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ORIGINAL ARTICLE

Radial Artery Occlusion after Percutaneous Coronary Intervention through Transradial Approach

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ABSTRACT

Introduction: Radial artery occlusion may occur after percutaneous coronary intervention when done via transradial approach. The frequency of radial artery occlusion is almost nil in patients after PCI through transradial approach. Thus radial artery approach for PCI can be a good opportunity to conduct the procedure.

Objective: To assess the frequency of radial artery occlusion after percutaneous coronary intervention through transradial approach in patients of acute coronary syndrome

Material & Methods

Study Design: Descriptive case study

Settings: Department of Cardiology, Punjab Institute of Cardiology, Lahore.

Duration: Six months i.e. 1st July 2020 to 31st December 2020.

Data Collection: Total 100 patients who underwent PCI through transradial approach 6 months ago were studied. All the selected patients then underwent Doppler scan to assess patency of radial artery. Radial artery occlusion was confirmed by when there was reduced flow in radial artery as compared to the adjacent side artery

Results: In this study, the mean age of patients was 54.56 ± 8.96 years. There were 43 (43%) males and 57 (57%) females. The frequency of radial artery occlusion in patients after PCI through transradial approach was seen in 3 (3%) of the patients.

Conclusion: Results of this study demonstrates that the frequency of radial artery occlusion is almost nil in patients after PCI through transradial approach. Thus radial artery approach for PCI can be a good opportunity to conduct the procedure.

Key Words: Radial artery Occlusion, Transradial approach, percutaneous coronary intervention, acute coronary syndrome

INTRODUCTION

Among patients of acute coronary syndrome, usually patients are planned to undergo percutaneous coronary intervention (PCI). There are two main approaches used for catheterization i.e. femoral artery (the most common one) and radial artery. Catheterization via transradial approach has many benefits than transfemoral approach. Its use is increasing in many clinical setting for both; diagnostic purpose e.g. coronary angiography and for management i.e. percutaneous coronary intervention.[1, 2] Transradial approach has many advantages including less complications of access site bleeding, early mobility after procedure as bed rest is unnecessary after the procedure and thus early discharge from the hospital which ultimately also reduce cost of procedure and after hospital burden, less chances of fistula formation and more cost effective.[3, 4]

Catheterization with the transradial technique might result in permanent closure of the radial artery.[5, 6] Because of the dual blood supply to the hand, it is normally clinically quiet, and as a consequence, it is frequently overlooked. However, the problem is not benign, as cases of hand ischemia caused by radial artery obstruction have been described.[7] The artery cannot be used as an access point for future catheterization or as an arterial channel for bypass operations once it has been obstructed. Because catheterization puts the patient's hand at danger of ischemia, the ipsilateral ulnar artery becomes useless as well.[8-10]

Some of the parameters linked to radial artery occlusion include anticoagulant dose, gender, patient body weight, radial artery diameter, sheath size, number of catheters, operation length, hemostatic compression technique, and compression time following the treatment.[11, 12] There is no local data about this complication that occurred after PCI. Doppler ultrasonography is the most accurate approach to assess the dual circulation of the hand and the blockage of the radial artery. We can determine the frequency of radial artery occlusion and, if it is high, identify and regulate the causes that cause it.

Objective: To assess the frequency of radial artery occlusion after percutaneous coronary intervention through transradial approach in patients of acute coronary syndrome

MATERIALS AND METHODS

Study Design: Descriptive case study

Setting: Department of Cardiology, Punjab Institute of Cardiology, Lahore.

Duration: 06 months i.e. 1st July 2020 to 31st December 2020.

Sample Size: Sample size of 100 patients is estimated by using 95% confidence level, 9.5% absolute precision with percentage of radial artery occlusion i.e. 32.9% after PCI through transradial approach

Sampling Technique: Non-probability, consecutive sampling

Inclusion Criteria: Patients of age 40 to 70 years, both genders, who already underwent PCI through transradial approach for acute coronary syndrome 6 months before and coming for routine follow-up / check-up, were included.

Acute coronary syndrome was defined as patients who were diagnosed to have ECG changes along with chest pain, dyspnea, CK-MB>25% than normal level.

Exclusion Criteria: Patients who had negative Allen test, peripheral vascular disease or arteritis, already undergone ipsilateral transulnar catheterization or transradial catheterization before were excluded from the study.

Data Collection Procedure: One hundred patients, who were underwent PCI through transradial approach were included and confirmed through medical record. All patients underwent color Doppler ultrasonography of radial artery by a single experienced radiologist and patency of radial artery was assessed. The assessment of flow velocity in proximal, middle, and distal segments of radial arteries were taken. The similar examination was done on other side to compare arterial blood flow in both hands. In case, if blood flow velocity is reduced, then radial artery occlusion was labeled.

Data Analysis: Data analysis was done in SPSS v. 22.0. Radial artery occlusion was presented as frequency and percentage.

RESULTS

Mean age of patients was 54.64 ± 8.96 years. Out of 100 patients, 43 (43%) were males and 57 (57%) were females. The male to female ratio was 1: 1.3. Mean height of patients was 1.67 ± 0.11 meters, mean weight was 75.78 ± 8.85 kg and mean BMI was 27.58 ± 4.93 kg/m^2. Mean duration of procedure was 35.39 ± 8.50 minutes. Table 1

Radial artery occlusion was seen in 3 (3%) of the patients who underwent PCI through transradial approach. Figure 1

It has been observed that the chances of radial artery occlusion was 3.8% in patients of age 40-55 years while 2.1% in patients of age above 55 years, while the difference was insignificant (p-value > 0.05). It was also noticed that the chances of radial artery occlusion was 0% in male patients while 5.3% in female patients, while the difference was insignificant (p-value > 0.05). But in patients with normal BMI, radial artery occlusion was noticed in 0% cases, 0% in overweight cases while 9.7% in obese cases, thus the chances of radial artery occlusion as significantly higher in obese patients (p-value < 0.05). The post-procedural radial artery occlusion occurred in 2.8% patients who had procedure for < 30 minutes while in 3.1% patients who had procedure for >30 minutes, although the statistical difference was insignificant (p-value > 0.05). Table 2

Table 1: Baseline characteristics of patients

n	100
Age	54.64 ± 8.96 years
Gender	
Male	43 (43%)
Female	57 (57%)
Height	1.67 ± 0.11 meters
Weight	75.78± 8.85 kg
Body Mass Index	27.58 ± 4.93 kg/m^2
Duration of PCI	35.39 ± 8.50 minutes

Figure 1: Frequency of radial artery occlusion after PCI through Transradial approach

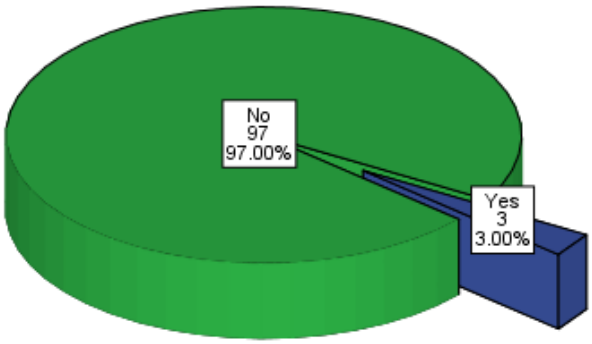

Table 2: Comparison of radial artery occlusion after PCI through Trans-radial approach with Age and gender

	Radial artery occlusion		p-value
	Yes	No	
n	3	97	
Age			
40-55 Years	2 (3.8%)	50 (96.2%)	0.606
56-70 Years	1 (2.1%)	47 (97.9%)	
Gender			
Male	0 (0.0%)	43 (100%)	0.127
Female	3 (5.3%)	54 (94.7%)	
BMI			
Normal	0 (0.0%)	34 (100%)	0.032
Overweight	0 (0.0%)	35 (100%)	
Obese	3 (9.7%)	28 (90.3%)	
Duration			
Less than 30 minutes	1 (2.8%)	35 (97.2%)	0.922
More than 30 minutes	2 (3.1%)	62 (96.9%)	

DISCUSSION

Radial artery occlusion is the most common procedural consequences after PCI when done via transradial approach, which is considered to be caused by a combination of traumatic and non-traumatic causes such as arterial spasms, endothelial damage, micro-thrombus development, or neo-intimal hyperplasia. [13]

There have been infrequent cases of digital ischemia in the context of radial artery occlusion, while it's unclear if the occlusion is directly leading to the ischemia or if it's because of embolization of thrombotic materials from the occlusive plugs. At the very least, radial artery occlusion that develops and persists prevents further transradial access in the afflicted arm. Surgeons have developed a variety of tactics to reduce the risk of arterial blockage during the last two decades, including employing smaller sheaths, proper anti-coagulation, and patent haemostasis procedures to enable ante-grade blood flow via radial artery throughout the procedure. [14]

Despite the fact that these tactics have a well-established role, survey results show that post-procedure practices vary widely. This is especially true when it comes to the anticoagulant type and dose utilized during transradial diagnostic and interventional procedures.[10]

In our study, the frequency of radial artery occlusion was seen in 3 (3%) in patients after PCI through transradial approach. Frequency of radial artery occlusion in acute coronary syndrome patients after the PCI through transradial approach did not show any statistically

significant association with age [40-55 years: 3.8%, 56-70 years: 2.1%], or gender [Male: 0% & Female: 5.3%] or duration of procedure [less than 30 minutes: 2.8% & more than 30 minutes: 3.1%], while significantly higher in patients with obese BMI i.e. 0% in normal BMI, 0% in overweight and 9.7% in obese patients.

In the literature, the incidence of this consequence, measured promptly after treatment, ranges from 1.5 percent to 30.5 percent, with an average of 5–12 percent.[10, 15] The rate of radial artery occlusion following PCI through transradial approach is in the literature's range, but it's on the high side.

Occlusion of the radial artery is determined by a variety of demographic, clinical, and peri-procedural parameters, as well as the period between the procedure and the patency evaluation. In comparison to the initial evaluation following compression bandage removal, it is even 50% lower if the examination is conducted 30 days after the treatment. This reveals that the radial artery often spontaneously recanalizes. [14, 16] Abdullah Tuncez in his study reported that in 10 of 106 (9.4%) patients, radial artery occlusion was detected at the 24th h visit.[17] Zhou in his study reported radial artery occlusion was present in 0.94% of the patients following transradial PCI.[18] Zankl reported incidence of radial artery occlusion in 10.5% of patients following transradial coronary angiography, [6] which was much higher than observed in our study.

According to the results of a recently published meta-analysis the incidence of radial artery occlusion was overall 7.7% within 24 hours and 5.8% at up to 30 days, which is comparable with currently published literature.[19] Frequency of radial artery occlusion in this study is low than reported in meta-analysis.

In numerous investigations, the timing of radial artery occlusion assessment varied, and radial artery occlusion rates reduced over time. In a patent hemostasis condition, a shorter compression duration and a larger heparin dosage both appear to minimize radial artery blockage. Larger investigations are needed to determine the relationship between radial arterial blockage and radial artery diameter. Individual studies have demonstrated that smaller sheath sizes reduce radial artery occlusion, but these findings need to be confirmed in larger randomized trials to reveal the real influence of sheath size.[19]

Several studies that looked at the rates of radial artery occlusion employed multivariable models to find independent factors. The diameter of the sheath and its connection to the radial artery size, duration of post-PCI compression and presence of anterograde flow in artery during hemostasis, and application of anti-coagulation have all been found as independent predictor in the majority of surveys. [14]

The transradial technique for PCI offers a number of benefits over transfemoral technique, and it is increasingly being employed for both diagnostic and therapeutic coronary angiography and PCI. When compared to the femoral approach, the procedure is linked with less vascular access issues and has been demonstrated to minimize severe hemorrhage.[1, 20]

CONCLUSION

Results of this study demonstrates that the frequency of radial artery occlusion is almost nil in patients after PCI through transradial approach. Thus radial artery approach for PCI can be a good opportunity to conduct the procedure. But still it is recommended that PCI done via the transradial approach must be followed by the pre-procedural assessment of radial artery patency before discharge of patient from the health care clinic.

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