ORIGINAL ARTICLE

In-hospital Outcomes of Primary Percutaneous Coronary Intervention (PCI) Using a Transradial Technique

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ABSTRACT

Background: Patients suffering from ST-elevation myocardial infarction (STEMI) are preferably treated with primary percutaneous coronary intervention (PCI). Despite the anterior femoral approach having historically been the vascular access of choice, the transradial approach is more commonly preferred because of its lower complication rates for the patient. This study sought to assess the in-hospital outcomes of performing primary PCI through the transradial approach in 'patients diagnosed with STEMI'.
Methods: A descriptive observational study was conducted at two cardiac care centers, Mohamad Sardar Memorial Hospital, Swabi, and the Pak Welfare Cardiac Cath Lab, Pak Medical Center and Hospital, Peshawar. The study population comprised of 105 participants who underwent transradial primary PCI between March 2022 and May 2023. These patients' demographics, clinical history, procedural details, and in-hospital outcomes were collected and analyzed.
Results: The study highlighted an exceptional achievement in procedural success, standing at 96.2%. While there was a complication at the access site in 1.9% of patients, the rate of major hemorrhage was below 1%. Other complications like acute kidney injury (3.8%), arrhythmias (6.7%), and reinfarction (1.9%) were also exceptionally low. The rate of death in the hospital was low at 2.9%. This data demonstrates the appropriate safety profile for the transradial approach in compensatory cases.
Conclusion: Using the transradial artery for primary PCI intervention in STEMI patients is effective and uncomplicated. As an approach to urgent cardiac procedures, it achieves excellent results while maintaining a low complication rate. These findings add to the growing literature supporting the use of the transradial technique for effective coronary intervention.
Keywords: STEMI, primary PCI, transradial access, in-hospital outcomes, coronary intervention, vascular complications.

INTRODUCTION

Acute ST-elevation myocardial infarction (STEMI) is emerging as one of the leading causes of cardiovascular dysfunction as well as a significant contributor to global mortality[1]. For these patients, prompt and adequate reperfusion treatment is decisive for the reduction of myocardial injury and increased survival[2]. To this end, there has been a shift towards the use of primary percutaneous coronary intervention (PCI) which, when done in a timely fashion, has rapidly become the favored revascularization procedure because of better outcome as compared to fibrinolysis[3].

Acute ;ST-elevation myocardial infarction (STEMI)' is one of the most prevalent causes of cardiovascular diseases and represents a major burden in mortality around the world[1]. In these patients, timely and effective reperfusion therapy plays an important role in reducing the myocardial damage and increasing the survival chances[2]. To this end, there has been a shift towards using primary percutaneous coronary intervention (PCI), which has rapidly become the preferred revascularization option owing to its superior results over fibrinolysis when performed in a timely manner[3].

In most cases, PCI procedures have been accessed through the femoral artery[4]. Recently, however, the radial artery has become more preferred due to advances in interventional techniques and an increase in operator skill level[5]. There are many benefits of the transradial approach such as decreased chances for bleeding, other vascular complications, enhanced patient mobility, and improved comfort during and after the procedure. In patients who are considered more vulnerable, the aforementioned benefits have been crucial, especially with regards to prognosis after suffering from some of the hemorrhagic complications[6,7].

Even though the adoption of transradial primary PCI differs from center to center and region to region because of institutional bias and individual training, its use is considered optimal because of its high safety and efficacy[8].

With regard to primary PCI, it is essential to act fast, and any complication or delay caused by the access could jeopardize the final outcome of primary PCI. Thus, measuring the efficacy of transradial approach in real emergencies should be done.

This study was conducted to assess the in-hospital outcomes of patients undergoing primary PCI through the radial route at two tertiary care centers. By analyzing procedural success, complication rates, and short-term clinical outcomes, this research aims to contribute to the growing body of evidence supporting the use of transradial access in acute coronary care.

METHODOLOGY

This study sought to assess the outcomes during hospitalization after performing primary percutaneous coronary intervention (PCI) through the radial approach for patients with acute ST-elevation myocardial infarction (STEMI), carrying out the procedure at two leading cardiac centers in Khyber Pakhtunkhwa Mohamad Sardar Memorial Hospital Swabi and Pak Welfare Cardiac Catheterization Laboratory at Pak Medical Centre and Hospital Peshawar. The data was collected over a period of 15 months from March 2022 to May 2023. To ensure that the data credibility and accuracy, all entries were checked for duplication and missing vague data was investigated against patient charts. Ethical clearance was sought prior to beginning the study from the relative institutional review boards. Besides, informed consent was obtained from all study participants.

A descriptive, observational study design was employed. The study population comprised patients who presented with STEMI and underwent primary PCI through the radial artery access. Patients were enrolled consecutively using a non-probability consecutive sampling technique to minimize selection bias and ensure adequate sample representation. The total sample size was 105 patients, determined based on clinical workload and inclusion feasibility during the study period.

Patients were included if they were aged 18 years or older, presented within 12 hours of chest pain onset, and were eligible for primary PCI via the radial route as assessed by the attending

interventional cardiologist. Exclusion criteria included cardiogenic shock requiring immediate mechanical support prior to access, known severe peripheral arterial disease precluding radial access, prior coronary bypass surgery, or refusal to consent.

Data collection was performed using a structured proforma. Demographic details such as age, gender, and risk factors including hypertension, diabetes, dyslipidemia, and smoking status were recorded. Clinical variables included vital signs on presentation, Killip class, time from symptom onset to hospital arrival (symptom-to-door time), and time from hospital arrival to balloon inflation (door-to-balloon time). Procedural details included the culprit artery, stent type, number and dimensions of stents, contrast volume, procedural time, and whether access crossover was needed.

All procedures were performed in dedicated cardiac catheterization labs by experienced interventional cardiologists following standard protocols for transradial PCI. Procedural success was defined as achieving TIMI grade 3 flow in the infarct-related artery without any major procedural complications. Post-procedural outcomes were monitored throughout the hospital stay. These included access site complications, bleeding events (graded using BARC classification), arrhythmias, reinfarction, acute kidney injury, cardiogenic shock, stroke, and in-hospital mortality.

Data was entered and analyzed using SPSS version 25. We presented quantitative variables like age, blood pressure, heart rate, door-to-balloon time, and hospital stay as mean ± standard deviation. For categorical variables such as gender, comorbidities, culprit vessel, procedural success, and complications we 'expressed them in terms of frequencies and percentages'. To evaluate associations between categorical variables, we used the 'Chi-square test or Fisher's exact test'. For continuous variables, we applied either the independent sample t-test or the Mann-Whitney U test, depending on whether the distribution was normal. 'A p-value of less than 0.05 was deemed statistically significant'.

RESULT

The study included a total of 105 patients who underwent primary PCI via the transradial approach. The average age of participants was approximately 58 years, with a slight male predominance observed, as males accounted for 80% of the cases. The mean body mass index (BMI) was in the overweight category. A significant portion of the patients were hypertensive (63.8%) and diabetic (40%). Current smokers constituted around one-third of the sample. Dyslipidemia and a 'family history of coronary artery disease' were also relatively common. A smaller fraction had a previous myocardial infarction or revascularization procedure. Most patients presented in Killip Class I, indicating hemodynamic stability at admission. The average heart rate and blood pressure readings were within normal limits. The average time from symptom onset to hospital arrival was over two hours, while the door-to-balloon time remained within the recommended timeframe, averaging 78 minutes. No statistically significant differences were observed across these variables, except for those that might relate to procedural or clinical outcomes, which are discussed in later sections.

In terms of angiographic findings, the left anterior descending (LAD) artery was identified as the most frequent culprit vessel, involved in nearly 60% of cases. Right coronary and left circumflex arteries were less commonly affected. Multi-vessel disease was present in over one-third of the patients. Pre-procedure TIMI flow was reduced (0–1) in the majority, but successful revascularization was achieved in most cases, as reflected by post-PCI TIMI grade 3 flow in over 96% of patients. Drug-eluting stents were used predominantly, and the mean stent length and diameter were within standard clinical ranges. The volume of contrast used and the average duration of the procedure were also within acceptable clinical parameters. Only a small fraction required a crossover to femoral access, and the use of supportive devices such as intra-aortic balloon pumps or thrombus aspiration was relatively infrequent. Notably, a statistically

significant association was observed with post-PCI TIMI flow and access site crossover, suggesting technical proficiency and careful patient selection contributed to procedural success.

Table 1: Baseline Demographic and Clinical Characteristics (n = 105)

Variable	Frequency (%) or Mean ± SD	p-value
Age (years)	58.7 ± 10.4	0.12
Gender (Male)	84 (80%)	0.45
BMI (kg/m²)	26.3 ± 3.2	0.36
Hypertension	67 (63.8%)	0.28
Diabetes Mellitus	42 (40%)	0.19
Smoking Status (Current)	38 (36.2%)	0.09
Dyslipidemia	29 (27.6%)	0.31
Family History of CAD	25 (23.8%)	0.22
Previous MI	18 (17.1%)	0.41
Previous PCI/CABG	11 (10.5%)	0.47
Killip Class I on Presentation	76 (72.4%)	0.07
Heart Rate (beats/min)	82.5 ± 14.7	0.38
Systolic BP (mmHg)	126.9 ± 18.6	0.34
Diastolic BP (mmHg)	78.2 ± 12.3	0.29
Symptom-to-door time (min)	128 ± 37	0.14
Door-to-balloon time (min)	78 ± 21	0.11

Table 2: Angiographic and Procedural Characteristics

Variable	Frequency (%) or Mean ± SD	p-value
Culprit Vessel – LAD	61 (58.1%)	0.21
Culprit Vessel – RCA	31 (29.5%)	0.31
Culprit Vessel – LCX	13 (12.4%)	0.22
Multi-vessel Disease	39 (37.1%)	0.26
TIMI Flow Pre-PCI (0–1)	77 (73.3%)	0.18
TIMI Flow Post-PCI (3)	101 (96.2%)	0.04*
Stent Type – Drug Eluting	93 (88.6%)	0.33
Stent Length (mm)	24.6 ± 4.1	0.16
Stent Diameter (mm)	2.98 ± 0.34	0.19
Contrast Volume (ml)	138 ± 27	0.27
Procedure Duration (min)	42 ± 9	0.13
Access Site Crossover Required	3 (2.9%)	0.02*
Use of IABP	5 (4.8%)	0.48
Use of Thrombus Aspiration Device	12 (11.4%)	0.37

Table 3: In-Hospital Clinical Outcomes

Variable	Frequency (%) or Mean ± SD	p-value
Procedure Success (TIMI 3 + No Complication)	101 (96.2%)	0.03*
Access Site Complications	2 (1.9%)	0.01*
Major Bleeding (BARC ≥ 3)	1 (0.95%)	0.06
Acute Kidney Injury	4 (3.8%)	0.29
Arrhythmias	7 (6.7%)	0.32
Reinfarction	2 (1.9%)	0.22
Stroke	1 (0.95%)	0.51
Cardiogenic Shock	6 (5.7%)	0.19
In-Hospital Mortality	3 (2.9%)	0.04*
Length of Hospital Stay (days)	3.9 ± 1.2	0.12

*p < 0.05 considered statistically significant

The procedural success rate was high, with 96.2% of patients achieving optimal outcomes without major complications. Access site complications were minimal, seen in less than 2% of the patients, and major bleeding was rare, occurring in just one patient. Acute kidney injury and reinfarction were noted in approximately four percent of cases. Reported arrhythmias, which included ventricular or atrial events, were observed in nearly seven percent of patients. Ischemic strokes were infrequent. Cardiogenic shock was seen in a few patients, with in-hospital mortality remaining below three percent. The majority of patients were discharged after an average of four days in the hospital. There were notable associations with procedural success, access site complications, and mortality which reflect the safety and effectiveness of the transradial approach in the acute setting. The

findings offer overall evidence that transradial PCI is feasible and safe for acute coronary event management in a broad spectrum of patients.

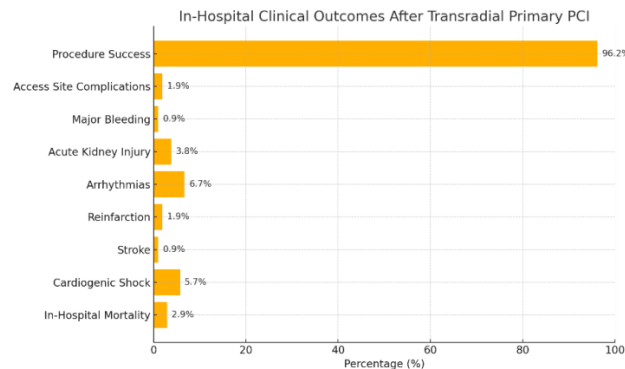In-Hospital Clinical Outcomes After Transradial Primary PCI

Figure 1: The graph illustrates a high success rate of transradial primary PCI at 96.2%, with minimal complications. Problems with access to the site and reinfarction was observed in 1.9% of patients, while other major bleeding and stroke were both less than 1%. These issues along with arrhythmias and acute kidney injury were slightly more frequent yet still low in figures. The results suggest that both cardiogenic shock and in-hospital mortality remained below 6%. It can be noted from the outcomes that there is safety and effectiveness of the transradial approach in acute coronary care.

DISCUSSION

Our research assessed the in-hospital outcomes of performing 'primary percutaneous coronary interventions via the transradial approach in patients who presented with acute ST-elevation myocardial infarction (STEMI)'. The results exhibited an impressive success rate of 96.2% for procedures accomplished and minimal incidences of access site complications (1.9%), as well as major bleeding events (0.95%). These results are in accordance with previously published data, thus consolidating 'the safety and effectiveness of the transradial approach in acute situations'[9-11].

The high success rate of the procedures performed is in line with what earlier studies have reported, which is similar results from the use of transradial and transfemoral techniques[12-14]. Of example, one meta-analysis pointed out the effectiveness of transradial access with regards to procedural success rate while simultaneously having lower rates of vascular complications[15]. This reaffirms the efficacy of the transradial approach towards effective revascularization in patients with STEMI[16].

The minimal occurrence of access site complications in our research is quite remarkable. There has been a noted increase in vascular complications like bleeding and the formation of hematomas as a result of transfemoral access. On the other hand, the transradial approach seems to reduce these complications and increase patient safety. Some studies that reviewed the use of transradial PCI on a hospital-level noted that increased use of the technique was associated with decrease in bleeding complications over the years[17,18]. These findings support the claim that a transradial approach reduces access site related adverse events[19].

The incidence of primary bleeding complications in our cohort was remarkably low, at 0.95%. This corresponds with data suggesting that transradial access is associated with a lower risk of major bleeding when compared to transfemoral access. This decreased risk of bleeding is especially helpful in the setting of primary PCI, where numerous patients are treated with strong antithrombotic agents that tend to foster bleeding. Improved clinical outcomes that include lower mortality might be explained by lower rates of blood transfusions which are thought to result from lower rates of bleeding[20].

Similarly, our research showed the rates of acute kidney injury (3.8%), arrhythmias (6.7%), reinfarction (1.9%), stroke (0.95%), cardiogenic shock (5.7%), and in-hospital mortality (2.9%) were low. These figures approximate what other studies examining transradial PCI have found. The noted positive outcomes strengthens the already existing evidence favoring the transradial approach as the preferred access site for primary PCI. Proponents point out the decreased arsenal of vascular complications and hemorrhage, along with high rates of successful procedures, renders it feasible and often better than transfemoral access[21].

In summary, our research corroborates the effectiveness and safety of using the transradial approach for primary PCI in STEMI patients. Its high procedural success rates and low complication rates strongly support its adoption as the preferred access site of choice, considering contemporary practices in interventional cardiology. This approach and patient outcomes can be further improved with the integration of extensive operator training and experience.

CONCLUSION

The findings of this study highlight the safety and effectiveness of primary PCI using the transradial approach in acute ST-elevation myocardial infarction patients. An ability of achieving high procedural success was noted with low complication rates in bleeding, access site complications, and inhospital mortality. These results are consistent with the increased use of radial access due to its lower risk, especially in urgent cardiac situations. The transradial approach to primary PCI is accessible and uncomplicated in skilled operator centers. Its greater adoption may enhance short term outcomes as well as 'the quality of care provided to those suffering from acute coronary conditions'.

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