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Comparison of X-Ray Duration and Contrast Agent Amount in Coronary Angiography Using Radial and Femoral Access in Bandar Abbas Angiography Center in 2017

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Abstract

Background: In recent years, radial access has emerged as an alternative for femoral access in coronary arteries angiography. The former has the privilege of shorter hospitalization and fewer side effects, as compared to the latter.
Objectives: The present survey aimed to compare the X-ray duration and contrast agent use between radial and femoral access sites.
Methods: The present descriptive study was conducted with a convenience sample of 400 patients in 2017 in Bandar Abbas. The sample size was the same in the radial and femoral groups. Information such as age, sex, weight, angiography type and method, X-ray duration and amount of contrast agent was recorded. The collected data were statistically analyzed using SPSS-23.
Results: The mean volume of the contrast agent was 44.74 $\pm$ 26.31 cc in the radial group and 28.77 $\pm$ 20.91 cc in the femoral group. The difference between the two groups was statistically significant ($P < 0.001$). The mean duration of X-ray was 383.66 $\pm$ 329.42 seconds in the radial group and 248.83 $\pm$ 225.72 seconds in the femoral group. The difference between the two groups was statistically significant ($P < 0.001$).
Conclusions: Overall, the duration of X-ray and amount of contrast agent used in patients undergoing coronary angiography was higher in radial than in femoral access. This was more evident among patients who had only diagnostic angiography than those who undergone angiography and PCI at the same time.

Keywords: Angiography, Radial Access, Femoral Access, X-Ray

1. Background

Coronary angiography is a key diagnostic medical procedure in patients with acute coronary disease. This procedure is accompanied by many different adverse effects (1) ranging from mild complications such as small hematoma that need no serious treatment to severe cases that require immediate treatment. Among the major adverse effects of angiography, myocardial infarction and stroke can be mentioned. There are certain access site complications such as access site bleeding, infection, arteriovenous (AV) fistula, Pseudoaneurysm, and thrombosis.

Newer methods have emerged for cardiac angiography with different side effects. The two popular forms of angiography conducted currently are femoral and radial access. The latter has shown to be with fewer adverse effects and shorter hospital stay.

A prevalent complication of angiography through radial access is radial artery occlusion (2-4). This prevalence in radial access is reported to range between 5 and 19% (5). In the majority of cases, this is of no clinical value. Due to the passing of blood through radial and ulnar arteries and their collaterals, the risk of ischemia is low in radial artery thrombosis. Yet, this can cause ischemia in patients with incomplete palmar arch.

There are quite many ways to prevent radial artery thrombosis (6). In the recent clinical body of research, no significant difference has been observed between radial and femoral PCI in terms of success (7). As sheaths 6-F and 7-F are fit for radial access, there is no limitation in the successful implementation of complicated PCI through this type of access (8, 9). Thus, high-risk cases such as the left coronary artery, chronic total occlusion, or complex coronary disease can be easily accessed through radial artery (10, 11).

Hemorrhage and arterial insufficiency showed to be significantly lower in the radial access than in the femoral access even when anti-hemorrhage tools were used at the insertion spot of femoral artery (7, 12, 13). In the most comprehensive study conducted so far, known as RIVAL (radial vs. femoral access for coronary intervention), 7021 ACS patients were randomly selected. The patients had either coronary angiography or a radial/femoral intervention (12). The findings revealed no significant difference between radial and femoral access in terms of mortality, MI, heart attack, and non-CABG type hemorrhage. Moreover, the arterial complications of access site were significantly lower in the radial group than in the femoral group. Overall, it was concluded that radial access angiography helped reduce arterial complications at the access site by 65%, non-CABG type hemorrhage by 49%, and need for blood transfusion by 35% (12).

Hemorrhage is not the only difference between radial and femoral access. In the above-mentioned survey, patients significantly preferred radial to femoral access (12, 14). Another advantage of radial access is its lower cost (15).

Though a large body of research has compared radial and femoral access, a few studies have compared these two methods of angiography in terms of X-ray duration and the amount of contrast agent.

2. Objectives

Thus, the present study aimed to compare these two methods among patients in Bandar Abbas in 2017.

3. Methods

The present descriptive study was conducted in Bandar Abbas in 2017. The target population comprised all patients admitted to an angiography center in Bandar Abbas to undergo angiography through either radial or femoral access. For this purpose, 200 patients were recruited in the radial group through convenience sampling method. The same number of patients was assigned to the femoral group. To do the angiography procedures, the contrast agent 'VISIPAQUE 320' was used for all patients.

A checklist was filled out for each participant to gather information such as age, sex, weight, angiography type and implementation (diagnostic or PCI), X-ray dose and duration (fluoroscopy) in seconds, and the amount of contrast agent in milliliters. The collected data were statistically analyzed using SPSS-23. Descriptive statistics (mean, standard deviation, frequency, and percentage) were used along with inferential statistics (*t*-test and chi-square test).

4. Results

The present study was conducted with 400 participants, half of whom (50%) were in the femoral group and the rest (50%) in the radial group. Among the participants, 233 patients (58.3%) were male and 167 (41.8%) were female. Among them, 145 patients (36.3%) belonged to the PCI group and 255 (63.7%) to the angiography group. The mean age and height of the participants are summarized in Table 1.

Table 1. Mean Age and Height of the Participants

Variable	Mean ± SD
Age	57.57 ± 11.54
Height	165.68 ± 8.64
Weight	68.96 ± 12.57

Table 2 makes a comparison between the two groups in terms of age and height. As indicated, there was no statistically significant difference between the two groups in terms of age (P = 0.945) and weight (0.175). However, participants' height was significantly greater in the radial group than in the femoral group (P < 0.001).

Table 2. Age and Height of the Participants[a]

Variable	Femoral Group	Radial Group	P Value
Age, y	57.53 ± 12.62	57.61 ± 10.38	0.945
Height, cm	163.98 ± 6.66	167.38 ± 9.97	< 0.001
Weight, kg	68.11 ± 12.22	69.82 ± 12.88	0.175

[a]Values are expressed as mean ± SD.

A comparison across sex and angiography type was done and reported in Table 3. No statistically significant difference was observed between the groups in terms of sex (P = 0.478). Concerning angiography type, however, the type was mostly diagnostic in the femoral group (P < 0.001).

X-ray duration and amount of contrast agent were cross-compared in the research groups once totally and once again in terms of the angiography type and the results are shown in Table 4. As can be seen, the amount of contrast agent and duration of exposure to X-ray totally and also among patients with diagnostic angiography were significantly higher in the radial group than in the femoral group (P < 0.001). In the two research groups, the amount of contrast agent (P = 0.310) and duration of X-ray (P = 0.508) did not diverge significantly among patients with interventional angiography.

Table 3. Sex and Angiography Type of Participants[a]

Variable	Femoral Group	Radial Group	P Value
Sex			0.478
Male	113 (56.5)	120 (60)	
Female	87 (43.5)	80 (47.9)	
Angiography type			< 0.001
Diagnostic angiography	145 (72.5)	110 (55)	
Angiography and PCI	55 (27.5)	90 (45)	

[a]Values are expressed as No. (%).

Table 4. X-Ray Duration and Amount of Contrast Agent in the Research Groups[a]

Variable/Group	Femoral Group	Radial Group	P Value
Amount of contrast agent, cc			
Diagnostic angiography	28.77 ± 20.91	44.74 ± 26.31	< 0.001
Angiography and PCI	80.09 ± 24.27	85.92 ± 44.48	0.310
All patients	42.88 ± 31.68	63.27 ± 41.06	< 0.001
X-ray duration/fluoroscopy, s			
Diagnostic angiography	169.37 ± 184.38	297.40 ± 265.67	< 0.001
Angiography and PCI	458.29 ± 188.32	489.08 ± 368.45	0.508
All patients	248.83 ± 225.72	383.66 ± 329.42	< 0.001

[a]Values are expressed as mean ± SD.

5. Discussion

The present survey compared coronary artery angiography via femoral and radial access in terms of the duration of X-ray received and the amount of contrast agent taken by patients. The results showed that radial access was associated with the longer X-ray duration and the increased amount of contrast agent overall in all patients specifically in those who had only undergone diagnostic angiography. The X-ray duration and amount of contrast agent used did not reveal any significant between-group difference among those who simultaneously had angiography and PCI.

This issue has also been explored in other investigations including one in Turkey; it showed that though radial access could be a reasonable alternative with shorter hospital stay compared to femoral access, it had disadvantages such as the need for more contrast agent use and X-ray exposure (16).

In a similar study, Michael et al. (17) observed that in patients who had previously undergone CABG and then referred back for angiography, radial access was associated with longer X-ray exposure and more contrast agent use than femoral access. One factor influencing angiography duration is the experience of the visiting doctor (18, 19). Angiography through radial access takes more time than femoral access (20-22). Moreover, consistency in using this access type requires more skill on the part of the doctor. It also needs appropriate equipment for implementation such as appropriate catheters that can shorten the duration of the whole procedure (22-24).

Several studies have reported results contradictory to our findings. One such research was a meta-analysis conducted in 2016, which showed that for those already having CABG and currently in need of angiography, X-ray duration and amount of contrast agent were similar between radial and femoral access groups (25).

Copious studies have compared femoral and radial access in terms of variables other than radiation duration and amount of contrast agent (26-36). Despite a great difference in results, the majority of these investigations suggested radial access as a proper alternative to femoral access (37, 38). Among the most significant advantages of radial compared to femoral access are the need for shorter hospitalization and fewer adverse effects (39). Though the present survey did not take into account patients' satisfaction and cost-effectiveness of radial angiography, these two variables have been investigated in many other studies, showing radial access superior to femoral access (20, 40-45).

The present descriptive-analytical study compared radial and femoral angiography. As the study was not a randomized clinical trial, it faced certain limitations. Patients were not randomly assigned to groups. Selecting the type of angiography was based on the visiting doctor's decision, which could have affected the results. However, as the two research groups in the present study were similar in terms of age and weight and only differed slightly in terms of height, these variables showed to have hardly influenced the results.

Another limitation is that the present survey only compared the two groups in terms of X-ray duration and amount of contrast agent and ignored other relevant aspects.

5.1. Conclusions

Overall, the duration of X-ray exposure and the amount of contrast agent were higher in angiography through radial access than through femoral access. This was also true for those who only had diagnostic angiography, yet, not for those having both angiography and PCI together. It is obvious that the acquisition of more experience by doctors and the employment of better and more sophisticated equipment in the near future will bring better results.

5.2. Suggestions for Further Research

Although both X-ray duration and amount of contrast agent were greater through diagnostic angiography using radial access, due to fewer adverse effects, shorter hospital stay, and more patient satisfaction mentioned in the European angiography guidelines, radial access is suggested as the preferred access site for coronary angiography, especially when radial access is used in diagnostic angiography and angioplasty.

Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

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Footnotes

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