ORIGINAL ARTICLE

The Effect of Different Factors on the Size of Radial and Ulnar Arteries

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ABSTRACT

Background: Heart disease is still one of the leading causes of mortality in our country and coronary angiography is still one of the golden methods of diagnosis for heart disease.There has always been some influence of factors such as age, sex and BMI, history of diabetes, hypertension, and clinical and paraclinical factors on the size of the arteries.
Aim: To evaluate the size of the radial and ulnar arteries and the factors affecting them in patients undergoing coronary angiography.
Method: This cross sectional study was done on 178 patients candidate for angiography or angioplasty referred to Imam Reza and Ghaem Hospitals of Mashhad from 2014 to 2015. We estimated ulnar, radial and brachial arteries size via angiography with calibration software in SIEMENS angiography machine. We also used a questionnaire for demographic data.
Result: One hundred seventy eight patients included in this study (Age: 59.71±12.08, 70 female and 108 male). There was no significant change about ulnar and radial size between sex and age parameters (P>0.05). The size of ulnar and radial arteries was significantly lower in diabetes and obese patients and higher in hypertensive groups (P< 0.05). We also reported the coronary anomalies and complications of the procedure.
Conclusion: We concluded that hypertension, Diabetes and obesity can effect on radial and ulnar size as an access for angiography or angioplasty.
Key words: Ulnar artery, radial artery, angiography, angioplasty, cardiac catheterization, risk factor

INTRODUCTION

Heart disease is still one of the leading causes of mortality in our country and coronary angiography is still one of the golden ways of diagnosing heart disease[1]. Since 1993 that Carpenter has suggested using radial artery as an alternative way for CABG it was used as another way to perform coronary angiography[2]. The radial artery is a branchof the brachial artery and its diameter is smaller than another branch of the brachial artery, the ulnar nerve artery[3].
The radial artery is above the superficial styloid appendage and is covered by skin and fascia[4].The simplest invasive procedure to diagnose heart disease is cardiac catheterization. Twenty-fiveinserting a catheter into each vessel is associated with some degree of bleeding[5]. For example, after femoral artery catheterization, the patient needs to lie flat without flexing the leg for up to 2 to 6 hours. Patients with radial catheterization are able to sit, walk and eat immediately and do not require prolonged immobility[6]. In previous studies the influence of factors such as age, sex, BMI, history of diabetes; hypertension, clinical and paraclinical factors on the size of the arteries have been suggested. The purpose of this study was to evaluate the size of the radial and ulnar arteries and the factors affecting on them in patients undergoing coronary angiography.

METHODS

This cross sectional study was done on 178 patients candidate for angiography or angioplasty referred to Imam Reza and Ghaem Hospitals of Mashhad from 2014 to 2015. Informed consent was obtained from each patient in accordance with the provisions of the Declaration of Helsinki. The inclusion criteria were age ≥ and normal Allen's and Barbeau's test. After injecting nitrates via transradial or transulnar access and using contrast, we estimated ulnar, radial and brachial arteries size via angiography with calibration software in SIEMENS angiography machine. Radial, ulnar and brachial artery size was calculated in the midline of the forearm at their largest transverse diameter. In addition to demographic factors (age, sex), Weight, height, history of diabetes, history of hypertension, artery size, spasm, tortuosity and stenosis in arteries, complications and congenital abnormalities were documented. Angiographic results were collected. Data were reported as percentage, mean and standard deviation. T-test and chi-square test were used for analysis. The significant level was considered as 0.05.
Statistical analysis: For descriptive data, the mean, standard deviation, frequency and percentage were used and the tables and charts were drawn. Quantitative variables were expressed as Mean (SD) and qualitative variables in terms of numbers and percentages. For cases of normal distribution of quantitative data, parametric tests and for abnormal distribution quantitative data non-parametric tests were used. A 95% confidence interval was used to express the estimation accuracy.

RESULTS

In this study, 178 patients participated 70(39.6%) female and 108 (60.7%) male) with mean age of 59.71±12.08. The

mean of radial artery size was 2.03±0.41mm, the ulnar artery was 2.03±0.41mm and the brachial artery was 3.49±0.69 mm. The spasm of the artery was seen inradial, ulnar and brachial artery in 90(50.6%), 14(7.9%) and 2(1.1%) patients respectively. We reported that five patients had complication after the procedure. There were 4(2.24%) cases of change of access and 3(1.68%) cases of perforation. The demographic data of patients is in table 1.

Coronary Artery disease (CAD), Slow flow coronary artery and unstable angina increased risk of radial spasm 3.77 fold, 3.39 fold and 6.83 fold respectively (P<0.05). We concluded that greater radial size decrease radial spasm (P<0.001) (Table 2).

Factors like medication, echocardiography findings (like mitral and tricuspid regurgitation or stenosis), radial size, radial atherosclerotic stenosis, patient setting (like unstable angina (UA), chronic stable angina (CSA), ST elevation MI (STEMI), non ST elevation MI (NSTEMI)), coronary angiography result (aneurysm, ectasia, coronary artery disease and slow flow) and congenital variations were documented and studied. We estimated that ulnar and brachial spasm occur in older patients and patient with unstable angina have higher risk of coronary spasm (P<0.05) (Table 3).

In addition, the use of atorvastatin and plavix, mitral stenosis (MS), USA and NSTEMI increased the risk of having both radial and ulnar spasms by 17.35, 19.16, 19.89, 18.133 and 40.87 folds, respectively. In addition, increase in ulnar size was significantly associated with a reduced chance of concurrent spasm (P<0.05). In addition, use of plavix, aortic insufficiency and NSTEMI increased risk of radial tortuosity 9.84, 1.62 and 17.15 fold respectively. Male gender and older age increased risk of tortuosity (P<0.005).

Table 1: Patient demographic and clinical data

Variables		**Total (n=178)**	**Variables**		**Total (n=178)**
Sex	**Female Male**	70(39.6%) 108(60.7%)	**Age; year (min-max)**		59.71±12.08 (28-96)
			BMI; kg/m² (min-max)		27.34±4.47 (18-46)
Past Historical	DM	55(30.9%)	Radial; mm		2.03±0.41
	HTN	81(45.5%)	Ulnar; mm		2.02±0.61
	PAD DLP	1(0.6%) 53(29.8%)	Brachial; mm		3.49±0.69
			Medication	Captopril	20(11.2%)
	RF	1(0.6%)		Atorvastatin	50(28.1%)
	CS	22(12.4%)		ASA	58(32.6%)
	CVA	4(2.2%)		Losartan	21(11.8%)
	OA	21(11.8%)		MetoralEnalapril	32(18%) 2(1.1%)
Spasm*	Non	72(40.4%)			
	Radial	90(50.6%)		Carvedilol	10(5.6%)
	Ulnar	37(20.8%)		Diltiazem	2(1.1%)
	Brachial	2(1.1%)		Plavix Nitrate	11(6.2%) 21(11.8%)
Tortuosity**	Non	162(91%)			
	Radial Ulnar	14(7.9%) 1(0.6%)		Other	48(27%)
			Pt. Setting	CSA	35(19.7%)
	Brachial	1(0.6%)		USA	17(9.6%)
Ath. Stenosis	Non	175(98.3%)		NSTEMI	104(58.4%)
	Radial Ulnar	2(1.1%) 1(0.6%)		STEMI	22(12.4%)
			Coro Angio	NL	21(11.8%)
	Non VHD	149(83.7%)		Coro Slow Flow	86(48.3%)
	AS (mod./sev.)	3(1.7%) 0/3		CAD	115(64.6%)
Echo	AI (mod./sev.)	6(3.4%) 5/1		Coro. Ectasia	31(17.4%)
	MS (mod./sev.)	5(2.8%) ¼		Coro Aneurysm	1(0.6%)
	MR (mod./sev.)	20(10.2%) 13/7	Congenital Variation	Non Lusoria	181(90.5%) 1(1.1%)
Complication	Non	171(96.1%)			
	Change of Access	4(2.2%)		Accessory RA	13(7.3%)
	Perforation	3(1.7%)		Other	2(1.1%)

* Twenty-three patients had both radial and ulnar spasm.
** One patient had both radial and ulnar tortuosity.

Table 2: The factors that affect radial spasm

Factors		**Radial Spasm**		**OR(95% CI)**	**P value**
		Yes	**No**		
CAD	Yes No	64 26	37 33	3.376(1.507-7.563)	0.003
Coro Slow Flow	Yes No	52 38	28 42	3.396(1.548-7.448)	0.002
Yes 15 2,		**USA** 6.834(1.343-34.766)		0.021	
Radial; mm: 1.88±0.39		0.094(0.032-0.277)		<0.001	

Table 3: factors affect ulnar spasm

Factors	Ulnar Spasm		OR(95% CI)	P value
	Yes	No		
Age; year	64.46±10.84	57.63±12.09	1.046(1.006-1.089)	0.024
Yes USA No	8 29	2 68	8.390(1.438-48.940)	0.018
Factors	Brachial Spasm		OR(95% CI)	P value
	Yes	No		
Age; year	76.00±1.41	57.63±12.09	1.123(1.001-1.265)	0.047

Table 4: Factors affect both radial and ulnar spasm and radial tortuosity

Factors		Radial and Ulnar spasm		OR(95% CI)	P value
		Yes	No		
Atorvastatin	Yes	9	16	17.351(1.339-24.865)	0.029
	No	14	54		
Plavix	Yes	5	1	19.167(2.105-74.510)	0.046
	No	18	69		
MS	Yes	2	1	19.895(2.769-142.931)	0.003
	No	21	69		
USA	Yes	8	2	18.133(3.492-49.163)	0.001
	No	15	68		
NSTEMI	Yes	11	40	40.873(1.789-93.955)	0.020
	No	12	30		
Ulnar; mm		1.62±0.34	2.05±0.41	0.003(0.000-0.126)	0.002
Radial Tortuosity					
Plavix	Yes	4	7	9.841(2.426-39.919)	0.008
	No	9	155		
Sex	Female	9	59	0.032(0.004-0.278)	0.002
	Male	4	103		
HTN	Yes	5	75	0.116(0.018-0.761)	0.025
	No	8	87		
AI	Yes	1	4	1.628(1.011-2.504)	0.007
	No	12	158		
NSTEMI	Yes	9	94	17.152(1.145-256.826)	0.040
	No	4	68		
Age; year		69.92±6.63	58.67±12.01	1.195(1.077-1.326)	0.001

Due to the small number of reported complications, none of the factors were significantly correlated with the incidence of angiography or angioplasty complications.

DISCUSSION

According to our study, there was no significant relationship between age, sex and size of radial and ulnar arteries. But there was a significant relationship between diabetes and hypertension and radial artery size. Also, there was a significant relationship between body mass index (BMI) and radial artery size. A study by Tariq Ashraf et al. on 251 patients in Karachi (2008) found that the median radial artery size was 2.3 mm and male sex, diabetes mellitus and smoking were associated with artery size significantly. But hypertension and body mass index (BMI) were not associated with artery size significantly[7]. Nakayama et al. found a significant relationship between gender and BMI with radial artery size which was consistent with our study[8]. According to Loh et al. study (2007) the mean arterial size was 2.45 mm and there was a significant relationship between radial artery size and gender, Hypertension and hyperlipidemia. But no significant effect of diabetes, age, renal disease, race and smoking on radial size were detected; which was consistent with our study[9].

Sunil et al. reported that male gender and hypertension were significantly related with larger artery size. But in diabetes and patients with higher BMI there was no significant relation with radial size; which was against our study

CONCLUSION

We concluded that hypertension, Diabetes and obesity can effect on radial and ulnar size as an access for angiography or angioplasty.

Limitations: Due to limited number of patients participated in our study we couldn't evaluate the cardiac catheterization complications via radial, ulnar or brachial access and we suggest to study in larger sample size.

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Statement of ethics: Subjects have given their written informed consent.The study protocol has been approved by Mashhad University of Medical Sciences' committee on human research and Ethics Committee.

Conflicts of interest: The authors have no conflicts of interest to declare.

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