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Journey of a Beginner for Transradial Approach of Coronary Angiography; First One Year Personal Experience

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Abstract

Background: Percutaneous coronary artery angiography (CAG) is commonly performed all over the world through the transfemoral approach (TFA) but now a days the transradial approach (TRA) for CAG is becoming popular in the world. And recently has gained acceptance among Bangladeshi interventional cardiologists. The aim of this study was to document novice single operator experience of the trans-radial approach to CAG and to examine the utility of dual hand circulation assessment prior to the TRA for assessing the procedural outcomes among the patients in a tertiary care hospital in Bangladesh.

Methods: This observational one-year study was conducted in National institute of Cardiovascular Disease (NICVD), Dhaka, Bangladesh among 167 patients who underwent trans radial coronary angiography. Patients who had acute or chronic coronary syndrome and who willingly to participate in this study were included. Patients were divided into two groups: A (the first 58 patients), in which dual hand circulation was assessed by Allen's test or oximetry test before TRA, and B (109) in which TRA was done without assessing dual hand circulation.

Results: Out of 167 patients, the mean age was 58±13.0 years. Most of the patient (61.7%) belonged under 60 years of age (61.7% vs 38.3%). Male patients were predominant (67.1% vs 32.9%). Among the risk factors, 54.1% had hypertension, 34.7% had diabetes mellitus, 58.7% were smoker, 62.9% had dyslipidemia & 10.8% had family history of IHD. Total trans-radial coronary angiography (CAG) success rate was 91.0%. From radial to femoral access crossover rate was 9.0% and more marked in old age (≥60 years) which was 17.2% of old patients. The primary causes for crossover were puncture failure (3.6%), radial artery spasm (2.4%), failure to engage the coronary artery (1.8%), severe tortuosity of subclavian artery (0.6%) & small radial artery (0.6%). The complications were forearm hematoma (6.6%), radial artery occlusion (RAO) (5.4%) & radial artery dissection (3.0%). There were no complications requiring surgery repair or blood transfusion. There was no significant statistical difference was found between two group.

Conclusions: The TRA for CAG is safe and highly effective. It almost 100% reduces access site major complications. Trans-radial

procedure gives much comfort to the patient. I think, transradial approach may be an attractive alternative to conventional transfemoral approach for CAG. The routine assessment of dual hand circulation before TRA might not be necessary.

Keywords: Coronary angiography; Trans-radial; Transfemoral; Radial artery occlusion

Background

Coronary angiography (CAG) can be performed via femoral or radial or brachial arteries. Traditionally, trans femoral approach had primary approach for the most operators [13]. Although transbrachial approach via brachial cut down, that has been introduced by Sones in 1959, was the prefer method for coronary angiography (CAG) in the 1950s and 1960s, because of the complexity of the procedure, it lost its popularity during last decades. Transfemoral (TF) approach is most popular and also dominant method for CAG, because of the simplicity of the technique and operator friendly. Whereas transradial (TR) approach in aortography for the first time was reported by Rander S, in 1948 [2], due to small vessel size, this technique has been abandoned until 1989, that Campeau did relive this technique and introduced it as an ideal approach for CAG, [2, 5] there is an increase in use of trans-radial access around the world. Although TF approach still is dominant approach worldwide, during the last two-decade TR approach has try to dominate as a new method for CAG, mostly in European countries & Japan. TR approach is becoming more popular now throughout the world as an alternative to the TF approach. [10, 16]

The major advantage of the TRA is the reduction in the incidence of puncture site complications than TFA with early ambulation and shortening of hospital stay [4, 11, 24]. The dual blood supply of the hand limits the potential for limb-threatening ischemia14; therefore, assessment of dual hand circulation is considered essential before performing TRA. The approach is advantageous for people with severe occlusive aortoiliac disease or difficulty lying down (e.g., due to back pain, obesity, or congestive heart failure) [1,14].

Although, TRA had been used as the preferred approach for CAG more than two decades across the world, unfortunately, its use in Bangladesh is still limited. Only a few Bangladeshi cardiologists in few cardiac centers use the radial access as the default approach, while the majority of cardiologists still prefer the femoral access. In our working center "National Institute Cardiovascular Diseases & Hospital (NICVD), Dhaka, Bangladesh", the TRA was started more than 15 years ago, but still now, less than 50% of coronary diagnostic and interventional procedures are done via the trans radial access. Risk for mortality and vascular complication lower TRA than FA. Because the radial artery is small and superficial, it is easily compressible. The aim of this study is to document single operator experience with the TRA for elective CAG, and to test the value of assessing dual hand circulation before the procedure.

Materials and Methods

Design and Study Population

It was an observational prospective study conducted in National Institute of Cardiovascular Disease (NICVD), Dhaka, Bangladesh. Informed written consent was taken by all participants. Over a one-year period, 167 patients were selected to our team in NICVD and underwent trans-radial CAG by the same operator who fulfilled the inclusion and exclusion criteria.

Inclusion Criteria

Patients with ACS (STEMI, NSTEMI, UA) & chronic stable angina (CSA) who were admitted under our team in NICVD within the study period was selected in the study.

Exclusion Criteria

Moderate to severe degree of valvular heart disease. Patient with congenital heart diseases. Patients with non-coronary causes of chest pain. Patients with acute dyspnea from non- cardiac causes. Significant co-morbidity reducing life expectancy to <1 year. Patients unwilling to participate in this study.

Study Procedure

- Patients admitted in the Department of Cardiology in NICVD, Dhaka, with ACS (STEMI, UA/NSTEMI) & CSA were considered for the study and those who fulfilled inclusion, exclusion criteria and agreed to enter the study protocol.
- Informed written consent was taken from each patient or legal guardian before enrollment.
- Meticulous history was taken and detailed clinical examination was performed and recorded in pre-designed structured form.
- Demographic data such as age, sex.
- Risk factor including diabetes mellitus, smoking, hypertension & dyslipidemia, family history of IHD.
- Base line laboratory investigation includes ECG, TroponinI/CK-MB, RBS/FBS/HbA1c, serum creatinine, fasting lipid profile & echocardiogram.
- To investigate the benefit of assessing dual hand circulation before the TRA, we divided the study population into two groups: groups A (the first 58 cases) and B (all other patients).
- In group A, dual hand circulation was assessed by Allen's test or oximetry test and patients with abnormal tests were excluded from the study.
- In group A, dual hand circulation was assessed by oximetry test and patients with abnormal tests were excluded from the study.
- While in group B, TRA was done without any assessment for dual hand circulation.
- The patients were prepared for radial and femoral approaches.
- All the procedures were done through the right TRA.
- Under local anesthesia (1–2ml, Xylocaine 5%), radial punctures were performed using the transradial kit which consisted of a 21-gauge needle, a 0.018″ guide-wire, and a short (7cm long) sheath.
- Six-F sheath was used for all patients. After sheath insertion, a cocktail containing 200μg nitroglycerin and 5000IU unfractionated heparin (UFH) was injected into the radial artery.
- For diagnostic CAG, the following catheters were used: 6F or 5F Tiger (TIG) catheter (Terumo, Japan) or 6F Ultimate catheter (Merit Medical) to cannulate the right coronary arteries or Judkin's left (JL 6/3.5 and 6/4) and Judkin's right (JR 6/4 and 6/3.5) catheters to cannulate the right femoral artery respectively.
- The radial sheath was removed immediately after the procedure and compression was performed proximal to puncture site for 2 hours. Thereafter, a light pressure bandage was applied and removed in the next day.

- The site of radial puncture was examined before discharge and after 2 weeks, and radial artery patency was assessed by checking the radial pulse.
- Radial artery occlusion (RAO) was considered in the absence of radial pulse distal to the puncture site.

Statistical Analysis

Statistical method Statistical analyses were performed using the SPSS 25. Continuous variables were analyzed and presented as mean±SD whereas categorical variables were given as numbers (percentages). The comparison between categorical variables was done by chi-square test. $p<0.05$ was considered statistically significant.

Results

A total of 167 consecutive patients were included. There were 112 males (67.1%) and 55 females (32.9%). The age ranged from 32 to 83 years (mean of 53±13.0). (Table-1).

Table 1: Baseline patients' characteristics (N=167)

Characteristics	N (%)
Age/year (Range 32-83 years)	58±13.0
Male	112(67.1)
Female	55 (32.9)
Hypertension	90(54.1)
Diabetes	58(34.7)
Smoking	98(58.7)
Dyslipidemia	105(62.9)
Family history of CAD	18 (10.8)

Total trans-radial procedural success rate was 85.6% & cross over from radial to femoral access was 9.0%. Crossover from radial to femoral access was higher in older patients (≥ 60 years) than younger patients (17.2% versus 3.9%); however, the difference between the two groups was statistically significant (p value=0.003). (Table-2)

Table 2: Procedural success (N=167)

Procedure(n=167)			N (%)
Trans-radial procedure success			152(91.0)
Trans-radial procedure failed (crossover from radial to femoral approach)			15(9.0)
Patient age (year)	Total (N/%)	Patients with crossover (n=15)	P value*
<60	103(61.7)	04 (3.9)	0.003
≥60	64 (38.3)	11 (17.2)	
Total	167	15	

*Significant level ≤0.05, chi-square test was done

Crossover from radial to femoral access occurred in 15(9.0%) patients. The main reasons for crossover were puncture failure in 06(3.6%) patients, severe radial artery spasm which did not respond to multiple doses of intra-arterial nitroglycerin and IV analge-

sia in 04(2.4%) patients, failure to engage the coronary artery in 03(1.8%) patients. (Table-3).

Table 3: Causes of crossover from radial to femoral approach (N=167)

Cause of crossover (n=15)	N (%)
Puncture failure	06(3.6)
Radial artery spasm*	04(2.4)
Failure to engage the coronary artery	03(1.8)
Tortuous subclavian artery	01(0.6)
Small radial artery	01(0.6)

*Which did not respond to multiple doses of intra-arterial nitroglycerin and IV analgesia.

The frequency of various complications was as follow: 11 patients (6.6%) had forearm hematoma which was treated conservatively. 05 patients (3.0%) had radial artery dissection with extravasation of contrast which was resolved conservatively. Radial artery occlusion (RAO) was observed in 09 patients (5.5%). There were no cases of hand ischemia, arteriovenous fistula, or bleeding complications that need surgical repair or blood transfusions (Table-4).

Table 4: Types of complications (N=167)

Complications (n=25)	N (%)
Hematoma	11(6.6)
Radial artery dissection	05(3.0)
Radial artery occlusion (RAO)	09(5.5)

We found no statistically significant difference between groups A and group B regarding the incidence of RAO, crossover rate or hematoma (p value=0.143) (Table-5).

Table 5: Parameters according to assessment of dual hand circulation (group A, patients who had assessment of dual hand circulation before TRA; group B, patients who underwent TRA without assessing dual hand circulation).

Parameter	Group A	Group B	*p value
Number(n=167)	58(34.7%)	109(65.3%)	0.143
Gender Male (n=112) Female (n=55)	39(67.2%)19(32.8%)	73(67.0%)36(33.0%)	
Cross over into femoral (n=15)	5(8.6%)	10(9.2%)	
Complications (n=25) Hematoma (n=11) Radial artery dissection (n= 05) RAO (n=09)	04(6.9%)02(3.4%)03(5.2%)	07(6.4%)03(2.8%)06(5.5%)	

*Significant level ≤0.05, chi-square test was done

Discussion

TRA for performing CAG has become increasingly popular day by day because it is associated with decreased incidence of puncture site complication especially hemorrhagic and vascular complication as well as increased patient comfort, earlier ambulation, earlier hospital discharge, and cost reduction [7, 12, 20]. This observational prospective study conducted in NICVD, Dhaka, Bangladesh over a one-year period. 167 patients were selected and underwent trans-radial CAG by myself who fulfilled the inclusion and exclusion criteria. The aim of this study is to document single operator experience with trans-radial access and to test the benefit of assessing dual hand circulation before the TRA for assessing the procedural outcome of the trans-radial CAG among the

patients in a tertiary care hospital in Bangladesh.

In my study, the mean age of the study population was 58±13.0 years & most of the patients were belonged under 60 years of age (61.7% vs 38.3%). Male patients were predominant in this study population (67.1% vs 32.9%). CM Shaheen Kabir M [6] found that mean age was 59.47 ± 10.22 years & 64.5% were male patients; [9] found that mean age was 57±10.0 years and 69.1% were male patients. These small variation of mean age & sex among these studies might be due to different study design & place in the same city.

Among the risk factors of my study, 54.1% had hypertension, 34.7% had diabetes mellitus, 58.7% were smoker, 62.9% had dyslipidemia and 10.8% had family history of IHD. Many studies carried out at home & abroad demonstrated more or less same pattern, as mentioned by Mohammad Saifullah Patwary [17]; CM Shaheen Kabir [6], Osama Tayeh & Federica Ettori [19] Jaafar Sadeq Aldoori [9] in their work. This little variation may be due to different study design & place as well as ethnic and cultural differences among the study populations.

Trans-radial procedural success rate of our study was 91.0%. Crossover from radial to femoral approach was 9.0% where crossover was high in patients age ≥60 years (17.2.% vs 3.9%) that is statically significant (p value-0.003%). The reasons for crossover were puncture failure (3.6%), severe radial artery spasm (2.4%) which did not respond to multiple doses of intra-arterial nitroglycerin and IV analgesia, failure to engage the coronary artery (1.8%), tortuous subclavian artery (0.6%) & small radial artery (0.6%). TRA has been associated with a greater access crossover rate, which was reported to be 4–7% in various studies [23]. Louvard et al. reported a crossover (radial to femoral) rate of 10% in the first 50 cases13, Jaafar Sadeq Aldoori [9] reported 4.4% & Osama Tayeh & Federica Ettori [19] reported 4.1% that mismatches the findings of my study. In the meta-analysis of elderly patients by Alnasser [21] access site crossover rate was higher for TRA compared to the TFA (11% vs. 3%, p = 0.0003), that is acceptably high in my study.

The incidence of complications of my study were forearm hematoma (6.6%), radial artery occlusion (RAO) (5.4%) & radial artery dissection (3.0%). There were no cases of hand ischemia or complications that needed surgical repair or blood transfusion. Many studies reported less bleeding [3, 8] that is similar to my study. The incidence of RAO varies between 3 -10%, according to different studies [15, 22] that is also similar to my study.

In our study, the majority of patients (65.3%) underwent trans-radial procedure without any assessment of dual hand circulation (group B); however, this did not result in worse outcomes such as hand ischemia or higher rates of access crossover or RAO that is similar to many international studies. In an international trans-radial practice survey by Bertrand [18] which included 1107 interventional cardiologists from 75 countries, [23].4–30.8% of operators did not assess dual hand circulation at all. Because the Allen test or the oximetry/ plethysmography test have not been shown to be predictive of hand ischemia in case of RAO, it remains uncertain whether the assessment of dual hand circulation before TRA is required [18].

Conclusions

The TRA for CAG is cost-effective and safe that can be readily applied in the majority of cases. Access site complications are less. More comfort to the patient. The approach is also advantageous for people with severe occlusive aortoiliac disease or difficulty lying down (e.g., due to back pain, obesity, or congestive heart failure). So, TRA is an attractive alternative to conventional transfemoral approach, in suitable patients at the hand of experienced operator, with appropriate hardwire and should be ready to cross over, to the femoral approach when needed. The routine assessment of dual hand circulation before TRA might not be mandatory, however more studies are needed to confirm our results. Of course, this needs further studies covering a larger population to draw a firm conclusion in this regard.

Conflict of Interest

There is no conflict of interest in this study.

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