3-vessel disease	103(20.6%)
LMS disease	29 (5.4%)

TR= Trans radial; TRA= Trans radial angiography
TRI= Trans radial intervention
LMS= Left main stem

Table-4: Procedural and In-Hospital Complications

	n= 500
Procedural Complications	
None	407(81.4%)
Radial artery spasm	93(18.6%)
Major arm haematoma(requiring blood transfusion/ surgical repair)	0 (0%)
In-Hospital Complications	
None	448(89.6%)
Minor bruising	45(9.0%)
Minor Haematoma	7(1.4%)
Major arm haematoma (requiring blood transfusion/ surgical repair)	0 (0%)
MACE (MI, Stroke, Death)	0 (0%)

MACE= major adverse cardiac events