Original Article

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Upper Extremity Dysfunction after Trans-Radial Interventions- Experience from a Tertiary Care Center of North India

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ABSTRACT

Introduction: Coronary artery disease treatment by percutaneous intervention has revolutionised the management of this disease and the choice and safety of vascular access site has significantly contributed to the outcome of the overall procedure.

Aim: To assess upper extremity dysfunction in patients undergoing Transradial Coronary Angiography (CAG) and Percutaneous Coronary Interventions (PCI).

Materials and Methods: This study involved patients planned for transradial coronary intervention. Patients were assessed for development of upper extremity dysfunction and other local complications post procedure at 24 hours, 2 weeks, 1 month and 6 months. Data analysis was done using SPSS Version 21.

Results: A total of 165 patients were enrolled in the study. There were 123 (74.5%) males. Total 156 patients (94.5%) had stable angina as underlying diagnosis, 4 (2.4%) had unstable angina, 2 (1.2%) had Non ST Elevation Myocardial Infarction (NSTEMI), 1 (0.6%) had ST Elevation Myocardial Infarction (STEMI) and 2 (1.2%) required CAG before valve replacement. A 5F sheath was used in 110 (66.67%) and 6F sheath in 55 (33.33%) cases. Tiger catheter was used in all 165 patients initially for diagnostic angiography. Dynamometer testing showed reversible downgrading of hand grip in 49% of patients post-procedure. Local site haematoma was seen in 3 (1.8%) at 24 hours, reversible vascular occlusion in 2 (1.2%) at 24 hours and Thrombolysis in Myocardial Infarction (TIMI) Minor bleed in 1 (0.6%) at 24 hours. No significant correlation was seen between sheath or catheter size with dynamometer testing or local complication.

Conclusion: There was no significant upper extremity dysfunction after trans-radial intervention in the study population.

Keywords: Coronary angiography, Coronary artery disease, Radial artery

INTRODUCTION

The CAG and the angioplasty are the standard procedures for diagnosis and treatment of coronary artery disease. Worldwide, most coronary angiographic procedures are performed via femoral artery with the trend changing lately. With radial artery having the advantage of being an easily compressible site of access, multiple randomised controlled trials have been evaluated radial access with transfemoral access. The radial approach is emerging as the preferred access route for catheterisation and PCI, mainly due to the lower number of access site related complications [1,2].

Transradial-Percutaneous Coronary Intervention (TR-PCI) has been shown to be associated with lower rates of mortality and major access site bleeding compared with the transfemoral approach in patients with acute STEMI [3-5]. The most frequent in-hospital complication of PCI is bleeding and it independently contributes to higher mortality [6,7]. Additionally, TR-PCI facilitates the early mobilisation and discharge of patients significantly reducing the in-hospital stay of these patients [8]. Not with standing the advantages, the complex variability of nerves and blood vessels in the upper limb makes TR-PCI more difficult technically.

This study was the first of its kind in the state, intended to generate data regarding the transradial interventions in the population. The aim was to access upper extremity dysfunction in patients undergoing transradial CAG and PCI.

MATERIALS AND METHODS

This was a prospective observational study, conducted over a period of 2 years from August 2017 to July 2019. This study included 165 patients that reported to the center for diagnostic CAG and PCI. The study protocol was reviewed and cleared by the Institutional Ethics Committee (IEC) and an informed consent was obtained from patients/relatives for utilisation of data for research purposes (Ref no. IEC/SKIMS protocol101/2017)

Inclusion criteria: All consenting patients undergoing CAG with good collateral arterial supply as determined by Allen's test were included in the study

Exclusion criteria: Patient with deranged kidney functions, contrast allergy, absent collaterals as determined by Allen's test and denying consent were excluded from the study.

The patient workup comprised of baseline clinical characteristics and baseline presentation, Body Mass Index (BMI), Diagnosis, Indication for CAG or PCI, CBC, KFT-urea/creatinine/creatinine clearance, Blood sugar fasting, Echocardiography (Left Ventricular Ejection Fraction).

Standard protocol was adopted for performing the radial procedure. Two of the most experienced operators were chosen for doing the procedure to decrease the inter-operator variability of the procedure. Selection regarding the choice of procedure was at the discretion of the operator. Allen's test to assess the patency of dual circulation of hand was performed prior to the radial procedure. Patients undergoing radial intervention were evaluated periodically for upper extremity dysfunction in the form of various complication at baseline, 24 hours, 2 weeks, 1 month and 6 months after the procedure and the data was recorded.

Procedure for Monitoring of Complications and Outcome

The primary clinical outcome was upper extremity dysfunction. Upper extremity dysfunction is defined as loss of strength, sensory loss, loss of coordination and/or loss of active range of motion, ascertained by patient history and/or through physical examination.

Upper extremity ischemia was defined as necrosis, symptomatic embolisation or thrombosis and claudication.

The following tests and measurements were performed in both the arms, the arm used for radial access and other arm at baseline, 24 hours, 2 weeks, 1 month and 6 months:

1. USG Doppler: to assess Radial Artery Occlusion (RAO) or venous anomalies and vascular complications.
2. Various Measurements of hand and forearm to access swelling.
3. Dynamometer Testing For Palmar grip.
4. Nerve Conduction Velocity (NCV).
5. Local Complications

- **Vasospasm:** Non-severe radial artery spasm was defined as operator perceived or radiological confirmed spasm, while severe radial artery spasm was defined as the inability to advance the guide wire and/or the inability to remove the sheath.
- **Haematoma:** Access-site haematoma was defined as non significant/Grade I with swelling in diameter <5 cm or significant/ grade II-V with swelling of ≥ 5 cm in diameter as per Early discharge after trans-radial stenting of coronary arteries study (EASY) grade [9].
- **Vessel occlusion:** it is a condition of complete RAO as evidenced by USG Doppler examination or by angiography during hospital admission (Early) or on follow-up (Late).
- AV Fistula
- Pseudoaneurysm
- **Bleeding:** the access site bleeding was classified into minor (requiring additional compressions) or major bleeding (requiring transfusion and/or hemoglobin drop of ≥5 g/dL) according to TIMI bleeding definition [10].
- **Perforation:** Perforation was confirmed by angiography.
- **Compartment syndrome:** Compartment syndrome, as diagnosed by the operator and requiring treatment
- Sterile Granuloma
- Radial Artery Avulsion
- **Dissection:** As confirmed by angiography.
- Pain by Visual Assessment Score (VAS): Pain was defined as paresthesia and/or a visual analogue score of ≥5 pre-procedure, post-procedure or at follow-up.

Dynamometer scoring: This study used Hand grip dynamometer to assess the motor dysfunction of hand muscles after a radial intervention. The handgrip strength was evaluated according to the Southampton protocol [11].

The hand grip strength was checked multiple times at a minimum of 15 second intervals and the highest result was recorded. The categorisation of hand muscle function has been given in the [Table/Fig-1] below (in kg and lbs). The values given below represented the average of highest score of each hand.

Rating*	Males		Females	
	(lbs)	(kg)	(lbs)	(kg)
Excellent	>141	>64	>84	>38
Very good	123-141	56-64	75-84	34-38
Above average	114-122	52-55	66-74	30-33
Average	105-113	48-51	57-65	26-29
Below average	96-104	44-47	49-56	23-25
Poor	88-95	40-43	44-48	20-22
Very poor	<88	<40	<44	<20

[Table/Fig-1]: Dynamometer test rating.

STATISTICAL ANALYSIS

After data compilation the continuous variables were analysed and interpreted by independent student t-test and the categorical variables were analysed as percentages and interpreted by chi-square test. The p-value ≤0.05 was considered significant. Data analysis of this study was done using SPSS Version 21 for window 10.

RESULTS

Patient characteristics: A total of 165 patients were included in the study. There were 123(74.5%) males and 42(25.5%) females. The mean age of the patients was 57.3±10.49 years. The mean BMI of the patients was 21±0.687. Other demographic data of the study population is given in the [Table/Fig-2].

Characteristics	Parameters	N (%)
Occupation	House workers	71 (43)
	Hand skilled workers	38 (23)
	Shopkeepers	18 (10.9)
	Laborers	9 (5.5)
	Retired employees	8 (4.8)
	Teachers	8 (4.8)
	Businessmen	7 (4.2)
	Office workers	4 (2.4)
	Medical professionals	2 (1.2)
Risk factors	Hypertension	107 (64.8)
	Smoking	91 (55.2)
	Diabetes	75 (45.5)
	Obesity	48 (29.1)
	Dyslipidemia	63 (38.2)
Indication of CAG	Stable angina	156 (94.5)
	Unstable angina	4 (2.4)
	NSTEMI	2 (1.2)
	STEMI	1 (0.6)
	Before valve replacement	2 (1.2)

[Table/Fig-2]: Other Demographics details of the study population. (N=165)

Intervention and hardware used: Initially, diagnostic Tiger catheter was used for all patients undergoing CAG. Later, Tiger catheter was exchanged with EBU, JL or JR catheters as per procedural requirement when PCI was planned. In 48 patients, PCI was done and multiple catheters including Tiger were used. In 117 patients, only Tiger catheter was used. Radial sheath/catheter used and vessel involved has been shown in [Table/Fig-3].

Dynamometer testing: In all patients dynamometer testing was done before procedure and on follow-up as per the protocol. Total 49% showed downgrading of handgrip strength on dynamometer testing post 24 hour, which improved at 2 weeks and returned to baseline (as pre procedure) at 1 month and remained the same till 6 months of follow-up as shown in [Table/Fig-4].

Dynamometer testing results in comparison with sheath size (5F vs 6F) relationship was not statistically significant [Table/Fig-5].

Complications: The most common Post-procedure complication was puncture site haematoma in 1.8% of patients. On radial doppler examination no patient developed AV fistula, pseudoaneurysm, TIMI major bleed, perforation, compartment syndrome, sterile granuloma, vasospasm, radial artery avulsion. The complication seen during the study is shown below [Table/Fig-6].

Majority of patients developed only mild oedema of upper limb at 24 hours of follow-up which significantly improved and none of the patients had any oedema after 1 month of follow-up [Table/Fig-7].

NCV was done in all 165 number of patients out of which 3 patients had abnormal NCV before TR procedure. The abnormality did not worsen after procedure. On clinical examination, Post-procedure there was no increase in neurological deficit. Patients post 24 hour

Parameters		N (%)
Radial sheath introducer	5F	110 (66.6)
	6F	55 (33.3)
Catheter used	Tiger	165 (100)
	JL	3 (1.8)
	JR	9 (5.4)
	AL	1 (0.6)
	AR	2 (1.2)
	EBU	16 (9.6)
	Tiger	117 (70.9)
	Multiple	48 (29.1)
Vessels involved	LMCA	0 (0)
	LAD	18 (10.9)
	LCX	6 (3.6)
	RCA	9 (5.4)
	Normal	115 (69.7)
	LAD&LCX	6 (3.6)
	LAD&RCA	6 (3.6)
	RCA&LCX	1 (0.6)
	LAD,RCA&LCX	4 (2.4)
	Total	165 (100)

[Table/Fig-3]: Radial sheath, catheter used and vessel involved.
JL: Judkins left; JR: Judkins right; Al: Amplatzar left; AR: Amplatzar right; EBU: Extra back up; LMCA: Left main coronary artery; RCA: Right coronary artery; LAD: Left coronary artery; LCX: Left cirfumflex artery

Dynamometer testing	Before procedure	After procedure n (%)			
		24 hours	2 weeks	1 month	6 months
Excellent	1 (0.6)	1 (0.6)	1 (0.6)	1 (0.6)	1 (0.6)
Very good	4 (2.4)	2 (1.2)	4 (2.4)	4 (2.4)	4 (2.4)
Above average	73 (44.2)	42 (25.5)	71 (43)	73 (44.2)	73 (44.2)
Average	83 (50.3)	98 (59.4)	85 (51.5)	83 (50.3)	83 (50.3)
Below average	4 (2.4)	18 (10.9)	4 (2.4)	4 (2.4)	4 (2.4)
Poor	0 (0)	4 (2.4)	0 (0)	0 (0)	0 (0)
Very poor	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

[Table/Fig-4]: Dynamometer testing before and after TR procedure.

NCV abnormality compared to pre procedure was not significant (p-value 0.974) [Table/Fig-8].

Sensory abnormality was found in 3 patients (1.8%) before the TR procedure. One patient developed new sensory abnormality post 24 hours which recovered at 1 month. In 97.6%, there was no sensory abnormality Post-procedure. Patients presented with sensory abnormality pre and Post-procedure are not significant (p-value=1).

Post-procedure pain assessment showed more than half of the patients did not experience any pain and only about 1/3rd had mild discomfort at local site at 24 hours which gradually subsided with no patient reporting any pain after 2 weeks of follow-up [Table/Fig-9].

Statistical relationships: No significant statistical correlation was found between types of catheters used and abnormal NCV post trans-radial procedure [Table/Fig-10].

No significant statistical correlation was found between local complications and PCI post trans-radial procedure [Table/Fig-11].

DISCUSSION

This study was designed to evaluate the outcomes of radial intervention in the study population in terms of upper extremity dysfunction. In this study dynamometer testing showed significant number of patients had down gradation in palmar grip strength post 24 hours (p-value <0.001) but palmar grip improved thereafter. Majority of patients regained their original grip strength at 2 weeks. Two patients regained at one month. All the patients maintained their original grip strength at 6 months. Dynamometer testing in relation to gender and worsening of grip strength had no statistical significance. Maintaining of proper hand grip strength is especially important for patients involved in some kind of skilled hand work. Zwaan E described a prospective multicenter study, in which 191 patients underwent the Dynamometer testing in radial access arm and the other arm at baseline, 24 hours, 2 weeks, 1 month, and 6 months [12]. They described upper extremity dysfunction in intervention arm in 74.9% patients, which was statistically significant compared with non intervention arm (p<0.001).

In their study, Wu SS et al., compared the hand strength of patients at one year after a trans-radial-PCI in 24 patients who had undergone the intervention using 8Fr system (sheath and guiding catheter) and 16 patients underwent coronary procedure using 6Fr system [13]. There was no significant difference between groups, nor when comparing opposite arms. In this study majority of patients 147 (89.1%) developed mild oedema Post-procedure. Only 3 patients developed ≥4 cm oedema that too resolved completely on follow-up. No significant relationship observed when statistically upper limb oedema correlated with sheath size (5F or 6F). The findings of the current study are in agreement with these findings.

Similarly, Tharmaratnam D et al., observed that the use of hydrophilic coated sheath compared to non-hydrophilic coated sheath which was associated with excess of local sterile inflammatory reactions for trans radial procedure [14].

Few studies reported swelling with an incidence of up to 3.5%. It has consistently been found to be a benign symptom [14-16]. The current study is in agreement with the above study conclusions, showing a majority of patients develop only mild oedema at first follow-up which completely resolved by second follow-up at 2 weeks.

The most common Post-procedure local complication was

Time		Dynamometer testing						Total n (%)	p-value
		Excellent n (%)	Very good n (%)	Above average n (%)	Average n (%)	Below average n (%)	Poor n (%)		
Pre	5F	1 (0.9)	3 (2.7)	45 (40.9)	58 (52.7)	3 (2.7)		110 (100.0)	0.742
	6F	0 (0.0)	1 (1.8)	28 (50.9)	25 (45.5)	1 (1.8)		55 (100.0)	
24 hrs	5F	1 (0.9)	2 (1.8)	26 (23.6)	69 (62.7)	11 (10.0)	1 (0.9)	110 (100.0)	0.383
	6F	0 (0.0)	0 (0.0)	17 (30.9)	28 (50.9)	8 (14.5)	2 (3.6)	55 (100.0)	
2 weeks	5F	1 (0.9)	3 (2.7)	44 (40.0)	59 (53.6)	3 (2.7)		110 (100.0)	0.783
	6F	0 (0.0)	1 (1.8)	27 (49.1)	26 (47.3)	1 (1.8)		55 (100.0)	
1 month	5F	1 (0.9)	3 (2.7)	45 (40.9)	58 (52.7)	3 (2.7)		110 (100.0)	0.742
	6F	0 (0.0)	1 (1.8)	28 (50.9)	25 (45.5)	1 (1.8)		55 (100.0)	
6 months	5F	1 (0.9)	3 (2.7)	45 (40.9)	58 (52.7)	3 (2.7)		110 (100.0)	0.742
	6F	0 (0.0)	1 (1.8)	28 (50.9)	25 (45.5)	1 (1.8)		55 (100.0)	

[Table/Fig-5]: Relation of sheath size with Dynamometer testing.
No significant statistical correlation found between gender and Dynamometer strength grading post trans-radial procedure

Local complications	Time after TR procedure			
	24 hours	2 weeks	1 month	6 months
Haematoma	3 (1.8)	0 (0)	0 (0)	0 (0)
Vessel occlusion	2 (1.2)	2 (1.2)	1 (0.6)	0
TIMI minor bleed	1 (0.6)	0 (0)	0 (0)	0 (0)
Dissection	1 (0.6)	1 (0.6)	0 (0)	0 (0)
No complication	158 (95.8)	162 (98.2)	164 (99.4)	165 (100)

[Table/Fig-6]: Local complications of trans-radial procedure in the study.

Upper limb oedema	After TR procedure n (%)			
	24 hours	2 weeks	1 month	6 months
<1 cm	147 (89.1)	1 (0.6)	1 (0.6)	0 (0)
1-1.9 cm	8 (4.8)	0 (0)	0 (0)	0 (0)
2-2.9 cm	2 (1.2)	0 (0)	0 (0)	0 (0)
3-3.9 cm	1 (0.6)	0 (0)	0 (0)	0 (0)
≥4 cm	3 (1.8)	0 (0)	0 (0)	0 (0)
Nil	4 (2.4)	164 (99.4)	164 (99.4)	165 (100)

[Table/Fig-7]: Upper limb oedema after trans-radial intervention.

NCV	Before procedure	After procedure n (%)			
		24 hours	2 weeks	1 month	6 months
Normal	162 (98.2)	161 (97.6)	161 (97.6)	162 (98.2)	162 (98.2)
Abnormal	3 (1.8)	4 (2.4)	4 (2.4)	3 (1.82)	3 (1.82)

[Table/Fig-8]: Nerve Conduction Velocity (NCV) of the study population.

VAS	After TR procedure			
	24 hours	2 weeks	1 month	6 months
0	85 (51.5)	161 (97.6)	165 (100)	165 (100)
1	63 (38.2)	3 (1.8)	0 (0)	0 (0)
2	11 (6.7)	1 (0.6)	0 (0)	0 (0)
3	6 (3.6)	0 (0)	0 (0)	0 (0)

[Table/Fig-9]: Pain assessment by Visual Assessment Score (VAS) after TR procedure in study patients.

Time			n(%)	Abnormal n (%)	Total n (%)	p-value
Pre	Catheters used	Tiger	115 (98.3)	2 (1.7)	117 (100.0)	0.87
		Multiple	47 (97.9)	1 (2.1)	48 (100.0)	
	Total		162 (98.2)	3 (1.8)	165 (100.0)	
24 hrs	Catheters used	Tiger	114 (97.4)	3 (2.6)	117(100.0)	0.86
		Multiple	47 (97.9)	1 (2.1)	48 (100.0)	
	Total		161 (97.6)	4 (2.4)	165 (100.0)	
2 wks	Catheters used	Tiger	114 (97.4)	3 (2.6)	117 (100.0)	0.86
		Multiple	47 (97.9)	1 (2.1)	48 (100.0)	
	Total		161 (97.6)	4 (2.4)	165 (100.0)	
1 month	Catheters used	Tiger	115 (98.3)	2 (1.7)	117 (100.0)	0.87
		Multiple	47 (97.9)	1 (2.1)	48 (100.0)	
	Total		162 (98.2)	3 (1.8)	165 (100.0)	
6 months	Catheters used	Tiger	115 (98.3)	2 (1.7)	117 (100.0)	0.87
		Multiple	47 (95.8)	1 (4.2)	48 (100.0)	
	Total		162 (98.2)	3 (1.8)	165 (100.0)	

[Table/Fig-10]: Catheters used in relation with Nerve Conduction Velocity (NCV) abnormality.

puncture site haematoma in 3 (1.8%) of patients. One patient had undergone PCI with use of multiple catheters. Other 2 patients had only diagnostic CAG with 5F catheter. All of the haematomas got resolved after 24 hours with mild oedema and that too resolved at 2 weeks of follow-up. Multiple article have reported on access-site haematoma, with a pooled incidence of 3.9%. Haematomas ranged from ecchymosis to haematomas requiring surgery [17,18]. Incidence of local haematomas is lower in this study probably due to use of higher French (Fr) size sheaths and catheters in other studies.

Second most common complication found in this study was asymptomatic RAO, which occurred in 2 (1.2%) patients. Radial Doppler examination revealed that 2 patients developed RAO without ischemic symptoms. One patient developed partial recanalisation at 1 month and same flow pattern persisted at 6 months. Second patient also got partial recanalisation at 1 month and normally patent artery and blood flow at 6 months. Stella PR et al., studied incidence and outcome of RAO following transradial artery coronary angioplasty [19]. At follow-up, persistent RAO was found in 16 patients (2.8%). Additionally, incidence of RAO was found to be low and patients with both temporary and persistent RAO were largely without any major clinical symptoms. Thus, in presence of a good collateral circulation RAO can be considered a minor complication.

In 95.8% of patients there was no complications. On radial Doppler examination no patient developed AV fistula, pseudoaneurysm. There was no TIMI major bleed, perforation, compartment syndrome, sterile granuloma or radial artery avulsion.

One patient developed dissection of radial artery with no blood flow compromise. It healed at 2 weeks of follow-up Doppler with no residual haematoma. A dissection incidence of up to 0.7% was shown by the pooled dissection data retrieved from various articles. Anatomical variations, such as a higher bifurcation of the radial artery, are more prone to dissection. One study by Prull MW et al., investigated functional outcome after dissection and reported normal outcome on follow-up [20].

There was no major accesses site bleeding. Only one patient developed TIMI minor bleed; which was not statistically significant.

Patients presenting with local complications post 24 hour of the procedure was not significant (p-value=0.415). Statistically, local complications in relation to 5F versus 6F were not significant. There was no significant statistical correlation between development of local complications with types and number of catheter used. No statistical significance of local complications with gender and BMI was found. Additionally, Local complications in relation with PCI were also not statistically significant.

Markovic S et al., in their study state that standardised radial approach reduces access site complications [21]. In their study, a haematoma of 5 cm or more was seen in two (0.5%) cases and haematoma of <5 cm was observed in 16% (N=59) without any statistical difference in occurrence of other complication like RAO, haematoma or vascular complication in 5F vs 6F sheath using procedures.

In the current study, only one patient developed abnormal NCV post 24 hours and it was radial sensory neuropathy which reverted to normal at one month. This patient also had puncture site haematoma with more than 4 cm oedema post-procedure that resolved after 24 hours. Three patients had abnormal NCV before the procedure likely due to pre-existing carpel tunnel syndrome that did not worsen Post-procedure. NCV abnormality Post-procedure and in relation to sheath size and BMI was not statistically significant. Sensory abnormality was found in 3 patients (1.8%) before the TR procedure which did not worsen Post-procedure. One patient developed new sensory abnormality post 24 hours which recovered at 1 month. In 97.6%, there was no sensory abnormality Post-procedure. Statistically no significant relationship was established between sensory abnormalities or NCV with diagnostic angiography and PCI.

Local complications in relation to BMI could not be established and statistically proven. (p-value=0.25). This study results were contrary to that of Garg N et al., who showed lower BMI is one of the predictors

Time								Total	p-value
				Vessel occlusion	TIMI minor bleed	none	Dissection		
24 h	PCI done	Yes	1 (2.08)	1 (2.1)	1 (2.1)	46 (95.8)	0 (0.0)	48 (100.0)	0.22
		No	2 (1.7)	1 (0.9)	0 (0.0)	112 (95.7)	1 (0.9)	117 (100.0)	
	Total			2 (1.2)	1 (0.6)	158 (95.8)	1 (0.6)	165 (100.0)	
2 wks	PCI done	Yes		1 (2.1)		47 (97.9)	0 (0.0)	48 (100.0)	0.65
		No		1 (0.9)		115 (98.3)	1 (0.9)	117 (100.0)	
	Total			2 (1.2)		162 (98.2)	1 (0.6)	165 (100.0)	
1 month	PCI done	Yes		0 (0.0)		48 (100.0)		48 (100.0)	0.52
		No		1 (0.9)		116 (99.1)		117 (100.0)	
	Total			1 (0.6)		164 (99.4)		165 (100.0)	
6 months	PCI done	Yes				48 (100.0)		48 (100.0)	-----
		No				117 (100.0)		117 (100.0)	
	Total					165 (100.0)		165 (100.0)	

[Table/Fig-11]: Relation between Percutaneous Coronary Interventions (PCI) and local complications.
TIMI: Thrombolysis in Myocardial Infarction

of RAO [22]. This discrepancy needs further investigation; however the different ethnicity of the study population may have a role.

Caputo RP et al., studied total 479 patients, numbness occurred in nine (1.8%) following the transradial procedure [23]. The NCS was performed for eight out of the nine patients, four (50%) of which had an abnormal NCS result at the superficial radial nerve as a transient injury to this nerve can lead to numbness. Further their study concludes that the use of 7 French sheath was independently associated with development of numbness.

All 165 patients in this study had muscle power of grade 5 when measured before TR procedure. One patient developed worsening of power from grade 5 to grade 4 which recovered to normal at 2 weeks of follow-up. This patient also had haematoma and limb oedema Post-procedure. Patients post 24 hour muscle strength worsening compared to pre-procedure is not significant (p-value=1). Even statistically muscle strength of the patients in relation to 5F versus 6F is not significant. No significant drop in muscle motor power was observed post 24 hours. This parameter has not been studied in previous studies.

In all 165 patients, pain assessment was done by VAS after the TR procedure. Majority of patients did not report any pain at 24 hours and only a small number of patients had mild local discomfort which also subsided completely by one month of follow-up. Severe pain (VAS ≥ 5) was reported in various studies and had a pooled incidence of up to 9.6% [12,13]. Pain, especially when chronic, affects all functional parameters and can be very debilitating. In the current study there was no significant pain at 24 hour and thereafter.

Radial intervention in this study was associated with overall lower discomfort and early ambulation resulting early discharge from the hospital. This significantly reduced the healthcare burden and reduces the Disability Adjusted Life Years (DALY) in patients.

Limitation(s)

The study group included mainly the stable coronary artery disease patients. This is because the study protocol includes having radial artery doppler and NCV testing done before the intervention, which are time consuming procedure and can result in delay in institution of required urgent treatment in unstable coronary disease like acute coronary syndrome.

CONCLUSION(S)

This study augmented the fact that Trans-radial approach is safe with very low rate of access site complications, early ambulation, shorter duration of hospital stay, more patient comfort and convenience and no significant upper limb dysfunction even in hand skilled workers.

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