

Size of radial and ulnar artery in local population

Tariq Ashraf, Ziauddin Panhwar, Sultana Habib, Muhammad Anis Memon, Fahad Shamsi, Javed Arif
National Institute of Cardiovascular Disease, Karachi.

Abstract

Objective: To evaluate radial and ulnar artery diameter in patients undergoing diagnostic coronary angiography.

Method: This was a cross-sectional study in which we measured the inner diameter of radial and ulnar artery by using two dimensional ultrasound and Doppler examination in 251 patients visiting our hospital for diagnostic coronary angiography between February to September 2008.

Results: The mean diameter of right and left radial artery was 2.3 ± 0.4 mm and 2.2 ± 0.4 mm respectively. The mean diameter of right and left ulnar artery was 2.4 ± 0.4 mm and 2.3 ± 0.3 mm respectively. The factors found to positively influence the size of radial artery included male sex, diabetes mellitus and smoking. There was no relationship of the size of the radial and ulnar artery with body size parameters (height, weight, Body Surface Area (BSA) & Body Mass Index (BMI)).

Conclusion: We conclude that ulnar artery diameter is larger than the radial artery in our population. Knowing the size will guide the interventional cardiologist in using appropriate size sheaths and guide catheters. Cardiac surgeons can utilize ulnar artery for bypass grafting when it is deemed unsafe to harvest the radial artery (JPMA 60:817; 2010).

Introduction

It has been 36 years since the radial artery was first used by Carpenter and colleagues¹ as an alternative conduit for coronary artery bypass grafting. In 1989, Campeau introduced trans-radial access for performing coronary angiography² and in 1993, Kiemeineij reported his experience with coronary angioplasty through the radial route.^{3,4} This experience was first reported by Tahir Saghir et al. in Pakistan.⁵

The versatility of the radial artery extends beyond its use as a conduit in bypass grafting; it is now increasingly being utilized as an alternative site of access for cardiac catheterization^{6,7} and in some cases reported ulnar artery was used as an alternative approach other than radial artery.⁸

Rodriguez and Colleagues reported that radial arteries < 2mm and those with diffuse calcification or a negative Allen's test should be abandoned for coronary artery bypass grafting.⁹ Size matching of conduits to native coronary artery vessels is also important as it can affect the long term patency.¹⁰

Different studies have mentioned diameter of radial and ulnar artery in their population.^{8,11,12}

The aim of the present prospective study was to assess the size of the radial and ulnar artery in our population for its suitability in performing cardiac diagnostic and therapeutic interventions.

Patients and Method

This cross-sectional descriptive study was carried out

in the department of Echocardiography, National Institute of Cardiovascular Diseases, Karachi from February to September 2008.

Patients who were advised to undergo coronary angiography via radial artery as a first time procedure were included in the study. Two hundred and fifty one consecutive patients were recruited in the above mentioned period. After having taken written consent before the study, right, left radial, right and left ulnar artery were screened with Duplex Doppler Ultrasonography with a 7.5 MHz probe, Toshiba Power Vision.

The smallest internal diameter in each one-third segment of the radial and ulnar arteries was recorded after comparing the size in both; the longitudinal and transverse sections.

The average diameter of the radial artery and ulnar artery was used for analysis. Pre-existing risk factors for coronary artery disease at the time of ultra-sonography were recorded i.e. gender, diabetes mellitus, hypertension and smoking; height, weight, body surface area and body mass index were also noted. Height measurement was taken as; maximum distance from the floor to the highest point on the head when the subject is facing directly ahead in centimeters (cms). Weight was measured by making the patient stand on a weighing machine without shoes; in kilograms (kg). Body mass index (BMI) was measured by; the individual body weight divided by the square of his or her height i.e. mass (kg)/height (m²). Body surface area (BSA) was calculated by Mosteller formula.¹³

Continuous variables were expressed as mean $\pm$ SD and independent t-test was used to analyze the diameter in groups whereas discrete variables were expressed as percentages and analyzed by Chi-Square Test.

A p-value < 0.05 was considered as statistically significant. Calculations were performed with statistical software package SPSS version 15.

Results

The patient demographics are listed in Table-1. The mean diameter of right and left radial artery was 2.3 ± 0.4 mm and 2.2 ± 0.4 mm, while that of right and left ulnar was 2.4 ± 0.4 mm and 2.3 ± 0.3 mm respectively. Table-3 shows the factors found to positively influencing the size of the radial artery. These included male sex, diabetes mellitus and smoking. The cumulative frequency of radial and ulnar artery diameter in males and females are shown in Figure.

Table-1: Demographics of 251 Patients who had radial and ulnar artery duplex Doppler ultra-sonography.

Variables	No. of Patients	Percentage
Male	197	78.5%
Female	54	21.5%
Hypertension	145	57.8%
Smoking	80	31.9%
Diabetes Mellitus	84	33.5%

Table-2: Descriptive Statistics of 251 Patients.

Variable	Minimum	Maximum	Mean $\pm$ S.D
Age (Years)	32	75	51.9 $\pm$ 9.8
Height (cms)	140	182	160.7 $\pm$ 7.98
Weight (kg)	40	107	66.6 $\pm$ 10.4
BSA	1.22	2.8	1.7 $\pm$ 0.18
BMI	14.2	39.3	25.8 $\pm$ 3.8
Right Radial artery diameter (mm)	1.4	3.6	2.3 $\pm$ 0.4
Left Radial Artery Diameter (mm)	1.2	3.1	2.2 $\pm$ 0.4
Right Ulnar Artery (mm)	1.3	3.7	2.4 $\pm$ 0.4
Left Ulnar Artery (mm)	1.5	3.1	2.3 $\pm$ 0.3

Table-3: Relationship between gender & risk factors with mean radial artery diameter in 251 patients.

	Mean $\pm$ S.D	Mean Difference	p-Value
1. Gender			
Male	2.3 $\pm$ 0.39		
Female	2.11 $\pm$ 0.29	.0834	.044
2. Diabetes Mellitus			
Yes	2.16 $\pm$ 0.35		
No	2.31 $\pm$ 0.38	- 0.152	.002
3. Hypertension			
Yes	2.24 $\pm$ 0.4		
No	2.3 $\pm$ 0.35	- 0.04	0.430
4. Smoking			
Yes	2.33 $\pm$ 0.42		
No	2.23 $\pm$ 0.35	0.104	0.042

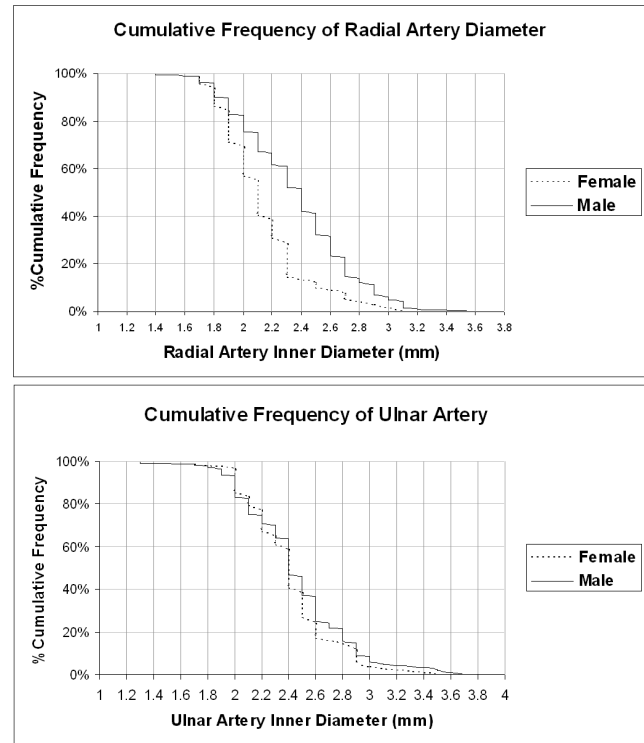


Figure: Cumulative Frequency of Radial Artery Diameter (Up) and Ulnar Artery (Down).

There was no association of radial and ulnar artery diameter with body weight parameters (height, weight, BMA and BMI).

Discussion

Our study showed a large size of ulnar artery as compared to radial artery. Male patients and non-diabetics tend to have significantly larger radial arteries.⁶

Patients with long term diabetes mellitus have the propensity to develop arteropathy and accelerated atherosclerosis. Ruengkularh and colleagues¹⁴ and Chowdhry et al¹⁵ also demonstrated that factors predictive of intimal hyperplasia and atherosclerosis in radial arteries were age and diabetes. This supports our observation in larger luminal diameter in non-diabetics and may have significance in the decision to harvest radial artery for bypass grafting and using radial artery for coronary interventions. In the presented series size of radial artery was larger in smokers which is in contrast to the study of Yee Jim Loh.¹²

The average mean of right and left radial artery diameter in our study was 2.25 ± 0.4 mm which is close to the measurement taken by Yes Jim loh et al,¹² but is less than that of Japanese population i.e. 3.10 ± 0.06 mm in male and 2.80 ± 0.60 in female patients.¹¹

No relationship between radial artery inner diameter

and body parameters were found which is the same as shown by Shigeru Saito¹¹ et al.

From this study knowing size of radial and ulnar artery diameter in our population will help the cardiac interventionist to cannulate various sizes of sheaths. In patients with a small size radial artery, the ulnar artery can be used as an alternative route of access and the cardiac surgeon can consider ulnar artery as a graft for coronary artery bypass grafting.¹⁶

The limitations of our study were that we did not take into account the duration of diabetes mellitus, type of diabetes or its control. The presence of dyslipidaemia was not determined in our study population. Reason of having a large size radial artery in smokers was also not clear. Further studies need to be undertaken to determine other factors that may influence the average size of radial artery. Studies should also be conducted to determine the impact of radial artery cardiac catheterization on the diameter of the radial artery.

Acknowledgement

We would like to thank Dr. Habiba Tasneem for allowing us to use Echocardiography Laboratory.

References

1. Carpenter A, Guernonprez JL, Deloche A, Frechette C, Dubois C. The aorta to coronary radial artery bypass graft. A technique avoiding pathological changes in grafts. *Am Thorac Surg* 1973; 16: 111-21.
2. Campeau L. Percutaneous radial artery approach for coronary angiography. *Cathet Cardiovasc Diagn* 1989; 16: 3-7.
3. Kiemeneij F, Laarman GJ. Percutaneous transradial artery approach for coronary stent implantation. *Cathet Cardiovasc Diagn* 1993; 30:173-8.
4. Kiemeneij F, Laarman GJ. Percutaneous transradial artery approach for coronary Palmaz Schatz Stent implantation. *Am Heart J* 1994; 128: 167-74.
5. Saghir T, Jan DM, Masood T, Shafi T, Qamar SN, Kundi A. Transradial diagnostic and percutaneous coronary intervention. *J Coll Physician Surg Pak* 2003; 13: 242-7.
6. Archbold RA, Robinson NM, Schilling RJ. Radial artery access for coronary angiography and percutaneous coronary intervention. *BMJ* 2004; 329: 443-6.
7. Lim VY, Chan CN, Kwok V, Mak KH, Koh TH. Transradial access for coronary angiography and angioplasty, a novel approach. *Singapore Med J* 2003; 44: 563-9.
8. Aptekar E, Dupony P, Chaouch MC, Bussy N, Catarino G. Percutaneous Transulnar Artery approach for diagnostic and Therapeutic Coronary Interventions. *J Inv Card* 2005; 17: 312-7.
9. Rodriguez E, Ormont ML, Lambert EH, Needleman L, Halpern EJ, Diehl JT. The role of pre-operative radial artery ultrasound and digital plethysmography prior to coronary artery bypass grafting. *Eur J Cardio Thorac Surg* 2001; 19: 135-9.
10. Shah PJ, Gordon I, Fuller J, Seevannayagam S, Rosalion A, Tatoulis J. Factors affecting Saphenous vein graft patency: Clinical and angiographic study in 1402 symptomatic patients operated on between 1977 and 1999. *J Thorac Cardiovasc Surg* 2003; 126: 1972.
11. Saito S, Hajimethari, Hosekawa G, Tanaka S. Influence of the ratio between Radial Artery inner diameter and sheath outer Diameter on radial artery flow after transradial Coronary intervention. *Cathet Cardiovasc Interv* 1999; 46: 173-8.
12. Loh YJ, Naka M, Tan WD, Lin CH, Tan YS, Chua YL. Factors influencing radial artery size. *Asian Cardiovasc Thorac Ann* 2007; 15: 324-6.
13. Mosteller RD. Simplified Calculation of Body surface area. *N Eng J Med* 1987; 22: 17: 1098.
14. Ruengsakulrach P, Sinclair R, Komeda M, Raman J, Gordon I, Buxton B. Comparative histopathology of radial artery versus internal thoracic artery and risk factors for development of intimal hyperplasia and atherosclerosis. *Circulation* 1999; 100: 139-44.
15. Chowdhery UK, Airan B, Mishra PK, Kothari SS, Subramanian GK, Ray R et al. Histopathology and morphometry of radial artery conduits: basic study and clinical application. *Ann Thorac Surg* 2004; 78: 1614-21.
16. Waheed A, Shabaz A, Khan JF, Tufail Z. Free radial artery as an alternate conduit in CABG. *Ann King Edward Med Coll* 2005; 11: 466-72.