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

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Abstract

BACKGROUND: *The clinical gold standard for evaluating individuals with cardiovascular disease is coronary Angiography. These Angiography are performed by using contrast mediums which are non-ionic. The most commonly used routes are trans radial and trans femoral. The protracted Angiography procedure leads to use of Larger volume of contrast medium which is directly associated with greater rates of contrast induced Nephropathy. So, choosing the appropriate route for coronary Angiography is imperative to minimizing the contrast volume dose*

OBJECTIVE: *To evaluate the average amount of contrast used in patients for radial versus femoral coronary Angiography approach.*

METHODOLOGY: *This cross-sectional comparative study was carried out at Gulab Devi Teaching Hospital's Cardiology Department. A total of 156 patients who had been diagnosed with CAD and had visited a cardiac catheterization lab were chosen at random. These patients received diagnostic (CA) procedure. According to the preferred routes by our interventional cardiologist, the patients were split into two groups. Group A (radial group) was assigned 125 patients, and Group B (femoral group) was assigned 31 patients. Non-Probability convenient sampling technique was used. The mean contrast volume (MCV) of dye was measured in both groups, along with the variables Age, Gender, Hypertension (HTN), Diabetes Mellitus (DM), and Smoking.*

RESULTS: *This study encompasses a total 156 patients who had underwent CA from August to December of 2022 and there were 125 patients in radial group and 31 patients were in femoral group. It was terminated by using Mann Whitney U test that the quantity of contrast volume administered was statistically significant since it was 56.88±9.19 in Group-A, whereas in GroupB, it was 52.25±10.55 and the p-value for this comparison was 0. 016.The data was further divided into groups according to age, gender, hypertension, diabetes, and smoking history. Following stratification, the p values ≥ 0.05 were deemed*

statistically insignificant except for smoking history and furthermore there were more Males (69.87%) than Females (30.13%), and more patients fell in Age group of (43-49years,23.1%) and (63-69years 21.8%) with mean age of 53years and there were (46.79%) Diabetics, (53.2%) Hypertension patients and (28.85%) Smokers in this study.

CONCLUSION: *It was summarized that there was a substantial variation in the mean contrast volume of dye in patients undergone coronary Angiography via radial versus femoral route So The average amount of contrast used is higher in coronary Angiography done by radial approach as compared to femoral approach.*

INTRODUCTION

French scientist Claude Bernard catheterized animals in the 19th century to gauge the pressures inside their major veins and heart chambers. Werner Forssman carried out the first cardiac catheterization on a person in 1929 as a result of this experiment, and André Frederic Cournand and Dickinson W. Richards went onto investigate the heart's hemodynamic as a consequence. The Nobel Prize in Physiology or Medicine was given to all three of these researchers in 1956.In 1958, the advent of coronary arteriography was made possible by cardiac catheterization. Clinicians were able to clarify the natural course of coronary artery disease using this imaging approach in conjunction with left ventriculography. The foundation for surgical treatment using coronary revascularization was laid by coronary arteriography and left ventriculography, which became the standard diagnostic methods for identifying pump function and artery anatomy.(Nabel and Braunwald 2012)

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. The gold standard test for determining the existence and degree of atherosclerotic coronary artery disease is coronary Angiography (CAD).(Shahid, Saboor et al. 2021)

Coronary Angiography is the radiographic visual examination of the coronary vessels following injection of radiopaque contrast agent. Specially designed intravascular catheters are most frequently used to conduct it. The technique is typically a part of cardiac catheterization, which may also involve angiography of other arterial systems, such as the aorta and left ventricle. The goal of coronary angiography is to determine the coronary anatomy and the degree of luminal stenosis of the coronary arteries. The most frequent uses of it are to find out if obstructive coronary artery disease (CAD) is present and how severe it is, as well as to assess the potential benefits and suitability of various treatment strategies including revascularization by interventional or invasive treatments. Furthermore, it is employed when the prognosis of coronary disease is equivocal and coronary disease cannot be reasonably excluded by noninvasive techniques.(Scanlon, Faxon et al. 1999)

The test, like any other invasive treatment, has distinct patient-dependent and procedure-related consequences. The clinical criterion for screening patients with suspected disease of the coronary arteries is coronary angiography. The number of coronary arteries with angiographically significant stenosis is intimately linked with patient outcome. Moreover,significant coronary artery disease and high-grade stenosis (>80% angiographic diameter narrowing) are linked to a greater probability of having a myocardial infarction-causing coronary artery blockage in the later. 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. Quantity of contrast used during coronary angiography is an establish risk factor for contrast induced nephropathy During the cardiac catheterization operation, contrast medium is injected. Many difficulties are connected with contrast media. Some consequences are minor while some only require palliative treatment, others require aggressive care. In addition to the contrast media's

chemical makeup, challenges are also influenced by the amount of media used. Limiting contrast volume is especially advantageous in patients with underlying renal failure and though seat risk of contrast-induced nephropathy(Desch, Fuernau et al. 2018)

The risks associated with having a coronary arteriography include both cardiac and noncardiac concerns, despite the fact that there are no definitive contraindications. Some medical conditions, such as advanced age, renal insufficiency, uncontrollable type 2 diabetes, and morbid obesity, can raise the likelihood of complications. A potentially major side effect of coronary angiography is contrast-induced nephropathy (CIN), which can have serious immediate and long-term repercussions. With appropriate risk assessment, contrast medium selection, operation phasing, and prophylactic control techniques, CIN can be mitigated. (Michael, Alomar et al. 2013)

According to studies CIN is classified as an increase in blood creatinine of less than 0.5 mg/dl or 25% above the baseline value. Clinically important effects include mortality and irreversible renal dysfunction necessitating hemodialysis.(Ando, Gragnano et al. 2018)

Dr. Lucien Campeau described the first Percutaneous trans radial approach (TRA) for diagnostic coronary angiography in 1989, and Dr. Ferdinand Kiemeneij characterized it for intervention in 1993.(Bertrand, Rao et al. 2010)

Intubation of the right or left radial artery is used to perform Trans radial procedures. At the moment, whether to use the right or left radial approach is primarily determined by the operator's inclination. The radial artery is easily compressible and not immediately connected to surrounding nerves or veins, which makes the trans radial approach advantageous for better hemostasis. Additionally, the palmar arch of the ulnar and radial arteries provides the hand with a dual blood supply. Due to the substantial collateral flow between the two arteries that perfuses the hand, any radial artery obstruction is not clinically significant in the majority of patients. The Allen test, when done correctly, is a quick and efficient way to determine whether collateral blood flow into the hand is adequate. Complications and blockage of hand flow are more common in persons in whom the Allen test is negative.(Tavakol, Ashraf et al. 2012)

The femoral approach is uncommonly used for coronary angiography. It results in Vascular and bleeding impediment at the femoral punctures and is a significant cause of morbidity. Access site difficulties are more probable to emerge when angiography is performed while receiving severe anticoagulation and antiplatelet medication.(Michael, Alomar et al. 2013)

Another complication of femoral approach is that it requires prolong bed rest. The trans radial route was developed with the goal to minimize the incidence of vascular access site bleeding issues and to preclude prolonged hospitalization. The physiological implications of systemic infusion of a bolus of contrast dye depend on the nature of the media and the injection site. When using a bolus of high-osmolarity ionic medium. Peripheral vasodilatation occurs immediately during ventriculography or aortography, resulting in a brief drop in systolic arterial pressure of 20 to 50 mm Hg and a reflex increase in heart rate. The hyper osmolarity of the contrast material is to blame for these changes; when low osmolarity media (ionic or non-ionic) are utilized for such a bolus injection, the physiological changes are minor and shorter-live

MATERIAL AND METHODS

This cross-sectional comparative study was conducted over a period of six months in the Catheterization Laboratory of Gulab Devi Teaching Hospital, Lahore, Pakistan. A total of 156 patients were enrolled using a non-probability convenience sampling technique, with 125 assigned to the radial group and 31 to the femoral group, based on a sample size calculated through G.Power (3.1.9.7). The target population included patients aged 30–70 years undergoing coronary angiography for coronary artery disease, while those with documented allergy to iodine-based contrast or impaired renal function (serum creatinine ≥1.5 mg/dL) were excluded. Study variables comprised demographic factors (age and gender), clinical risk factors (hypertension, diabetes, and smoking), and angiographic parameters, specifically the mean contrast volume used for each vascular approach. Data were collected using a structured patient proforma. Standard angiographic

procedures were followed, including arterial sheath insertion, administration of 3000 units of heparin and 200 mcg of nitroglycerine, and performance of coronary angiography with a 6Fr catheter using non-ionic contrast media. The contrast volume, procedure duration, and all relevant clinical and demographic details were recorded systematically for subsequent analysis.

RESULTS

This study encompasses a total 156 patients who had underwent CA from August to December of 2022 and there were 125 patients in radial group and 31 patients were in femoral group. It was terminated by using Mann Whitney U test that the quantity of contrast volume administered was statistically significant since it was 56.88±9.19 in Group-A, whereas in Group-B, it was 61.61±12.67 and the p-value for this comparison was 0.031.The data was further divided into groups according to age, gender, hypertension, diabetes, and smoking history. Following stratification, the p values ≥ 0.05 were deemed statistically insignificant except for smoking history and furthermore there were more Males (69.87%) than Females (30.13%),and more patients fell in Age group of (43-49years,23.1%) and (63-69years 21.8%) with mean age of 53years and there were (46.79%) Diabetics, (53.2%) Hypertension patients and (28.85%) Smokers in this study.Overall, the results indicate that the radial approach uses a greater amount of contrast medium than the femoral approach.

Table no.1
Mean contrast volume of dye used via radial approach in ml

Mean Contrast Volume (ml)	Frequency	Percentage
40.00	3	1.9
50.00	61	39.1
60.00	38	24.4
70.00	20	12.8
80.00	2	1.3
100.00	1	.6
Total	125	80.1

Figure 1.

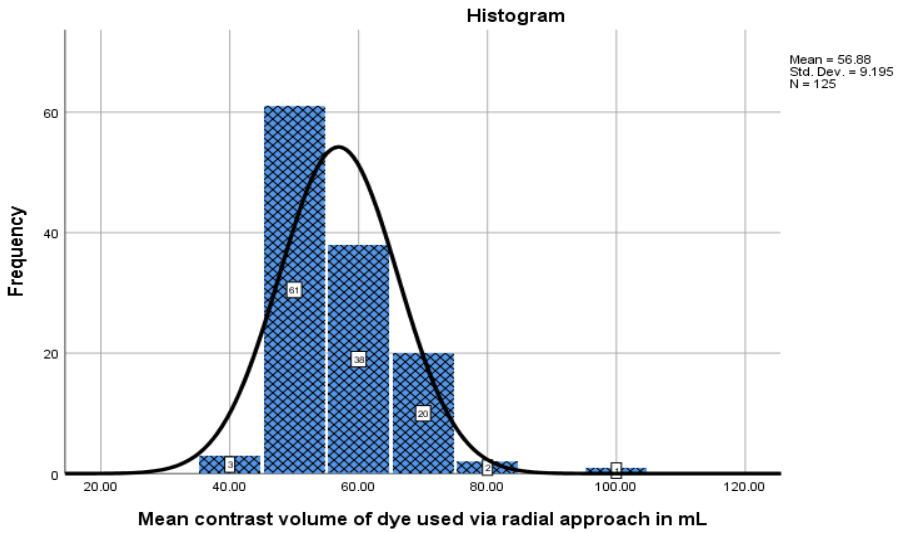


Table no.2
Mean contrast volume of dye used via femoral approach in ml

Mean Contrast Volume (ml)	Frequency	Percentage
40.00	2	1.3
50.00	10	6.4
60.00	3	1.9
70.00	15	9.6
100.00	1	.6
Total	31	19.9

Figure 2.

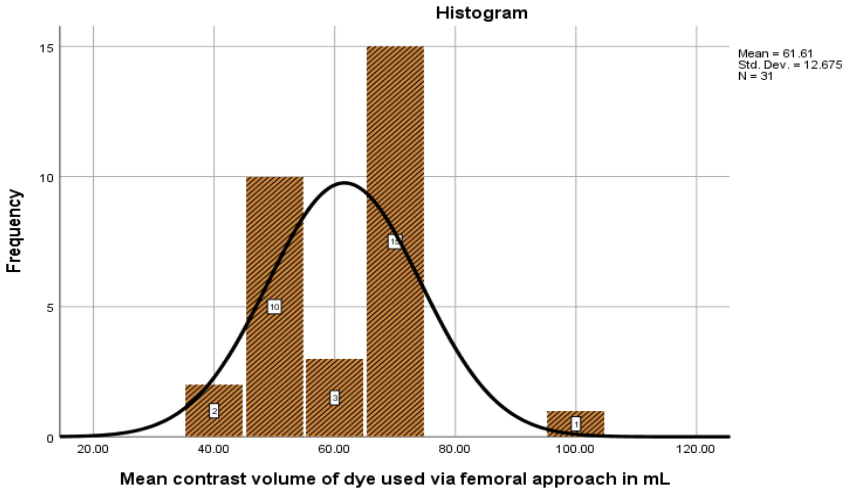


Table no.3
Frequency table of Age

Age in years	Frequency	Percentage
30 - 36	7	4.5
37 - 42	22	14.1
43 - 49	36	23.1
50 - 56	29	18.6
57 - 62	28	17.9
63 - 69	34	21.8
Total	156	100.0

Figure3.

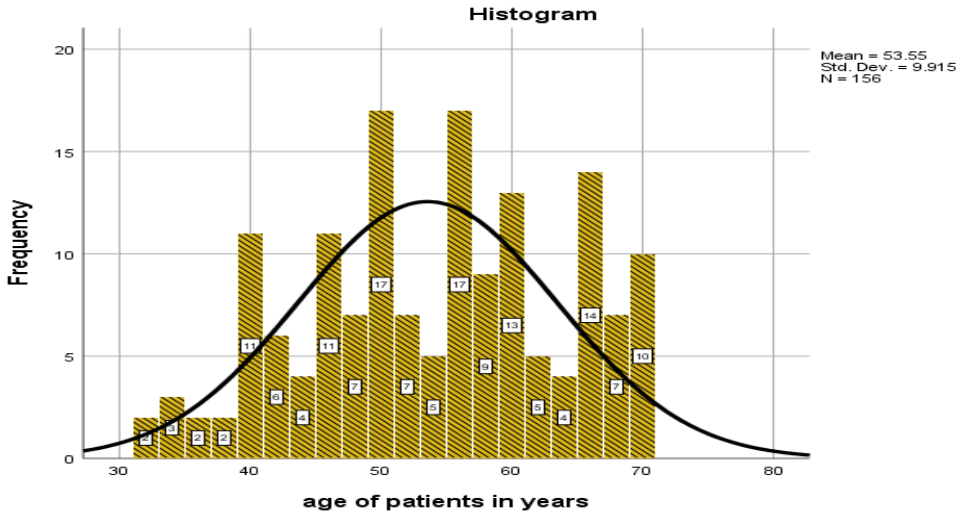
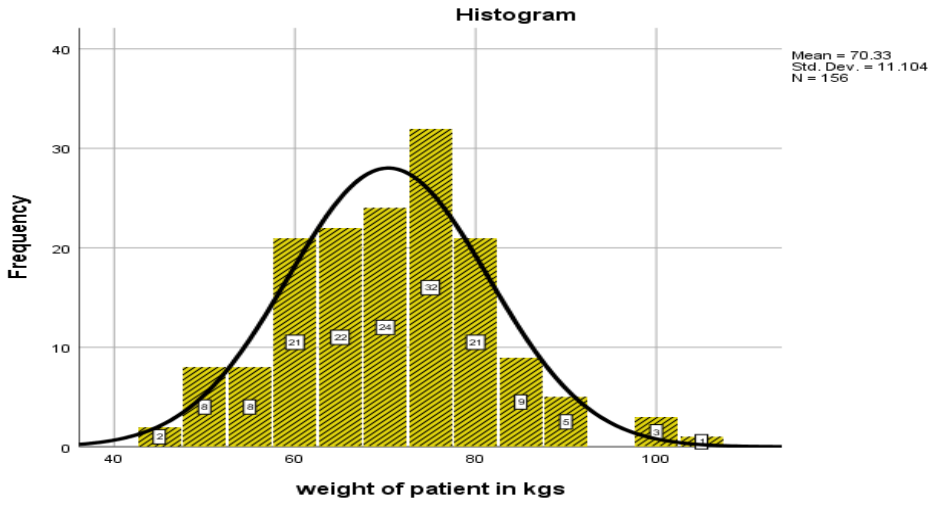


Table no.4
Frequency table of Weight

Weight in kgs	Frequency	Percentage
45 - 50	10	6.4
51 - 56	8	5.1
57 - 61	21	13.5
62 - 67	27	17.3
68 - 73	24	15.4
74 - 79	42	26.9
80 - 85	13	8.3
86 - 90	6	3.8
91 - 96	1	.6
97 - 102	3	1.9
103+	1	.6
Total	156	100.0

Figure 4.



ANALYSIS FOLLOWING MANN-WHITNEY U TEST

Table no.5

Descriptive table of MCV

	Ranks	N	Mean Rank	Sum of Ranks
MEAN CONTRAST VOLUME	RADIAL APPROACH	125	74.87	9358.5
	FEMORAL APPROACH	31	93.15	2887.5
	Total	156		

Table no.6

Test Statistics	
	Combined data
Mann-Whitney U	1483.5
Wilcoxon W	9358.5
Z	-2.154
Asymp. Sig. (2-tailed)	0.031
a. Grouping Variable: ranks	

NORMALITY TEST FOR THE DISTRIBUTION OF DATA

Table no.7

Tests of Normality							
		Statistic	df	Sig.	Statistic	df	Sig.
MCV	Radial	0.505	125	0.00	0.451	125	0.00
	Femoral	0.429	31	0.00	0.591	31	0.00
Gender of	MALE	0.481	109	0.00	0.511	109	0.00

patients	FEMALE	0.512	47	0.00	0.426	47	0.00
	YES	0.499	45	0.00	0.465	45	0.00
Smoking	NO	0.487	111	0.00	0.497	111	0.00
	YES	0.488	83	0.00	0.495	83	0.00
Hypertension	NO	0.494	73	0.00	0.481	73	0.00
	YES	0.488	73	0.00	0.496	73	0.00
Diabetes mellitus	NO	0.494	83	0.00	0.482	83	0.00

Table no.8

COMPARISON OF AVERAGE CONTRAST VOLUME IN PATIENTS UNDERWENT CORONARY ANGIOGRAPHY VIA RADIAL VERSUS FEMORAL ACCESS, AGE, GENDER, DIABETES MELLITUS AND SMOKING.

VARIABLE		**CONTRAST VOLUME**				
		Group A (n= 125)		Group B (n=31)		
		mean	SD	Mean	SD	**P Value**
Radial VS Femoral Approach		56.88	9.19	61.61	12.67	0.031*
Age (Years)	30-49	56.15	11.61	63.33	15.56	
	50-70	57.08	7.53	60.55	11.09	0.556
Gender	Male	56.7	9.31	63.33	12.38	
	Female	57.29	9.02	58	13.16	0.874
Diabetes Mellitus	Yes	55.93	7.68	58.57	10.99	
	No	57.72	10.34	64.11	13.71	0.858
Hypertension	Yes	57.65	9.87	63.15	13.35	
	No	56.06	8.42	59.16	11.64	0.54
Smoking	Yes	60.5	10.84	54	8.94	
	No	55.17	7.8	63.07	12.89	0.007*

DISCUSSION

Nowadays, coronary angiography via the radial route is preferred since there is less difficulty than via the femoral route. Studies have demonstrated that the complication of bleeding after coronary intervention is less common when using a radial route. Also, the radial route is associated with patient ease and early hospital discharge. Nevertheless, spasm, vascularity, and anomalous arteries may present difficulties during radial artery catheterization. Sometimes it gets challenging to pass through the innominate artery loop. These anatomical challenges may lead to lengthy procedures, and excessive amount of contrast used.

The motive of this study is to resolve the conflict and determine the average volume of contrast used during coronary angiography; this study is pursuing to repeat the clinical trial in the local population. This will allow for the adoption of a better strategy that uses less contrast volume and is potentially safer for the patients so in our study according to operator preference of route and as radial route is gaining momentum so the angiographies were done. So the comparison of mean contrast volume of patients undergoing coronary angiography via radial versus femoral approach shows that in Group A it was 56.88±9.19 and in Group B it was 61.61±12.67, p-value was 0.031 so basically less amount of dye had been given via radial route.

Khan S.R.et al. conducted study in which the patients were underwent coronary angiographies via either radial or femoral access and the contrast volume was noted as (70±34 vs. 72±40 ml respectively, p=0.267) and so left radial approach seems more effective and required relatively lower contrast volume so it may relates with our study.(Khan, Kabir et al. 2019)

Similarly another investigation conducted by Osama Tayeh and Federica Ettori concluded that patients who underwent coronary angiography in the contrast volume study; 586 of them underwent the procedure via the radial route, and 214 got the procedure via the femoral route. When comparing the two approaches, the radial technique used substantially less contrast than the femoral approach (67.63± 25.49 vs. 81.53 ±24.80 ml respectively, P = 0.03) (Tayeh and Ettori 2014) so as these findings are near to our study ,but we find a significant difference in both techniques.

CONCLUSION

It was concluded that there was a significant difference in the average contrast volume of dye in individuals undergoing coronary angiography via radial versus femoral route since our p value (0.031) was smaller than alpha value (0.05). Although radial access was used on a higher proportion of patients, hence less MCV was administered via radial approach (50ml, 39.1%) than via femoral approach (70ml, 9.6%) to prevent post-angiography complications. Mean contrast volume was significantly lesser in patients undergoing coronary angiography by radial when compared to those with femoral.

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