

COMPARISON OF MEAN CONTRAST VOLUME IN PATIENTS UNDERGOING CORONARY ANGIOGRAPHY VIA RADIAL VERSUS FEMORAL APPROACH

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ABSTRACT:

INTRODUCTION: *The long procedure time during the angiography results in a large radiation dose as well as large contrast volume used which is linked with higher rates of contrast-induced nephropathy. So the selection of best route for coronary angiography is very important to reduce the amount of both radiation and contrast volume.*

AIMS & OBJECTIVE: *To compare mean contrast volume in patients undergoing coronary angiography by radial versus femoral approach.*

MATERIAL & METHODS: *It was a randomized controlled trial. The study was conducted in Cardiology Department, Shaikh Zayed Hospital, Lahore from June 9, 2018 to December 9, 2018. Total 128 patients were counseled and explained the details of the study. Patients were randomly divided into following two groups using lottery method as Group A: Radial Approach and Group-B: Femoral Approach. Vascular puncture was carried out by using standard radial arterial sheaths. After insertion of sheath in to the artery standard 5000U of heparin and 200mcg of nitroglycerin was administered and by using 6Fr angiographic catheters angiography was performed using non-ionic contrast, timing of the procedure was noted.*

RESULTS: *Age distribution of the patients was done, it shows that 27(42.19%) in Group-A and 25(39.06%) in Group-B were between 30-50 years of age whereas 37(57.81%) in Group-A and 39(60.94%) in Group-B were between 51-70 years of age. Gender distribution of the patients was done, it shows that 36(56.25%) in Group-A and 36(56.25%) in Group-B were male whereas 28(43.75%) in Group-A and 28(43.75%) in Group-B were females. Comparison of mean contrast volume in patients undergoing coronary angiography by radial versus femoral approach shows that in Group-A, it was 82.70 ± 2.59 and in Group-B, it was 76.19 ± 3.42 , p value was 0.0001. The data was stratified for age, gender, hypertension, diabetes, dyslipidemia and history of smoking. Post-stratification, independent sample t-test was applied taking p value of ≤ 0.05 as statistically significant.*

CONCLUSION: *Mean contrast volume was significantly higher in patients undergoing coronary angiography by radial when compared to those with femoral approach.*

KEY WORDS:

Coronary angiography, radial approach, femoral approach, mean contrast volume.

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INTRODUCTION:

Coronary artery disease (CAD) is still a leading cause of death and disability in the twenty first century. Chest pain is one of the signals of this disease but could be fatal even in its first notice while it can exist in asymptomatic patients without any warning signals.¹ Adverse effects of coronary angiography includes local anesthetic toxicity, nephropathy, heparin induced thrombocytopenia, infections, bleeding, exposure to the radiations, chemotoxic or anaphylactoid reactions to the contrast.²

These angiographies are performed by using contrast mediums which are iodine based and are visualized by exposing the patients to radiation which have their own adverse effects upon the body.³ Quantity of contrast used during coronary angiography is an establish risk factor for contrast induced nephropathy.⁴

Usman et al in 2015 conducted a study on the comparison of mean contrast volume in patients undergoing coronary angiography through radial vs. femoral artery route and found that to be 115 ± 55 ml vs. 90 ± 45 ml; $p < 0.001$.⁵ Tayeh et al. in 2013 conducted a similar study among the Egyptian population and found that to be 67.63 ± 25.49 ml in radial group vs. 81.53 ± 24.80 ml in femoral group; $p = 0.03$.⁶

There is a conflict regarding the mean volume of contrast used for coronary angiography from radial artery vs. femoral artery (115 ± 55 ml radial vs. 90 ± 45 ml femoral; $p < 0.001$, 67.63 ± 25.49 ml radial vs. 81.53 ± 24.80 ml femoral; $p = 0.03$.⁶ This conflict can be due to the difference between the expertise level or due to the fact that one study included patients who had myocardial infarction while the other study excluded such patients or due to the genotypical variation between the two studies group population (Pakistan vs. Egyptian).

As the dose of the contrast is directly related to the volume of the contrast administered and is associated with reactions and contrast induced nephropathy^{2,4}. So the purpose of this study is to

repeat this clinical trial in local population to resolve the conflict and to determine the mean volume of contrast administered during coronary angiography so that a better route could be adopted in the local population which uses less contrast volume and can be safer for the patients.

MATERIAL AND METHODS:

It randomized controlled trial was conducted in Cardiology Department, Shaikh Zayed Hospital, Lahore from June 9, 2018 to December 9, 2018. A total of 128 patients fulfilling inclusion criteria (patients of both gender groups with ages in the range of 30-70 years undergoing coronary angiography and patients who signed informed consent) were included. Patients who are sensitive to iodine containing contrast as per history and clinical record, patients with impaired renal functions (serum creatinine ≥ 1.5 mg/dl in past 1 week) as per clinical record and patients who have undergone angiography, angioplasty or coronary artery bypass as per clinical record were excluded from the study.

Detailed history of the disease and co morbid conditions (hypertension (BP $> 160/90$), diabetes (BSR > 200 mg/dl), smoking (> 5 packs per year), dyslipidemia (TC > 200 mg/dl)) were taken from each patient. Participants were randomly divided into following two groups as Group A: radial approach and Group-B: femoral approach.

Vascular puncture was carried out by using standard arterial sheath. After insertion of sheath in to the artery standard 5000U of heparin and 200mcg of nitroglycerine was administered and by using 6Fr catheter angiography was performed using non-ionic contrast and the volume of contrast, timing of the procedure was noted and recorded into the attached proforma along with demographic details of the patient. All the angiographies were performed by the same consultant of the cardiology department using contrast of the same brand with the help of same angiography machine to eliminate bias and confounding variables were controlled by exclusion.

Coronary angiography was performed by the invasive method in patients having one of the following as per history and clinical record in past 6 months, ST elevation myocardial infarction (>2mm in limb leads or >1mm in chest levels), ST depression with positive troponin T test, patients having chest pain on walking few steps with positive troponin T, patients with abnormal stress test underwent insertion of angiographic catheter till it reaches the coronary vessels and all three vessels (left anterior descending, right coronary artery with marginal branch and circumferance arteries) are visualized. Volume of Contrast was measured in milliliters as the amount of contrast needed to completely visualize all three major vessels till the end.

All the collected data was entered and analyzed into SPSS version 21. Numerical variables i.e age, volume of the contrast used and duration of procedure was presented by mean ±SD and range. T-test was applied for comparison of mean contrast volume between the two groups. Categorical variables i.e. gender, hypertension, diabetes, dyslipidemia and history of smoking were presented as frequency and percentage. The data was stratified for age, gender, duration of procedure, hypertension, diabetes, dyslipidemia and history of smoking. Post stratification independent sample

T-test was applied taking p value of ≤0.05 as statistically significant.

RESULTS:

A total of 128 cases (64 in each group) fulfilling the selection criteria were enrolled to compare mean contrast volume in patients undergoing coronary angiography by radial versus femoral approach. Age distribution of the patients was done, it shows that 27(42.19%) in Group-A and 25(39.06%) in Group-B were between 30-50 years of age whereas 37(57.81%) in Group-A and 39(60.94%) in Group-B were between 51-70 years of age, mean age was calculated as 50.69±7.66 years in Group-A and 50.13±8.04 years in Group-B.

Gender distribution of the patients was done, it shows that 36(56.25%) in Group-A and 36(56.25%) in Group-B were male whereas 28(43.75%) in Group-A and 28(43.75%) in Group-B were females.

Comparison of mean contrast volume in patients undergoing coronary angiography by radial versus femoral approach shows that in Group-A, it was 82.70±2.59 and in Group-B, it was 76.19±3.42, p value was 0.0001. The data was stratified for age, gender, hypertension, diabetes, dyslipidemia and history of smoking. Post-stratification, independent sample t-test was applied taking p value of ≤0.05 as statistically significant.

Table No. 1: Age Distribution (n=128)					
Variables		Group-A (n=64)		Group-B (n=64)	
		No. of patients	%	No. of patients	%
Age (in years)	30-50	27	42.19	25	39.06
	51-70	37	57.81	39	60.94
Gender	Male	36	56.25	36	56.25
	Female	28	43.75	28	43.75
Diabetes Mellitus	Yes	40	62.5	42	65.63
	No	24	37.5	22	34.37
Hypertension	Yes	44	68.75	41	64.06
	No	20	31.25	23	35.94
Dyslipidemia	Yes	39	60.94	38	59.38
	No	25	39.06	26	40.62
Smoking	Yes	14	21.88	14	21.88
	No	50	78.12	50	78.12

Table No. 2: Comparison of mean contrast volume in patients undergoing coronary angiography by radial versus femoral approach, age, gender, diabetes mellitus, dyslipidemia and smoking.

Variables	CONTRAST VOLUME				P-value	
	Group-A (n=64)		Group-B (n=64)			
	Mean	SD	Mean	SD		
Radial Vs. Femoral approach	82.70	2.59	76.19	3.42	0.0001	
AGE (years)	30-50	82.52	2.76	76.64	3.20	0.0001
	51-70	82.84	2.49	75.90	3.56	
Gender	Male	82.33	2.52	75.44	3.64	0.0001
	Female	83.18	2.65	77.14	2.89	
Diabetes Mellitus	Yes	82.90	2.70	76.00	3.66	0.0001
	No	82.38	2.43	76.55	2.94	
Dyslipidemia	Yes	82.87	2.44	76.08	2.85	0.0001
	No	82.44	2.84	76.35	4.17	
Smoking	Yes	81.29	2.67	76.64	3.79	0.0009
	No	83.10	2.45	76.06	3.33	0.0001

DISCUSSION:

Coronary catheterization through radial route is on priority these days as there are fewer complications as compared to femoral route. After coronary intervention, bleeding complication is a major concern, while various studies have shown that it occurs less in radial approach. Moreover, early hospital discharge and patient comfort is also associated with radial route.⁷⁻⁸ But during radial artery cannulation, spasm, tortuosity and aberrant artery might be a challenge. Sometimes it becomes difficult to negotiate through innominate artery loop. Long procedural time, radiation exposure and large amount of contrast could be result of these anatomical hurdles.⁹⁻¹²

Peri-procedural complications may result in increased radiation dose.¹³ Usually patients undergo many imaging studies apart from cardiology which increases cumulative radiation exposure; while operator is also exposed to hazardous effect of radiation.¹⁴ Therefore preventive measures should be under taken to reduce radiation exposure time.

Contrast induced nephropathy (CIN) is linked with increased contrast volume. Pre-existing renal disease and DM are the frequent complications of CIN, while both of them are risk factors for coronary artery disease.¹⁵ CIN increases mortality and morbidity in patients requiring coronary catheterization. CIN is directly related with volume of contrast used, so low volume can reduce the risk of NIC.¹³

Previous studies showing conflict in results when compared radial versus femoral approach in

patients undergoing angiography. This conflict can be due to the difference between the expertise level or due to the fact that one study included patients who had myocardial infarction while the other study excluded such patients or due to the genotypical variation between the two studies group population (Pakistan vs. Egyptian). As the dose of the contrast is directly related to the volume of the contrast administered and is associated with reactions and contrast induced nephropathy.

So the purpose of this study was to repeat this clinical trial in local population to resolve the conflict and to determine the mean volume of contrast administered during coronary angiography so that a better route could be adopted in the local population which uses less contrast volume and can be safer for the patients.

In our study, 42.19%(n=27) in Group-A and 39.06%(n=25) in Group-B were between 30-50 years of age whereas 57.81%(n=37) in Group-A and 60.94%(n=39) in Group-B were between 51-70 years of age, mean age was calculated as 50.69+7.66 years in Group-A and 50.13+8.04 years in Group-B, 56.25%(n=36) in Group-A and 56.25%(n=36) in Group-B were male whereas 43.75%(n=28) in Group-A and 43.75%(n=28) in Group-B were females, comparison of mean contrast volume in patients undergoing coronary angiography by radial versus femoral approach shows that in Group-A, it was 82.70+2.59 and in Group-B, it was 76.19+3.42, p value was 0.0001.

Usman et al in 2015 conducted a study on the comparison of mean contrast volume in patients

undergoing coronary angiography through radial vs. femoral artery route and found that to be 115 ± 55 ml vs. 90 ± 45 ml; $p < 0.0015$. These findings are higher than recorded in our study. Another trial by Tayeh et al. in 2013 conducted a similar study among the Egyptian population and found that to be $67.6325.49$ ml in radial group vs. 81.53 ± 24.80 ml in femoral group; $p = 0.03$.⁶ These findings are near to our results.

Another recent local trial¹⁶ compared radiation and contrast safety between radial and femoral

approaches in patients undergoing coronary catheterization and recorded mean contrast volume as 80.833 ± 25.59 in radial approach and 78.3538 ± 24.46 ml in femoral approach, but the difference was not significant. These findings are near to our study, but we found a significant difference in both techniques.

CONCLUSION:

Mean contrast volume was significantly higher in patients undergoing coronary angiography by radial when compared to those with femoral approach.

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