

REVIEW ARTICLE

A Scoping Review of The Percutaneous Coronary Intervention: Practice Transformation for the Operational Access

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Abstract

Background: *The transfemoral approach is the commonest and most widely practiced access for Percutaneous coronary intervention (PCI). However, the less invasive operational access for PCI is growing substantially and gaining popularity over the conventional practice. Although, there is little known about the true benefits regarding access for the PCI in adult Bangladeshi patients requiring coronary revascularization. This systematic review was aimed to compile literature evidence for the alternative PCI access when compared with standard transfemoral practice in our country.*

Method: *A scoping review according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines was conducted. As there is a scarcity of published literature comparing transfemoral vs alternative PCI routes, this scoping review was not aimed to produce a critical appraisal rather an overview and map of synthesized evidence based on the available literature.*

Results: *498 articles were accessed from PubMed, BanglaJOL, and Web of Science databases. A total of seven articles were included for final analysis, comprising 1212 patients undergoing PCI at the different tertiary hospitals across the country. Among the included patients 834 PCI were performed via transfemoral access, 330 via transradial access, and 48 procedures were done via transulnar access.*

Conclusion: *Alternative access for PCI is gaining popularity in adult Bangladeshi patients requiring coronary revascularization. It's a rational approach for the selective population in coronary revascularization strategy.*

Keywords: *Angioplasty; Balloon; Coronary; Percutaneous; Intervention; Systematic review*

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Introduction:

Percutaneous coronary intervention (PCI), previously known as angioplasty or stenting, is an intervention to the coronary arteries that is done by using a thin, flexible catheter into the coronary arteries, which has been stenosed due to atherosclerotic plaque formation. Access to the bloodstream is achieved either in the groin (via the femoral artery) or in the arm (via the radial or ulnar artery).¹⁻⁵ Real-time X-ray fluoroscopy is used to visualize the location of the catheter and tissues then the catheter is advanced to ascending aorta and the preferred coronary artery, IV contrast is introduced in the coronary artery to delineate the anatomy and intervene the lesion. Transfemoral access (TFA) is the commonest and conventional practice for the PCI, has its pros and cons.⁴⁻⁹ However, patients' mobility, puncture site bleeding are the

most important concerns for TFA, which led to the search for alternative access like transradial access (TRA) and transulnar access (TUA).

Additionally, as a recommended best practice for fluoroscopic and ultrasound guidance, most operators use palpation alone. Inconsistency of the Femoral angiography method, despite guideline recommendations, is also a potential cause leading to an increased rate of complication.¹⁰⁻¹² In alignment, there is significant popularity of the alternative access for approaches that are used as a diagnostic and therapeutic purpose in catheterization, which has been overserved in recent years.¹³ For example, the Bi-radial approach for complex Chronic Total Occlusion (CTO) lesion, the Distal radial approach for treating a left main lesion, Axillary access, brachial access, and least the ulnar access has been

reported in the published literature.¹⁴⁻¹⁸ However, there was increasing concern about the procedural completeness, addressing the left-main disease, usefulness in primary PCI by using the alternative access for PCI.¹⁹⁻²¹

PCI is a known procedure and well practices via both the traditional and alternative approaches in Bangladesh.²²⁻²⁶ The reported procedural technique and clinical outcomes have been reflected the potential risk-benefit profile of the percutaneous coronary intervention scenario. However, a head-to-head comparative study evaluating similar parameters in our population is limited. Additionally, the reports from multiple institutes in Bangladesh also showed good periprocedural outcomes, despite a true comparison being made. A systematic evidence synthesis, comprising the potential outcome and risk-benefit profile has never been published. Hence, in our study, we opted to compile the summative evidence, comprising the TFA with alternative approaches from the published literature.

Methods

Search Strategy:

Database search has been conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) standard.²⁷ We conducted electronic searches on Medline (via PubMed), and Web of Science from the date of inception to 9th February 2022. On the PubMed database, a repetitive and exhaustive combination of the following ‘Medical Subject Headings’ (MeSH) search terms were used: “Angioplasty”[MeSH Terms] OR “angioplasty, balloon, laser assisted”[MeSH Terms] OR “angioplasty, laser”[MeSH Terms] OR “angioplasty, balloon, coronary”[MeSH Terms] OR “angioplasty, balloon”[MeSH Terms]) AND “Bangladesh”[MeSH Terms].

Additionally, we searched on The Ubiquity Partner Network (UPN) via Bangladesh Journal Online (BanglaJOL)²⁸ was also performed using the following search terms: “Coronary”, “Angioplasty”, “Percutaneous coronary intervention” and other Mesh terms were repeated as mentioned above. An alternative search we conducted for scholarly articles in Google Scholar was performed to authenticate the primary search.

Inclusion criteria and exclusion criteria:

Clinical trials, prospective observational, interventional studies, retrospective cohort studies, case-control studies, cross-sectional studies, and randomized controlled trials that reported clinical outcomes of PCI for coronary revascularization were included. Experimental studies, survey results, small case series, case reports, preclinical studies, and reports not written in English were excluded.

Study selection:

Authors screened and assessed the studies independently for inclusion. The published articles were first screened by their titles and abstracts, where the criteria used were purposely broad to include all relevant studies. The full-text review was performed on articles if the reviewer was unable to confirm the relevance of the study for inclusion. Two authors independently abstracted the details of the study population, including study characteristics.

Quality of evidence (QoE):

All the included studies were clinical- observational studies with the majority reporting the TFA and alternative access for PCI. As illustrated in chapter 11 of the Cochrane handbook of reviews,²⁹ GradePro was used to evaluate the quality of evidence in the included studies (Table-1). As recommended in chapter 25 (section 25.3) of the online Cochrane Handbook version 5.1,³⁰ the software ROBINS-I tool³¹ (Risk of Bias in Non-randomized Studies-of Interventions) was utilized to assess the risk of bias for non-randomized studies.

Included studies were assessed for the following characteristics: study design (retrospective or prospective), randomization of the study subjects (random allocation applied or not), single-center vs. multi-center participant enrolment (yes or no), characteristics of study participants (selection bias), outcome assessment of the PCI procedure (detection bias), incomplete outcome data addressed (attrition bias) and consideration of multivariate adjustment(s) for possible confounders.

Agreement between the two reviewers was assessed using kappa statistics for full-text screening and rating each review of the full-text for identifying the risk of bias. In the event of disagreement concerning the risk of bias, a third reviewer (the first author) checked the data and determined the final decision on the differing (controversial) opinions.

Results:

The systematic search has extracted a total of 495 potential articles were identified from all databases (Figure 1). 7 studies that included 1212 patients (inclusive of a total number of patients 834 from TRA, 330 for TRA, and 48 from TUA) were selected following pre-determined inclusion criteria for further analysis.

Quantity of evidence:

The initial systematic search using our search strategy revealed a total of 495 published papers. An extensive search on The Ubiquity Partner Network (UPN) via Bangladesh Journal Online (BanglaJOL)²⁸ for published papers from Bangladesh revealed a total of 450 articles. After duplicates were excluded using-

Endnote X20 reference management software, 41 manuscripts were excluded, and 454 articles remained for further review.

Based on the screening of titles and abstracts, irrelevant studies that did not satisfy our inclusion criteria were excluded (n=418), leaving 36 articles for full-text review. Following the full-text assessment of these articles, studies that are either of the following- presentation abstract, title not found, and editorial (N=3) were excluded, leaving 26 papers for eligibility assessment for the present study. On further review of the eligible articles, 19 other records were excluded on full-text review for the mentioned reasons, namely, No comparison group, single-arm study, Interest variables are

not aligned, Assessing gender difference, Assessing Primary PCI outcome, Assessing QTC dispersion on ECG, Assessing TIMI risk score, Octogenarians, and grouping based on age, Review of the procedure or Subsequent experiment on the same study group. The PRISMA statement flow diagram shown in Figure 1 highlights the aforementioned screening process. The search was tailored to the final inclusion of seven³²⁻³⁸ studies for the complete assessment and analysis into this systematic review scope.

Risk of Bias (RoB)

The risk of bias for each individual study³²⁻³⁸ was mostly serious to critical (Table-1) as per the quality of evidence

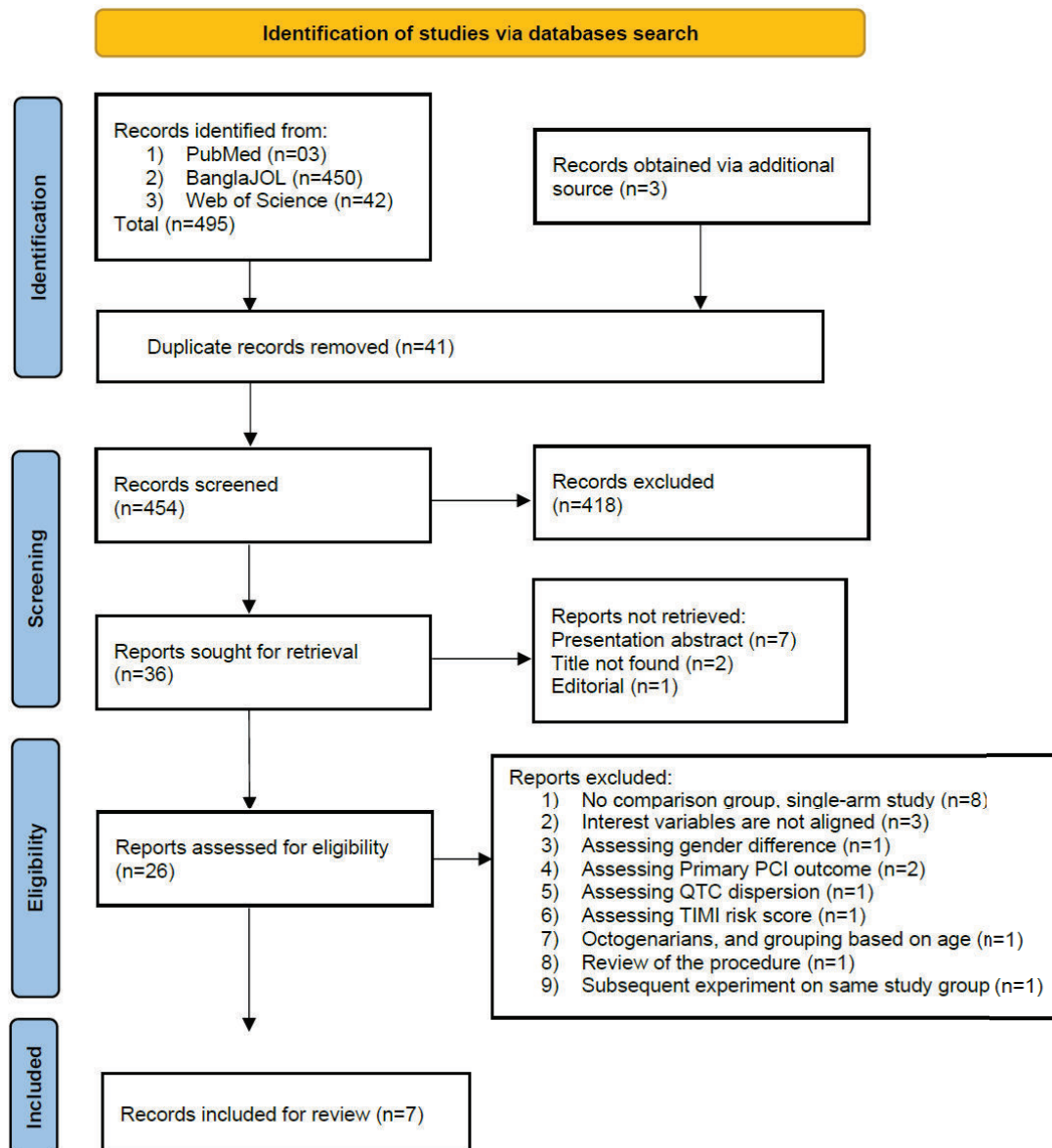


Fig.-1: PRISMA flow diagram showing the method of extraction of the manuscripts. From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71

synthesis by using GradePro.³¹ We believe that the retrospective and non-randomized nature of the included studies is responsible for these results. Since most of the studies used in this systematic review were observational studies, it has contributed to significant confounding and selection bias.

The scientific journals reported that the operators' choice to proceed with the preferred route of intervention (i.e. TFA, or TRA) was heavily influenced by institutional practice and the expertise of the individual cardiologist, which would somewhat explain the bias present in the studies. Moreover, a number of the included studies had missing data for the other groups of interest, further contributing to the overall bias.

Quality of evidence

From the quality of evidence analysis of the included studies, we determined that seven observational studies looking at the clinical endpoint has moderate certainty with critical importance (Table-1).

For the two prospective observational studies looking at the Vascular complication, there was a low level of certainty and serious imprecision but important for inclusion in the current evidence synthesis. Three of the included observation studies were analyzing the Vasospasm of the radial artery had a moderate level of certainty and were critical for inclusion. Additionally, studies that evaluated bleeding complications were also a moderate level of certainty and critical for inclusion. One of the researchers was looking into Vascular access failure, and the article was assessed as having a moderate level of certainty and critical for inclusion.

These included studies,³²⁻³⁸ there was a high risk of bias in confounding factors due to the absence of randomization. Additionally, the bias in the selection of patients was observed in retrospective studies³⁶ which is typical of studies that are retrospective in nature. The included cross-sectional^{33,34,38} studies were also devoid of all comparative groups and thus had low significance to our study due to their small sample sizes. We determined that the evidence provided by these studies (and the included studies overall) was still of an acceptable quality (Table 1).

Of the 7 included studies³²⁻³⁸, 1 was a non-randomized clinical trial, 1 was retrospective cohort studies, 1 was a randomized interventional trial, 2 were cross-sectional studies and 2 were prospective observational studies (Table 2). All studies were single-center studies (Table 2).

Demographics characteristics: The reports age groups were very young in most of the included studies, as appeared, The mean age was found 50.18±9.35years in Group I and 49.94±8.17 years in Group II³² [32]; 58.2±9.9 in males and 53.6±8.9 in females³³; 49±50 in case group and 50±70 in the control group³⁴, 50.3±11.4 years³⁵; 60.7±8.9 in radial group and 60.3±8.2 in the femoral group³⁶; 55.04±10.49 in group 1 and 52.40±10 in group 2³⁷; 53.49±9.9 in the bivalirudin and 52.99±8.9 in the heparin group.

As reported by Kawsar et al Smoking was found in 60 (66.7%) in group I and 57 (63.3%) patients in group II). Hypertension was found 55 (66.1%) and 56 (62.2%) in group I and group II respectively. Diabetes mellitus was found 27 (30%) and 30 (33.3%) in group I and group II respectively. Dyslipidemia was found 62 (68.9%) in group I and 58 (64.4%) in group II. Family history of CAD had found 28 (31.1%) and 25 (27.8%) in group I and group II respectively. The mean pulse rate was found 78.3±5.6/min in group I and 80.6±7.8/min in group II. The mean systolic blood pressure was 126.6±16.6 mmHg in group I and 129.3±16.6 mmHg in group II. The mean diastolic blood pressure was 79.0±8.8 mmHg in group I and 79.5±9.2 mmHg in group II. All baseline characteristics were statistically insignificant in both groups³². As reported by Islam et al, among the studied population 36(75%) were Dyslipidemia, 35(73%) were hypertensive; 34(70.1%) patients were Diabetic, FH 11(23%), and 12(25%) were all male smoker³³. Afroz et al analyzed and compared the common risk factors for coronary artery diseases between two groups. Smoking was found 13 (32.5%) in group I and 9 (22.5%) patients in group II and statistically insignificant (p=0.31). Hypertension was found 15 (37.5%) and 20 (50%) in group I and group II respectively. The association was statistically insignificant (p=0.26). Diabetes mellitus was found 18 (45%) and 22 (55%) in group I and group II respectively with statistically insignificant (p=0.37) association³⁵. In the study by Khan et al, there were no significant differences with regard to age, gender, prior MI, prior PCI, and diabetes between TRA and TFA³⁶. The baseline characteristics and angiographic characteristics were well-balanced between the two groups in the study of Iqbal et al and Mostafa et al^{34,38}.

Additionally, Kawsar et al reported patients with chronic stable angina were 41 (45.6%) and 38 (42.2%), NSTEMI were 12 (13.3%) and 10 (11.1%) and STEMI were 37 (41.1%) and 42 (46.7%) in the group I and group II respectively³². Islam et al reported the angiographic

Table-I
Quality of evidence synthesis by using GradePro

№ of studies	Study design	Certainty assessment				№ of patients		Effect		Certainty	Importance
		Inconsistency	Indirectness	Imprecision	Other considerations	PCI via TFA	Alternative access	Relative (95% CI)	Absolute (95% CI)		
Clinical endpoint											
7	observational studies	not serious	serious ^a	not serious	none	825/834 (98.9%)	365/378 (96.6%)	not estimable		⊕⊕○ Moderate	CRITICAL
Vascular complication											
2	observational studies	not serious	serious ^a	serious ^a	none	27/130 (20.8%)	9/130 (6.9%)	not estimable		⊕⊕○ Low	IMPORTANT
Vasospasm of radial artery											
3	observational studies	not serious	serious ^a	not serious	none	43/210 (20.5%)	16/210 (7.6%)	not estimable		⊕⊕○ Moderate	CRITICAL
Bleeding											
4	observational studies	not serious	serious ^a	not serious	none	45/778 (5.8%)	12/378 (3.2%)	not estimable		⊕⊕○ Moderate	CRITICAL
Vascular access failure											
1	observational studies	not serious	serious ^a	not serious	none	0/45 (0.0%)	13/45 (28.9%)	not estimable		⊕⊕○ Moderate	CRITICAL

CI: confidence interval
 Explanations: a. observational study

Table-II
Characteristics of the included studies

SN	Title	Author	Journal/Year	Study Design	Patients	TFA	TRA	TUA	Place of Study
1	Comparison of Vascular Complications in Patients with Percutaneous Coronary Intervention by Trans-radial and Trans-femoral Approach	Kawsar et al ³²	Bangladesh Heart Journal/2017	Observational comparative study	180	90	90	-	National Institute of Cardiovascular Diseases
2	Safety and Efficacy of Trans-Ulnar Coronary Intervention	Islam et al ³³	Cardiovascular Journal/2018	Preliminary Clinical trial	48	-	-	48	Department of Cardiology, Apollo Hospitals, Dhaka
3	Effectiveness of Ranolazine to Prevent Myocardial Injury During Elective Percutaneous Coronary Intervention	Iqbal et al ³⁴	Anwer Khan Modern Medical College Journal/2019	Prospective interventional study	110	110	-	-	Bangabandhu Sheikh Mujib Medical University
4	Comparison of In-Hospital Outcomes of ST Elevation Myocardial Infarction in Patients Undergoing Transradial and Transfemoral Primary Percutaneous Coronary Intervention	Afroz et al ³⁵	Cardiovascular Journal/2019	Prospective observational study	80	40	40	-	National Institute of Cardiovascular Diseases
5	Comparison of Left Radial Versus Femoral Approaches for Coronary Procedures in Patients with Previous Coronary Artery Bypass Grafts	Khan et al ³⁶	Anwer Khan Modern Medical College Journal/2019	Retrospective analysis	380	225	155	-	Ibrahim Cardiac Hospital & Research Institute
6	Safety and Efficacy of Trans-Radial Percutaneous Coronary Intervention – Experience in a Tertiary Level Hospital of Bangladesh	Shimu et al ³⁷	Cardiovascular Journal/2020	Prospective observational study	90	45	45	-	National Institute of Cardiovascular Diseases
7	Comparison of anti-thrombotic strategies using Bivalirudin, Heparin plus Eptifibatid, and Unfractionated Heparin Monotherapy for acute coronary syndrome (ACS) patients undergoing percutaneous coronary intervention (PCI): A single-center observational study	Mostofa et al ³⁸	University Heart Journal/2021	Prospective observational study	324	324	-	-	Bangabandhu Sheikh Mujib Medical University
Total					1212	834	330	48	

TFA: Transfemoral access;

TRA: Transradial access;

TUA: Transulnar access

diagnosis of TVD 8(16.6%), DVD 6(25%), SVD 17 (35.4%), Normal Coronaries 8(16.6%), ISR or patent stent 5(10.4%), and severe Calcified disease 4(12%).³³

Primary Outcomes: The composite outcome among the included studies were the bleeding time, procedural time, fluoroscopy time, ambulation time, and overall adverse outcome. In their study, Kawsar et al found a mean bleeding time of 3.42 ± 0.33 min in group I and 3.56 ± 0.30 min in group II. The mean clotting time was 6.48 ± 0.6 min and 6.78 ± 0.5 min in group I and group II (not significant). The mean procedural time was 37.44 ± 5.13 min in group I and 34.14 ± 4.52 min in group II with statistically significant differences ($p=0.004$). The mean fluoroscopy time was 21.62 ± 4.11 min and 17.55 ± 2.78 min in group I and group II respectively with statistically significant differences ($p=0.02$). The mean hemostasis time was 7.58 ± 1.11 min and 15.59 ± 3.33 min in group I and group II respectively with statistically significant differences ($p=0.005$). The ambulation time was 0.00 ± 0.00 hours in group I and 15.84 ± 4.89 hour in group II with statistically significant differences ($p<0.001$). Among the total procedural complications, the number of patients who noticed arterial spasms following puncture was 6 (6.7%) in group I and none in group II with the statistically significant difference ($p=0.01$).³²

Islam et al reported the Fluoroscopic time in males 111.8 ± 31.1 min and in females 123.8 ± 23.9 min. Their Fluro dose was 386 ± 184.4 ml and 397.8 ± 114.1 in the respective groups.³³ Iqbal et al reported no significant adverse effect of the drug used in their study. There were no in-hospital and 30-day Major Adverse Cardiac Events (cardiac death, spontaneous MI, target vessel revascularization, and stroke) in any of the groups³⁴. Afroz et al showed that bleeding occurred 1 (2.5%) in Group I and 6 (15%) in Group II patients, Vascular complications occurred in 1 (2.5%) and 5 (12.5%) patients Group I and Group II respectively. No death was observed in Group I and 3 (7.5%) patients died in group II. So the bleeding and vascular complications were significantly occurred in Group II than in Group I with a statistically significant ($p<0.05$) association. The occurrence of other adverse outcomes was not varied statistically significantly ($p>0.05$). Out of 40 patients, 37.5% of patients in group II experienced overall adverse outcomes, on the contrary, 15% of the patients in group I did have such experience. So, the overall outcome was less in group I than group II which is statistically significant ($p<0.05$).³⁵

Khan et al found, compared to femoral access, diagnostic CAG required relatively lower contrast volume though

statistically not significant via radial access (70 ± 34 vs. 72 ± 40 ml, $p=0.267$). Procedure time (25.2 ± 10.7 vs. 26.9 ± 6.8 min, $p=0.735$), fluoroscopy time (10.7 ± 5.5 vs. 9.5 ± 4.7 min, $p=0.424$) were almost similar in both access for CAG [36]. They reported adhoc PCI was more frequent in the radial group ($n=54$ out of 155, 34.8%) than in the femoral group ($n=44$ out of 225, 19.6%) with $p=0.01$. The stent was deployed in more than 90% of both groups. The mean diameter of the stents was larger in the TFA group, but no significant difference was detected with regard to the mean number and total length of stents for each patient. Contrast volume in between two groups was pretty similar with $p=0.226$. The incidence of other secondary endpoints was also not statistically significant. TRA was associated with a lower rate of vascular complications and access site-related bleeding. Major complications were limited to 2 cases of acute renal failure and 1 cerebrovascular event in the TFA group, and 1 case of acute renal failure in the TRA group ($p=NS$). Three failed cases of TRA necessitated crossover to TFA: One was due to the spasm of the radial artery; two were due to the tortuosities of the upper arms. There were no crossovers from TFA to TRA.³⁶

Similarly, Shimu et al found most of the patients of both groups had involvement of left anterior descending artery (45% vs. 48.08%, respectively), right coronary artery (30% vs. 25%, respectively), and left circumflex artery (23.3% vs. 21.15%, respectively) as affected vessels³⁷. The overall complications were commoner in group 1 than in group 2 (35.6% vs. 22.2%, respectively), however, the differences were not statistically significant ($p = 0.097$). Regarding changes of vascular access, radial-to-femoral was needed in 26.67% of group 1, but femoral-to-radial access was done for only 1 (2.22%) of the study subjects. Hematoma (4.44% in each group) and ecchymosis (2.22% in group 2, none in group 1) were the major puncture-related complications in both groups. Regarding post-procedural complications, bleeding (8.89% and 4.44% in group 1 and group 2 respectively) and arrhythmia (2.22% in group 2, none in group 1) were the common post-procedural complications in both groups but the bleeding was more frequently seen in group 1 than in group 2.³⁷

Mostafa et al found lesion characteristics, the groups were almost homogeneous with Type-A lesion being higher in either group. LAD followed by RCA PCI was common in each group. Distribution of the number of treated lesions per patient, number of stents per patient, stent length, and width were similar among the study group ($p>0.05$). In their study, the patients of the Bivalirudin group, as compared to the UFH group, had a significantly lower

incidence of Q-wave MI (0% vs. 6 %; p=0.03) and major bleeding (0% vs. 7%; p=0.007). The incidence of major bleeding was also significantly lower in the Bivalirudin group, as compared to the Heparin plus Eptifibatide group (0% vs.6 %; p=0.03).³⁸

Secondary Outcomes: As per Kawsar et al in group I, 0 (0.0%) and 4 (4.4%) in group II had major hematoma with

statistically significant differences (p= 0.04). There were 5 (5.7%) and 13 (14.4%) minor hematoma in group I and group II with statistically significant differences (p=0.04)³². The secondary outcomes of the included studies have been summarized in Table-3.

The outcomes include major hematoma, ecchymosis, catheter non-engagement, Artery-venous fistula, etc. A

Table-III
Analysis of primary and secondary outcomes

Interest Variable	Study	TFA	TRA	TUA	p-value
Procedural time (min)	Kawsar et al ³²	34.14±4.52	37.44±5.13	-	0.004 ^s
	Khan et al ³⁶	26.9±6.8	25.2±10.7	-	0.735
Fluoroscopy time (min)	Kawsar et al ³²	17.55±2.78	21.62±4.11	-	0.02 ^s
	Islam et al ³³	-	-	M: 111.8±31.1 F: 123.8±23.9	
Hemostasis time (min)	Khan et al ³⁶	9.5±4.7	10.7±5.5	-	0.424
	Kawsar et al ³²	15.59±3.33	7.58±1.11	-	0.005 ^s
Ambulation time (hr)	Kawsar et al ³²	15.84±4.89	0.00±0.00	-	<0.001 ^s
Arterial spasm following puncture (%)	Kawsar et al ³²	0	6.7	-	0.01 ^s
	Khan et al ³⁶	0	0.65	-	-
Access site bleeding (%)	Kawsar et al ³²	8.9	2.2	-	0.04 ^s
	Afroz et al ³⁵	15	2.5	-	0.04 ^s
	Shimu et al ³⁷	8.89	4.44	-	0.39 ^{ns}
	Mostofa et al ³⁸	4.01	-	-	-
Catheter non-engagement (%)	Kawsar et al ³²	0	3.3	-	0.08 ^{ns}
Major hematoma (%)	Kawsar et al ³²	4.4	0	-	0.04 ^s
	Shimu et al ³⁷	4.44%	4.44%	-	1.0 ^{ns}
Minor hematoma (%)	Kawsar et al ³²	14.4	5.7	-	0.04 ^s
	Mostofa et al ³⁸	2.78	-	-	-
Ecchymosis (%)	Kawsar et al ³²	13.3	4.4	-	0.03 ^s
	Shimu et al ³⁷	0	2.2	-	0.16 ^{ns}
Vessel occlusion / complication (%)	Kawsar et al ³²	0	5.7	-	0.02 ^s
	Afroz et al ³⁵	12.5	2.5	-	0.04 ^s
	Shimu et al ³⁷	0	0	-	-
	Mostofa et al ³⁸	3	-	-	-
Artery-venous fistula	Kawsar et al ³²	0	0	-	-
	Shimu et al ³⁷	0	0	-	-
Limb ischemia	Kawsar et al ³²	0	0	-	-
	Shimu et al ³⁷	0	0	-	-
Duration of hospital stay (days)	Kawsar et al ³²	2.54±0.62	1.64±0.42	-	0.01 ^s
	Afroz et al ³⁵	6.3±2.9	4.4±2.2	-	<0.001 ^s
Adverse in-hospital outcome (%)	Afroz et al ³⁵	37.5	15.0	-	0.02 ^s
S/P CABG patients (%)	Khan et al ³⁶	59.21	40.79	-	-
Pseudoaneurysm (%)	Shimu et al ³⁷	0	0	-	-
Stent thrombosis (%)	Shimu et al ³⁷	2.22	6.67	-	0.31 ^{ns}
	Mostofa et al ³⁸	0.31	-	-	-
Peri-procedural MI (%)	Iqbal et al ³⁴	Gr-1: 1.8%Gr-2: 5.45%	-	-	P=0.0002 ^s
	Afroz et al ³⁵	2.5	0	-	-
	Mostofa et al ³⁸	2.47	-	-	-
Death (%)	Afroz et al ³⁵	7.5	0	-	0.07 ^{ns}
	Shimu et al ³⁷	2.22	0	-	0.16 ^{ns}
	Mostofa et al ³⁸	1.85	-	-	-

s=significant, ns=non-significant, Gr=Group

head-to-head comparison was not made in the study reported by Islam et al.³³ and Mostafa et al.³⁸ However, the majority of the included studies described the incidence of procedure-related and post-procedural complication rates.

Discussion:

The present systematic review of the published literature summarized the evidence of the current practice of PCI in the Bangladeshi population with the emphasis on practice transformation for the producers' access and synthesis of the related primary and secondary outcomes. The published evidence suggests that there is a transformation of PCI access from traditional femoral to the radial route in a selective population that required coronary revascularization.

Transradial approach PCI has been increasingly used since its first successful application in 1997 not only because of the easier puncturing and hemostasis but also for the better survival rate in certain patients.³⁹⁻⁴² However, there is a scarcity of publications on the practice of PCI via TRA in the Bangladeshi population.

Our study showed a non-exhaustive search report of the practice via TRA, as such, with the procedural and periprocedural outcomes. Additionally, one report of using ulnar access (TUA) also showed the use of another possible PCI-access. The preliminary study in a local center reported the use of ulnar artery approach site for the invasive and interventional procedure. The authors performed a transulnar procedure when they failed to cannulate radial artery due to difficult or anomalous radial courses or access through transradial artery was very difficult due to significant radial artery abnormalities, severe loops and curvatures, tortuous course, hypoplastic artery, after failed puncture and repeated uses of the radial artery. The authors suggested the use of TUA because, even among dedicated radialist, the crossover rate can reach more than 2%. Radial artery occlusion may occur in 5% of patients at hospital discharge, preventing its reuse in future procedures.⁴³ However, the procedure time for TUA was considerably longer compared to TRA and TFA.

The composite comparison of traditional TFA and TFA showed multiple significant periprocedural and clinical outcomes, namely, bleeding, hematoma, hemostasis time, ambulation time, etc. Kawsar et al found no-time ambulation for the TFA patient group suggesting a stronger potential of the use of the access. However, the different populations also showed such potential benefits in similar comparative studies^{44,45}. Hence, it's a justified statement

that when a study was conducted to evaluate the vascular complications of trans-radial percutaneous coronary intervention compared to the transfemoral percutaneous coronary intervention in CAD patients, can suggest TRA is safe in respect of procedural and post-procedural vascular complications.

However, the quality-of-life measures were not quantitatively and qualitatively evaluated in any of the studies, likewise measured by other studies.⁴⁶ But indirect evidence also suggests a TRA procedure leads to improved quality of life after the procedure and thus gives much comfort to the patient.³²

The use of TRA in the post-CABG group was an interesting analysis and provides a wide spectrum use of TRA for coronary revascularization. Patients with a history of CABG usually have severe coronary lesions and are at high risk of cardiovascular events. However, the report was inconclusive for inclusion criteria of post-CABG patients. Additionally, the overall procedure rate seems higher, as the total number of surgical revascularization patients from the author's institute in the reported publication does not match the ratio.⁴⁷⁻⁴⁸ Despite the fact that the proportion of patients presenting with the acute coronary syndrome and previous CABG surgery is approximately 13% internationally.⁴⁹ This number will continue to increase and patients with coronary grafts will continue to make up a significant proportion of patients undergoing acute or elective coronary angiography.⁵⁰

The present review poses some inevitable limitations. Firstly, although the practice of using alternative access for PCI, there is a scarcity of the number of publications. The number of study patients included in each study is also comparatively small and in the most instance are non-randomized. Secondly, a head-to-head comparison involving a larger population was never reported. Lastly, the outcome parameters were not uniform across the included studies. We suggest a multicenter clinical trial with focused peri-procedural, clinical, and quality of life outcomes comparison may add significant value to the current practice.

Conclusion:

This systematic evidence showed that alternative access for PCI is gaining popularity in adult Bangladeshi patients requiring coronary revascularization. In addition to conventional transfemoral, transradial, transulnar approach is being used by some of the interventional cardiologists. It's a rational approach for the selective population in coronary revascularization strategy.

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The authors declare that there is no conflict of interest.

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