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COMPARISON OF RADIATION AND CONTRAST SAFETY BETWEEN RADIAL AND FEMORAL APPROACHES IN PATIENTS UNDERGOING CORONARY CATHETERIZATION

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Contribution

SFM conceived, designed and did statistical analysis & manuscript writing. TS, KN, NK and JAS did data collection and manuscript writing. NHR did review and final approval of manuscript

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ABSTRACT

Objective: To compare radiation and contrast safety between radial and femoral approaches in patients undergoing coronary catheterization.

Methodology: This cross sectional study was conducted at National Institute of Cardiovascular Diseases, Karachi from June 2014 to June 2015. Patients of either gender and any age undergoing cardiac catheterization procedures were included in the study. Fluoroscopy time was measured in min and contrast amount was measured in terms of milliliter (ml). Procedures were divided in 2 groups on basis of access sites [(femoral (f-CA) and radial (r-CA)]. Procedures were performed by different operators with different level of expertise and were grouped into three (consultants, senior registrar and post fellow trainees). Procedures were categorized into two groups depending on the nature of procedure (coronary angiography, elective PCI). Statistical analysis was performed using SPSS-20.

Results: A total of 957 patients were included in this study out of which 731 were diagnostic coronary angiograms and 226 were percutaneous coronary intervention. Among patients in coronary angiography group, mean age was 53.97 ± 10.748 years. Mean fluoroscopic time was 4.175 ± 4.13 min. About 671 (79%) were f-CA and 70 (21%) were r-CA. Significant difference in fluoroscopy time was observed in patients who underwent r-CA as compared to the f-CA group ($p = 0.003$). Mean contrast volume was 78.54 ± 24.54 ml. No significant difference was found in two groups ($p = 0.454$). Out of 226 PCI, 163 were f-PCI (72.12%) and 63 (27.86%) were r-PCI. Mean fluoroscopic time was 9.613 ± 6.072 min. No significant difference in fluoroscopy time was observed in patients who underwent r-CA as compared to the f-CA group ($p = 0.129$). Mean contrast volume was 147.82 ± 44.83 ml. No significant difference was found in two groups ($p = 0.248$).

Conclusion: Fluoroscopy time of patients undergoing radial angiography was significantly increased than femoral route. No such difference was observed for PCI. Contrast amount used was similar in two groups of patient undergoing angiography or angioplasty.

Key Words: Coronary angiography, Contrast amount, CIN.

INTRODUCTION

Currently radial route is preferred method of coronary catheterization. Increased frequency of radial route is mainly due to fewer complications. Various studies have shown that bleeding complications, one of the major concerns after coronary intervention is less with radial approach.[1] Radial approach is also associated with early hospital discharge and patient comfort.[2-3] But at the same time radial artery canulation may pose unexpected challenges like spasm, tortuosity and aberrant artery. Sometimes it becomes difficult to negotiate through innominate artery loop.[4] These natural anatomical hurdles results in increase procedural time, radiation exposure and increased use of contrast amount.[4-7]

Increased radiation dose is associated with increased number of peri-procedural complications.[8] Nowadays patients usually undergo many imaging studies apart from cardiology which increases cumulative radiation exposure. At the same time operator is also exposed to hazardous effect of radiation.[9] Therefore every step should be undertaken to minimize radiation exposure time.

Increased contrast volume is associated with Contrast induced nephropathy (CIN). CIN frequently complicates patients with preexisting renal disease and DM.[10] Ironically these two disorders are risk factors for coronary artery disease. Hence requiring coronary catheterization in these patients. CIN increases mortality and morbidity. CIN is directly related with volume of contrast used.[8] Therefore lesser volume will result in fewer episodes of CIN.

Aim of this study was to compare safety between radial and femoral approaches in patients undergoing coronary catheterization in terms of radiation exposure and contrast volume. The results of this study may increase the confidence of operator regarding radial route as preferred approach for coronary catheterization.

METHODOLOGY

This cross sectional study was conducted at catheterization laboratory of National Institute of Cardiovascular Diseases, Karachi from June 2014 to June 2015. This study was approved by hospital ethical committee and informed consent was taken from all patients included in the study. Patients of both gender and age between 18 to 90 years undergoing cardiac catheterization procedures due to different indications were included in the study. Radiation exposure time was measured in terms of fluoroscopy time (FT), minutes from time of onset of fluoroscopy till the end of procedure. Contrast volume was measured in ml. Procedures were categorized into two groups depending on access site approach (Radial Vs Femoral).

All the procedures were performed by different operators with different level of expertise and were grouped into three (consultants, senior registrar and post fellow trainees). Procedures were categorized into two groups depending on the nature of procedure (Coronary angiography and PCI).

Statistical analysis was performed using SPSS-20. Fluoroscopy time and contrast volume is presented in min and ml as mean and SD. Other continuous variables like age is given as mean with standard deviation, and categorical variables are displayed as frequencies and percentages. Student's T test was used to compare the fluoroscopy time and contrast volume between two groups (femoral vs radial).

RESULTS

A total of 957 patients were included in this study out of which 731 were diagnostic coronary angiograms and 226 were PCI (Table 1). Among patients in Coronary angiography group mean age was 53.97 ± 10.748 years. Mean fluoroscopic time was 4.175 ± 4.13. 671 (79%) were f-CA and 70 (21%) were r-CA. Significant difference in fluoroscopy time was observed in patients who underwent r-CA as compared to the f-CA group ($p=0.003$). Mean contrast volume was 78.54 ± 24.54. No significant difference was found in two groups ($p = 0.454$) (Table 2).

Out of 226 PCI, 163 were f-PCI and 63 were r-PCI. Mean fluoroscopic time was 9.613 ± 6.072 min. No significant difference in fluoroscopy time was observed in patients who underwent r-CA as compared to the f-CA group ($p=0.129$). Mean contrast volume was 147.82 ± 44.83ml. No significant difference was found in two groups ($p= 0.248$).

On subgroup analysis difference in FT was more pronounced in consultants who performed angiographies. Mean FT among consults, senior registrars and post fellow was (7.844 Vs 3.775, 2.91 vs 3.27, 5.50 Vs 4.24) respectively for femoral and radial group [$p = 0.001$ for consultants]. While no such difference was found in contrast volume among different operators.

DISCUSSION

We found a significant difference in fluoroscope time between radial vs femoral angiographies. Same has been found in other studies.[8,11] In a previous study, conducted at same center, researchers have mentioned fluoroscopy time of 6.3 ± 3.8 for radial and 4.0 ± 2.9 for femoral route.[12] Where as our study showed FT 4 ± 4.02 for femoral and 5.6 ± 4.95 for radial route. A smaller decrease in fluoroscopy time can be explained due to the fact that in our study radial route procedures were carried out more frequently than before. Initially consultant as well as trainee doctors were reluctant for radial procedure. Increase in number of radial procedure was in part due to patient's preference and partly due to increased confidence of operator.

This trend is reported by Agostoni et al. and Brasselet et al.[9,13]

Table 1: Baseline Characteristics of Patients in Study Population (n=957)

Variable		PCI	CA
Gender	Male	184(25.1%)	550(74.9%)
	Female	42(18.8%)	181(81.2%)
Site of approach	Femoral	163(19.5%)	671(80.5%)
	Radial	63(51.2%)	60(48.8%)
LM disease	Yes	2(3.6%)	54(96.4%)
	No	224(96.4%)	677(75.1%)
LAD disease	Yes	136(21.9%)	484(78.1%)
	No	90(26.7%)	247(73.3%)
RCA disease	Yes	74(17.5%)	348(82.5%)
	No	152(28.4%)	383(71.6%)
LCX disease	Yes	37(9.6%)	349(90.4%)
	No	189(33.1%)	382(66.9%)

Table 2: The Comparison of Radiation Dose And Volume of Contrast Agent Used In Analyzed Groups (n=957)

Variable	Radial	Femoral	p-value
Coronary angiography			
n %	60(8.2%)	671 (91.8%)	
Dose of radiation (min)	5.698±4.9521	4.039±4.0256	0.003
Contrast volume (ml)	80.833±25.59	78.3538±24.46	0.454
PCI			
n %	63 (27.9%)	163 (72.1%)	
Dose of radiation (min)	10.600±6.559	9.2325±5.850	0.129
Contrast volume (ml)	140.86±48.469	151.95±42.427	0.248

According to reports FT has reduced by > 75% in two decades due to increased turnover of radial approach.[14] Like our study Louvard et al. reported that in patients undergoing CA fluoroscopy time was longer in trans radial group than trans femoral group (4.5 ±3.7 versus 6.0 ± 4.4 min; $p < 0.05$) same finding though on smaller scale was also reported by Plourde et al.[15,16]

Our Radial CA time is compatible with other local centers. Therefore radial route should be advised as safe method for coronary angiography.[17] Radial procedure has a learning curve.[18,19] Prolong fluoroscopy time can be attributed to the fact that procedures were done by most senior consultants as well as post fellows with relatively little experience. For the beginners radial procedure is difficult at various stages from access site puncture to engagement. Prolong fluoroscopy may be required to go through radial tortuosity, at innominate artery level or while engagement. During radial approach engagement is often suboptimal. Therefore images obtained are less clear. This necessitates either repeat images or other view. This results in prolong FT.

Another important finding of our study was that consultants FT was significantly prolonged in radial vs femoral approach angiographies. Reason may be that many consultants have made one of the approaches as their routine method.

Our study did not found any difference in FT among PCI group. On other study conducted by Brueck et al all showed a significant difference in radial vs femoral PCI [9.0 (3.9-10.7) 5.8 (1.7-7.5)] [$p = 0.001$].[4]

Our study did not find a difference between radial and femoral route. Other study too has similar results. [132 (80-160) vs 129 (90-160)] ($p = 0.43$).[4] Comparable results are reported by Sinha SK et all where contrast volume used was 67.52 ± 22.54 in femoral and 71.63 ± 25.41 in radial group [$p = 0.32$].[14] Our results are in contradiction to Rao et al. and Kawashima et al. which reports lesser amount in femoral approach.[20,21]

In a study conducted at same center about five years back showed a significant difference in contrast volume in patients undergoing radial and femoral route coronary angiography.[11] Use of contrast volume was 75.6 ± 27.2 in femoral group while 82.9± 28.7 ml in radial group ($p = 0.001$). While our study did not show such difference. This may be due to the fact that back then radial approach was not undertaken frequently. Only limited numbers of operators were doing radial angiography. While in our study radial approach was used comparatively frequently by all type of

operators (consultants, senior registrar, post fellows).

This difference between two groups could be explained due to phenomenon of advanced learning curve associated with radial approach.[22.23]

During the study period both femoral and radial route were used quite frequently. So operators were familiar with both approaches almost with same confidence level. Most of the studies showing a significant difference in radial vs femoral group belong to center with shifting period from femoral to radial. [24]

CONCLUSION

Fluoroscopy time of patients undergoing radial angiography was significantly increased than femoral route. No such difference was observed for PCI. Contrast amount use was similar in two groups either patient underwent angiography or angioplasty.

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