ORIGINAL RESEARCH

Submitted: 28.10.2020; Accepted: 25.11.2020; Published online: 21.05.2021

Left distal radial artery approach versus conventional radial artery for coronary angiography

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Abstract

We aimed to evaluate feasibility, contrast utilization and complications of trans-radial approach comparing the left distal trans-radial artery (lt. dTRA) access versus conventional right trans-radial artery (rt. TRA) access in coronary angiography.

Subjects and Methods: This study was conducted on (100) patients who underwent coronary angiography (50 patients via lt. dTRA & 50 patients via rt. TRA) and was performed in the department of cardiology, Benha University Hospital. All patients performed ECG, echocardiography, arterial doppler pre and post procedures.

Results

In comparison with conventional right trans-radial artery (rt. TRA), Our study revealed that performing coronary angiography via lt. dTRA had more difficulties at which it had significantly more failure rate to get puncture and high significantly more time to insert a sheath but with significantly less contrast volume required. Also, lt. dTRA approach had significantly less incidence to cause radial artery occlusion and less incidence to cause bleeding or infection without significant difference. Patients were more satisfied when procedures performed via lt. dTRA approach and they had less hospital stay time.

Conclusion

Compared to conventional right trans-radial artery (rt. TRA) access for coronary angiography procedure, left distal trans-radial artery (lt. dTRA) access has more failure rate to get puncture and more time to insert sheath but with less contrast volume required, less incidence of RAO and less hospital stay time.

Keywords

Left distal trans-radial, Radial; Snuff box, Coronary angiography

Imprint

Mahmoud Shawky Abd El-Moneum, Mohamed Asem Alam*, Hesham Khaled Rashid, Mohamed Abd El-Shafy Tabl. Left distal radial artery approach versus conventional radial artery for coronary angiography. Cardiometry; Issue 18; May 2021; p.60-66; DOI: 10.18137/cardiometry.2021.18.6066; Available from: http://www.cardiometry.net/issues/no18-may-2021/coronary-angiography

Introduction

Since its first performance in 1929, cardiac catheterization has continued to develop [1]. The advancement in technology and understanding the physiological properties of the vascular system have contributed to new vision into coronary angiography procedures. In concerning with arterial entry sites, a variety of research studies have been undertaken to establish which entry site is better suited for individual patients and situations. Notwithstanding the ease of access of femoral artery to coronary angiography, vascular-related complications and bleeding have resulted in increased morbidity , deaths and hospitalization, especially when anticoagulation and antiplatelet therapy are implemented[2]. The Femoral approach was compared in several randomized and observational trials with radial approach for both coronary angiography and interventional procedures. The established results were the safety of the patient and satisfaction, as well as reduced bleeding complications and immediate post-procedural mobilization as significant advantages of radial access. [3]. Based on the findings of these randomized trials, trans-radial access is taken as the default coronary access technique [4]. The majority of operators choose the right radial artery, as they operate on the patients' right side. On the other hand, the occlusion of the radial arteries, the underdeveloped right radial artery, extreme tortuosity, sclerosis, calcification, past or potential use of the proper radial artery as a free arterial graft leads to change the operator decision to use left radial artery. [5]. Otherwise, left radial access may be exhausting for the operator as he should bend over the patient to insert the sheath and deal with it. This annoying location could make the catheterization process uncomfortable and it is probable that he moves to another artery access site. A possible way to provide a convenient position for both the patient and the operator is to reach through left distal radial artery situated on the anatomical snuff-

box or "fossa radialis" [5]. Anatomical snuffbox (AS) is an area of depression within the radial portion of the wrist. It is seen when you stretch the thumb. It is laterally surrounded by the tendons of the abductor pollicis longus and extensor pollicis brevis muscles and medially by the extensor pollicis longus muscle tendon. The base of this triangular region is created by the distal radius, scaphoid, trapezium and base of the first metacarpal bone. [6].

Aim of the work

The aim of this study was to evaluate feasibility, contrast utilization and complications of trans-radial approach comparing the left distal trans-radial artery (lt. dTRA) in the anatomical snuffbox versus conventional right trans-radial artery (rt. TRA) approach in coronary angiography procedures.

Study design and population

This study was conducted over one year period from July 2019 to July 2020 and was performed in the department of cardiology, Benha University Hospital, Benha City, Egypt on one hundred (100) patients who underwent diagnostic coronary angiography (50 patients via left distal trans-radial artery (lt. dTRA) approach who represented group A & 50 patients via conventional right trans-radial artery (rt. TRA) approach who represented group B). All patients were indicated for coronary angiography. Exclusion criteria were refusal of patients, patients in whom radial approach were contraindicated, Patients who suffer from previous unsuccessful or complicated Radial approach, in this case the femoral approach may be more suitable for the operator and in patients with moderate to sever renal impairment or coagulopathy. The protocol was approved by the hospital's ethics committee.

All participants included in our study had been subjected to:

• Informed written consent for coronary angiography via right trans-radial or left distal trans-radial Approach.

• Complete history taken: included history of hypertension, diabetes mellitus, dyslipidemia, peripheral vascular disease, smoking habit and analysis of chest pain.

• physical examination: included:

1) General examination e.g. heart rate and blood pressure.

2) Local examination of heart e.g. heart sounds and cardiac murmurs.

• Investigations:

- 12 lead ECG: A 12-lead surface ECG was done for each patient on admission. The electrocardiograms were recorded at a paper speed of 25 mm/s and an amplification of 10 mm/mV with special assessment for heart rate, rhythm, ST-T changes.

- Laboratory investigations: blood samples were dragged from all participants and the following investigations were performed: Serum creatinine, PT, PTT, INR, CBC, virology markers and HbA1C.

- Echo-doppler study: A conventional transthoracic echocardiographic evaluation was performed in all patients after hospital admission with special assessment for the left ventricular systolic function, valve assessment and regional wall motion.

- Arterial doppler pre and post procedure to detect blood flow and complications.

• Procedure:

After gaining approval from the institutional review board and all consents and pre-procedural tests, patients were put in a typical supine position on the catheterization lab table. Their arm was kept immobilized and the wrist was hyperextended and then wrapped in a sterilized way, access was made to the right radial or left distal radial artery by:-

A- Left distal trans-radial approach technique (Anatomical Snuff Box):

- The patient had been wrapped with a sterilized drape during disinfection. The operator bring the patient's left hand to his right iliac area and took a nearby site, then subcutaneous 3 ml Lidocaine administered at the Snuff Box area.

- The patient was pinched his thumb inside the other four fingers to bring the artery superficially. The radial artery was penetrated by a 21 G needle with angle of 30-45 degrees.

- The needle was pointed proximally to the direction of the strongest pulse in snuff box triangle.

- Following the succeeded puncture in the anterior wall of the radial artery, the guide wire was easily advanced through the needle and used to direct the sheath through the artery, accompanied by a slight incision in the skin, followed by the insertion of a 6F radial sheath.

- Thereafter, 0.2 mg of nitroglycerin and 500 IU heparin were administered. At the level of the patient's thigh, operator took a position to advance the diagnostic guide wire and the diagnostic catheters (left and right) to proceed the coronary angiography.

- The sheath had been removed after the angiography and pressure was placed over the arteriotomy site to maintain hemostasis with implementation of TR – band.

B- Conventional right trans-radial approach technique:

- The patient had been wrapped with a sterilized drape during disinfection. The operator took up a position near right upper limb of the patient then subcutaneous 3 ml Lidocaine injected at the site of radius bone styolid process.

- The radial artery was penetrated at an angle of 45 degrees, 1 cm proximal to the stylized radius process with a 21 G needle.

- Following the succeeded puncture in the anterior wall of the radial artery, the guide wire was easily advanced through the needle and used to direct the sheath through the artery, accompanied by a slight incision in the skin, followed by the insertion of a 6F radial sheath.

- Thereafter, 0.2 mg of nitroglycerin and 5000 IU heparin were administered. At the level of the patient's thigh, operator took a position to advance the diagnostic guide wire and the diagnostic catheters (left and right) to proceed the coronary angiography.

- The sheath had been removed after the angiography and pressure was placed over the arteriotomy site to maintain hemostasis with implementation of TR – band.

Follow up

Arterial Doppler had been performed post procedural for all the patients in the two groups to assess the flow through the artery and post procedural complications.

Outcomes of the procedures in the two groups had been reviewed including:

- Success and failure rate of cannulation.
- Post Catheterization Radial Artery Occlusion (RAO) and thrombosis.
- Bleeding or hematoma.
- Infection.
- Total duration of the procedure.
- Discharge time and satisfaction between groups.

Statistical analysis

Using an IBM compatible personal computer with SPSS statistical package version 23 (SPSS Inc. Released 2015. IBM SPSS statistics for windows, version 23.0, Armnok, NY: IBM Corp.), results were collected, tabulated and statistically analyzed by an

There were two types of statistical analysis:

a) Descriptive statistics e.g. g. Number (No), percentage (%), mean ($\bar{X}$) and standard deviation (SD).

- Arithmetic mean (x): The measure used for central tendency.
- Standard deviation (SD): The measure for dispersion.
- Percentage (%).
- Median: was used as a measure of central tendency.
- Range: was used as a measure of dispersion

b) Analytic statistics:

- Chi-squared test ($\chi 2$): a parametric test used to find the correlation between two or more qualitative variables.
- Fischer exact test: for 2 x 2 tables, in case the predicted cells count of more than 25 percent of cases were less than 5 and the significant p-value < 0.05.
- Student t-test: is a significant test used for comparing with independent parametric data between two classes of quantitative variables

P value at 0.05 was used to indicate the significance:

- P-value > 0.05 means non- significant statistically.
- P-value ≤ 0.05 is used to mean significant statistically.
- P-value ≤ 0.001 means of high significant statistically.

Results

Demographic features of studied patients

Our study included one hundred (100) patients who underwent coronary angiography (50 patients via left distal trans-radial approach (lt. dTRA) which represented group A & 50 patients via conventional right trans-radial approach (rt. TRA) which represented group B).

Risk factors of studied patients

As regarding risk factors, there was no significant difference between groups. Out of the 100 patients, 11 (22%) were diabetics in group (A) whereas 10 (20%) members of group (B) (p=0.806). 30 (60%) patients had dyslipidemia in group (A) whereas 29 (58%) members of group (B) (p=0.839). 13 (26%) were hypertensives in group (A) whereas 15 (30%) members of group (B) (p=0. 656). 11 (22%) were smokers in group (A) whereas 10(20%) members of group (B) (p=0.806) (table 2).

Procedural aspects of studied patients

As regarding procedural aspects of the groups, there was a significant difference between the groups

Table 1
Distribution of studied patients according to demographic features (n = 100)

Demographic features	Group A No=50	Group B No=50	Test of sig.	Value
Age				
Mean ± SD	51.34±8.53	51.46±8.47	t	0.944
Range	35-65	36-65	0.071	NS
Median	54	54		
Sex				
Male	35(70%)	36(72%)	χ^2	0.826
Female	15(30%)	14(28%)	0.049	NS

t = Student's t test χ^2 - chi-square test NS = non-significant

Table 2
Distribution of the studied patients according to risk factors (n = 100)

Risk factors	Group A No=50		Group B No=50		χ^2	P value
	No	%	No	%		
DM						
Yes	11	22	10	20	0.060	0.806
No	39	78	40	80		NS
HTN						
Yes	13	26	15	30	0.198	0.656
No	37	74	35	70		NS
Dyslipidemia						
Yes	30	60	29	58		0.839
No	20	40	21	42	0.041	NS
Smoking						
Yes	11	22	10	20	0.060	0.806
No	39	78	40	80		NS

χ^2 - chi-square test NS = non-significant

Table 3
Comparison between studied groups as regard procedural aspects (n=100)

Procedural aspects	Group A No=50		Group B No=50		Test of sig.	P value
	No	%	No	%		
Failure to get puncture						
Yes	7	14	1	2	χ^2	0.03
No	43	86	49	98	4.9	S
Time to insert sheath (minutes)						
Mean ± SD	5.08±0.75		4.02±0.55		t	<0.001
Range	4-7		3-5		8.03	S
Median	5		4			
Total procedure duration (minutes)						
Mean ± SD	19.34±1.81		19.90±1.79		t	0.124
Range	17-23		17-23		1.55	NS
Median	19		19			
Contrast volume						
Mean ± SD	56.50±8.93		63.20±11.68		t	0.002
Range	40-80		40-100		3.22	S
Median	60		60			

FXT = Fisher's exact test t = Student's t test S=significant NS = non-significant HS = High significant

as regarding failure rate to get puncture at which operators failed to get puncture in 7 (14%) of group (A) while there was 1 (2%) failed puncture in group (B) (p=0.03). As regarding time to insert sheath, there were 5.08±0.75 minutes for sheath insertion in group (A) and 4.02±0.55 minutes in group (B) (p<0.001) with highly significant difference between groups. As regarding total duration of procedure, there were 19.34 ±1.81 minutes in group (A) and 19.90±1.79 minutes in group (B) (p=0.124) with no significant difference between groups. As regarding contrast volume used in procedure, there was a significant difference between both

Table 4
Comparison between studied groups as regard procedural aspects (n=100)

Complications	Group A No=50		Group B No=50		Test of sig.	P value
	No	%	No	%		
Bleeding						
Yes	3	6	4	8	FXT	0.500
No	47	94	46	92	0.154	NS
Infection						
Yes	2	4	1	2	FXT	0.558
No	48	96	49	98	0.344	NS
Thrombosis						
Yes	3	6	10	20	χ^2	0.040
No	47	94	40	80	4.18	S

FXT = Fisher's exact test, χ^2 = chi-square test NS = non-significant S = significant

Table 5
Comparison between studied groups as regard Patients satisfaction (n = 100)

Patients satisfaction	Group A No=50		Group B No=50		Test of sig.	P value
	No	%	No	%		
Yes	46	92	40	80	χ^2	0.084
No	4	8	10	20	2.99	NS

χ^2 = chi-square test NS = non-significant

Table 6
Comparison between studied groups as regard Patients satisfaction (n = 100)

Hospital stay time (Hours)	Group A No=50		Group B No=50		Test of sig.	P value
	No	%	No	%		
Mean ± SD	3.92±1.06		5.56±0.951		t	< 0.001
Range	3-8		4-8		8.11	HS
Median	4		6			

t = Student's t test HS = High significant

groups at which operators used about 56.50 ± 8.93 mL of contrast in group (A) and 63.20 ±11.68 mL of contrast used in group (B) (p=0.002).(Table 3)

Complications of studied patients

As regarding post-procedural complications, there was bleeding in 3(6%) of cases of group (A) and in 4(8%) cases of group (B) (p=0.500) with no significant difference between the groups. Infection occurred in 2(4%) of cases of group (A) while that occurred in 1(2%) case of group (B) (p=0.558) with no significant difference between groups. Thrombosis and radial artery occlusion (RAO) occurred in 3(6%) of cases of group (A) while that occurred in 10(20%) cases of group (B) (p=0.040) with a significant difference between 2 groups (Table 4).

Satisfaction of studied patients

Regarding patient satisfaction, there was no significant difference between the 2 groups, as there were 4(8%) patients from group (A) were not satisfied while there were 10(20%) patients from group (B) (p=0.084).

Discussion

Coronary artery disease (CAD) is one of the most prevalent causes of morbidity and mortality worldwide [7]. Trans-radial arterial technique (TRA) is a relatively easy way of intervention for coronaries [8]. Recently, interventional cardiologists have begun to follow a modulation of the trans-radial approach, the left distal trans-radial technique (lt. dTRA) for coronary procedures [9].

In our study we aimed to evaluate feasibility, contrast utilization and complications of trans-radial approach comparing the left distal trans-radial (lt. dTRA) versus conventional right trans-radial (rt. TRA) approach in coronary angiography procedures.

This study showed that out of the 100 patients, 35 (70%) were males and 15 (30%) were females in (group A) whereas 36 (72%) members of the (group B) were males and 14 (28%) were females. No significant variation between groups regarding gender. The mean ± SD ages were distributed between both groups as 51.34±8.53 and 51.46±8.47 respectively with no sig-

nificant difference between groups. Our results were in agreement with the study conducted by Roghani-Dehkordi et al. which reported that in 159 patients, men were 76% with age 58.1 ± 10.5 years and women were 24% with age 61.2 ± 9.6 years [10]. But our results were in disagreement with Brunet et al. regarding sex of patients who reported that male participants comprised only 21.2% of the recruited participants [11].

This study showed that regarding risk factors, 11 (22%) were diabetics in group (A) whereas there were 10 (20%) members of the group (B), 30 (60%) had dyslipidemia in group (A) whereas there were 29 (58%) members of the group (B), 13 (26%) were hypertensives in group (A) whereas there were 15 (30 %) members of the group (B) and 11 (22%) were smokers in group (A) whereas there were 10 (20 %) members of the group (B). Our results were in disagreement with Soydan & Akın who documented that the most common risk factor for patients who experienced coronary angiography via left distal radial artery was hypertension with rate of 61.1 percent [12].

This study showed that regarding procedural aspects, there was a significant difference between the groups as regarding failure rate to get puncture at which operators failed to get puncture in 7 (14%) of group (A) while there was 1 (2%) failed puncture in group (B) (p=0.03). Our results were in agreement with the study conducted by Brunet et al. which reported that failure rate to get puncture via distal radial approach was 8%, with the majority of failed cases converted to trans-femoral artery for convenience [11]. Our results were in disagreement with the study conducted by Mizuguchi et al. which reported that failure rate for initial puncture was 0.4%, with conversion to contralateral distal radial artery [13].

This study showed that contrast volume used for coronary angiography in group (A) was significantly less than used in group (B) at which it was 56.50±8.93 mL and 63.20±11.68 mL respectively, P = 0.002. This was in disagreement with Coughlan et al. who showed that there was no statistically significant difference in contrast dose used for coronary angiography in distal trans-radial versus conventional trans-radial artery access (82.93 ± 23 vs 92.1 ± 33 mL respectively, P = 0.1215) [14].

This study showed that total procedure time in group (A) in comparison with group (B) was non significantly shorter as time distributed was 19.34±1.81 min and 19.90±1.79 min between groups respectively. This was in agreement with Coughlan et al. who showed that Procedural length did not vary significantly between groups (28.95 ± 5.89 vs 29.76 ± 8.16 min, P = 0.5824) [14].

Arterial Doppler had been performed pre-procedural and post-procedural for all the patients in the two groups to assess the flow through the radial artery and to evaluate the post-procedural complications especially radial artery occlusion (RAO).

This study showed that the rate of RAO was significantly higher with group B (20%) than group A (6%) (P=0.040). Our results were in agreement with a study of 1320 patients who subjected to dTRA for coronary intervention, late RAO was observed in few cases about 0.61% [15]. Our results were in disagreement with Sinha et al. who showed that the rate of RAO in conventional radial artery was low (1–6%) [9].

Regarding bleeding, there was no significant difference between the 2 groups, as there were 3(6%) patients from group (A) had bleeding while there were 4(8%) patients from group (B) had bleeding (p=0.500). Our results were in agreement with Wretowski et al. who documented that only single patient on oral anticoagulation with DAPT had minor bleeding and had treated conservatively [16].

Regarding patient satisfaction, there was no significant difference between the 2 groups, as there were 4(8%) patients from group (A) were not satisfied while there were 10(20%) patients from group (B) (p=0.084). This was in agreement with Koutouzis et al. who found that slightly higher rates of patient satisfaction in the distal trans-radial group than in the conventional trans-radial artery group, although this difference was not significant [17].

Our study showed that rt. TRA was associated with highly significant increase in hospital stay time after procedure in comparison with lt. dTRA (5.56±0.951 hours vs 3.92±1.06 hours respectively, P<.001). This was in agreement with Coughlan et al. who showed that from the other benefits of snuff box access was shorter discharge time due to statistically significant decreases in the time required for radial artery compression [14].

Conclusion

In conclusion, compared to conventional right trans-radial artery (rt. TRA) access for coronary angiography procedure, left distal trans-radial artery (lt. dTRA) access has more failure rate to get puncture and more time to insert sheath but with less contrast volume required, less incidence of RAO and less hospital stay time.

Limitations

- This study is a single-center study.
- Small sample size.
- Short duration of study.

Financial support and sponsorship

Nil

Statement on ethical issues

Research involving people and/or animals is in full compliance with current national and international ethical standards.

Conflict of interest

None declared.

Author contributions

The authors read the ICMJE criteria for authorship and approved the final manuscript.

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