DOI: https://doi.org/10.53350/pjmhs211592405

ORIGINAL ARTICLE

Frequency of Radial Artery Occlusion (RAO) in Patients undergoing Percutaneous Cardiac Catheterization

GAUHAR RAHMAN[1], HAMID MAHMOOD[2], AHMAD FAWAD[3], ZOHAIB ALI[4], SHER BAHADAR KHAN[5], SHAHZEB[6]
[1]*Consultant Cardiologist, Cardiology Department Category A Hospital, Batkhela Malakand*
[2]*Senior Registrar and Consultant Cardiologist, North West General Hospital and Research Centre, Peshawar,*
[3]*Associate Professor Cardiology, North West General Hospital, Peshawar*
[4]*Physical Therapist Institute of Physical Medicine and Rehabilitation KMU, Peshawar*
[5]*Associate professor Cardiology department MTI LRH, Peshawar*
[6]*Assistant Professor Cardiology department MTI PIC, Peshawar*
Corresponding author: Dr Gauhar Rahman, Email: gauhar066@gmail.com, Cell No: +923459750680

ABSTRACT

Objective: The aim of this study was to determine the frequency of radial artery occlusion (RAO) in patients undergoing percutaneous cardiac catheterization.

Study Design: Prospective study

Place and Duration: The study was conducted at cardiology department of Cat A Hospital Batkhela and Fauji Foundation Hospital Peshawar for six months duration from January 2021 to June 2021.

Methods: Total one hundred and forty patients of both genders were included in this study. Patients' detailed demographics including age, sex and body mass index were recorded after taking informed written consent. Patients who underwent percutaneous cardiac catheterization were presented in this study. Hypertension, diabetes mellitus and smoking history were analyzed. Frequency of radial artery occlusion (RAO) was measured by Barbeau test. Chi square test and fisher test was used to measure prevalence of RAO with respect to co-morbidities. Complete data was analyzed by SPSS 23.0 version.

Results: There were 100 (71.4%) male patients and 40 (28.6%) patients were females. Mean age of the patients was 53.7±8.44 years with mean BMI 28.6±9.51 kg/m^2. Mean height of the patients 167.5 ± 5.11 cm with mean weight 75.9±11.14 kg. Most common risk factor was hypertension found in 90 (64.3%) cases, followed by smokers 80 (57.14%) and diabetes mellitus 75 (53.6%). Prevalence of radial artery occlusion (RAO) was found among 25 (17.9%) cases, most of them were females. Prevalence of RAO was most common among smokers 20 (80%) followed by diabetes mellitus 17 (68%) and hypertension 14 (56%).

Conclusion: We concluded in this study that frequency of radial artery occlusion (RAO) was 17.9% among patients undergoing percutaneous cardiac catheterization. Hypertension, smoking and diabetes were the most common risk factors among all these cases. To achieve long-term patency of the radial artery in patients with high predictors of RAO, meticulous management and close follow-up are essential.

Keywords: Cardiac Catheterization, Radial Artery Occlusion (RAO), DM, HTN, Smoking

INTRODUCTION

Coronary artery disease (CAD) has long been recognized as a leading cause of death and disability in industrialized nations. Deaths from CAD have decreased over the last seven decades, but they still account for a third or more of all deaths in people over 55[1].

Coronary angiography, the gold standard for diagnosing and treating atherosclerotic coronary artery disease, is now widely available.[2]

It is possible to do coronary angiography by using the radial, femoral, or ulnar arteries. Angiograms and angioplasty are most commonly performed through the common femoral artery. However, during transfemoral approach (TFA) surgeries, vascular access site problems such as hemorrhage, hematoma, arteriovenous fistula, or pseudoaneurysm are not uncommon[3].

In addition to the increased risk of death, myocardial infarction (MI), stroke, and stent thrombosis that brings bleeding problems, they also raise the cost of care[4].

The vascular access site is responsible for the majority of bleeding problems in patients having percutaneous coronary intervention (PCI)[5]. PCI's ability to reduce ischemic events and complications while also reducing bleeding problems raises the risk of both morbidity and death[6].

Campeau was the first to use the transradial technique (TRA) for diagnostic coronary angiography in 1989[7]. After that, Kiemeneij and Laarman expanded on it for PCI[8].

The radial artery is more easily compressible because it is anatomically more accessible than the femoral artery[9]. TRA has several advantages to transfemoral (TF) access, including less access site bleeding, quicker ambulation, and increased patient comfort[10]. This is especially true when patients are receiving anticoagulation and antiplatelet medication. Radial access has been recommended as the conventional route for coronary angiography and angioplasty by the European Society of Cardiology Guidelines on Myocardial Revascularization, provided that no overriding operations are necessary[11].

After radial artery catheterization, radial artery occlusion (RAO) looks to be a silent foe. Hand ischemia, for example, can be a significant consequence of RAO. When this complication is studied promptly after surgery, the incidence ranges from 2 to 18 percent[13] in the literature. The radial pulse method, Barbeau's test (plethysmographic evidence), and a vascular doppler examination can all be used to determine if a person has RAO. Researchers found that the incidence of instant occlusion by radial pulse method was 4.7% and the rate of immediate occlusion by

vascular doppler research was 11.7 percent in Huang et al's study[14].

There are several demographic, clinical, and procedural factors that influence RAO. There are several risk factors for RAO, including: low body weight[15], female gender[16], anticoagulant use and dose[17], radial artery diameter[18], sheath size[19], number of catheters[20], operation duration[21], and the type and duration of access site compression following the surgery[22]. Low BMI, diabetes mellitus, preprocedural radial artery diameter "2.5 mm," low preprocedural peak systolic velocity, and a radial-artery-to-sheath ratio of 1 were found to be further predictors of RAO in an Indian study recently conducted by Garg et al[20]. According to Kim et al[21], a thrombus is a direct pathophysiological factor in RAO, which is caused by damage to the endothelium, arterial smooth muscle contraction, and a slow/no blood flow, which creates a conducive environment for thrombi to form. Histopathological analysis of the artery-aspirated material revealed a thrombus13. The use of reprocessed sheaths can lead to alterations in the microstructure of the blood, increasing the risk of thromboembolism. As the pathophysiological process is more understood and the problem's importance is recognized, RAO is becoming less common. This is because effective preventative techniques have been identified and implemented[22].

MATERIAL AND METHODS

This prospective study was conducted at cardiology department of Cat A Hospital Batkhela and Fauji Foundation Hospital Peshawar for six months duration from January 2021 to June 2021.

The study consisted of 140 patients of both genders. Detailed demographics of enrolled cases including age, sex and body mass index were recorded after taking informed written consent. Patients who had history of angiograms or cardiac catheterization and patients who did not give any written consent were excluded from this study.

Patients were aged between 19-65 years. Patients, who underwent percutaneous cardiac catheterization were presented in this study. Hypertension, diabetes mellitus and smoking history were analyzed. Frequency of radial artery occlusion (RAO) was measured by Barbeau test. HTN was determined by looking at a patient's past medical history (PMH) for HTN or by measuring their blood pressure, which was found to be greater than 140/90 mmHg. PMH, a fasting glucose > 126 mg/dl, or a random blood glucose > 200 mg/dl were used to determine DM. The patient's social history provided information on his or her smoking habits.

Chi square test and fisher test was used to measure prevalence of RAO with respect to co-morbidities. Complete data was analyzed by SPSS 23.0 version. Categorical variables were assessed by frequencies and percentages.

RESULTS

There were 100 (71.4%) male patients and 40 (28.6%) patients were females. Mean age of the patients was 53.7±8.44 years with mean BMI 28.6±9.51 kg/m^2. Mean height of the patients 167.5 ± 5.11 cm with mean weight 75.9±11.14 kg. Most common risk factor was hypertension found in 90 (64.3%) cases, followed by smokers 80 (57.14%) and diabetes mellitus 75 (53.6%).(Table 1)

Table 1: Baseline detailed demographics of enrolled cases

Variables	Frequency (n=140)	%age
Gender		
Male	100	71.4
Female	40	28.6
Mean age (years)	53.7±8.44	-
Mean BMI (kg/m^2)	28.6±9.51	-
Mean height (cm)	167.5 ± 5.11	-
Mean weight (kg)	75.9±11.14	-
Risk factors		
Hypertension	90	64.3
Smoking	80	57.14
Diabetes Mellitus	75	53.6

Prevalence of radial artery occlusion (RAO) was found among 25 (17.9%) cases , most of the cases were females. (Table 2)

Table 2: Frequency of RAO among enrolled cases

Variables	Frequency	%age
RAO		
Yes	25	17.9
No	115	82.1
Gender		
Male	9	36
Female	16	64
Total	25	100

Prevalence of RAO was most common among smokers 20 (80%), followed by diabetes mellitus 17 (68%) and hypertension 14 (56%). (Table 3)

Table 3: Prevalence of RAO with respect to co-morbidities

RAO	Frequency (n=25)	%age
Smoking		
Yes	20	80
No	5	20
Diabetes Mellitus		
Yes	17	68
No	8	32
Hypertension		
Yes	14	56
No	11	44

DISCUSSION

Cardiac catheterizations commonly employ the radial artery (RA) as the primary entry point, and efforts to maintain the RA's patency for future use are becoming standard practice. In this study we determined the frequency of radial artery occlusion (RAO) in patients undergoing percutaneous cardiac catheterization.

In this prospective study 140 patients of both genders were presented. Patients were aged between 19-65 years. Majority of the patients were male 71.4%. Mean age of the patients was 53.7±8.44 years with mean BMI 28.6±9.51 kg/m^2. Mean height of the patients was measured 167.5 ± 5.11 cm with mean weight of 75.9±11.14 kg. These findings were comparable to the previous studies[23,24]. Most common risk factor was hypertension, found in 90 (64.3%) cases, followed by smokers 80 (57.14%) and diabetes mellitus 75 (53.6%). This was similar to the previous study[25]

In a study conducted in Brazil by Sa' et al.[26], incidence of early RAO (within 07 days) was reported to be 10.5%. Patients who had transradial coronary angioplasty in India underwent a vascular doppler-guided examination, and the RAO rate was 15.2% one day later[27] The findings of our investigation, which found a frequency of RAO of 17.9%, are in line with prior findings. Among 17.9% cases

of RAO, majority were females. Because of the increased usage of radial approach, the incidence of RAO has declined in recent years. RAO was found in 15% of patients in a research conducted by the catheter laboratory[28]. In current study prevalence of RAO was most commonly found among smokers 20 (80%) followed by diabetes mellitus 17 (68%) and hypertension 14 (56%). The most prevalent and most serious side effect of TRA is radial artery occlusion (RAO). It's been dubbed the TR technique's "Achilles' heel"[29]. Such a problem has an incidence ranging from 8% to 30%[30].

Using the Hemoband (HemoBand Corporation, Portland, OR), the Prevention of Radial Artery Occlusion-Patent Hemostasis Evaluation Trial (PROPHET) looked into the effectiveness of patent hemostasis.[31] After a procedure, Bernat et al compressed the ulnar artery to improve flow in the blocked radial artery using a nonpharmacological new technique. According to the study results, the RAO rate was much lower after compression of the ulnar artery, and this helped to restore flow in the radial artery and open it again.[32]

CONCLUSION

We concluded in this study that frequency of radial artery occlusion (RAO) was 17.9% among patients undergoing percutaneous cardiac catheterization. Hypertension, smoking and diabetes were the most common risk factors among all these cases. To achieve long-term patency of the radial artery in patients with high predictors of RAO, meticulous management and close follow-up are essential.

REFERENCE

1. Nichols M, Townsend N, Scarborough P et al (2014) Cardiovascular disease in Europe 2014: epidemiological update. Eur Heart J 35(42):2950–2959
2. Rao SV, Ou F-S, Wang TY et al (2008) Trends in the prevalence and outcomes of radial and femoral approaches to percutaneous coronary intervention: a report from the National Cardiovascular Data Registry. J Am Coll Cardiol Intv 1(4):379–386
3. Sciahbasi A, Pristipino C, Ambrosio G et al (2009) Arterial access-site–related outcomes of patients undergoing invasive coronary procedures for acute coronary syndromes (from the ComPaRison of Early Invasive and Conservative Treatment in Patients With Non-ST-ElevatiOn Acute Coronary Syndromes [PRESTO-ACS] Vascular Substudy). Am J Cardiol 103(6):796–800
4. Rao SV, Kaul PR, Liao L et al (2008) Association between bleeding, blood transfusion, and costs among patients with non-ST-segment elevation acute coronary syndromes. Am Heart J 155(2):369–374
5. Kinnaird TD, Stabile E, Mintz GS et al (2003) Incidence, predictors, and prognostic implications of bleeding and blood transfusion following percutaneous coronary interventions. Am J Cardiol 92(8):930–935
6. Ziakas A, Gomma A, Mcdonald J et al (2007) A comparison of the radial and the femoral approaches in primary or rescue percutaneous coronary intervention for acute myocardial infarction in the elderly. Acute Cardiac Care. 9(2):93–96
7. Campeau L (1989) Percutaneous radial artery approach for coronary angiography. Catheter Cardiovasc Diagn 16(1):3–7
8. Kiemeneij F, Jan Laarman G (1993) Percutaneous transradial artery approach for coronary stent implantation. Catheter Cardiovasc Diagn 30(2):173–178
9. Cooper CJ, El-Shiekh RA, Cohen DJ et al (1999) Effect of transradial access on quality of life and cost of cardiac catheterization: a randomized comparison. Am Heart J 138(3):430–436
10. Cantor WJ, Puley G, Natarajan MK et al (2005) Radial versus femoral access for emergent percutaneous coronary intervention with adjunct glycoprotein IIb/IIIa inhibition in acute myocardial infarction—the RADIAL-AMI pilot randomized trial. Am Heart J 150(3):543–549
11. Sousa-Uva M, Neumann F-J, Ahlsson A et al (2018) 2018 ESC/EACTS guidelines on myocardial revascularization. Eur J Cardiothorac Surg 55(1):4–90
12. Rademakers LM, Laarman, GJ. Critical hand ischaemia after transradial cardiac catheterisation: an uncommon complication of a common pro-cedure. Neth Heart J. 2012;20:372-375
13. Pancholy SB. Transradial access in an occluded radial artery: New technique. J Invasive Cardiol. 2007;19:541-544.
14. Huang CH, Chen CY, Chen IC. Impact of the tansradial approach to coronary angiography or angioplasty on radial artery in Taiwanese population. Acta Cardiol Sin. 2004;20:212-218.
15. Plante S, Cantor WJ, Goldman L, Miner S, Quesnelle A, Ganapathy A, et al. Comparison of bivalirudin versus heparin on radial artery occlusion after transradial catheterization. Cath-eter Cardiovasc Interv. 2010;76:654-658.
16. Tunçez A, Kaya Z, Aras D, Yildiz A, Gul EE, Tekinalp M, et al. Incidence and predictors of radial ar-tery occlusion associated transradial catheterization. Int J Med Sci. 2013;10(12):1715-1719.
17. Spaulding C, Lefevre T, Funck F, Thebault B, Chauveau M, Hamda, KB, et al. Left radial approach for coronary angiography: results of a prospective study. Cathet Cardiovasc Diagn. 1996;39(4): 365-370.
18. Pancholy S, Coppola J, Patel T. Roke-Thomas M. Prevention of radial artery occlusion-patent hemostasis evaluation trial (PROPHET study): a randomized comparison of traditional versus patency documented hemostasis after transradial catheterization. Catheter Cardiovasc Interv. 2008;72:335-340.
19. Pancholy SB, Patel TM. Effect of duration of hemostatic compression on radial artery occlusion after transradial access. Catheter Cardiovasc Interv. 2012;79:78-81.
20. Garg N, Madan BK, Khanna R, Sinha A, Kapoor A, Tewari S, et al. Incidence and predictors of radial artery occlusion after transradial coronary angioplasty: Doppler-guided follow-up study. J Invasive Cardiol. 2015;27:106-112.
21. Kim KS, Park HS, Jang WI, Park JH. Thrombotic occlusion of the radial artery as a complication of the transradial coronary intervention'. J Cardiovasc Ultrasound. 2010;18(1):31.
22. Hamon M, Pristipino C, Di-Mario C, Nolan J, Ludwig J, Tubaro M, Consensus document on the radial approach in percutaneous cardiovascular interventions: position paper by the European Association of Percutaneous Cardiovascular Interventions and Working Groups on Acute Cardiac Care and Thrombosis of the European Society of Cardiology'. EuroIntervention, 2013;8:1242-1251.
23. Sadaka MA, Etman W, Ahmed W, Kandil S, Eltahan S. Incidence and predictors of radial artery occlusion after transradial coronary catheterization. Egypt Heart J. 2019;71(1):12. Published 2019 Sep 5.
24. Hashmi, K.A., Iqbal, Z., Hashmi, A.A. et al. The frequency of radial artery occlusion following cardiac catheterization with the use of transradial pneumatic compression band. BMC Res Notes 13, 486 (2020).
25. Avdikos G, Karatasakis A, Tsoumeleas A, Lazaris E, Ziakas A, Koutouzis M. Radial artery occlusion after transradial coronary catheterization. Cardiovasc Diagn Ther. 2017;7(3):305-316.
26. Sá BJL, Barros LFT, Bandao SCS, Victor EG. Interference of Reprocessed Introducers in Radial Artery Occlusion after Cardiac Catheterization. Rev Bras Cardiol Invasiva. 2013;21(3):270-275.
27. Garg N, Madan BK, Khanna R, Sinha A, Kapoor A, Tewari S, et al. Incidence and predictors of radial artery occlusion after transradial coronary angioplasty: Doppler-guided follow-up study. J Invasive Cardiol. 2015;27:106-112.
28. Sławin J, Kubler P, Szczepański A, Piątek J, Stępkowski M, Reczuch K. Radial artery occlusion after percutaneous coronary interventions—an underestimated issue. PostepyKardiolInterwencyjnej. 2013;9(4):353–61.
29. Kalpak O, Pejkov H, Kalpak G et al (2017) Crossover alternatives of default right radial artery access for acute myocardial infarction intervention. Macedonian Med Rev 71(1):38–43
30. Bricker R, Valle J (2018) Access site complications. Textbook of catheter-based cardiovascular interventions. Springer, pp 465–482
31. Pancholy S, Coppola J, Patel T, Roke-Thomas M. Prevention of radial artery occlusion-patent hemostasis evaluation trial (PROPHET study): a randomized comparison of traditional versus patency documented hemostasis after transradial catheterization. Catheter Cardiovasc Interv. 2008;72:335–40.
32. Bernat I, Bertrand OF, Rokyta R, Kacer M, Pesek J, Koza J, Smid M, Bruhova H, Sterbakova G, Stepankova L, Costerousse O. Efficacy and safety of transient ulnar artery compression to recanalize acute radial artery occlusion after transradial catheterization. Am J Cardiol. 2011;107:1698–1701.