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Retrospective Comparison of Radial and Femoral Access in Coronary Interventions

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ABSTRACT

Introduction: Percutaneous coronary interventions (PCI) remain a debatable choice of access site. Procedural success, complications, and recovery outcomes in terms of the impact of complications were shown to be lower for radial access when compared to femoral access. However, comparative outcomes in terms of procedural success require further evaluation. **Objective**: To compare the outcomes of radial and femoral access in PCI settings with respect to procedural success, complications, and patient recovery. **Materials and Method:** This retrospective cohort study conducted at Department of Cardiology, Hayatabad Medical Complex, Peshawar from July, 2022 to December, 2022. Five hundred patients undergoing PCI were analyzed, and data were compared regarding procedural success, complications, and recovery outcomes between radial and femoral access. **Results**: Fewer complications, such as bleeding and hematoma, and shorter hospital stays were found with radial access. However, the groups had no significant differences in major adverse cardiac events. **Conclusion**: Femoral access is safer and more convenient for PCI, but it has more complications and slower recovery compared to radial access.

INTRODUCTION

Percutaneous coronary interventions (PCI) access site choice has recently become a topic of interest over the past few years for several reasons related to possible influence on complications, recovery time, and long-term survival rates. The most commonly used access sites are radial and femoral arteries. Proponents for both of these access routes exist, and in particular, radial access has occasionally been advertised to have lower complication rates and faster recovery time than femoral access. With the new rapidly evolving PCI techniques and devices (1), there is a need to understand these access points and their nuances and trade-offs. Femoral access means catheterizing the groin's femoral artery, and radial access means catheterizing the wrist's radial artery. In the past, femoral access was the predominant approach for PCI due to familiarity with and practice with the procedures of the technique.

During the past two decades, radial access has become popular because it is less likely to complicate the vessels, has lower mortality, and greater patient comfort (2). The advantages of radial access have been established by several studies based on post-procedural recovery and the risk of subsequent adverse events (3). Data showing that radial access is safer and with similar outcomes, such as procedural success and long-term mortality, have driven this shift in practice (4). This initial success of radial access can be attributed to several factors. First, the femoral artery is a large vessel injured by this method, whereas the radial artery is a small vessel (5). Additionally, the procedure can be performed with the patient awake and in a sitting position, resulting in a shorter recovery time, including the patient typically being able to walk shortly after the procedure (6).

These benefits are of particular importance in the setting of high-risk populations, such as those with cardiovascular comorbidities, who may be at increased risk of complications from femoral access (7). Nevertheless, radial access has many flaws. The radial approach can be technically difficult or impossible in some patients, especially those with smaller or more tortuous radial arteries. In these cases, femoral access is a possible option (8). Additionally, although the radial approach has been demonstrated to reduce major

bleeding complications, the long-term clinical outcomes (such as all-cause death and cardiovascular events) are not improved (9). The radial approach is associated with fewer short-term complications, but longer-term survival studies indicate it does not provide a survival advantage relative to femoral access.

Several studies have been conducted with respect to the efficacy of these two access sites in order to screen which of the two sites is the most balanced in terms of safety, efficacy, and cost-effectiveness. For instance, Chiarito et al. meta-analyzed randomized trials demonstrating that bleeding complications and access site infection rates were significantly lower with radial access. However, mortality and myocardial infarction rates were not different from those with acute MI (10). Another study also showed that radial access was safer than femoral access in terms of access site complications and that femoral access had slightly better procedural success in more complex cases, as demonstrated by Reifart et al. In addition, recent technology has contributed to the radial and femoral access debate. This may have led to improved outcomes for both access sites through the advent of more sophisticated coronary stenting techniques and novel antithrombotic regimens (11).

For instance, studies show that with newer drug-eluting stents, radial and femoral access have the same procedural success and post-procedural outcome (12). However, this means that whereas access site choice did make a difference, technological advancements were possibly closing gaps that were otherwise found in using these approaches. Nevertheless, patient-related factors remain equally important in selecting the 'right' access site. Moreover, whether one approach is more successful and safer depends on factors including body size, comorbidities, and vascular conditions. For instance, in patients with ST-elevation myocardial infarction (STEMI), radial access is superior to femoral access and is associated with faster mobilization and fewer complications (13). For patients with complex coronary anatomy, the larger caliber and more facile catheter entry into femoral access may be preferred, especially for more complex procedures.

Adding to the debate between radial versus femoral access further skews the issue in that acute and chronic coronary syndromes are not managed the same way. Femoral access was more favorable than radial access for acute coronary syndrome (ACS) due to reduced bleeding risks and quicker recovery. However, in complex interventions, including bifurcation lesions or chronic total occlusions, femoral access might have an advantage as it provides better support for large bore catheters (5, 14). The finding of this bifurcation in clinical strategy stresses the need for patient-specific and procedure-dependent decision-making in individualized clinical strategy. Finally, radial and femoral access to PCI has pros and cons, but radial access is primarily used for most patients because it is safer, quicker, and more comfortable. With the industry moving towards radial access as a preferred route, femoral access still has its use, particularly for more complex procedures or situations where radial access is impossible. Continued advances in the performance of PCI techniques and devices, coupled with a better appreciation of the patient-specific factors, will broaden the merits for both access sites in clinical practice (15).

Objective

The objective of this study is to retrospectively compare the outcomes of radial versus femoral access in coronary interventions, focusing on safety, efficacy, complication rates, and long-term patient outcomes.

MATERIALS AND METHODS

Design: Retrospective Cohort Study.

Study setting: The study was conducted at Department of Cardiology, Hayatabad Medical Complex, Peshawar

Duration: The study was carried out over a six-month period from from July, 2022 to December, 2022.

Inclusion Criteria: The participants were the patients who had undergone elective or emergency percutaneous coronary interventions (PCI) at Department of Cardiology, Hayatabad Medical Complex, Peshawar during half of the year 2024. Any adult patient with both genders who suffers from stable coronary artery disease or acute coronary syndrome and who underwent the procedure via the radial or femoral site was included in this study. Participants for the study were those patients who underwent the PCI procedure at the identified hospital.

Exclusion Criteria: Patients with contraindications to radial or femoral access, including severe vascular disease or prior surgical procedures compromising the access site, were excluded. Patients under 18 years old, patients undergoing coronary surgery or coronary intervention via alternative access sites, and patients with missing procedural records was excluded from the study.

Methods: This retrospective observational study involved patients of PCI performed at Department of Cardiology, Hayatabad Medical Complex, Peshawar from July, 2022 to December, 2022. Patients were classified as radial or femoral on the access site used. Some of the main outcome measures for post-procedure assessment included procedural success, access site complication (bleeding or hematoma), and occurrence of MACE within 30 days. The secondary parameters were the hospital stay, time to recovery, and the need for revascularization. Baseline participants' demographic, clinical, and procedural data was retrieved from the hospital's electronic medical records. Descriptive statistics were used in this study for categorical data, including control and the two access groups, using the Chi-square test. In contrast, the t-test was used for

continuous variables. The multivariable regression models controlled for potential confounding variables, for example, the age of the patients, their gender, and the presence of other cardiovascular risks. The ethical approval was sought from the hospital research ethical review committee.

RESULTS

A total of 500 patients who had undergone PCI procedures at Department of Cardiology, Hayatabad Medical Complex, Peshawar from July, 2022 to December, 2022 were enrolled in this study. Out of these, 250 patients were given radial access and 250 patients were given femoral access. The patient demographics and baseline characteristics are presented in Table 1.

Table 1

Baseline Characteristics of Study Participants

Characteristic	Radial Access (n=250)	Femoral Access (n=250)	p-value
Age (years)	60.5 ± 12.3	61.2 ± 11.8	0.48
Male (%)	65%	67%	0.55
Hypertension (%)	58%	62%	0.32
Diabetes Mellitus (%)	45%	50%	0.24
Previous PCI (%)	32%	30%	0.61
Acute Coronary Syndrome (%)	42%	45%	0.56

Procedural Success and Complications

Both groups had high rates of procedural success. The procedural success rate was 98% in the radial access group and 99% in the femoral access group. Yet, complications were much lower in the radial access group. The incidence of access site-related complications, such as bleeding and hematoma formation, is provided in Table 2.

Table 2

Access Site-Related Complications

Complication	Radial Access (n=250)	Femoral Access (n=250)	p-value
Bleeding	3.2%	7.6%	0.02
Hematoma	2.8%	6.4%	0.04
Vascular Complications	1.6%	4.4%	0.03
Access Site Infection	0.4%	1.6%	0.10

The rate of major adverse cardiac events (MACE), which included death, myocardial infarction, or requirement for revascularization, was marginally lower in the radial access arm (4.4%) than in the femoral access arm (5.2%), though this difference did not reach statistical significance (p=0.45).

Table 3

Major Adverse Cardiac Events (MACE)

MACE Outcome	Radial Access (n=250)	Femoral Access (n=250)	p-value
Death	1.2%	1.6%	0.60
Myocardial Infarction	2.0%	2.4%	0.72
Revascularization	1.2%	1.2%	1.00

Post-Procedure Recovery and Hospitalization

Patients undergoing radial access had a significantly reduced hospital stay duration (mean 1.5 ± 0.8 days) than those undergoing femoral access (mean 2.3 ± 1.1 days, $p<0.01$). The radial access patients also had quicker ambulation times, with the majority of them being able to ambulate within 6 hours of the procedure compared to femoral access patients, who took approximately 12 hours to ambulate. Finally, although the procedural success was comparable between groups, radial access was linked to fewer access site complications and more rapid recovery periods. Yet, there were no discernible differences seen in major adverse cardiac events. These results note the safety and effectiveness of using radial access in PCI procedures, specifically in cutting down on access site-related complications.

DISCUSSION

In the last several decades, deciding which access site to use for percutaneous coronary intervention (PCI) has been controversial. Femoral access has historically and still remained the standard technique for coronary intervention due to familiarity, feasibility and applicability in any clinical situation. However, this radial access has recently become more popular due to a positive correlation with better patient outcomes, particularly with vascular complications and recovery. Retrospective RAC for PCI from Department of Cardiology, Hayatabad Medical Complex, Peshawar, between 01.01.2024 and 06.2024 was to compare Radial and Femoral access results. This research also finds insightful information on the safety, efficacy, and recovery of patients who use both methods.

This research's main result was that despite high procedural success rates for radial (98%) and femoral (99%) access, radial access was associated with fewer access site-related complications. Several other studies have already shown that radial access is better than femoral access in the reduction of vascular complications such as bleeding, hematoma formation, and other access site-related problems. As reported by Ng et al., radial access correlated considerably with major bleeding complications compared to femoral access, which is consistent with this research (1). In their meta-analysis of studies at randomization, Chiarito et al. also showed that radial access caused a reduction of vascular complications in their favor, recommending radial access for all types of patients (2). This study further substantiates these findings using radial access, which results in lower bleeding (3.2% versus 7.6%) and hematoma formation (2.8% versus 6.4%).

This might be because of anatomical differences between the radial and femoral arteries. This is because the radial artery is more minor and superficial, more easily cannulated, and less likely to have serious complications. The femoral artery is bigger, resulting in

a higher caliber of the vessel and increased frequency of bleeding, hematoma, and pseudoaneurysm development because of difficulty obtaining hemostasis after the procedure (6). Patients with femoral access are also usually less comfortable, and more uncomfortable can increase the time it takes to recover and the risk of complications. This concept of faster patient mobilization and discharge would be consistent with the reduced recovery time seen in this study for radial access patients (1.5 ± 0.8 days versus 2.3 ± 1.1 days).

However, radial access also has its own limitations. In some patients, even with technically easy or impossible radial artery perforation, it can even be difficult or impossible (7) in contrast to femoral access, which may be more possible, particularly in patients with difficult vascular anatomy. The reality is also that femoral access is still superior for some high-risk patients or some intricate procedures. For example, patients undergoing highly complex coronary interventions such as CTOs associates with femoral access as the femoral artery is larger and can support such devices (8). While this study is not primarily interested in advanced coronary interventions, the literature has highlighted the limitation of radial access, where more specialized equipment or techniques may be required.

However, despite these limitations, radial access goes a long way toward minimizing vascular complications. The radial access group had a slightly lower incidence of major adverse cardiac events (MACE, death, myocardial infarction, revascularization, 4.4% vs. 5.2%). Nevertheless, this change was not significant statistically. This is consistent with previous research by Meijers et al., who found no difference between the rates of MACE among radial and femoral access procedures for complex PCI (7). Though decreased complication rates do not necessarily imply a significant alteration in long-term outcomes in all groups of patients, the diminished incidence of complications due to the access site, hematoma or bleeding, can contribute to enhanced patient comfort, shorter recovery time, and fewer possible long-term consequences, such as post-procedural infections or extended inpatient stay.

Secondly, there was a shorter time to walk in the radial access group, another important result of the present study. The study results demonstrated that most patients in the radial access group walked after six hours, and those in the femoral access group walked after twelve hours. This might explain the lower number of hospital days in the radial access group. Similarly, these results align with several previous studies that have proven beneficial from a radial access strategy due to its effect on reducing hospital stays and associated recovery. Reifart et al. also showed that, like the radial access technique, early discharge post-intervention is possible in patients undergoing such treatment, allowing the system to utilize less time (6). This is especially important if the length of stay is relatively short in an environment with a high patient turnover, where it will be critical to maximize resource utilization efficiency.

However, it should be mentioned that there is no significant difference in MACE between the two groups, which means that radial access is not worse than femoral access in terms of long-term clinical results. Indeed, recent studies have suggested that the long-term morbidity advantage of radial access might be additional among certain patients with, for example, acute coronary syndrome (ACS) or severe comorbidities. Based on a study by Alex and Andrej (4), radial access could reduce mortality in ACS patients in the long term. These benefits, however, could be seen more clearly in longer follow-ups and may not necessarily be immediate post-procedure, as was seen in the study.

Finally, the outcome of the study confirms that radial access is a safe and effective strategy for PCI, possessing considerable advantages over femoral access, particularly in lower vascular complications and quicker recovery. While femoral access can still be used for some of the more complicated cases, radial access should be preferred in most patients due to its attendant advantages in patient comfort, fewer complications, and shorter discharge times. Additional prospective studies with longer follow-ups are necessary to evaluate the long-term efficacy of radial access, especially in patients with higher-risk profiles or complex coronary lesions.

CONCLUSION

This research proves that percutaneous coronary interventions (PCI) via radial access are linked to lower access site complications, such as bleeding and hematoma formation, than femoral access. Patients who had radial access also had shorter recovery periods and shorter times of ambulation, leading to shorter hospital stays. Although both radial and femoral access had comparable procedural success rates, and none had significant statistical variation regarding major adverse cardiac events (MACE), the benefits of radial access in patient comfort and quicker recovery were apparent. These results are consistent with the expanding body of evidence supporting radial access for PCI, particularly in lower-risk-profile patients. However, femoral access is still an option for complicated cases, especially when large-bore catheters or difficult vascular anatomy are necessary. Generally, radial access provides a safer and more efficient means for most PCI procedures, potentially improving patient outcomes.

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