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Case Study of Femoral and Radial Angiography in Cardiovascular Patients

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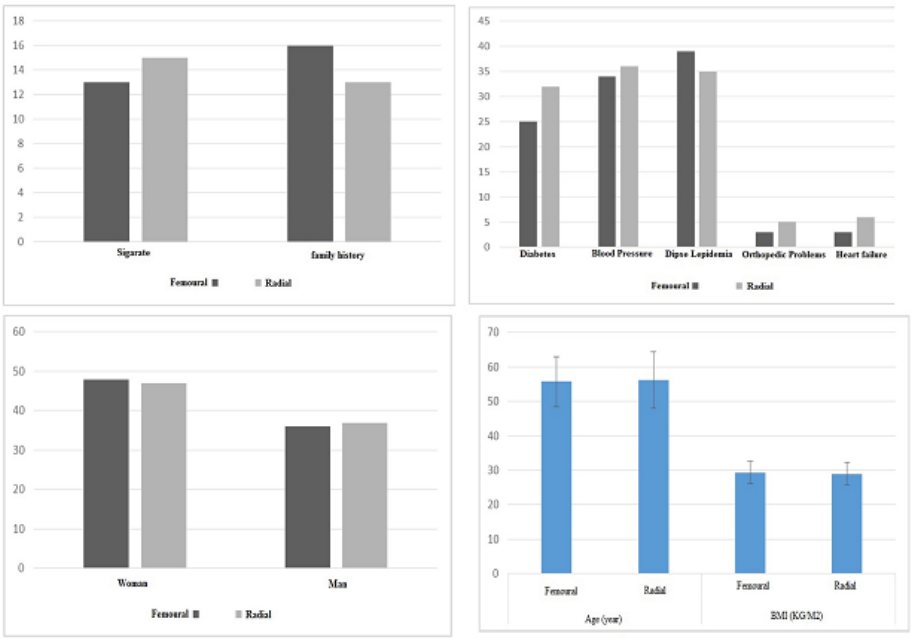
ABSTRACT

In the present study, in order to evaluate the benefits and side effects of two angiographic methods through radial and femoral arteries in angiographic patients, we applied SPSS software and statistical operations including Fisher Exact, Chi-square and Mann-Whitney tests. This case study was performed on patients of Shaheed Behesti Hospital in Qom in 2017. The results of the present study showed that the incidence of complications such as catheter pain, hematoma, swelling, bruising and duration of hospitalization in the femoral angiography group was more than the radial group. However, due to the fact that the duration of contact radiation and duration of fluoroscopy in the group of femoral angiography was less than radial, depending on the case and according to the patient and the existence of various risk factors in the patient, the decision should be made for femoral or radial angiography for the patient. On the other hand, if the duration of surgery extended and the amount of radiation received by the patient increases, femoral angiography is more important, and when complications such as hematoma and symptoms are present, radial angiography is used, which is different depending on the case.

GRAPHICAL ABSTRACT



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Introduction

Cardiovascular diseases are the leading cause of death worldwide and the leading cause of death in developed and developing countries. The specific death rate from cardiovascular diseases is more than 17 million per year, which is about 30% of all deaths in the world and accounts for 10% of the total disease burden [1-3]. Among them, coronary heart diseases account for more than 7 million deaths from cardiovascular diseases. In the United States, cardiovascular diseases have become a social problem and the resulting death rate by 4.6 per 10,000 population has the highest mortality rate [4]. One of the ways to diagnose coronary artery disease is coronary angiography, which is today performed by two methods of angiography through the femoral or radial arteries. The most common method in the world for coronary angiography is access method through femoral artery and radial artery considered as femoral replacement [5-8]. Angiography, in addition to being invasive, has complications including death, heart attack, and bleeding, while its fatal complications are very low and is about 1 in 1000 [9]. The most common complication is bleeding at the site of arterial access [10]. Bleeding from angiography is the most important cause of increased risk of death and recurrent ischemic events [11-13]. In 1989, Compeau first reported the possibility of angiography through the radial artery [14] and stated that the major benefits of the radial method were related to the reduction of bleeding and vascular complications at the puncture site [15-18]. Other benefits of the radial method include increasing patient satisfaction and comfort, reducing the length of hospital stay and reducing costs [19-22]. Unlike the United States, the radial method has been expanding in Europe, Asia, and Canada over the past few years. Most centers use the radial method in less than 10% of cases and only 7 centers in the world use the radial method in over 40% of cases [23]. The reason for the low acceptance of this method, despite its many advantages, is that this method is a new technique and requires a special training course. In addition, this method, like any new method, has its own side effects that their recognition, prevention and treatment require special skills. For this reason, and due to the importance of the subject, extensive studies conducted on how to treat cardiovascular disease by comparing radial and femoral methods [24]. A study by Iwachow P et al. (2017) showed no contrast usage. On the other hand, the average procedure time in the RA group was significantly less than that of the FA group. In addition, fluoroscopic times, X-ray dose, and contrast use were similar in RA and FA, while the total routine time in RA was significantly less than in the FA group. However, elderly patients in the RA group required longer fluoroscopy to complete PCI, and this was observed in the FA [25]. Also, in 2016, Schussler JM and associates compared radial and femoral angiography. In this study, patients undergoing TRA had less bleeding, less dialysis, and less than patients undergoing TFA ($p = 0.02$). On the other hand, by studying logistic regression, complications, readmission and hospital mortality were less in TRA patients than in TFA patients. As a result, patients undergoing angiography with / without PCI via TRA showed fewer complications [38]. Examining radial angiography with femoral angiography in 657 patients in California, Christopher R. Balwanz and associates (2103) found that the mean duration of fluoroscopy in the femoral group was 7.9. minutes and 10.4 minutes in the radial group. However, by comparison, the mean duration of surgery in the femoral group was less than the radial group and this difference was not statistically significant. On the other hand, the average volume of contrast in the femoral and radial groups was equal to 128 ml [26]. In addition, Erdal Aktürk and associates (2014) conducted a study on 836 patients to evaluate radial angiography with femoral angiography. Their results showed that the rate of severe bleeding in the radial group was equal to 0% of cases and in the femoral group, it was equal to 0.2% of cases. In addition, the rates of hematoma were 3.7% and 1.2% in the femoral group and in the radial group, respectively. The mortality rate in the femoral group was 0.2% and in the radial group was zero. Further, the average length of hospital stay in the femoral group was 24.4 hours while it was equal to 3.3. 8 hours in the radial group, which was also statistically significant. On the other hand, in this study, it was

found that spasm in the radial group was equal to 21.3% and in the femoral group it was equal to zero [28-31].

Methods

This study was a descriptive-analytical and retrospective study. The samples were collected by non-probability method in the second half of 2017. Accordingly, the file information of angiogr2Q1 aphed patients in the lip office of Shaheed Beheshti Hospital in Qom in the second half of 2017 was used consecutively and non-probabilistically until the sample size was completed. Also, from the patients' records, demographic information including age, height, sex, weight, body mass index, underlying disease, equipment used during angiography, complications during angiography and the time until the patient's discharge, duration of hospitalization and success rate was all kept. Completion of angiography, subjective complaints at the puncture site such as pain, swelling, movement disorder, sensory disturbance, and bruising were recorded in both methods and then were examined. It should be noted that in order to study the process based on the following formula, 84 people from each group (168 people in total) entered the study and were examined based on the following formula (Equation 1):

$$N = \frac{z\frac{1-\propto}{2} + z(1-\beta)^2}{(\omega\prime)^2} \qquad \text{(eq. 1)}$$

ώ=0.3 α =0.95 β =0.8

It should be noted that in order to collect information in the descriptive section, the library study method and in the survey section, questionnaires were used (Table 1). The tools used in this study included a checklist in which the first part includes demographic information and the second part contains information about clinical findings and angiographic complications. All patients' information was fed into SPSS 22 software and statistical analyses were presented in two descriptive and analytical sections. In the descriptive section, the frequency of complications was presented as the main variable in different groups and all demographic and clinical properties of patients were reported based on descriptive criteria. In the analytical section, according to the establishment of statistical presuppositions, proportional and non-parametric proportional tests were used. Chi-square (CHI-SQUARE) and Fisher Exet tests were applied to analyze the qualitative findings and independent t-test was used to compare quantitative data. If the initial assumptions do not meet as normal, Mann-Whitney parametric bread is used and all tests are examined at a 5% error level.

Table 1: Questionnaire used to analyze the statistical population under study

Scale	Variable properties		Variable type (role)				Variable title	row
	Qualitatively	Quantitatively	Dependent	Independed	Confusing	Background		
year	☐	☒	☐	☐	☐	☒	age	1
Male/female	☒	☐	☐	☐	☐	☒	Gender	2
Kg/square meter	☐	☒	☐	☐	☒	☐	BMI	3
Femora /Radial	☒	☐	☐	☒	☐	☐	Angiographic method	4

Continue of Table 1.

Complete or incomplete in the appropriate manner	☒	☐	☒	☐	☐	☐	Success in angiography	5
Mortality, stroke, stroke	☒	☐	☒	☐	☐	☐	General complications	6
Lack of pulse, Bleeding, Hematoma, Pseudo aneurysm, Dissection, Venous arterial fistula	☒	☐	☒	☐	☐	☐	Vascular complications at the puncture site	7
the watch	☐	☒	☒	☐	☐	☐	Duration of hospitalization	8
1-2-3 –more than 3	☐	☒	☒	☐	☐	☐	Number of catheters used	9
Pain, swelling, movement disorder, sensory disturbance, bruising	☒	☐	☒	☐	☐	☐	Subjective complaint after angiography	10
cc	☐	☒	☒	☐	☐	☐	The volume of contrast medium used	11
Second	☐	☒	☒	☐	☐	☐	Fluoroscopy time	12
Milligram	☐	☒	☒	☐	☐	☐	The amount of radiation	13
Diabetes, hypertension, hyperlipidemia	☒	☐	☐	☐	☒	☐	Risk factor	14

Result and Discussions

Mann-Whitney test results in mean and standard deviation of age and BMI

In the study population, as can be seen, the mean and deviation of age and BMI in the study groups were not statistically significant due to P> 0.05 (Table 2 and Figure 1):

Table 2: Mean and age deviation and BMI in the studied groups

P-value	Standard deviation	Mean value	number	Study group	Variable
0.623	7.31	55.72	84	**Femoral**	**age**
	8.20	56.23	84	**Radial**	
0.448	3.28	29.38	84	**Femoral**	**BMI(kg/m²)**
	3.25	28.96	84	**Radial**	

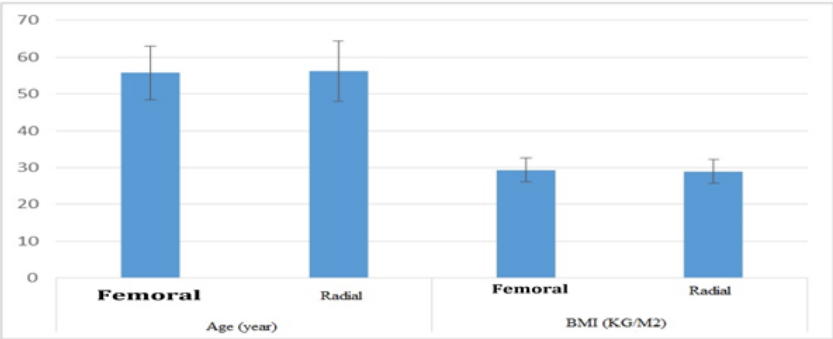

Figure 1: Mean and standard deviation of age and BMI parameters in the studied groups

Chi-square test in the analysis of gender frequency in the community under study

As can be seen from the results of Chi-square test, the frequency and percentage of gender in different treatment groups do not show a statistically significant difference, as P-value = 0.876 (Table 3 and Figure 2).

Table 3: Frequency of gender in different groups studied

P-value	Male	Female	Gender / Group	
0.876	36	48	**Number**	**Femoral**
	42.9%	57.1%	**%**	
	37	47	**Number**	**Radial**
	44.0%	56.0%	**%**	
	73	95	**Number**	**Total**
	43.5%	56.5%	**%**	

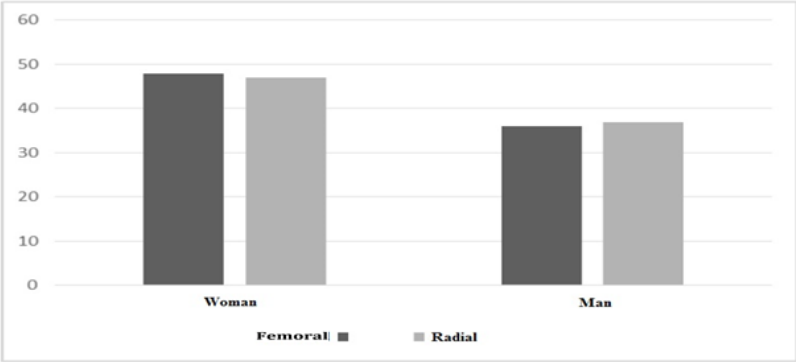

Figure 2: Frequency of gender in different groups studied

Frequency analysis of underlying diseases in different treatment groups using Chi-square and Fisher-Exact test

As can be seen in Table 4, the frequency of underlying diseases in different treatment groups did not show a statistically significant difference (P> 0.05). This shows by Chi-square and Fisher-Except tests below. (Table 4 and Figure. 3).

Table 4: Frequency of underlying diseases in different treatment groups

P-value FISHER EXCACT	P-value CHI-SQUARE	Total	Radial	Femoral	Underlying disease / Group	
-	0.254	57	32	25	Number	**Diabetes**
		33.9%	38.1%	29.8%	%	
-	0.754	70	36	34	Number	**blood pressure**
		41.7%	42.9%	40.5%	%	
-	0.534	74	35	39	Number	**Dyslipidemia**
		44.0%	41.7%	46.4%	%	
1	-	8	5	3	Number	**Orthopedic problems**
		4.8%	6.0%	3.6%	%	
0.304	-	9	6	3	Number	**Heart failure (EF less than 35%)**
		5.4%	7.1%	3.6%	%	

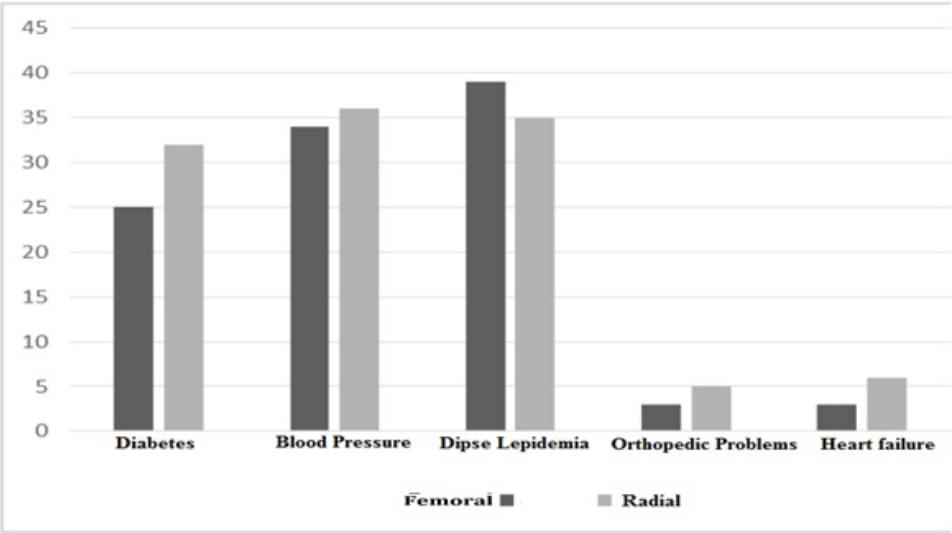

Figure 3: Prevalence of underlying diseases in different treatment groups

Chi-square test in the analysis of smoking history

According to the results of Chi-square test, as can be seen from the results, the frequency of smoking and family history in different treatment groups did not show a statistically significant difference (P-value> 0.05) (Table 5 and Fig. 4).

Table 5: Frequency of smoking history and family history in different treatment groups

P-value	Total	Radial	Femoral	Group / Variable	
0/679	28	15	13	Number	Cigarettes
	16.7%	17.9%	15.5%	%	
0.54	29	13	16	Number	Family history
	17.3%	15.5%	19.0%	%	

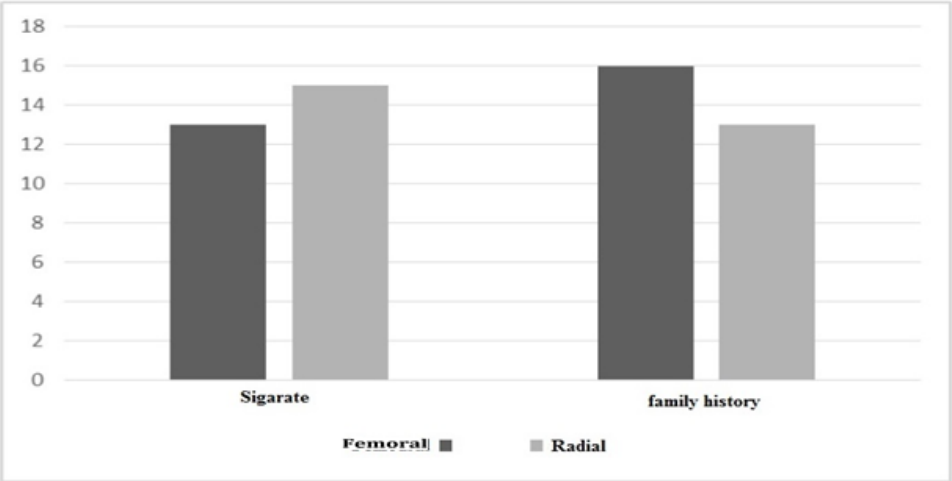

Figure 4: Frequency of smoking history and family history in different treatment groups

Chi-square test to evaluate the success rate of the first angiography

As can be seen from the results of Chi-square test, the frequency of success in the first angiography attempt in different treatment groups did not show a statistically significant difference and P-value> 0.05 was reported (Table 6 and Figure 5):

Table 6: Frequency of success in the first angiography attempt in different treatment groups

P-value	OR	total	Radial	Femoral	Variable / Group	
0.278	(0.26-1.47) 0.62	25	15	10	Number	**Unsuccessful**
		14.9%	17.9%	11.9%	%	
		143	69	74	Number	**Successful**
		85.1%	82.1%	88.1%	%	

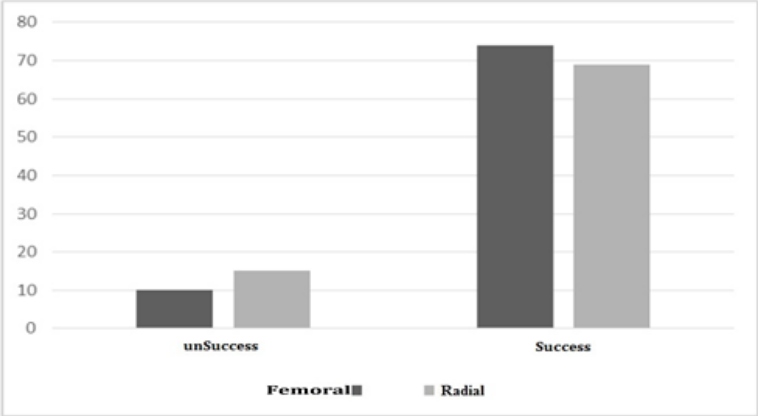

Figure 5: Frequency of success in the first angiography attempt in different treatment groups

Fisher Exact test to evaluate the incidence of general complications after angiography

As can be seen in the results of Fisher Exact test in Table 7, the frequency of general complications in different treatment groups does not show a statistically significant difference (P-value> 0.05).

Table 7: Frequency of general complications in different treatment groups

P-value	total	Radial	Femoral	Variable / Group	
1	166	84	82	**Number**	**does not have**
	98.8%	100.0%	97.6%	**%**	
	0	0	0	**Number**	**Death**
	0%	0%	0%	**%**	
	1	0	1	**Number**	**heart attack**
	6%	0%	1.2%	**%**	
	0	0	0	**Number**	**stroke**
	0%	0%	0%	**%**	

Fisher Exact test in the frequency of hospitalization in patients under study

As the results of Fisher Exert test show, the frequency of hospitalization for more than 24 hours in patients undergoing femoral angiography was equal to 14.3%.

In the group under radial angiography, it was equal to zero, which is a statistically significant difference (P <0.001) Also, the frequency of 3 catheters in patients under femoral angiography was equal to 11.9% and in the group under radial angiography, it was equal to 4.8. This difference is also statistically significant (P <0.001). Table 9 shows the results of the analysis.

Table 9: Frequency of hospitalization and number of catheters in different treatment groups

P-value	Total	Radial	Femoral	Group / Variable		
<0.001	34	34	0	**Number**	**Less than 12 hours**	**Duration of hospitalization**
	20.2%	40.5%	.0%	**%**		
	122	50	72	**Number**	**12 to 24 hours**	
	72.6%	59.5%	85.7%	**%**		
	12	0	12	**Number**	**More than 24 hours**	
	7.1%	0%	14.3%	**%**		
<0.001	61	61	0	**Number**	**One**	**Number of catheters**
	36.3%	72.6%	0%	**%**		
	93	19	74	**Number**	**Two**	
	55.4%	22.6%	88.1%	**%**		
	14	4	10	**Number**	**Three**	
	8.3%	4.8%	11.9%	**%**		

Fisher Exact and Chi-square test to evaluate the occurrence of various symptoms after angiography

As can be seen, the incidence of severe pain (11.9% vs. 2.4%), swelling (20.2% vs. 7.1%) and bruising (59.5% vs. 20.2%) Patients undergoing femoral angiography were significantly more than the group under radial angiography (P <0.05). In the present study, no case of movement disorder was reported (Table 10).

Table 10: Frequency of different symptoms in different treatment groups

P-value CHI-SQUARE	P-value fisher exact	OR	Total	Radial	Femoral	Group / Variable	
-	0.032	0.18 (0.03-0.85)	12	2	10	**Number**	**Severe pain**
			7.1%	2.4%	11.9%	**%**	
-	0.023	0.3 (0.11-0.81)	23	6	17	**Number**	**Inflation**
			13.7%	7.1%	20.2%	**%**	
-	0.497	0.49 (0.42-0.57)	2	2	0	**Number**	**Emotional disorder**
			1.2%	2.4%	0%	**%**	
<0.001	-	0.17 (0.08-0.34)	67	17	50	**Number**	**Bruising**
			39.9%	20.2%	59.5%	**%**	

Chi-square test in contrast type analysis

As the results of Chi-square test show, the frequency of contrast material in different treatment groups does not show a statistically significant difference (P> 0.05), which is reported in Table 11.

Table 11: Frequency of contrast agent type in different treatment groups

P-value	Total	Radial	Femoral	Group / Variable	
0.635	103	53	50	**Number**	**Aminopack**
	61.3%	63.1%	59.5%	**%**	
	65	31	34	**Number**	**ultrasonic**
	38.7%	36.9%	40.5%	%	

Mann-Whitney test in calculating the mean and standard deviation of the studied groups

As can be seen in the test results, a statistically significant difference was observed only in the mean radiation parameter in the femoral group

(2190.47 mg) and in the radial group (13452.38 mg) (P-value <0.001) (Table 12). In addition, this significant difference was seen in the mean duration of fluoroscopy in the femoral group (62.61 seconds) and in the radial group (108.2 seconds) (P-value <0.001), while the average volume of contrast between the two groups was different, not statistically significant (P-value> 0.05).

Table 12: Mean and deviation of the studied variables in the study groups

P-value	Standard deviation	Average	Number	Study group	Variable
<0/001	1290.14	2190.47	84	**Femoral**	**Radiation rate (milligrams)**
	4665.7	13452.38	84	**Radial**	
<0/001	10.14	62.61	84	**Femoral**	**Fluoroscopic duration (seconds)**
	13.45	108.2	84	**Radial**	
0/86	8.04	40.29	84	**Femoral**	**Contrast volume (cc)**
	7.7	40.17	84	**Radial**	

Conclusion

The results of Fisher Exact, Chi-square and Mann-Whitney tests in comparing the benefits, complications of radio vascular and femoral angiography in angiography patients showed that demographic characteristics, underlying disease, family history, frequency of success in the first attempt, the general side effects and the type of contrast agent in the different treatment groups were not of a statistically significant difference. While the frequency of hematoma in patients undergoing femoral angiography was 9.5% and in the group under radial angiography was 1.2%, this difference was statistically significant (P = 0.034) and in contrast, the frequency incidence of other complications in different treatment groups did not show a statistically significant difference. Also, the incidence of statistically significant differences in the frequency of hospitalization for more than 24 hours in patients undergoing femoral and radial angiography was zero. On the other hand, the complications of angiography in patients undergoing femoral angiography were significantly higher than the group under radial angiography (P <0.05).

Conflict of Interest

We have no conflicts of interest to disclose.

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