

RADIAL ARTERY OCCLUSION- A BURDEN OR A CHALLENGE?

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Contribution

FM helped in literature review, research design and finalizing the manuscript. YH helped in data collection and data analysis. FM helped in final draft. Both the authors contributed significantly to the submitted manuscript.

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ABSTRACT

Objective: To determine the frequency of radial artery occlusion (RAO) in patients undergoing coronary procedures via transradial catheterization (TRC).

Methodology: This cross sectional study included patients who underwent coronary procedures successfully via TRC. Total duration of study was 6 months, from 3rd August 2015 to 2nd February 2016 and was done in Shifa International Hospital Islamabad. Information about coronary procedures, its length, RAO and interval of its occlusion was collected. Findings of the study were described as frequency and percentages. Secondary analysis of RAO with relation to age, gender, coronary procedures and its length was established.

Results: Out of 141 patients that were enrolled for study, 68.8% were males. The mean age of patients was 57.62 ± 10.1 years. Total of 39 (27.7%) patients underwent diagnostic coronary angiogram whereas 102 (72.3%) patients had PCI. RAO developed in 10 (7.1%) patients, statistically higher among age group above 50 years and in females.

Conclusion: Relatively low incidence of RAO was found in our sample population undergoing coronary procedures via TRC, comparable with international studies and less than documented in other local studies.

Key Words: Radia artery occlusion, Trans radial catheterization, Percutaneous coronary intervention, Coronary artery disease.

INTRODUCTION

Coronary artery disease is the most leading cause of death accounting for 12.8% of all deaths throughout the world. Every year above seven million people die from coronary artery disease (CAD).¹ Gold standard method for the diagnosis of coronary artery disease is coronary angiogram, which also helps in establishing the treatment strategies.² It can be performed via different routes for example femoral, radial, brachial, ulnar and axillary artery.² Most commonly used vascular access is femoral artery.³ However femoral artery access is associated with considerable risk of vascular complications, like bleeding at puncture site which increases patient mortality and length of hospital stay.⁴

As an alternate, radial artery access was initially used for diagnostic coronary angiogram and later in 1993 for percutaneous coronary intervention (PCI).^{5,7} Many international studies have demonstrated that radial artery is readily accessed and is the best way to substantially reduce the risk of vascular complications especially bleeding at access site in patient with acute coronary syndrome (ACS).^{4, 8, 9} It also helps in reducing hospital mortality and length of stay thus lowers financial burden along with patient comfort and safe hemostasis.^{6,7}

Despite of it, radial artery access accounts for 10% of coronary catheterization world wide.⁷ Reason for this, are radial artery occlusion and increased radiation exposure in transradial catheterization.^{2,7} Radial artery occlusion is potentially a significant problem. In the published data, radial artery occlusion rates are variable, lowest one reported is 2%, but in one of the major prospective study, its incidence reported is 18%.^{2,8} Factors affecting are, prolonged high compression of radial artery, no anticoagulant used, small artery to sheath size ratio, use of non-hydrophilic sheath and repeated attempts.^{2,7,10} Treatment of symptomatic Radial artery occlusion is Low molecular weight heparin in body weight adjusted dose.¹¹

The study aim was to determine the burden of radial artery occlusion through transradial catheterization in our population as local research was lacking and also transradial approach is less practised despite of its established safety.

METHODOLOGY

This is a cross sectional study was conducted at Shifa International Hospital Islamabad, Department of Cardiology. The total study period was six months from 3rd August 2015 to 2nd February 2016. Patients were selected through consecutive (non-probability) sampling technique. WHO sample size calculator was used with confidence interval 95%.

All the patients of either gender between age 20 to 75 years who were admitted in cardiology department (CCU/Ward) and day-care centre for coronary procedures either for establishing CAD or with coronary events like ACS were included. Patients with negative ALLEN TEST (described below in data collection procedure), patients with history peripheral arterial disease with ankle brachial pressure index <0.90, confirmed on Doppler Ultrasound examination, cardiogenic shock and with accessory radial artery found on transradial catheterization via fluoroscope were excluded.

Radial artery occlusion (RAO) was defined as loss of radial pulse on palpation, confirmed by loss of audible sound of blood flow across the radial artery accessed via hand held portable Doppler. Radial pulse was checked for occlusion at three different intervals. First at the time of transradial (TR) band application and removal after 2 hours of procedure. Second at the time of discharge from CCU / daycare centre within 24 to 48 hours of coronary procedure. Third at follow up visit within 7 to 10 days of coronary procedure.

Two types of coronary procedures was taken for study purpose.

a. **Coronary angiogram:** Visualization of coronary arteries via fluoroscopic Xray using a dye which make the heart blood vessels visible.

b. **Percutaneous coronary intervention (PCI):** A procedure to open up the blocked/narrowed arteries via balloon angioplasty or stent.

Transradial catheterization: A procedure used to cannulate radial artery with the help of radial sheath after puncturing the artery.

Informed consent was taken from patients / next of kin for enrolment before coronary procedure for transradial catheterization. Patients underwent routine history and physical examination, ECG were obtained along with baseline tests like complete blood picture and electrolytes. Cardiac enzymes were recorded for patients with ACS who were managed according to ACS pathways developed by multidisciplinary team of our hospital. Allen's test was performed on all patients prior to transradial catheterization. Hydrophilic Radial sheaths were used and hemostasis was achieved with TR compression band and in the end of coronary procedure performed. Procedure length/duration was recorded. Patency of radial artery was checked via palpation and hand held portable Doppler. Data was collected from medical records. All this data was entered on data collection form. The whole process of data collection and data entry was done by trainee researcher.

All the data was entered and analysed using statistical package for social science (SPSS) version 21.0. Descriptive statistics were calculated for both quantitative and

qualitative variables. Quantitative variable like age was presented as mean and standard deviation whereas frequencies and percentages were calculated for categorical variables like gender and radial artery occlusion. Effect modifiers like age, gender, coronary procedure and procedure duration were controlled by stratification. Post stratification chi-square test was applied. $P \leq 0.05$ was considered significant.

RESULTS

Out of 141 patients that were enrolled for study, 68.8% were males. The mean age of patients was 57.62 ± 10.1 years. Total of 39 (27.7%) patients underwent diagnostic coronary angiogram whereas 102 (72.3%) patients had PCI. Radial artery occlusion developed in 10 (7.1%) patients. Among them, 9 patients developed this complication after PCI and only 1 patient had RAO after diagnostic coronary

angiogram. About 7 (5.0%) patients were found to have occluded Radial artery on follow up visit within 7 to 10 days and 3 (2.1%) patients developed RAO within 24 to 48 hours of coronary procedure. None of the patient had immediate RAO in 2 hours.

The incidence of RAO was higher among age group of above 50 years as compared to below 50 years of age (10.1% vs 0%) ($p= 0.03$) as shown in table 1. RAO was found to be more common in females as compared to males (60% vs 40%) ($p=0.04$) (Table 2).

Procedure length was less than 30minutes in 27.7% patients, less than 60 min in 46.8% and was more than an hour in 15.6% of patients. Coronary procedure and procedure length was compared to radial artery occlusion. The results were statistically not significant ($p >0.05$) as shown in table 3 and 4.

Table 1: Stratification of RAO in Age Groups in study population (n=141)

Age	Radial Artery Occlusion		p value
	YES	NO	
50 years	0	42	0.03
> 50 years	10	89	
Total	10	131	

Table 2: Stratification of RAO with Respect to Gender in study population (n=141)

Gender	Radial Artery Occlusion		Total	p value
	Yes	no		
Male	4	93	97	0.04
Female	6	38	44	
Total	10	131	141	

Table 3: Stratification of RAO with Respect to Coronary Procedures in study population (n=141)

Radial Artery Occlusion	Coronary Procedure		Total	p value
	Coronary Angiogram	PCI		
Yes	1	9	10	0.195
No	38	93	131	
Total	39	102	141	

Table 4: Stratification of RAO with Respect to Procedure Length in study population (n=141)

Procedure Length	Radial Artery Occlusion		Total	p value
	yes	no		
Less than 30 minutes	1	52	53	
Less than 60 minutes	7	59	66	3.55
More than one hour	2	20	22	
Total	10	131	141	

DISCUSSION

In this study, we aimed to determine the burden of radial artery occlusion through transradial catheterization in our population as local research is lacking and transradial approach is less practised despite of its established safety.

Most common complication of transradial catheterization is asymptomatic RAO which is detected in variable range of 2% to 18% patients.² Risk factor associated in various randomized study were no anticoagulant use, prolonged high pressure compression of the radial artery and small radial to sheath size ratio. In our study we used 5000 IU and 100 IU/ kg (maximum of 10,000 IU) of heparin in patients undergoing coronary angiogram and PCI respectively. Hydrophilic radial sheath of 6F were used in all patients and hemostasis was achieved at the end of procedure with pressure adjusted TR band.

In our study, frequency of RAO was 7.1% which is less than found in large prospective non- randomized study Tuncez et al where it was reported 9.4% and significantly less than 13.1% reported Indian study Sreevasta et al and results are comparable to recent systemic review and meta-analysis published Rashid et al where its overall incidence reported was 7.7% in first 24 hours and 5.8% in 30 days.^{2,14}

In our study, statistically significant difference of RAO was found in term of gender distribution. In 10 of 141 (7.1%) patients with RAO six (6) of those were females and four (4) were males patients (60% vs 40%) ($p < 0.04$). Similar difference were found in study by Tuncez et al where 80% of patients with RAO were females and in meta-analysis by Rashid et al in which reported incidence of RAO among females is 66.7%.² Most likely reason is small radial artery to sheath ratio in females as compared to male.

In the current study, mean age was 57.62 years which is slightly less than 58.1 year reported by Tuncez et al.² Beside gender, age is also a predictor of RAO, with higher incidence

is found in elderly population above 60 years. In our study all the patients with RAO were above 50 years of age.

In current study RAO was predominantly found as late complication on follow up visit as compared to 24 to 48hour visit (5.0% vs 2.1%) which are comparable to the one found in meta-analysis Rashid et al where incidence reported at day 1 is 6.7%, at 2 to 6 days 9.9% and at 7 days to 1 month was 6.2%.^{8,7} This is because recanalization of occluded radial artery usually occur in 1 to 3 months after which its incidence decreases further.

Radial artery occlusion was higher in PCI group as compared to coronary angiogram group (9 vs 1 patient) which are comparable to Tuncez et al study.² Among 10 patients with RAO, procedure length was < 30 minutes in one patient, < 60 minutes in 7 patients and was more than an hour in 2 patients. Secondary analysis of the effect of coronary procedure type and procedure length on RAO were not found statistically significant with p value of 0.195 and 3.55 respectively, but were comparable to international study Tuncez et al.²

CONCLUSION

Trans Radial Catheterization has well established safety and increasingly used access site. Relatively low incidence of RAO was found in our sample population undergoing coronary procedures via TRC, comparable with international studies and less than local studies, which had facilitated our cardiologists to adopt this approach on priority basis.

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