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FREQUENCY OF LOSS OF RADIAL PULSE IN PATIENT UNDERGOING CORONARY ANGIOGRAPHY

Original Research

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ABSTRACT

Background: Coronary angiography via the transradial approach is widely preferred due to its lower risk of bleeding and improved patient comfort. However, vascular complications such as radial artery occlusion and transient or permanent loss of radial pulse remain concerns. These complications can compromise future vascular access and impact procedural success. Understanding the frequency, risk factors, and recovery patterns of radial pulse loss post-procedure is essential for optimizing patient management and refining procedural protocols to enhance safety and long-term arterial patency.

Objective: This study aimed to determine the frequency of radial pulse loss following coronary angiography, assess its temporal recovery, and evaluate associated patient and procedural factors.

Methods: A prospective descriptive cross-sectional study was conducted at the National Institute of Cardiovascular Diseases (NICVD), Karachi. A total of 890 patients aged 18 to 70 years undergoing primary percutaneous coronary intervention (PCI) via the radial approach were enrolled. Patients with non-ST elevation myocardial infarction (NSTEMI), prior radial access, or peripheral arterial disease were excluded. Radial pulse was assessed at multiple time points using palpation and Doppler ultrasound. Data were analyzed using SPSS Version 21.0, with statistical tests applied to evaluate associations between patient characteristics, procedural variables, and pulse loss incidence.

Results: The mean patient age was 54.79 ± 9.14 years, with 70.22% being male. Hypertension (59.78%), diabetes mellitus (31.35%), and smoking history (34.27%) were common comorbidities. Immediately post-procedure, radial pulse loss occurred in 9.21% of patients. By 12 hours, pulse was restored in 89.10%, increasing to 93.93% at 24 hours, 848 (95.28%) at discharge and 97.64% at follow-up. Doppler flow confirmed recovery in 92.81% at baseline, 91.80% at 12 hours, 96.07% at 24 hours, 849 (95.39%) at discharge and 97.75% at follow-up.

Conclusion: Radial pulse loss following coronary angiography was initially observed in a significant proportion of patients but showed substantial recovery over time. Early identification, standardized hemostasis protocols, and improved monitoring strategies are crucial to minimizing vascular complications and ensuring long-term arterial patency.

Keywords: Angiography, Cardiology, Coronary Disease, Percutaneous Coronary Intervention, Radial Artery, Radial Pulse, Vascular Complications

INTRODUCTION

Coronary angiography is a pivotal diagnostic and interventional procedure widely used in the management of coronary artery disease (CAD). Despite its well-established benefits, it is not without complications, with vascular events being among the most significant concerns. One such complication, the loss of radial pulse, has emerged as a critical issue, warranting further investigation into its frequency, underlying mechanisms, and clinical implications. This phenomenon, often attributed to vascular spasm, thromboembolism, or arterial injury, can have significant repercussions on patient outcomes, making it imperative to comprehensively assess its incidence and contributing factors(1, 2). The radial artery, a preferred access site for coronary catheterization due to its association with reduced bleeding risk and enhanced patient comfort, is nonetheless vulnerable to procedural complications. The temporary or permanent loss of radial pulse following angiography may serve as a surrogate marker of vascular compromise, necessitating close monitoring and preventive strategies. Various studies have attempted to quantify the incidence of radial pulse loss, yet discrepancies in study designs, patient populations, and assessment methods contribute to heterogeneous findings. A thorough examination of these variations can provide valuable insights into modifiable risk factors and guide clinicians in optimizing procedural safety(3, 4).

Understanding patient-specific predictors of radial pulse loss is crucial in refining interventional strategies. Factors such as arterial diameter, procedural techniques, sheath size, anticoagulation protocols, and operator experience may all influence the likelihood of pulse loss. Additionally, patient comorbidities, including diabetes, hypertension, and peripheral arterial disease, may predispose individuals to heightened vascular reactivity or impaired arterial integrity, further increasing the risk. Investigating these associations can aid in developing targeted interventions to minimize complications and improve overall procedural success(5, 6). Given the evolving landscape of interventional cardiology, consolidating existing evidence on radial pulse loss is essential for enhancing clinical decision-making. By synthesizing findings from diverse studies, this research seeks to establish a clearer understanding of the frequency, risk factors, and implications of radial pulse loss following coronary angiography. Identifying these factors can contribute to refining procedural protocols, improving patient selection, and advancing post-procedure care. In light of these considerations, this study aims to determine the frequency of radial pulse loss in patients undergoing coronary angiography at the National Institute of Cardiovascular Diseases (NICVD) Karachi, providing valuable data to inform clinical practice and patient safety strategies(7, 8).

METHODS

This prospective descriptive cross-sectional study was conducted at the Department of Adult Cardiology, National Institute of Cardiovascular Diseases (NICVD), Karachi, following approval from the Institutional Review Board (IRB) and Ethics Committee. The study spanned a duration of six months post-approval, enrolling patients undergoing primary percutaneous coronary intervention (PCI) via the radial approach. Informed consent was obtained from all participants before inclusion in the study, ensuring compliance with ethical guidelines and patient autonomy(9, 10). The study population comprised patients aged 18 to 70 years presenting with ST-segment elevation myocardial infarction (STEMI) and undergoing their first radial approach for coronary angiography. Patients who declined participation, presented with non-ST elevation myocardial infarction (NSTEMI), underwent coronary intervention via an approach other than the radial artery, had known peripheral arterial disease, or were outside the specified age range were excluded to maintain study homogeneity and reliability of findings(11, 12).

A non-probability consecutive sampling technique was employed to enroll eligible patients. The sample size was determined using the WHO sample size calculator, considering a 95% confidence interval, resulting in a sample size of 890 participants. All consecutive patients meeting the inclusion criteria during the study period were included(13, 14). Data collection was systematically performed at multiple time points to assess changes in radial pulse status. The radial pulse was evaluated pre-procedure, immediately post-procedure following removal of the transradial (TR) band, and subsequently at12, and 24 hours, at the time of discharge and follow up as well as at the time of discharge. Standardized clinical assessment techniques were used for pulse palpation, and any reduction or absence of radial pulse amplitude was documented as an indicator of vascular complications(15, 16).

Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 21.0 (IBM Corp., Armonk, NY, US). Continuous variables were expressed as mean ± standard deviation (SD) if normally distributed, while those not assuming normality were summarized as median and interquartile range (IQR). Categorical variables were presented as frequencies and percentages. Appropriate

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statistical tests were applied to determine associations between patient characteristics, procedural factors, and the incidence of radial pulse loss, ensuring robust data interpretation(17). This study adhered to ethical principles, with all procedures aligned with institutional and international guidelines for human research. Patient confidentiality was maintained, and data handling complied with ethical and legal standards. The findings aim to contribute to the growing body of evidence on vascular complications associated with coronary angiography and inform strategies for improving patient outcomes and procedural safety.

RESULTS

The study included a total of 890 patients, with a mean age of 54.79 ± 9.14 years. The majority were male (625, 70.22%), while female patients comprised 29.78% (265). Among the clinical characteristics, hypertension was present in 532 patients (59.78%), diabetes mellitus in 279 (31.35%), smoking history in 305 (34.27%), a family history of coronary artery disease in 223 (25.06%), and obesity in 351 (39.44%). Chronic kidney disease was reported in 95 patients (10.67%).

Demographic characteristics

Characteristic	**Value**
Age (years)	54.79 ± 9.14
Gender	Male: 625 (70.22%), Female: 265 (29.78%)

Clinical Characteristics

Characteristic	Yes	No
Hypertension	532 (59.78%)	358 (40.22%)
Diabetes Mellitus	279 (31.35%)	611 (68.65%)
Smoking	305 (34.27%)	585 (65.73%)
Family History	223 (25.06%)	667 (74.94%)
Obesity	351 (39.44%)	539 (60.56%)
Chronic Kidney Disease (CKD)	95 (10.67%)	795 (89.33%)
Primary PCI (PPCI)	767 (86.18%)	123 (13.82%)
Radial Pulse Palpable	808 (90.79%)	82 (9.21%)
Doppler Flow Detection	826 (92.81%)	64 (7.19%)
STEMI	AWMI	434 (48.76%)
	IWMI	268 (30.11%)
	LWMI	73 (8.20%)
	PWMI	80 (8.99%)
	ALWMI	35 (3.93%)

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Regarding STEMI distribution, the most common presentation was anterior wall myocardial infarction (AWMI) in 434 patients (48.76%), followed by inferior wall myocardial infarction (IWMI) in 268 (30.11%), lateral wall myocardial infarction (LWMI) in 73 (8.20%), posterior wall myocardial infarction (PWMI) in 80 (8.99%), and anterolateral wall myocardial infarction (ALWMI) in 35 (3.93%). A total of 767 patients (86.18%) underwent primary percutaneous coronary intervention (PPCI), while 123 (13.82%) did not.

Killip Class and RBS Results

Characteristic	Value
Killip Class I	612 (68.76%)
Killip Class II	183 (20.56%)
Killip Class III	72 (8.09%)
Killip Class IV	23 (2.58%)
RBS at Time of Presentation (mg/dL)	179.51 Â± 47.68

Killip classification at presentation revealed that 612 patients (68.76%) were in Killip Class I, 183 (20.56%) in Class II, 72 (8.09%) in Class III, and 23 (2.58%) in Class IV. The mean random blood sugar (RBS) at the time of presentation was 179.51 ± 47.68 mg/dL.

Radial Pulse and Doppler Flow Results

Characteristic	Yes	No
Radial Pulse 12 Hours	793 (89.10%)	97 (10.90%)
Radial Pulse 24 Hours	836 (93.93%)	54 (6.07%)
Radial Pulse At Discharge	848 (95.28%)	42 (4.72%)
Radial Pulse Follow-up	869 (97.64%)	21 (2.36%)
Doppler Flow 12 Hours	817 (91.80%)	73 (8.20%)
Doppler Flow 24 Hours	855 (96.07%)	35 (3.93%)
Doppler Flow At Discharge	849 (95.39%)	41 (4.61%)
Doppler Flow Follow-up	870 (97.75%)	20 (2.25%)

Assessment of radial pulse palpability post-procedure showed that 808 patients (90.79%) had a palpable pulse immediately, while 82 (9.21%) had lost radial pulse. Doppler flow detection was positive in 826 patients (92.81%) and absent in 64 (7.19%). Over time, radial pulse palpability improved, with 793 patients (89.10%) retaining it at 12 hours, 836 (93.93%) at 24 hours, 848 (95.28%) at the time of discharge and 869 (97.64%) at follow-up. Similarly, Doppler flow positivity was noted in 817 patients (91.80%) at 12 hours, 855 (96.07%) at 24 hours, 849 (95.39%) at Discharge and 870 (97.75%) at follow-up.

The findings highlight a substantial proportion of patients experiencing transient radial pulse loss post-procedure, with progressive recovery over time. The study provides valuable insights into patient characteristics, procedural outcomes, and vascular complications associated with coronary angiography.

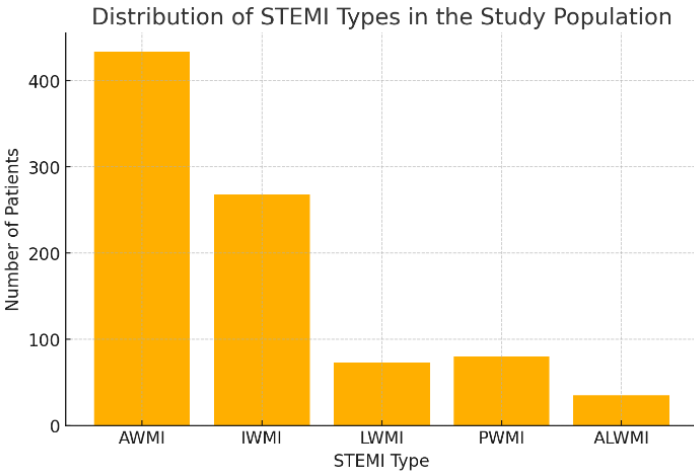

Figure 2 Distribution of STEMI Types in the study Population

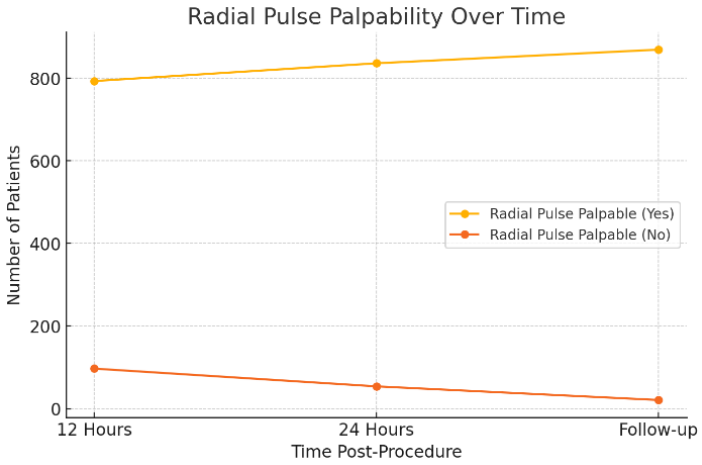

Figure 1 Radial Pulse Palpability Over Time

DISCUSSION

The findings of this study highlight the incidence and temporal progression of radial pulse loss following coronary angiography via the transradial route. The overall frequency of radial pulse loss immediately post-procedure was 9.21%, which improved over time, with the pulse being palpable in 97.64% of patients at follow-up. This aligns with recent literature indicating that radial artery occlusion (RAO) and pulse loss are transient in most cases, often resolving spontaneously or with conservative management (18). However, the rate of radial artery loss varies significantly between studies, with some reporting rates as low as 2.6% at one-month follow-up (19) and others as high as 10.8% immediately post-procedure (20). The variability in reported incidence suggests differences in procedural techniques, patient populations, and follow-up methodologies. The findings reinforce the role of patient-related and procedural factors in determining radial pulse outcomes. Previous studies have identified factors such as advanced age, female gender, smaller arterial diameter, diabetes, and prior transradial access as independent predictors of RAO (20). The present study also observed a higher prevalence of hypertension (59.78%) and diabetes (31.35%) among participants, conditions known to predispose individuals to endothelial dysfunction and vascular spasm, which may contribute to transient pulse loss (18). Moreover, prior research has emphasized the significance of procedural factors, such as sheath size, duration of arterial occlusion, and adequacy of hemostasis techniques, in minimizing vascular complications (21). This study's results reinforce the importance of optimizing these parameters to enhance procedural safety.

One of the critical implications of these findings is the need for systematic monitoring and risk stratification to identify patients at higher risk of RAO. While most cases resolve without intervention, undetected RAO can lead to long-term arterial occlusion, precluding future use of the radial artery for coronary interventions or grafting (19). Routine Doppler ultrasound assessment has been recommended to improve detection rates, as it can identify occlusions that are clinically silent (20). This study's inclusion of Doppler assessment adds to its strength by providing an objective measure of vascular compromise, ensuring accurate documentation of radial artery patency. While the study contributes valuable epidemiological data, certain limitations should be acknowledged. The use of a single-center cohort may limit the generalizability of findings to broader populations with varying procedural techniques and operator experience. Additionally, the study did not evaluate long-term radial artery patency beyond the immediate follow-up period, a crucial aspect given that some cases of RAO persist subclinically. Moreover, the influence of specific procedural variables, such as the impact of hemostasis protocols, anticoagulation regimens, and sheath size variations, was not systematically analyzed. Future studies should incorporate multicenter designs, longer follow-up durations, and detailed subgroup analyses to refine preventive strategies. Despite these limitations, the study offers valuable insights into the frequency and resolution of radial pulse loss following coronary angiography. The observed trend of pulse recovery over time suggests that most cases represent transient arterial spasm rather than irreversible occlusion. Nevertheless, the persistence of non-palpable pulses in 2.36% of cases at follow-up warrants further exploration into alternative hemostatic approaches and enhanced post-procedural care (22). By integrating findings from contemporary research, this study underscores the importance of individualized risk assessment and protocol optimization to mitigate vascular complications in transradial coronary procedures.

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CONCLUSION

This study highlights the transient yet clinically significant occurrence of radial pulse loss following coronary angiography via the transradial approach, emphasizing its gradual resolution over time. The findings reinforce the importance of vigilant post-procedural monitoring and individualized risk assessment to mitigate vascular complications. While most cases of pulse loss appear to be temporary, a small proportion persist, necessitating further exploration of optimized hemostasis techniques and procedural modifications to preserve long-term arterial patency. By contributing valuable data on the frequency and recovery patterns of radial pulse loss, this research underscores the need for refining procedural protocols and enhancing patient selection criteria to improve overall safety and long-term outcomes in interventional cardiology.

AUTHOR CONTRIBUTIONS

Author	Contribution
Ahsan Ali Gaad*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Abdul Wasay	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Asif Ali	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Ahmed Ilyas	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Anjli Chawla	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Abdul Samad	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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