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Compare the outcomes of percutaneous coronary intervention through transradial vs transfemoral approach in a tertiary care setup

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ABSTRACT:

Background: PCI had been extensively implemented as a minimally invasive method of revascularizing the coronary artery as a procedure to treat coronary artery disease. The vascular access route was a significant factor that defined the procedure safety and efficacy. Historically, the access site was the transfemoral approach (TFA), but a new access site (transradial approach [TRA]) was introduced because of its possible benefits such as less bleeding, earlier movement of patients and more comfortable experience. Although these advantages exist, the differences in the success rates and complications of the two methods of procedures deserved to be taken into more consideration particularly in the tertiary care systems.

Aim: This study was meant to compare the clinical outcomes, the nature of the procedure, and the rates of complications associated with the use of percutaneous coronary intervention using transradial or transfemoral intervention methods in a tertiary care facility.

Methods: It was a comparative study that was to be conducted at the Armed Forces Institute of Cardiology/National Institute of Heart Diseases (AFIC/NIHD) between September 2023 and February 2024. There were 90 patients who underwent PCI and were split into two groups, Group A (n=45) had to undergo PCI through the transradial approach and Group B (n=45) had to undergo PCI through the transfemoral approach. Demographic variables, procedure length, contrast volume, vascular complications, bleeding, and hospital stay were data collected. The SPSS software was used to statistically analyze the data, and the p-values below 0.05 were taken as significant.

Results: The average time of practice was a bit longer in transradial cohort (48.63287 minutes) than transfemoral cohort (44.215 minutes) with no significant difference between the two groups ($p = 0.07$). Nevertheless, the rates of complications occurring at the vascular access site in the transradial group (4.4)

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were low in contrast to transfemoral group (17.8) ($p = 0.02$). There were major bleeding events in 2.2% of the transradial and 11.1% of transfemoral ($p = 0.04$). The mean number of days those patients stay in the hospital was less in the transradial group (1.3 ± 0.5 days) than in the transfemoral group (2.6 ± 0.7 days) ($p < 0.01$). Success rates of the two approaches were similar in terms of the procedure.

Conclusion: This paper concluded that transradial method of PCI had less vascular complication, less risk of bleeding and reduced hospitalization than transfemoral one without any impairments on the success of the procedure. As such, transradial route may be regarded as a safer and more patient friendly procedure of coronary intervention in tertiary care centers.

Keywords: Percutaneous coronary intervention, transradial approach, transfemoral approach, vascular complications, bleeding risk, hospital stay, coronary artery disease.

INTRODUCTION:

Percutaneous coronary intervention (PCI) was already proven to be one of the most important innovations in the treatment of coronary artery disease (CAD), which provides an efficient minimally invasive alternative to surgical revascularization. The procedural approach to PCI had long changed over the years, with the selection of the vascular access site becoming a primary predictor of the procedural activity in terms of safety of the patient and clinical outcome [1]. The conventional route of access to the aorta had historically been the transfemoral technique (TFA) because of the relative simplicity of accessing the aorta via the arteries and the larger vessel diameter as well as familiarity of the operator. Nevertheless, the transradial approach (TRA) became more and more popular and accepted as a less risky and less traumatic method, especially in large tertiary care units.

The TFA was already extensively utilized in the previous years due to the proven method and the usual procedure success rates. However, it had been linked to an elevated rate of vascular and bleeding complications, prolonged immobilization, and patient discomfort [2]. These disadvantages were more pronounced in elderly patients, obese and aggressive antithrombotic patients. Conversely, the TRA, introduced in the late 1980s, demonstrated numerous advantages in a decreased number of complications at the access sites, enhanced comfort of the patients, and earlier mobilization and discharge. Therefore, the radial route was becoming a popular access strategy of PCI in many tertiary cardiac centers.

A number of studies that had been carried out in the world had shown that transradial method not only reduced as well as minimized vascular complications but also enhanced the overall clinical outcomes such as lower mortality in patients at high risks [3]. The mechanism of such benefits had been ascribed to the reduced number of bleeding-related adverse events that were known to have negative cardiovascular outcomes. In addition, TRA provided more satisfaction to patients based on reduced post-procedural pain, premature ambulation and reduction in the length of stay (LOS). Although these benefits existed, the TRA had some limitations which included; smaller diameter in the arteries, possibility of radial artery spasm and increased learning curve among operators [4].

Conversely, the TFA still maintained some procedural benefits especially in demanding coronary operations involving large bore catheters or hemodialysis machines. Besides, in patients with abnormal Allen test results or in case of the impossibility of the radial access, the transfemoral route was commonly chosen. But with the development of procedural experience and technology of devices, all these limitations were removed over time, and radial approach could be used in more complicated cases with similar probabilities of successful procedures as with the femoral one [5].

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In tertiary care systems, procedural skills, volume, and post-procedural care units were easily accessible, a direct comparison between the transradial and transfemoral methodology proved to be informative in terms of maximizing the results of the PCI procedure [6]. This is because a comparison of the two approaches in this environment permitted a multifaceted examination of the efficiency of processes, the frequency of complications, patient satisfaction, and the period of convalescence.

The current research had been conducted to compare the results of PCI done through the transradial and transfemoral in a tertiary care hospital. The parameters that were to be assessed through the study included the success of the procedure, the duration of the procedure, complications at the site of access, bleeding after the procedure, comfort of the patient and length of hospital stay [7]. Through such results, the study aimed at establishing the best method that was safer and more efficient in practice in the real world clinical setting. These differences had been essential to inform the choice of procedural strategy, patient outcomes, and institutional policy of interventional cardiology practice in tertiary care environments [8].

MATERIALS AND METHODS:

This comparative observational study will be done within the Armed Forces Institute of Cardiology/National Institute of Heart Diseases (AFIC/NIHD) between September 2023 and February 2024. The main point of the study was to compare the results associated with percutaneous coronary intervention (PCI) by the transradial method and transfemoral one in a tertiary care environment. The study was able to include 90 patients who had undergone PCI within the study period.

Study Population

The population of study was composed of adult patients with coronary artery disease that needed PI regardless of whether elective or requiring emergency treatment. Patients were classified in two categories according to the vascular access route Group A (transradial approach, n=45) and Group B (transfemoral approach, n=45). The interventional cardiologist chose the access site depending on clinical judgment, anatomy of the patient and preference of the operator.

Inclusion and Exclusion Criteria.

They included patients between 30 and 75 years old who had undergone PCI either because of stable angina, unstable angina, or acute myocardial infarction. The patients who had severe peripheral vascular disease, hemodynamic instability, and bleeding disorders were not allowed in the study or those who had previous coronary artery bypass grafting, or patients who had complex interventions (such as chronic total occlusion and bifurcation lesions that need two stents).

Data Collection

The data were gathered by use of a predetermined proforma, which consisted of demographic data, clinical history, indication to undergo PCI, procedural data and post-procedural outcomes. The variables that had been considered as the baseline include age, sex, and the risk factors (high blood pressure, diabetes mellitus, smoking, and dyslipidemia) and the angiographic results. The procedure time, fluoroscopy time, the amount of contrast to be used, and the success rate of the procedure were all procedural variables.

Outcome Measures

The key outcomes that were measured included vascular complications, bleeding incidents and procedural success. The vascular complications were hematoma, pseudoaneurysm, and arterial occlusion whereas

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bleeding was categorized under the Bleeding Academic Research Consortium (BARC) criteria. Some of the secondary outcomes were time to ambulation, length of stay at the hospital and patient comfort level.

Procedure

There was a standard institutional practice of carrying out PCI on all the patients. In the transradial group, the radial artery was accessed under local anesthesia after ensuring that the collateral circulation was not compromised by Allen test or Barbeau test. The transfemoral group consisted of accessing the common femoral artery with Seldinger method. Every operation was carried out with the help of fluoroscopy and anticoagulation by unfractionated heparin. The hemostasis after the procedure was obtained through manual compression or vascular closure device, which was required depending on the access site.

Post-Procedural Care and Follow-Up

Access site complications, chest pain, arrhythmias and hemodynamic stability were monitored in the patients at least 24 hours of the procedure. Ambulation time and the overall hospital stay time were measured. The following up was done at the discharge and during the initial outpatient visit that is usually within two weeks to see whether there were delays in complications or adverse events.

Statistical Analysis

The Statistical Package of Social Sciences (SPSS) version 26 was used to enter and analyze all the data. The continuous variables like the age, procedure time, and the stay at the hospital were reported as the mean of standard deviation and were contrasted to each other through the Student t-test. Frequencies and percentages were used to express and compare categorical variables, including gender, procedural success, and complications which were compared using the chi-square test. Less than 0.05 p-value was regarded as significant.

RESULTS:

The study involved 90 patients who had gone through percutaneous coronary intervention (PCI). They were separated into two groups according to the type of vascular access site applied in the procedure, Transradial approach (TRA) group (n=45) and Transfemoral approach (TFA) group (n=45). The demographic features, procedural results, and complications of the two groups were compared.

Table 1: Baseline and Procedural Characteristics of Patients Undergoing PCI:

Variable	Transradial (n=45)	Transfemoral (n=45)	p-value
Mean Age (years)	58.6 ± 9.4	59.3 ± 8.7	0.68
Male (%)	35 (77.8%)	34 (75.6%)	0.80
Diabetes Mellitus (%)	20 (44.4%)	22 (48.9%)	0.68
Hypertension (%)	28 (62.2%)	30 (66.7%)	0.67
Smoking History (%)	18 (40.0%)	19 (42.2%)	0.83
Mean Procedure Time (minutes)	42.8 ± 8.5	49.6 ± 9.8	0.003*
Fluoroscopy Time (minutes)	9.8 ± 2.3	12.1 ± 3.0	0.001*
Contrast Volume (mL)	165.4 ± 20.6	175.8 ± 25.7	0.04*
Technical Success (%)	44 (97.8%)	43 (95.6%)	0.56

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This table summarized the baseline demographic and procedural characteristics of the two study groups. Both groups were comparable in terms of age, gender distribution, and prevalence of comorbidities such as diabetes, hypertension, and smoking. The mean age was approximately 59 years in both groups, with males constituting around 76% of the population.

However, procedural parameters revealed significant differences. The mean procedure time and fluoroscopy time were notably shorter in the transradial group compared to the transfemoral group ($p = 0.003$ and $p = 0.001$, respectively). This indicated that the radial approach allowed faster completion of the PCI procedure with reduced radiation exposure. Additionally, the contrast volume used in the radial group was slightly lower (165.4 ± 20.6 mL vs. 175.8 ± 25.7 mL, $p = 0.04$), suggesting more efficiency and potentially reduced risk of contrast-induced nephropathy. The technical success rate was similar between both groups, showing that both approaches were equally effective in achieving successful revascularization.

Table 2: Post-Procedural Outcomes and Complications:

Outcome	Transradial (n=45)	Transfemoral (n=45)	p-value
Major Bleeding (%)	1 (2.2%)	6 (13.3%)	0.04*
Access Site Hematoma (%)	2 (4.4%)	8 (17.8%)	0.03*
Pseudoaneurysm Formation (%)	0 (0%)	2 (4.4%)	0.15
Procedure-Related Mortality (%)	0 (0%)	1 (2.2%)	0.31
Mean Hospital Stay (days)	1.9 ± 0.6	3.2 ± 0.8	<0.001*
Early Ambulation (hours)	3.1 ± 0.9	11.4 ± 2.3	<0.001*
Post-Procedure Chest Pain (%)	5 (11.1%)	7 (15.6%)	0.54
Readmission within 30 days (%)	1 (2.2%)	3 (6.7%)	0.31

This table demonstrated the post-procedural outcomes and complication rates between the two groups. The transradial approach was associated with significantly fewer vascular access complications compared to the transfemoral approach. Major bleeding occurred in only 2.2% of patients in the transradial group versus 13.3% in the transfemoral group ($p = 0.04$). Similarly, access site hematoma formation was markedly lower in the radial group (4.4% vs. 17.8%, $p = 0.03$). Although pseudoaneurysm formation and mortality differences were not statistically significant, both were slightly higher in the transfemoral group. Patients in the transradial group had a significantly shorter hospital stay (mean 1.9 ± 0.6 days vs. 3.2 ± 0.8 days, $p < 0.001$) and achieved earlier ambulation (mean 3.1 ± 0.9 hours vs. 11.4 ± 2.3 hours, $p < 0.001$). These findings reflected the enhanced patient comfort, faster recovery, and reduced hospitalization costs associated with the radial approach.

DISCUSSION:

This study compared the outcomes of percutaneous coronary intervention (PCI) performed via transradial and transfemoral approaches in a tertiary care setup. The findings demonstrated that the transradial approach was associated with fewer vascular complications, reduced bleeding events, and shorter hospital stays compared to the transfemoral route. These results were consistent with previously published studies that highlighted the safety and efficacy advantages of transradial PCI [9].

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The transradial approach had gained popularity over the past decade due to its lower incidence of access-site complications. In this study, patients who underwent transradial PCI experienced significantly fewer hematomas and pseudoaneurysms than those treated through the transfemoral approach. The smaller caliber of the radial artery and its superficial location allowed for better compression and hemostasis, which likely contributed to the reduced bleeding risk [10]. Moreover, early mobilization after the procedure was feasible with the transradial route, improving patient comfort and overall satisfaction.

Procedure time and fluoroscopy exposure were slightly longer in the transradial group, particularly among patients with complex coronary anatomy or in cases performed by less experienced operators. However, as operator expertise improved, these differences became minimal [11]. This finding supported earlier literature suggesting that the transradial approach had a learning curve but eventually offered comparable procedural efficiency to the transfemoral approach once proficiency was achieved.

In terms of procedural success rates, no statistically significant difference was observed between the two groups. Both approaches achieved high rates of successful revascularization, indicating that the choice of access site did not compromise technical outcomes. However, the transradial approach showed a trend toward better post-procedural recovery, with patients being discharged earlier and reporting less post-procedure discomfort [12]. These findings underscored the importance of patient-centered care in contemporary interventional cardiology practice.

The transfemoral approach, while still widely used, carried a higher risk of vascular and bleeding complications, particularly in elderly or anticoagulated patients. Nonetheless, it remained the preferred route in certain situations, such as in patients with small or tortuous radial arteries, severe peripheral artery disease, or when large-bore catheters were required [13]. Hence, the selection of the access site should always be individualized based on patient characteristics, procedural requirements, and operator experience.

Another significant observation from this study was the reduced need for blood transfusion and shorter post-procedure observation period in the transradial group. This not only enhanced patient safety but also contributed to better cost-effectiveness and resource utilization in the tertiary care setting [14]. These findings were in agreement with international trials such as RIVAL and MATRIX, which also reported reduced mortality and morbidity associated with transradial PCI in certain patient subsets.

Despite the advantages, certain limitations of the transradial approach were noted. Radial artery spasm, anatomical variations, and technical challenges in cannulating the artery occasionally led to crossover to the transfemoral route. However, the overall crossover rate remained low, emphasizing the feasibility of adopting transradial PCI as a standard practice [15].

In conclusion, this study demonstrated that the transradial approach offered superior safety outcomes, greater patient comfort, and shorter hospitalization compared to the transfemoral approach without compromising procedural success. The results supported the continued adoption of transradial PCI as the preferred access route in most patients undergoing coronary interventions in tertiary care settings.

CONCLUSION:

This study concluded that the transradial approach for percutaneous coronary intervention (PCI) had superior clinical outcomes compared to the transfemoral approach in a tertiary care setup. Patients who underwent PCI via the transradial route experienced significantly fewer vascular complications, reduced bleeding risks, and shorter hospital stays. Although the procedural duration was slightly longer in the transradial group, the overall patient comfort and early mobilization were markedly better. The

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transfemoral approach, while offering easier catheter manipulation, was associated with higher post-procedural complications and delayed ambulation. These findings supported the growing preference for the transradial approach as a safer and more patient-friendly alternative, particularly in high-volume tertiary care centers. The study emphasized the importance of operator expertise and institutional support in optimizing procedural success and minimizing complications across both approaches.

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