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Anatomical features of the radial artery in the Xinjiang population in China and its impact on the transradial coronary intervention procedure

Anatomical features of the radial artery in the Xinjiang population in China

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Abstract

Background: The anatomical features of the radial artery influence the transradial coronary intervention. The aim of this study is to discuss the anatomical features of the radial artery in the Xinjiang population and to guide interventionists in decreasing complications and improving success rates.

Materials and methods: We enrolled 1731 patients in this study. All relevant basic information was recorded in detail, and the radial artery diameter was examined. Patients were divided into a radial artery variation group and a radial artery non-variation group; univariate and multivariate factor analyses were performed to evaluate the relevant factors for radial artery diameter and the predictive value of the variable factors in radial artery variations.

Results: 1. The mean radial artery diameter for all patients was 3.01±0.14 mm. The multi-factorial analysis showed that height, gender, and occupation are significantly associated with radial artery diameter (*P*<0.05). **2.** The incidence of radial artery variation was 4.97% (86/1731) . Multi-factorial analysis showed that： gender (OR=2.72, 95%CI 1.469-5.037, *P* < 0.01), occupation (OR=2.228, 95%CI 1.0.000-0.012, *P* < 0.001) and radial artery inner diameter (OR=0.002, 95%CI 0.000-0.012, *P* < 0.001) are significantly associated with the incidence of radial artery variation.

Conclusions: The mean radial artery diameter in the Xinjiang population was 3.01±0.14 mm. height, gender. occupation are associated with radial artery diameter. gender, farmer, radial artery diameter are associated with radial artery variation. These factors can guide the interventionists to choose the appropriate equipment before the operation then can increase the efficiency of operation and prevent from the complications.

Key words: radial artery, predictive factors, transradial coronary intervention

Introduction

As the internal diameter of the femoral artery is large, the puncture site can conveniently be located, puncturing is easy, thus, it is used for initial coronary intervention[1]. However, due to important vascular and nerve companions with the femoral artery pathway and the anatomical position is deeper, there are complications such as puncture site bleeding; thus, interventionists realize the drawbacks of the femoral artery approach. The transradial(TR) approach for percutaneous coronary intervention (PCI) has been shown to decrease vascular complications and improve clinical outcomes compared with the transfemoral approach (TF) in both young[2] and elderly patients[3]. The TR-PCI is associated with a lower risk of access site bleeding and hematoma[4-5], early patient ambulation [6], shorter length of hospital stay[7], and lower hospital costs [8-9]. Therefore, the radial artery (RA) approach has been widely used as an alternative access for coronary intervention in many centers[10]. However, because of the variation in the radial artery, it is prone to spasm, and puncturing is not easily accomplished[11], it is also possible that intubation difficulty and radial artery occlusion may occur [12].

The purpose of this study is to analyze the anatomical features of the radial artery in the Xinjiang population, its clinical predictive factors and impact on the transradial artery coronary intervention, therefore providing an information about anatomical features of radial artery to the interventionists to select the appropriate interventional instruments and operation routes.

Materials and methods

1. Study population: A total of 1731 patients who underwent transradial coronary intervention for the first time during the period of January 2016 to June 2016 in People's Hospital of Xinjiang Uyghur Autonomous Region. The inclusion criteria were as follows: 1) positive Allen′s test; 2) the patients underwent first-time transradial coronary procedures and simultaneously completed angiography of the radial artery 3) the patient signed an informed consent form. The exclusion criteria were as follows: 1) negative Allen′s test; 2) faint or no radial artery pulse; 3) failure of the radial artery puncture or requiring alternative arterial access to complete the angiography; 4) previously performed transradial intervention; 5) patients with peripheral vessel disease.

2. Methods: All patients were examined for the inner diameter of the right radial artery by ultrasound. Measurement of the radial artery diameter was made at a point approximately 2cm proximal to the styloid process, where the puncture of the radial artery is usually made. A mean of three readings was taken for the diameter of the radial artery, and then radial artery angiography was undertaken, recording the anatomic variation of the radial artery. If the procedure failed, the route changed to the right radial artery or the

femoral artery route, which to change was left to the interventionist's discretion. Procedure length of time, fluoroscopy time, and radiation dose were recorded, and coronary arteriography or the coronary intervention was performed. Univariate and multivariate factor analyses were performed to evaluate the predictive value of variable factors for radial artery variations.

3. Statistical analysis: SPSS software (version 23.0; SPSS Inc., Chicago, IL, USA) was used; continuous quantitative data were expressed as the mean±standard deviation, while discrete quantitative data were expressed as frequency (percentage). Student's t test was used for the intra-group comparison of data, while a modified t test was used when population variance was heterogeneous; the average value comparison of different groups was analyzed via the standard variation, and the t test and variance analysis were used for the comparison of the average number of samples. If there was homogeneity of variances with the the log rank test and analysis of variance with Welch's t test, the x2 test was used for frequency data. Stepwise logistic regression was used to analyze the effect of the variables on the incidence of radial artery variation, and the goodness of fit of the logistic regression model was tested with the Hosmer-Lem eshow test. Multiple linear regression was used for relevant analysis, and $P<0.05$ was defined as significant.

Definition of anatomical variations

Variations in the radial artery were defined as[12] anatomical variations in the radial artery, including abnormal origin of the radial artery, radioulnar loop and tortuous configuration. The site of abnormal origin was determined relative to the intercondylar line of the humerus. This line represented the proximal border of the antecubital fossa. Bifurcation of the brachial artery proximal to this line was considered to be abnormal origin of the RA. A radioulnar loop was defined as the presence of a full 360° loop of the RA distal to the bifurcation of the brachial artery. Tortuous configuration of the RA was defined as the presence of maximum angulation of >90°.

Definition of procedure length of time

the time period between the beginning of pushing the guidewire into the radial artery and the head end of the catheter reaching the sinus of the aorta was recorded. If the procedure was not succeed, it was necessary to change the access site, and it included all of the procedure time, which was used for disinfection of the new puncture site, puncturing the new puncture site, etc.

Results

1.Characteristics of the inner diameter of the radial artery and its related factors：For all patients, the mean diameter of the adial artery was 3.01±0.14 mm, and the diameter of the radial artery was greater than a 6F Cordis sheath in 98.5% (1705/1731) of the patients and greater than a 7F Cordis sheath in 9.5% (164/1731) of the patients. A comparison of the relevant factors for radial artery diameter are presented in table 1.

Table 1: The univariate analysis of the relevant factors of radial artery diameter

Variables		Patients numbers	Inner diameter	$t/X^2/r$	*P*
Age		1731	-	-0.106	<0.001*
Weight		1731	-	0.191	<0.001*
Height		1731	-	0.318	<0.001*
Body mass index		1731	-	0.023	0.331
Gender				-13.156	<0.001*
	Male	1462	3.04±0.129		
	Female	269	2.91±0.138		
Ethnicity				0.536	0.709
	Han	735	3.01±0.15		
	Uyghur	733	3.02±0.13		
	Hui	134	3.01±0.13		
	Kazakh	95	3.01±0.13		
	Other	34	3.00±0.18		
Occupation				14.737	<0.001*
	Cadre	1380	3.02±0.14		
	Farmer	187	2.98±0.12		
	Other	164	2.98±0.12		
Smoking				-5.717	<0.001*
	Yes	556	3.04±0.125		
	No	1175	3.00±0.143		
Drinking alcohol				-4.187	<0.001*
	Yes	357	3.04±0.126		
	No	1374	3.01±0.141		
Hyperlipidemia				1.770	0.077
	Yes	234	3.00±0.145		
	No	1497	3.02±0.138		
Hypertension				0.243	0.808
	Yes	998	3.01±0.137		
	No	733	3.02±0.140		

Diabetes				-2.043	0.041*
	Yes	516	3.01±0.147		
	No	1215	3.02±0.127		

***Significant differences**

The results showed that age, weight, height, female gender, farmer occupation, smoking, drinking alcohol, and diabetes are relevant for radial artery diameter (*P*<0.005).

Multivariate factor analysis of relevant factors with *P*<0.1 was performed; see table 2.

Table 2. Multivariate logistic regression analysis of radial artery diameter

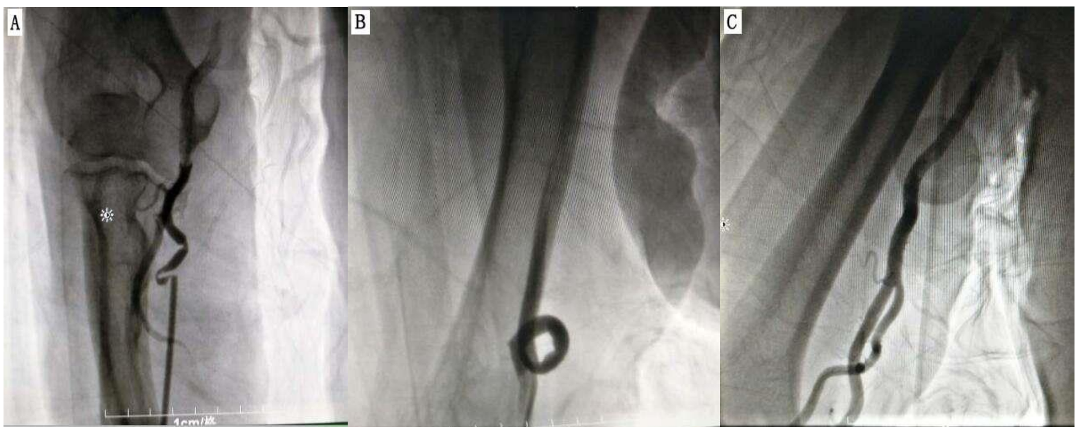
Variables			**B**	**S.E.**	**β**	**t**	**P**	**95.0% CI**	
								L-limit	**U-limit**
Constants			2.479	0.077		32.256	0.000	2.328	2.630
Age			-0.004	0.003	-0.030	-1.258	0.209	-0.009	0.002
Height			0.004	0.000	0.237	8.615	0.000*	0.003	0.005
Weight			0.000	0.000	0.009	0.345	0.730	0.000	0.001
Gender	Male	Female	-0.082	0.010	-0.214	-8.420	0.000*	-0.101	-0.063
Occupation	Farmer	Cadre	-0.024	0.010	-0.053	-2.342	0.019*	-0.044	-0.004
	Other		-0.032	0.011	-0.067	-2.984	0.003*	-0.053	-0.011
Smoking	Yes	Not	0.001	0.009	0.002	0.059	0.953	-0.017	0.018
Drinking	Yes	Not	0.001	0.010	0.004	0.122	0.903	-0.018	0.021
Hyperlipidemia	Yes	Not	-0.012	0.009	-0.030	-1.367	0.172	-0.030	0.005
Diabetes	Yes	Not	0.001	0.007	0.003	0.135	0.893	-0.012	0.014

***Significant differences**

The results showed that height, female gender, and occupation of farmer are significantly associated with the radial artery diameter (*P*<0.001).

2. The incidence of radial artery variation and types: The total incidence of radial artery variation in the Xinjiang population is 4.97% (86/1731); the incidence in females is higher than the incidence in males (14.5% vs 3.32%, P<0.001). The incidence in various ethnic groups is: Hanzu: 5.17% (38/735), Uyghur: 5.59% (41/733), Hui zu: 2.98% (4/134), Kazakh: 3.15% (3/95), and other ethnic groups 0% (0/34).

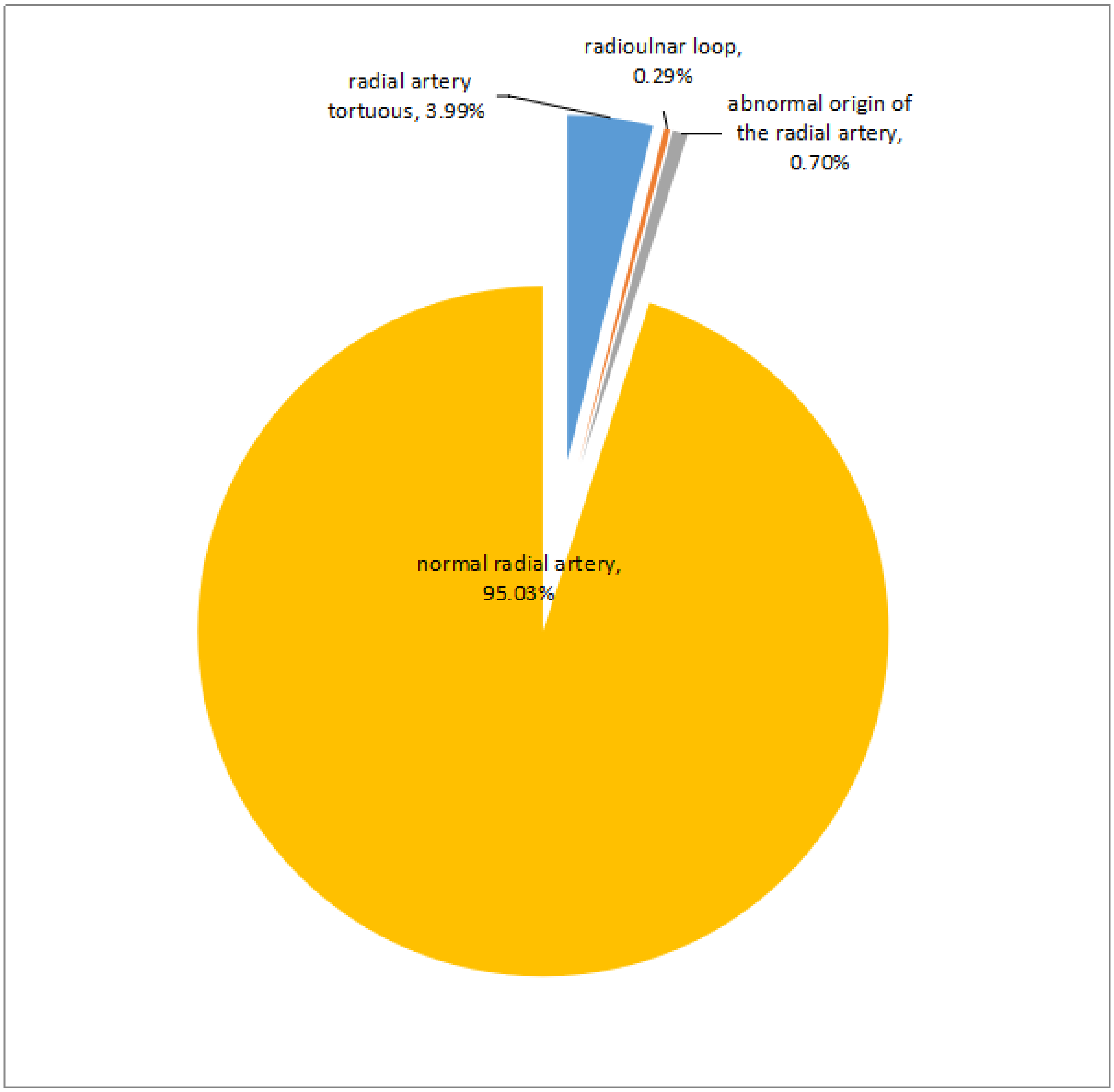
There were several types of variations found: radial artery tortuous, radioulnar loop and abnormal origin of the radial artery; see Figure 1.



A: tortuous B: loop C: abnormal origin

Figure 1. Types of radial artery variation founded in this study

Its incidence are 3.99% (69/1731), 0.29% (5/1731), and 0.7% (12/1731), respectively, see Figure2 .



3. The impact of radial artery variation on transradial coronary intervention:

3.1: Distribution of radial artery variation and change of artery access: In 86 cases of patients with radial artery variation, 23 cases required changing the radial artery access, 9 cases changed to the opposite radial artery access, which included 2 cases of abnormal origin of the radial artery, 1 case of radial artery loop, and 6 cases of radial artery tortuosity. A total of 14 cases changed to femoral artery access, which included 3 cases of abnormal origin of the radial artery, 4 cases of radial artery loop, and 7 cases of radial artery tortuosity, see table 3.

Table 3. Distribution of radial artery variation and change in access site

Variation type	Case number	Right radial artery	Changed to left radial artery	Changed to femoral artery
Abnormal origin of radial artery	12	7	2	3
Radial artery loop	5	0	1	4
Radial artery tortuosity	69	56	6	7

3.2: Interventional procedure outcome of patients by radial artery: In the following coronary angiography（CAG）or PCI, 45 cases of serious spasm occurred in patients with normal radial artery, and there were 29 cases in the radial artery variation group; the difference between the two groups was significant (P<0.001). Via giving antispasm drugs, waiting for a few minutes, or changing the primary guide wire to a super slip guide wire in the radial artery normal group, 20 cases had relieved spasm performing the CAG or PCI by right radial artery, and 25 cases did not have spasm relieved, which necessitated changing the radial artery access, 9 cases were changed to left radial artery access, and 16 cases were changed to femoral artery access. The failure rate of CAG or PCI by right radial artery was 1.5% (25/1645). In the radial artery variation group, 29 cases of serious spasm occurred. By using the same method with the spasm cases, which occurred in the radial artery normal group, 6 cases had relieved spasm performing the CAG or PCI by right radial artery, and 23 cases did not have spasm relieved, which necessitated changing the radial artery access, 9 cases were changed to left radial artery access and 14 cases were changed to femoral artery access. The failure rate of CAG or PCI by right radial artery was 26.7% (23/86), and the difference between the two groups is significant (P<0.001); see table 4.

Table 4. Interventional procedure outcome of patients by radial artery

	Normal group	**Variation group**	***P*-value**
Radial artery spasm (number/%)	45/2.70%	29/33.80%	<0.001*
Failure of TRI by right radial artery (number/%)	25/1.50%	23/26.70%	<0.001*
Relieving spasm (number/%)	20/1.58%	6/0.07%	<0.001*

*The differences are significant.

3.3. The impact of radial artery variation on transradial coronary intervention procedure: The procedure length of time in the radial artery normal group was 85.19±9.83 s and 267.75±24.50☆ s in the radial artery variation not-changed route group, while it was 895.00±80.40☆# s in the radial artery variation and changed-route group; the difference between the three groups is significant (*P* < 0.01). Fluoroscopy time in the radial artery normal group was 55.27±5.90 s, and in the radial artery variation not-changed route group, it was 163.30±23.62☆ s, while it was 204.61±52.57☆# s in the radial artery variation and changed-route group, and the difference between the three groups is significant (*P* < 0.01). The radiation dose was 24.29±3.08 mGy in the radial artery normal group and 76.59±12.58☆ mGy in the radial artery variation not-changed route group, while it was 94.91±24.15☆# mGy in the radial artery variation and changed-route group, and the difference between the three groups is significant (*P* < 0.01); see table 5.

Table 5. The impact of radial artery variation on transradial coronary intervention procedure

Variables	Radial artery normal	Radial artery variation not-changed route	Radial artery variation and changed route	*F*	*P* value
Procedure length of time (s)	85.19±9.83	267.75±24.50☆	895.00±80.40☆#	2634.154	<0.001*
Fluoroscopy time (s)	55.27±5.90	163.30±23.62☆	204.61±52.57☆#	706.172	<0.001*
Radiation dose (mGy)	24.29±3.08	76.59±12.58☆	94.91±24.15☆#	604.510	<0.001*

Notes: Compared with the normal group ☆*P*<0.05, compared with the radial artery variation not-changed route group #*P*<0.05.*Significant differences

4. **The predictor factors of radial artery variation：** According to the definition of radial artery variation, patients were divided into the radial artery variation group and the radial artery nonvariation group. A comparison of clinical baseline data is shown in table 6.

Table 6. Univariate-factor analysis of the related factors of radial artery variation

Variables	Variation(-)	Variation(+)	t/X^2	*P*- value
Age (year)	58.90±11.34	62.42±9.88	-2.825	0.005*
Weight (kg)	75.82±13.23	72.86±14.8	2.008	0.045*
Height (cm)	167.87±8.45	164.41±9.16	3.685	<0.001*
Inner diameter（mm）	3.02±0.14	2.88±0.14	9.423	<0.001*
Body mass index (kg/m^2)	26.91±4.90	26.95±5.26	-0.071	0.943
Gender (number/%)			61.137	<0.001*
Male	1415/86.00	47/54.65		
Female	230/14.00	39/45.35		
Ethnicity (number/%)			4.005	0.405
Han	697/42.47	38/44.19		
Uyghur	692/42.17	41/47.67		

Hui	130/7.92	4/4.65		
Kazakh	92/5.61	3/3.49		
Other	34/1.83	0/0.00		
Occupation (number/%)			15.457	<0.001*
Cadre	1323/80.55	57/66.28		
Farmer	167/10.06	20/23.26		
Other	155/9.39	9/10.47		
Smoking (number/%)			5.149	0.023*
Yes	537/32.64	18/20.93		
Not	1108/67.36	68/79.07		
Drinking (number/%)			8.554	0.003*
Yes	349/21.22	7/8.14		
Not	1296/78.78	79/91.86		
Hyperlipidemia (number/%)			4.335	0.037*
Yes	215/13.07	18/20.93		
Not	1430/86.93	68/79.07		
Hypertension (number/%)			1.000	0.317
Yes	943/57.33	54/62.79		
Not	702/42.67	32/37.21		
Diabetes (number/%)			0.117	0.732
Yes	488/29.67	27/31.4		
Not	1157/70.33	59/68.6		

*Significant differences

The results showed：in the comparison of age, weight, height, inner diameter, female gender, occupation of farmer, smoking, drinking alcohol and hyperlipidemia, the differences between the two groups are significant (P<0.05).

The related factors for radial artery variation were analyzed with multivariate logistic regression,see table7.

Table 7. Multivariate Logistic regression analysis of the related factors of radial artery variation

Parameter		β	SE	Wald	*P*	*OR*	95% CI	
							L-limit	U-limit
Constants		8.919	3.469	6.612	0.010	7472.917		
Age		0.209	0.119	3.095	0.079	1.232	0.976	1.555
Height		0.029	0.019	2.409	0.121	1.030	0.992	1.068
Weight		0.005	0.010	0.275	0.600	1.005	0.986	1.025
Inner diameter		-6.271	0.927	45.808	0.000*	0.002	0.000	0.012
Gender	Male					1.000		
	Female	1.001	0.314	10.138	0.001*	2.720	1.469	5.037
Hyperlipidemia	Not					1.000		
	Yes	0.492	0.297	2.746	0.097	1.635	0.914	2.925
Smoking	Not					1.000		
	Yes	0.265	0.357	0.551	0.458	1.303	0.648	2.621
Drinking alcohol	Not					1.000		
	Yes	-0.732	0.487	2.260	0.133	0.481	0.185	1.249
Occupation	Cadre					1.000		
	Farmer	0.801	0.296	7.322	0.007*	2.228	1.247	3.980
	Other	0.082	0.392	0.044	0.835	1.085	0.503	2.342

*Significant differences

The results of table7 indicated that gender (OR=2.72，95%CI 1.469-5.037, $P < 0.01$), occupation (OR=2.228，95%CI 1.0.000-0.012, $P < 0.001$), and inner diameter of the radial artery (OR=0.002，95%CI 0.000-0.012, $P < 0.001$) are significantly associated with the existence of radial artery variation; the risk of radial artery variation in females is 2.72 times as high as males. The risk of radial artery variation in farmers is 2.228 times as high as cadres, and the incidence of radial artery variation decreases 500 times with every additional 1mm of radial artery diameter.

Discussion

The transradial approach was initially described by Campeau[13-14] in 1989 and is the common access sites for cardiac catheterization. Although the radial approach has been shown to be an effective

alternative that reduces vascular complications[15-16], because of the existence of radial artery variation, it cannot be used in all patients. Our study analyzed the anatomical features of the radial artery and their impact on transradial coronary intervention，the predictive factors for radial artery variations.

1.**features of the radial artery diameter：**

The mean inner diameter of all patients is 3.01±0.14 mm, and the inner diameter of the radial artery was greater than a 6F Cordis sheath in 98.5% (1705/1731) of patients and greater than a 7F Cordis sheath in 9.5% (164/1731) of patients. The 6F and 7F Cordis sheath tubes, which have an outer diameter of 2.67 mm and 3.02 mm, respectively, are commonly used in coronary interventions. Saito,et[13] reported that the incidence of post-TRI stenosis and shunt of the radial artery dramatically increases when the ratio of the inner diameter of the radial artery to sheathing tube is <1.0, it is reported that[17]：it increase the occurrence of radial artery occlusion and the risk of medial dissections if the diameter/sheath ratiois ≤1. Therefore, it is safe to utilize a sheath tube, which has a smaller outer diameter than radial artery diameter; thus, it is important to evaluate the radial artery diameter by relevant factors to avoid complications.

1.1 related factors of radial artery diameter： Multivariate analysis showed that gender, height, and occupation are significantly associated with radial artery diameter. The results of this study are different from other report[13] that: gender, weight, and diabetes affect the radial artery diameter. There is a coincidence in two reports: gender is the relevant factor for radial artery diameter; in the other report, the different is: other researcher repoted: weight are positively effect radial artery diameter, this study found that: height are relevant whith it, in some means: weight hase direct portion with highet ,therefore it can be seen that two report are same

in a sense, As far as diabetes, others reported that diabetes affects the radial artery diameter, although in our study, the univariate-factor analysis, diabetes was shown to be relevant for the radial artery diameter, it can be seen that the two reports are the same in a sense.

1.2 Analysis of the related factors of radial artery diameter:

1.2.1 The correlation between height and radial artery diameter：Height is the relevant factor for the radial artery diameter, and radial artery diameter increases 0.004mm with every additional 1cm increase in height. Normally, the diameter of every organ of the body is correspondingly related to body stature diameter, so there is no strange to association between radial artery diameter and height.

1.2.2 The correlation between gender and radial artery diameter: The result of our study：The mean inner diameter in female is smaller than in male, all of the female body diameter is smaller than the male and corresponds with a smaller radial artery diameter.

1.2.3 The correlation between occupation and radial artery diameter：The radial artery diameter of farmers is smaller than cadres and may have to do with the heavy activity of a farmer’s life, and heavy activity may impact the diameter of the radial artery.

2. The incidence of radial artery variation and its predictive factors：

2.1. The incidence of radial artery variation is reported differently in different literature. It is 16.2% in the populatuion of southeren China[13],According to the Autopsy study, the incidence of upper limb artery variation is 4%–18.5%[18]. In patients who

accepted transradial coronary intervention, the incidence of radial artery variation is 7.4% to 22.8%[18-20、21] found by angiographic examination.

This study found that the incidence of radial artery variation is 4.97% (86/1731). These data are lower than other data[13] because our study’s scope is smaller, and is limited to the anatomical variation of the radial artery. The other researcher’s study includes the variation of the radial artery and the upper limb artery，including radial artery variation, humerus artery variation, subclavian artery variation etc.

it is reported that[13] the failure rate of transradial artery coronary intervention is 1.8% in the normal radial artery group and 22.8% in the radial artery variation group. In our study, the failure rate of transradial artery coronary intervention is 1.5% in the normal radial artery group and 26.7% in the radial artery variation group. It can be seen that radial artery variation is the main cause for failuring of transradial artery coronary intervention. Different studies have reported differently about the failure rate of coronary intervention by the radial artery[12, 18,21-23]. The reason for these differences may be related to several factors, including the technical level of the surgeons and the existence of radial artery variation.

2.2. Predictive factors for radial artery variation: Multivariate analysis showed that the radial artery diameter, gender,occupation have predictive value for the existence of radial artery variation. It is reported that[13]the predictive factors for radial artery variation in Southern China population are: advanced age, female gender, short stature, body mass index, hypertension, hyperlipidemia, smoking, etc. There are some differences in the reports of the two studies; possible reasons are that on the one hand our scope of research is smaller than other researchers and is limited to the anatomical variation of the radial artery. The other researchers study includes the variation of the radial artery and the upper limb artery, including radial artery variation, humerus artery variation, subclavian artery variation, etc. On the other hand, the study population is not the same and is relevant to the stature characteristics, habits and customs.

2.3 Analysis of the predictive factors for radial artery variation：

2.3.1 The correlation between diameter and radial artery variation: The smaller the inner diameter is, the more prone to radial artery variation, perhaps the smaller the inner diameter is the more prone the tissue of the artery to relaxing, the more thin, and the more it impacts the changing of the structure of the radial artery.

2.3.2 The risk of radial artery variation in females is 2.72 times as high as males, and the vessels are smaller and thinner in females than in males, females become nervous more easily than males, and this factor might influence the radial artery resulting variation.

2.3.3 The risk of radial artery variation in farmers is 2.228 times as high as cadres; the possible reasons are that a farmer's life is long-term dominated by heavy physical activity, and a cadre's life is dominated by mental labor; thus, in the farmer's life, heavy physical activity causes the radial artery to pull, and nervous spasm may be the result of the variation of radial artery.

Study limitation

In this study, The categorization of patient's occupation was based on the basic information from when patients were hospitalized. In our study, it was deemed that a farmer's life is dominated by heavy physical activity, and a cadre's life is dominated by mental labor; the specific labor time and its volume of active strength was not specifically recorded, analyzed and compared. There are no past reports about this; therefore, this report has a certain value for evaluating the correlation between occupation and radial artery diameter、radial artery variation. The specific reason needs further study.

Conclusions

To sum up, height, gender, occupation were correlated with radial artery diameter. radial artery diameter, gender，occupation have predictive value for radial artery variation. Therefore, it is valuable to evaluate the patient's basic clinical information to estimate the radial artery diameter and to find the radial artery variation before the operation, as information about the radial artery diameter and abnormal anatomy of the radial artery can be given to the interventionists. It is convenient for the interventionists to choosing the appropriate equipment and operation route, thus preventing complications, optimizing the operation procedures, and shortening procedure time, fluoroscopy time and radiation dose, and improving the operation's success to reduce the patient's pain.

Abbreviations: RA: radial artery; PCI: percutanouos coronary intervention; TF: transfemoral approach; TR-PCI: transradial percutanuos coronary intervention; CAG: coronary angiography

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References

1. Dandekar VK, Vidovich MI, Shroff AR. Complications of transradial catheterization., CardiovascRevascMed.2012;13:39-50.

2. Agostoni P, Biondi-Zoccai GG, de Benedictis ML, et al. Radial versus femoral approach for percutaneous coronary diagnostic and interventional procedures; Systematic overview and meta-analysis of randomized trials. J Am Coll Cardiol. 2004;44:349-356.

3. Kassam S, Cantor WJ, Patel D, et al. Radial versus femoral access for rescue percutaneous coronary intervention with adjuvant glycoprotein IIb/IIIa inhibitor use. Canadian Journal of Cardiology. 2004;20:1439-1442.

4. Rao SV, Ou FS, Wang TY, et al. Trends in the Prevalence and Outcomes of Radial and Femoral Approaches to Percutaneous Coronary Intervention : A Report From the National Cardiovascular Data Registry. Jacc Cardiovascular Interventions. 2008;1:379-386.

5. Jaffe R, Hong T, Sharieff W, et al. Comparison of radial versus femoral approach for percutaneous coronary interventions in octogenarians. Catheter Cardiovasc Interv. 2007;69:815-820.

6. Cantor WJ, Mahaffey KW, Huang Z, et al. Bleeding complications in patients with acute coronary syndrome undergoing early invasive management can be reduced with radial access, smaller sheath diameters, and timely sheath removal. Catheterization & Cardiovascular Interventions Official Journal of the Society for Cardiac Angiography & Interventions. 2007;69:73-83.

7. Jolly SS, Amlani S, Hamon M, Yusuf S, Mehta SR. Radial versus femoral access for coronary angiography or intervention and the impact on major bleeding and ischemic events: a systematic review and meta-analysis of randomized trials. American Heart Journal. 2009;157:132-140.

8. Wiper A, Kumar S, Macdonald J, Roberts DH. Day case transradial coronary angioplasty: a four-year single-center experience. Catheterization & Cardiovascular Interventions Official Journal of the Society for Cardiac Angiography & Interventions. 2006;68:549-553.

9. Bertrand OF, Larochellière RD, Rodéscabau J, et al. A Randomized Study Comparing Same-Day Home Discharge and Abciximab Bolus Only to Overnight Hospitalization and Abciximab Bolus and Infusion After Transradial Coronary Stent Implantation. Digest of the World Core Medical Journals. 2006;114:2636-2643.

10. Mann T, Cubeddu G, Bowen J, et al. Stenting in acute coronary syndromes: a comparison of radial versus femoral access sites. Journal of the American College of Cardiology. 1998;32:572-576.

11. Kiemeneij F, Hofland J, Laarman GJ, Dh VDE, Van dLH. Cost comparison between two modes of Palmaz Schatz coronary stent implantation: transradial bare stent technique vs. transfemoral sheath-protected stent technique. Catheterization & Cardiovascular Diagnosis. 1995;35:301-309.

12. Numasawa Y, Kawamura A, Kohsaka S, et al. Anatomical variations affect radial artery spasm and procedural achievement of transradial cardiac catheterization. Heart & Vessels. 2014;29:49-57.

13. Li L, Zeng ZY, Zhong JM, et al. Features and variations of a radial artery approach in southern Chinese populations and their clinical significance in percutaneous coronary intervention. Chinese medical journal. 2013;126:1046-1052.

14. Trilla M, Freixa X, Regueiro A, et al. Impact of Aging on Radial Spasm During Coronary Catheterization. Journal of Invasive Cardiology. 2015;27:E303-E307.

15. Chase AJ, Fretz EB, Warburton WP, et al. Association of the arterial access site at angioplasty with transfusion and mortality: the M.O.R.T.A.L study (Mortality benefit Of Reduced Transfusion after percutaneous coronary intervention via the Arm or Leg). Heart. 2008;94:1019-1025.

16. A S, C P, G A, et al. Arterial Access-Site-Related Outcomes of Patients Undergoing Invasive Coronary Procedures for Acute Coronary Syndromes (from the ComPaRison of Early Invasive and Conservative Treatment in Patients With Non-ST- ElevatiOn Acute Coronary Syndromes [PRESTO-ACS]. American Journal of Cardiology. 2009;103:796-800.

17. Bi XL, Fu XH, Gu XS, et al. Influence of Puncture Site on Radial Artery Occlusion After Transradial Coronary Intervention. Chinese medical journal. 2016;129:898-902.

18. Lo TS, Nolan J, Fountzopoulos E, et al. Radial artery anomaly and its influence on transradial coronary procedural outcome. Heart. 2009;95:410-415.

19. Yan ZX, Zhou YJ, Zhao YX, Zhou ZM, Yang SW, Wang ZJ. Anatomical study of forearm arteries with ultrasound for percutaneous coronary procedures. Circulation Journal. 2010;74:686-692.

20. Yoo BS, Yoon J, Ko JY, et al. Anatomical consideration of the radial artery for transradial coronary procedures: arterial diameter, branching anomaly and vessel tortuosity. International Journal of Cardiology. 2005;101:421-427.

21. Valsecchi O, Vassileva A, Musumeci G, et al. Failure of transradial approach during coronary interventions: anatomic considerations. Catheterization & Cardiovascular Interventions. 2006;67:870–878.

22. Yang HJ, Gil YC, Jung WS, Lee HY. Variations of the Superficial Brachial Artery in Korean Cadavers. Journal of Korean Medical Science. 2008;23:884-887.

23. Nie B, Zhou YJ, Li GZ, Shi DM, Wang JL. Clinical study of arterial anatomic variations for transradial coronary procedure in Chinese population. Chinese medical journal. 2009;122:2097-2102.