BENHA MEDICAL JOURNAL bmj
Print ISSN 1110-208X
Online ISSN 2357-0016

Original article

Adoption of Transradial Primary Percutaneous Coronary Intervention for ST Elevation Myocardial Infarction and Its Association with Door-To-Balloon Time

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Received:

Accepted:

Abstract

Background: Access-site bleeding is the most frequent bleeding complication of transfemoral primary percutaneous coronary intervention (TF-PPCI). In contrast, transradial PPCI (TR-PPCI) has been demonstrated in multiple trials to be safer than the femoral approach due to the lower risk of significant bleeding. This study's objective was to study adoption of TR-PPCI for STEMI and its association with door-to-balloon time (D2BT). **Methods:** This study was carried out on 70 patients diagnosed as STEMI treated with PPCI were compared according to the access site used during the procedure. Patients were divided into 2 equal groups, group I: STEMI patients treated with TR-PPCI, and group II: STEMI patients treated with TF-PPCI. Patients were subjected to physical examination, risk assessment, electrocardiogram (ECG), transthoracic echocardiography, and coronary angioplasty. **Results:** D2BT was 107 min in TF-PPCI compared to 114 min in TF-PPCI group with no statistically significant difference. BMI and presence of prior peripheral arterial disease were significantly higher in TR-PPCI group compared to TF-PPCI group. Presence of cardiogenic shock and cardiac arrest within prior 24 h, and mean contrast volume were significantly lower in TR-PPCI group compared to TF-PPCI group ($p \leq 0.05$). Clinical data, ECG, laboratory data, patients' presenting location, time in minutes, procedural medications, angiographic data, thrombus aspiration device, balloon angioplasty, direct stenting, number and type of stents, TIMI pre and post, and complications were insignificantly different between the studied groups. **Conclusions:** TR-PPCI can be successfully implemented without compromising D2BT performance offering the potential to improve STEMI outcomes if widely embraced.

Keywords: Transradial Primary Percutaneous Coronary Intervention; ST Elevation Myocardial Infarction; Door-To-Balloon Time

Introduction

Worldwide, ischemic heart disease is the single most common cause of death and its frequency is increasing. However, there has been an overall trend for a reduction in ischemic heart disease mortality over the past three decades (1).

The mortality in STEMI patients is influenced by many factors, among them advanced age, Killip class, time delay to treatment, presence of emergency medical system (EMS)-based STEMI networks, treatment strategy, history of MI, diabetes mellitus (DM), renal failure, number of diseased coronary arteries, and left ventricular ejection fraction (LVEF) (2).

Several recent studies have highlighted a fall in acute and long-term mortality following STEMI in parallel with greater use of reperfusion therapy, primary percutaneous coronary intervention (PCI), modern antithrombotic therapy, and secondary prevention (3).

Bleeding complications are frequent in the setting of PPCI due to the intensive antithrombotic treatment used in this group of patients. Recently, bleeding after coronary interventions has been associated with an increased mortality rate in multiple trials. Therefore, strategies to reduce the risk of bleeding are needed (4).

Concerns about prolonging door-to-balloon time (D2BT) have contributed to slow adoption of TR-PPCI in the United States, where D2BT has been an important quality metric (5).

This study aimed to study adoption of TR-PPCI for STEMI and its association with D2BT.

Patients and Methods

This cross-sectional study was conducted on 70 patients diagnosed as STEMI treated with PPCI were compared according to the access site used during the procedure at Cardiology Department, Benha University Hospital, National Heart Institute (NHI) during the period from July 2021 to June 2023. The choice of arterial access was at the discretion of the operating physician. Patients' data were prospectively recorded in a computerized database and included demographic and clinical variables, risk factors, hemodynamic status and left ventricular function during admission, door-to-balloon time, angiographic and procedural characteristics, bleeding complication at the access site and other sites, hematoma, perforation, spasm, dissection and stroke.

This study was done after approval by the institutional ethical committees of Benha University Hospital **(MD.3.6.2021)** and patients were informed about the study & informed consents were also obtained.

According to the access site used during the procedure, patients with STEMI and treated with PPCI were divided into group I: STEMI patients treated with TR-PPCI, and group II: STEMI patients treated with TF-PPCI with primary endpoint was door to balloon time.

Inclusion criteria were STEMI diagnosis based on patient's history, electrocardiographic (ECG) findings (more than 1 mm ST-segment elevation on two concordant ECG leads, new left bundle branch block (6), identifiable culprit lesion on coronary angiogram and elevated cardio-specific serum markers [troponin I (cTNI), CK MB] treated with primary PCI.

Exclusion criteria were the need for mechanical circulatory support device, refusal of patients, patients in whom radial approach was contraindicated or suffer from previous unsuccessful or complicated radial approach, in this case the femoral approach may be more suitable for the operator.

All patients were subjected to 1) Full history taking (a) Full analysis of the chest pain, and (b) full analysis of dyspnea and its grade according to New York Heart Association (NYHA) grading from I to IV, (c) Past history with coronary artery disease (CAD) risk factors including: DM, hypertension (HTN), dyslipidemia, and (d) Family history of CAD and/or its risk factors, (e) Medication history. **2) Thorough physical examination and risk assessment including:** weight and hight, body mass index (BMI) & body surface area (BSA), pulse and blood pressure, neck veins, edema of lower limbs, abdominal and chest examination., cardiac examination, the patients who had developed heart failure (HF) were classified regarding KILLIP class (7) as: Class I: no clinical signs of HF, class II: rales or crackles in the lungs, an S3, and elevated jugular venous pressure, class III: frank acute pulmonary edema, and class IV: cardiogenic shock. **3) Resting 12-lead standard surface electrocardiogram (ECG) (8):** to diagnose and localize STEMI on admission at emergency room triage at a paper speed of 25 mm/second and amplification of 10 mm/mv, the diagnosis was according to: New ST segment elevation at J-point in ≥ 2 contiguous leads of ≥ 2 mm in leadsV1, V2, or V3 and ≥ 1 mm in other leads. ST-segment depression ≥ 1mm in leads V1 to V3, consistent with a posterior STEMI, was considered as ST-segment elevation. The ST segment elevation measured 20 ms after the J point. The height (in mm) of ST segment elevations was measured in leads I, aVL, and V1 through V6 for anterior infarction; leads II, III, aVF for inferior infarction and leads V5 to V6 for lateral with right ventricular leads (V3R,V4R) and posterior leads (V7,V8) when right ventricular and or posterior myocardial infarction were suspected. **4) Blood samples for** (a) Cardiac enzymes [total creatine kinase (CK), CK-MB, and cTNI], (b) Renal function tests, and (c) Complete blood count).

Transthoracic echocardiography (ECHO):

Comprehensive M-mode, 2-Dimentional, and Doppler ECHO assessment were performed within 72 hours from admission. Examination was done with the patient in the left semi-lateral position; utilizing left parasternal long axis, short axis, apical 4 (A4C), apical 5, and apical 2-chamber (A2C) views according to the recommendations of the American society of echocardiography.

Systolic function parameters:

Cardiac dimensions and functions, including the left ventricular end-diastolic dimension (LVEDD) and left ventricular end-systolic dimension (LVESD) were assessed using 2D measurements in millimeters (mm). The volumes were calculated using the biplane Simpson's method. The LVED and LVES volumes were measured in both the apical four-chamber (A4C) and apical two-chamber (A2C) views. End-systole was defined as the frame with the smallest cavity area, while end-diastole was defined as the frame with the largest left ventricular cavity area.

Segmental wall motion assessment:

Visual semi-quantitative assessment of regional wall motion and thickening was performed to calculate the Wall Motion Score Index (WMSI). The 16-segment model recommended by the American Society of Echocardiography (ASE) was used. The left ventricle was divided into six segments at the basal and mid-ventricular levels, and into four segments at the apical level. Each segment was assigned a score based on the following grading system: normal (1), hypokinesia (2), akinesia (3), dyskinesia (4), or aneurysm (5). The total WMS was obtained by summing the scores for each segment, and the WMSI was calculated by dividing the total wall motion score by 16.

Diastolic function parameters:

Mitral flow parameters, including E wave velocity, A velocity, E/A ratio, and E-wave deceleration time were assessed.

Mitral regurge assessment:

Mitral regurgitation (MR) was evaluated according to the ESC/EACVI guidelines, using the vena contracta (VC) diameter averaged from measurements over at least two to three beats and using two orthogonal planes, whenever possible. A VC measurement of 3 mm indicates mild MR, while a width of ≥7 mm defines severe MR. The severity of MR was also assessed using the maximal MR jet area to left atrial (LA) area ratio, following the guidelines of the American College of Cardiology and American Heart Association. The severity of MR was quantified using a 4-point scale: 0 for no MR (if the percentage of maximal MR color jet area-to-maximal LA area was 0%), 1 for trace MR (if the ratio was ≤10%), 2 for mild MR (if the ratio was 10–19%), 3 for moderate MR (if the ratio was 20–39%), and 4 for severe MR (if the ratio was 40%) (19).

Coronary angioplasty:

Patients were promptly transferred to the cath lab following guidelines, with door-to-balloon time measured from the onset of chest pain to diagnosis. Before the procedure, all patients received chewable aspirin, clopidogrel or ticagrelor, and unfractionated heparin. The use of glycoprotein IIb/IIIa antagonists was at the discretion of the operator.

Coronary angiography was performed using standard techniques, with the choice of access artery (typically right radial) based on operator preference and convenience. Catheters with J-wires were used for left and right coronary angiography, and multiple projections

were obtained for lesion analysis. Thrombus aspiration and drug-eluting stent placement were performed in the infarct-related artery.

Digital coronary angiograms were analyzed offline using an automated edge detection system. The severity of the infarct-related artery was assessed based on antegrade flow and opacification.

Lesions were classified based on their location (ostial, proximal, mid-location, or distal), and angiographically significant lesions were defined as ≥50% luminal narrowing in a major epicardial vessel with a diameter ≥2.5 mm. The culprit lesion was determined by angiographic appearance and ECG data, and myocardial perfusion was evaluated using the TIMI flow grading system.

The total number of vessels with lesions was calculated, and significant lesions were identified as ≥70% stenosis in a major epicardial coronary artery, with ≥50% stenosis considered significant for the left main artery.

Statistical analysis:

Statistical analysis was done by SPSS v22 (IBM Inc., Armonk, NY, USA). Quantitative parametric data were presented as mean and standard deviation (SD) and analysed by Student's t- test or Mann-Whitney test for non-parametric data. Qualitative data were presented as frequency and percentage (%), and chi-square test was used to determine whether there is an association between two categorical variables. Odds Ratio (OR) was used to estimates of risk statistics. *p*-value <0.05 was considered significant.

Results

There was no statistically significant difference between the two groups regarding age, gender, BSA, HTN, DM, smoking, dyslipidemia, family history, prior MI, prior PCI, prior CABG, prior CVS, chronic lung disease, ESRD, and NYHA classification. BMI and presence of prior PAD were significantly higher in TR-PPCI group compared to TF-PPCI group. Presence of cardiogenic shock and cardiac arrest within prior 24 h were significantly lower in TR-PPCI group compared to TF-PPCI group (**Table, 1).**

Clinical data, ECG, laboratory data, and patients' presenting location were insignificantly different between the studied groups (**Table, 2)**

Different procedural medications are mentioned in **table 3**. Time in minutes, and procedural medications were insignificantly different between the two studied groups.

Regarding door to balloon time, mean D2BT was 114 minutes in TR-PPCI group, on the other hand, TF-PPCI group required 107 minutes as mean D2BT with statistically non-significant difference between two groups (*p*-value = 0.186).

Angiographic data were insignificantly different between the two studied groups (**Table, 4).**

The mean contrast volume was significantly lower in the TR-PPCI group compared to the TF-PPCI group. The other procedural characteristics

(Thrombus aspiration device, balloon angioplasty, direct stenting, number and type of stents, TIMI pre and post, and complications) were insignificantly different between the studied groups (**Table, 5).**

Echocardiographic data (EF, wall motion score index (WMSI), MR) were insignificantly different between both studied groups (**Table, 6).** In-hospital mortality was insignificantly different between both of the studied groups.

Table 1: Comparison between groups according to baseline characteristics

Baseline characteristics		**TR-PPCI Group (n=35)**	**TF-PPCI Group (n=35)**	**Test value**	***p*-value**
Age (years)		54.74±10.70	55.83±10.03	t:-0.438	0.663
Gender	**Female**	13 (37.1%)	14 (40.0%)	x^2:0.060	0.806
	Male	22 (62.9%)	21 (60.0%)		
BMI (kg/m^2)		33.02±4.39	30.06±3.71	t:3.047	0.003*
BSA (m^2)		2.03±0.08	2.03±0.08	t:0.093	0.926
Risk factors	**HTN**	25 (71.4%)	24 (68.6%)	x^2:0.060	0.806
	DM	15 (42.9%)	17 (48.6%)	x^2:0.230	0.631
	Smoking	17 (48.6%)	19 (54.3%)	x^2:0.229	0.632
	Dyslipidemia	27 (77.1%)	24 (68.6%)	x^2:0.650	0.420
	Family History	11 (31.4%)	11 (31.4%)	x^2:0.000	1.000
	Prior MI	3 (8.6%)	7 (20.0%)	x^2:1.867	FE:0.172
	Prior PCI	4 (11.4%)	5 (14.3%)	x^2:0.128	FE:0.721
	Prior CABG	0 (0.0%)	2 (5.7%)	x^2:2.059	FE:0.151
	Prior CVS	3 (8.6%)	4 (11.4%)	x^2:0.159	FE:0.690
	Prior PAD	10 (28.6%)	3 (8.6%)	x^2:4.557	FE:0.033*
	Chronic lung disease	4 (11.4%)	5 (14.3%)	x^2:0.128	FE:0.721
	ESRD on Hdx	1 (2.9%)	1 (2.9%)	x^2:0.000	FE:1.000
NYHA classification	**Class 1**	28 (80.0%)	27 (77.1%)	x^2:1.352	FE:0.717
	Class 2	5 (14.3%)	7 (20.0%)		
	Class 3	1 (2.9%)	1 (2.9%)		
	Class 4	1 (2.9%)	0 (0.0%)		
Cardiogenic shock within prior 24 h		1 (2.9%)	6 (17.1%)	x^2:3.865	FE:0.049*
Cardiac arrest within prior 24 h		0 (0%)	4 (11.4%)	x^2:4.171	FE:0.041*

t: Independent Sample t-test; x^2: Chi-square test or Fisher's Exact test, p-value >0.05 is insignificant; **p*-value <0.05 is significant; ***p*-value <0.001 is highly significant, TR-PPCI: Transradial primary percutaneous coronary intervention, TF-PPCI: Transfemoral primary percutaneous coronary intervention, BMI: Body mass index, BSA: Body surface area, HTN: Hypertension, DM: Diabetes mellitus, MI: Myocardial infarction, PCI: Percutaneous coronary intervention, CABG: Coronary artery bypass graft, PAD: Peripheral arterial disease, ESRD: End-stage renal disease, NYHA: New York Heart Association.

Table 2: Comparison between groups according to clinical data, ECG, laboratory data, and presenting location

		TR-PPCI Group (n=35)	TF-PPCI Group (n=35)	Test value	*p*-value
Clinical Data	**SBP (mmHg)**	117.00±28.75	116.71±29.08	t:0.041	0.967
	DBP (mmHg)	73.14±14.76	72.86±15.11	t:0.080	0.936
	HR (beat/min)	85.60±14.13	85.60±14.13	t:0.000	1.000
ECG	**Anterior**	18 (51.4%)	20 (57.1%)	t:1.439	FE:0.963
	Inferior	10 (28.6%)	10 (28.6%)		
	Inferior+RV inf	1 (2.9%)	1 (2.9%)		
	Inferoposterior	2 (5.7%)	2 (5.7%)		
	Inferoposterior + RV infarction	1 (2.9%)	1 (2.9%)		
	Lateral	2 (5.7%)	1 (2.9%)		
	Posterior	1 (2.9%)	0 (0.0%)		
Labs	**CKMB (IU/L)**	61.09±50.74	61.09±50.74	t:0.000	1.000
	Troponin (µg/L)	31 (88.6%)	31 (88.6%)	x^2:0.000	1.000
	Creatinine Pre-catheter (mg/dl)	1.22±1.09	1.37±1.68	t:0.457	0.649
	Creatinine Post-catheter (mg/dl)	1.51±1.30	1.48±1.31	t:0.101	0.920
	CIN	1 (2.9%)	2 (5.7%)	x^2:0.348	FE:0.555
	Hb (g/dL)	12.22±1.47	12.17±1.32	t:0.128	0.898
	TLC (cells/µL)	10.63±3.97	9.69±3.30	U:1.082	0.283
	Plt (platelets/µL)	244.20±84.61	244.43±81.28	U:0.012	0.991
Presenting location	Primary emergency department	23 (65.7%)	24 (68.6%)	x^2=0.065	0.799
	Interhospital transfer	11 (31.4%)	10 (28.6%)	x^2=0.068	0.794
	Inhospital	1 (2.9%)	1 (2.9%)	x^2=0.000	FE:1.000

t: Independent Sample t-test, x^2: Chi-square test or Fisher's Exact test, U-Mann-Whitney test, *p*-value >0.05 is insignificant. TR-PPCI: Transradial primary percutaneous coronary intervention, TF-PPCI: Transfemoral primary percutaneous coronary intervention, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, RV: Right ventricle, CKMB: Creatine phosphokinase-MB, CIN: Contrast-induced nephropathy, Hb: Hemoglobin, TLC: Total leukocyte count, Plt: Platelets

Table 3: Comparison between groups according to time in minutes, and procedural medications

		TR-PPCI Group (n=35)	TF-PPCI Group (n=35)	Test value	*p*-value
Time in minutes	**Door to cath lab arrival**	80.14±12.40	78.86±12.90	t:0.425	0.672
	Cath lab arrival to balloon time	35.00±11.76	31.14±10.77	t:1.432	0.157
	Door to balloon	114.86±24.12	107.29±23.25	t:1.337	0.186
Procedural medications	**ASA**	35 (100.0%)	35 (100.0%)	x^2:0.000	1.000
	Ticagrelor	24 (68.6%)	26 (74.3%)	x^2:0.280	0.597
	Clopidogrel	11 (31.4%)	9 (25.7%)	x^2:0.280	0.597
	Unfractionated Heparin	32 (91.4%)	33 (94.3%)	x^2:0.215	0.643
	LMWH	3 (8.6%)	2 (5.7%)	x^2:0.215	FE:0.643
	GP IIb/IIIa inhibitor	4 (11.4%)	3 (8.6%)	x^2:0.159	FE:0.690

Data is presented as mean ± SD or frequency (%), t-Independent Sample t-test, x^2: Chi-square test or Fisher's Exact test, *p*-value >0.05 is insignificant. TR-PPCI: Transradial primary percutaneous coronary intervention, TF-PPCI: Transfemoral primary percutaneous coronary intervention, ASA: Acetylsalicylic acid, LMWH: Low molecular weight heparin, GP: Glycoprotein.

Table 4: Comparison between groups according to procedural characteristics (Angiographic data)

Procedural characteristics	TR-PPCI Group (n=35)	TF-PPCI Group (n=35)	x^2	*p*-value
No of diseased vessels				
1	19 (54.3%)	19 (54.3%)	0.000	FE: 1.000
2	13 (37.1%)	13 (37.1%)		
3	3 (8.6%)	3 (8.6%)		
Non-culprit vessel				
LAD	7 (20.0%)	4 (11.4%)	3.912	FE: 0.790
LAD & LCX	1 (2.9%)	1 (2.9%)		
LCX	4 (11.4%)	6 (17.1%)		
LCX & RCA	0 (0.0%)	1 (2.9%)		
LCX&PDA	1 (2.9%)	0 (0.0%)		
RCA	2 (5.7%)	4 (11.4%)		
RCA & LCX	1 (2.9%)	1 (2.9%)		
No	19 (54.3%)	18 (51.4%)		
Culprit vessel				
Diagonal	1 (2.9%)	1 (2.9%)	4.610	FE: 0.595
LAD	18 (51.4%)	19 (54.3%)		
LCX	8 (22.9%)	4 (11.4%)		
LIMA (bypass graft)	0 (0.0%)	1 (2.9%)		
Ramus	1 (2.9%)	0 (0.0%)		
RCA	7 (20.0%)	9 (25.7%)		
SVG to RCA (bypass graft)	0 (0.0%)	1 (2.9%)		
Site of lesion				
Distal	3 (8.6%)	0 (0.0%)	5.006	FE: 0.171
Mid	4 (11.4%)	9 (25.7%)		
Ostial	3 (8.6%)	3 (8.6%)		
Proximal	25 (71.4%)	23 (65.7%)		

Data is presented as frequency (%), t-Independent Sample t-test; x^2: Chi-square test or Fisher's Exact test, *p*-value >0.05 is insignificant; **p*-value <0.05 is significant; ***p*-value <0.001 is highly significant. TR-PPCI: Transradial primary percutaneous coronary intervention, TF-PPCI: Transfemoral primary percutaneous coronary intervention, LAD: Left anterior descending artery, LCX: Left circumflex artery, RCA: Right coronary artery, PDA: Patent ductus arteriosus, SVG: Saphenous vein grafts

Table 5: Comparison between groups according to procedural characteristics

Procedural characteristics	TR-PPCI Group (n=35)	TF-PPCI Group (n=35)	x^2	*p*-value
Thrombus aspiration device	3 (8.6%)	4 (11.4%)	0.159	FE:0.690
Balloon angioplasty	20 (57.1%)	21 (60.0%)	0.059	0.808
Direct stenting	15 (42.9%)	14 (40.0%)	0.059	0.808
No. of stents				
0	1 (2.9%)	1 (2.9%)	0.086	FE:0.958
1	27 (77.1%)	26 (74.3%)		
2	7 (20.0%)	8 (22.9%)		
Type of stents				
DES	35 (100.0%)	35 (100.0%)	0.000	1.000
TIMI pre				
0	26 (74.3%)	24 (68.6%)	0.366	FE:0.833
1	6 (17.1%)	8 (22.9%)		
2	3 (8.6%)	3 (8.6%)		
TIMI post				
1	1 (2.9%)	1 (2.9%)	0.159	FE:0.923
2	4 (11.4%)	3 (8.6%)		
3	30 (85.7%)	31 (88.6%)		
Contrast volume (ml)	173.43±30.77	201.14±52.34	t:2.700	0.009*
Complications related to PCI procedure				
No complications	***33 (94.3%)***	***29 (82.9%)***	--	--
Complications	***2 (5.7%)***	***6 (17.1%)***	--	--
Bleeding	*0 (0.0%)*	*2 (5.7%)*	7.245	FE:0.203
Dissection	*0 (0.0%)*	*1 (2.9%)*		
Hematoma	*0 (0.0%)*	*2 (5.7%)*		
Pseudoaneurysm	*0 (0.0%)*	*1 (2.9%)*		
Vessel occlusion	*1 (2.9%)*	*0 (0.0%)*		
Vessel spasm grade III	*1 (2.9%)*	*0 (0.0%)*		

Data is presented as mean ± SD or frequency (%), t-Independent Sample t-test; x^2: Chi-square test or Fisher's Exact test, *p*-value >0.05 is insignificant; **p*-value <0.05 is significant; ***p*-value <0.001 is highly significant, TR-PPCI: Transradial primary percutaneous coronary intervention, TF-PPCI: Transfemoral primary percutaneous coronary intervention, PCI: Percutaneous coronary intervention, TIMI: Thrombolysis in Myocardial Infarction Score

Table 6: Comparison between groups according to Echo

Echo	TR-PPCI Group (n=35)	TF-PPCI Group (n=35)	Test value	*p*-value
EF (%)	39.66±7.90	40.31±7.03	t:0.367	0.714
WMSI	1.57±0.25	1.59±0.24	t:0.240	0.811
MR				
1	10 (28.6%)	10 (28.6%)	x^2:0.222	0.895
2	22 (62.9%)	23 (65.7%)		
3	3 (8.6%)	2 (5.7%)		

Data is presented as mean ± SD or frequency (%), t-Independent Sample t-test; x^2: Chi-square test or Fisher's Exact test, *p*-value >0.05 is insignificant, TR-PPCI: Transradial primary percutaneous coronary intervention, TF-PPCI: Transfemoral primary percutaneous coronary intervention, EF: Ejection fraction, WMSI: Wall motion score index, MR: Mitral Regurgitation.

Cases:

Case from TR-PPCI group:

A 55-year-old male patient, heavy smoker, presented with typical chest pain lasting for 2 hours. On admission, his blood pressure was 90/60 mmHg, pulse was regular at 100 beats/min, and he was classified as Killip class I. No audible murmurs were detected on heart examination. The ECG showed extensive anterolateral ST-elevation myocardial infarction (STEMI) with reciprocal ST depression in the inferior leads. Laboratory results indicated CK-MB levels of 53, positive cTnI, pre-PCI creatinine of 0.8 mg/dl, post-PCI creatinine of 0.9 mg/dl, and hemoglobin of 13.4 g%. The case was diagnosed as anterolateral STEMI. The echocardiogram revealed a left ventricular ejection fraction (LVEF) of 39% by Simpson's biplane method, and grade I/IV mitral regurgitation (MR). There were segmental wall motion abnormalities (SWMA) in the form of hypokinetic anterior septum, mid, and apical anterior wall, with a Wall Motion Score Index (WMSI) of 1.31. Coronary angiography was done through right radial access and demonstrated an ectatic dominant right coronary artery (RCA) with a proximal borderline lesion and the left anterior descending artery (LAD) showed proximal two successive significant thrombotic lesions. The left circumflex artery (LCX) had no significant lesions. The patient underwent primary PCI to the LAD with a 3.5x38 mm drug-eluting stent (DES), followed by post-dilation with a non-compliant balloon (NC) of size 4.0x12 mm. door to balloon time was 105 minutes and amount of contrast was 200 ml. The patient passed smooth hospital course with no complications until discharge (Fig., 1).

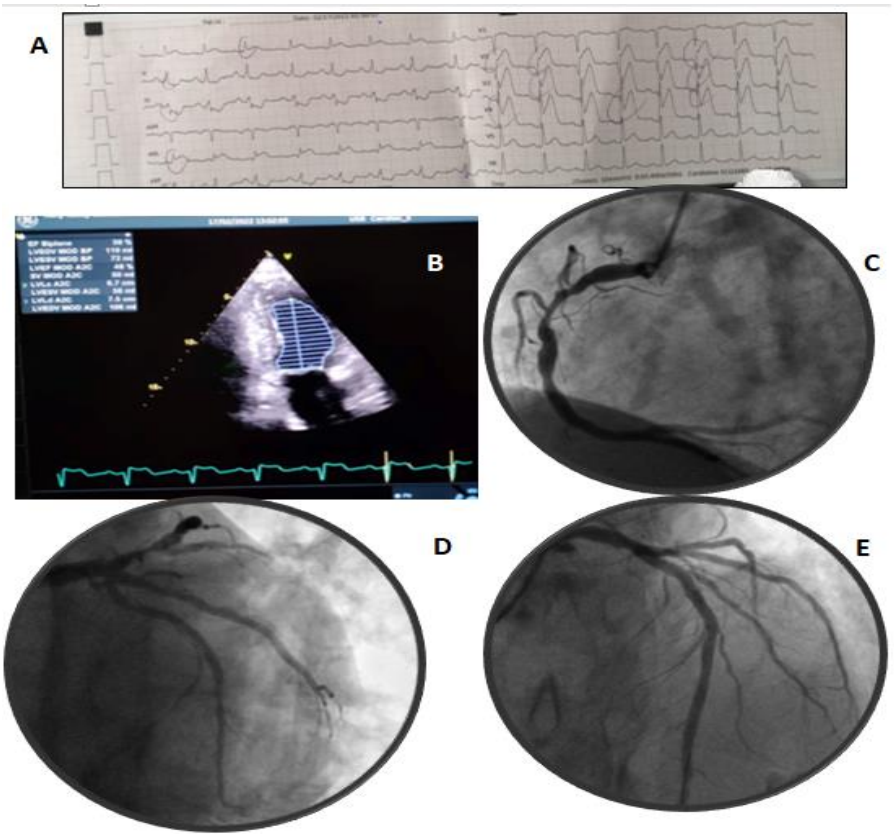

Figure 1: a) ECG of the patient showing extensive antero-lateral STEMI, b) Apical 2-chamber echo view with Simpson's biplane calculation of LVEF, c) LAO cranial view showing ectatic RCA with proximal borderline lesion, d) PA caudal view of left coronary system showing proximal LAD significant thrombotic lesion & atherosclerotic LCX with no significant lesions, e) PA cranial view of left coronary system post-stenting of LAD

Case from TF-PPCI group:

A 57-year-old male patient, hypertensive and smoker, presented with typical chest pain lasting for 12 hours. On admission, his blood pressure was 150/80 mmHg, pulse was regular at 90 beats/min, and he was classified as Killip class I. Muffled S1 and a pansystolic murmur on the apex were noted during cardiac examination. The ECG showed ST-segment elevation at the anterior leads (Tombstone appearance) with ST depression and inverted T-wave in the inferior leads. Laboratory results revealed CK-MB levels of 60, positive cTnI, pre-PCI creatinine of 1.2 mg/dl, post-PCI creatinine of 1.3 mg/dl, and hemoglobin of 12 g%. The diagnosis was acute anterior STEMI. The echocardiogram showed a depressed LVEF of 33% and grade II/IV MR. There were regional wall motion abnormalities (RWMA) in the form of hypokinetic basal, mid, and apical anterior segments, apical cap, and the entire anterior septum, as well as the apical and mid-lateral walls, with a Wall Motion Score Index (WMSI) of 1.6. The patient underwent primary PCI through right femoral access the totally occluded proximal LAD using a 3.5x28 mm DES resulting in TIMI flow grade III. Door to balloon time was 100 minutes and amount of contrast was 250 ml. There was self-limiting hematoma related to

access site and the patient was discharged after 2 days (Fig., 2).

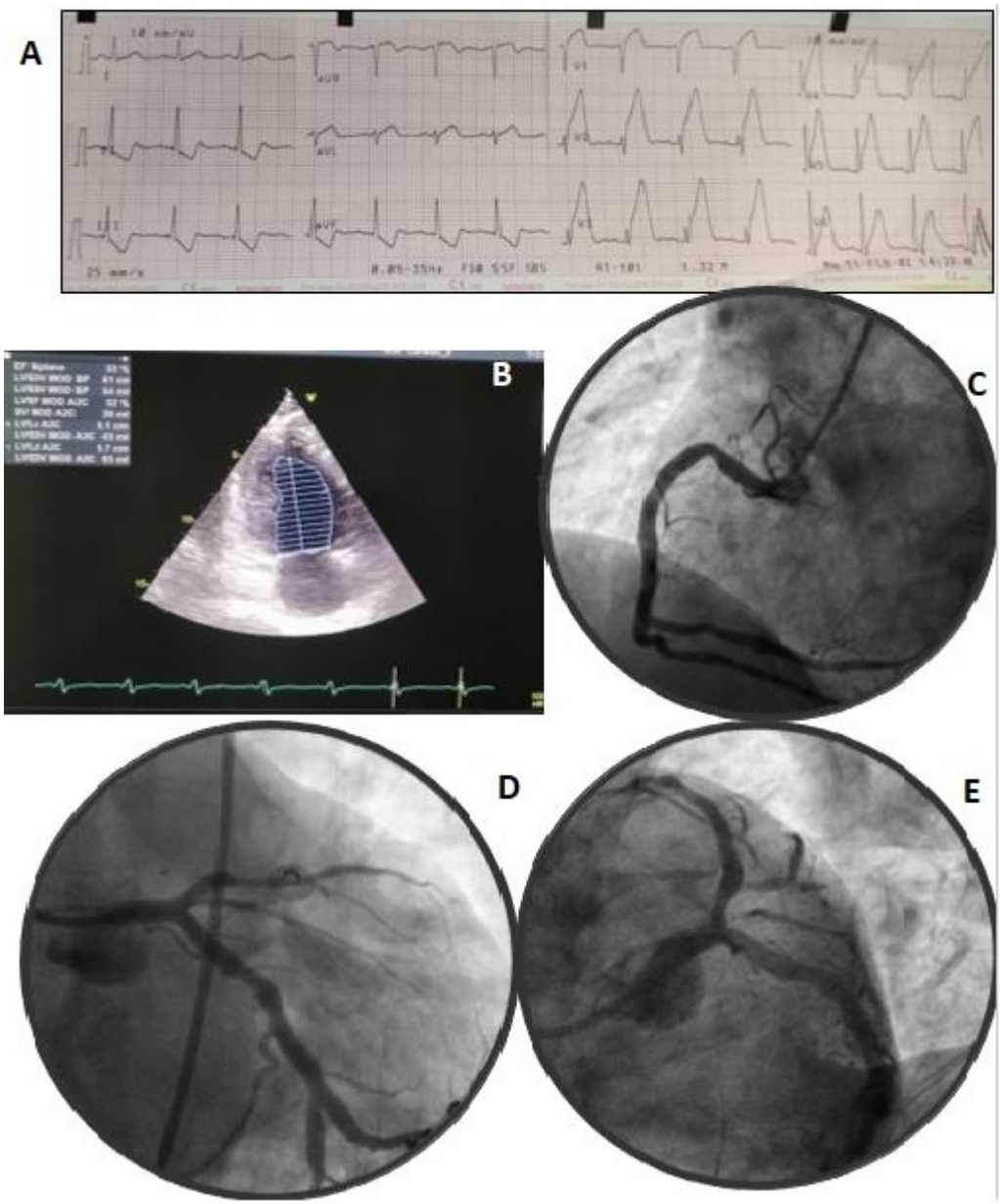

Figure 2: a) ECG of the patient showing anterior STEMI, b) Apical 2-chamber echo view with Simpson's biplane calculation of LVEF, c) LAO cranial view of RCA showing atherosclerotic large artery with no significant lesions, d) PA caudal view showing totally occluded LAD proximally with atherosclerotic ectatic LCX with no significant lesions, e) LAO caudal view of left coronary system post-stenting of LAD.

Discussion

In our study, mean D2BT, mean door to cath lab arrival time and mean cath lab arrival to balloon time were insignificantly different between both groups where mean D2BT was 114 min in TR-PPCI group compared to 107 min in TF-PPCI group with *p*-value 0.186

The mean BMI was significantly higher in TR-PPCI group compared to TF-PPCI group (p = 0.003), which was in agreement with study done by Huded et al (9), with higher body weight in TR-PPCI group (p <0.001).

Regarding complications, two cases in TR-PPCI group developed complications representing (5.7% of all group) "one patient with vessel occlusion and the other developed grade III vessel spasm" while six patients developed complications in TF-PPCI group (representing 17.1%) "two patients developed femoral hematoma, two patients developed mild bleeding, one patient developed self-limited femoral dissection and one patient developed pseudoaneurysm). This was in concordance with meta-analysis comparing both trans-radial and trans-femoral PCI reported by a previous study (10), which showed that radial access is associated with significantly lower rates of bleeding, transfusions, and vascular complications.

Our study was concordant with major observational registry in USA of 546 patients with STEMI treated with PPCI endorsed by Huded et al (9) which found that TR-PPCI can be successfully implemented without compromising D2BT performance concluding that the purposeful transition of low-percentage TR-PPCI hospitals and operators into high-percentage TR-PPCI hospitals and operators can be achieved without sacrificing D2BT gains, offering the potential to improve STEMI outcomes at the population level if widely embraced.

We found that cath lab arrival time to first balloon inflation was 35 min in TR-PPCI group vs 31 min in TF-PPCI group with no significant statistical difference (p = 0.157). Concordantly, in a multicenter Canadian registry (11), they reported that TR-PPCI was associated with a 3-min delay in the time from cath lab arrival to first balloon inflation (30 vs. 27 min, $p < .001$) compared with TF-PPCI among 2,947 patients with STEMI, but the difference in the time from first ECG showing STEMI to balloon inflation was statistically insignificant (91 vs. 88 min, $p = .20$).

In agreement with our study where there was 7 minutes difference in D2BT between TR-PPCI and TF-PPCI groups, in a trial of Trans-Radial Versus Trans-Femoral PCI access site approach in patients with unstable angina or myocardial infarction managed with an invasive strategy (RIVAL), the time from randomization to the start of the PCI procedure was 1 minute longer and the time from randomization to the end of the PCI procedure was 5 minutes longer for the radial group among primary PCI patients (12).

Comparison of procedure time in STEMI patients undergoing emergent PCI with radial versus femoral access has been done in other meta-analysis as

a secondary end point. A meta-analysis (13) of nine CRTs which included 2046 patients concluded that radial approach in STEMI patients took a small longer time (1.5 min) compared to femoral access although this difference was statistically significant.

Our results were in discordance with the results obtained by Bhat et al (14). The authors reported that the access time was more with the transradial approach compared with the transfemoral approach (6.0 ± 1.8 min versus 4.2 ± 0.70 min, the *p* value of < 0.0001). The total procedure time was also more in the transradial approach group compared with the transfemoral approach group (29 ± 11.3 min versus 27.3 ± 12.4 min, the *p* value of 0.03).

Our results were also in discordance with the results obtained by another two studies (15,16), they also showed similar results concerning procedure time and fluoroscopic time.

Our findings are well acknowledged in previous reports where results show that in real-world clinical practice, as in the randomized trials, the overall difference in treatment times between radial and femoral access is small and unlikely to be clinically relevant (17).

Radial center volume was independently associated with the primary end point of death, MI, stroke, or non–coronary artery bypass graft-related major bleeding. These findings suggest that the best outcomes may be achieved when radial access is used at centers that have more experience with radial access (18).

However, among the STEMI patients in RIVAL, radial access was associated with a significantly lower mortality even after adjustment for operator and center experience. It is therefore possible that radial access may improve outcomes even at centers with less radial experience (12).

Conclusion

TR-PPCI can be successfully implemented without compromising D2BT performance with the purposeful transition of low-percentage TR-PPCI hospitals and operators into high-percentage TR-PPCI hospitals and operators can be achieved without sacrificing D2BT gains, offering the potential to improve STEMI outcomes if widely embraced.

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To cite this article: Mostafa R. Zahran, Khaled E. El Rabat, Yasser H. Abd El Rahman, Ashraf A. Abd El Mageed, Amr E. El Nagar. Adoption of Transradial Primary Percutaneous Coronary Intervention for ST Elevation Myocardial Infarction and Its Association with Door-To-Balloon Time. BMFJ XXX, DOI: 10.21608/bmfj.2023.218914.1843