Original Article

Coronary artery dimensions in normal Indians

Barendra Kumar Raut, Vijaysinh Namdeo Patil*, George Cherian

Cardiology Dept., Narayana Hrudayalaya Health City, Bangalore, India

ARTICLE INFO

Article history:
Received 4 July 2016
Accepted 13 January 2017
Available online 20 January 2017

Keywords:
Coronary angiogram
Coronary artery dimension
Indian population

ABSTRACT

Background: Diameter of coronary artery is an important predictor of outcome after percutaneous coronary interventions and coronary artery bypass graft surgery. There is very limited data available about coronary artery dimensions in an Indian population.

Aims: To study the normal dimensions of the coronary artery segments in Indians without coronary artery disease by using quantitative coronary angiography and also to compare the dimensions in Indians with Western.

Material and method: 229 patients who have undergone coronary angiography with entirely normal coronary angiogram were included in our study.

Results: This study showed the diameter of vessels in males and females when taken together the left main was larger in size followed by proximal LAD, proximal RCA & proximal LCX respectively (4.08 ± 0.44 mm, 3.27 ± 0.23 mm, 3.20 ± 0.37 mm, 2.97 ± 0.37 mm). When the vessel diameter was indexed to body surface area there was no statistical difference between male and female (p value > 0.05). The computed value of proximal coronary artery diameter unadjusted for individual body surface area, when compared to Caucasians showed that Caucasians have larger coronary artery dimensions than Indians. But when the proximal vessel diameter was indexed to body surface area there was no statistical significant difference between Indians and Caucasians (p value > 0.05).

Conclusions: We found that coronary artery size when indexed to body surface area is not statistically different in Indian males and females and compared to Caucasians. However with a smaller body habitus Indians have smaller coronary arteries.

© 2017 Published by Elsevier B.V. on behalf of Cardiological Society of India. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Current understanding and development regarding coronary atherosclerosis are predicated on the understanding of the normal coronary anatomy. There are several postmortem studies regarding dimensions of coronary arteries. However there are only few studies regarding real life dimensions.1 Size of the coronary artery is an important predictor of outcome after percutaneous coronary interventions (PCI) and coronary artery bypass graft surgery (CABG). Coronary artery dimensions are influenced by age, sex, anatomic variation, left ventricular hypertrophy or dilatation and body mass index.2 It has been shown that men have larger coronaries than women. Left ventricular hypertrophy and dilated cardiomyopathy are also associated with larger coronaries.3 4 Only limited data is available about coronary artery dimensions in an Indian population.5 6 The aim of this study was to determine coronary artery dimensions in an Indian population with angiographically normal coronary arteries.

2. Method

We studied 229 patients who had coronary angiography and were found to have normal coronary angiogram based on visual assessment of absence of any luminal irregularities. Patients with history of diabetes mellitus, hypertension, renal disease, valvular heart disease, cardiomyopathy, abnormal ECGs, abnormal echo report were excluded. Coronary angiography was performed by femoral route with 5f/6f Judkin’s or Amplatz right and left catheter. Standard projections were taken for visualization of main epicardial coronary arteries on Innova 2000 and 2100 imaging system. Coronary angiograms with evidence of localized atheroma, coronary spasm, and previous history of myocardial infarction with recanalised arteries were excluded. The dimension of the coronary artery was then measured with reference to the catheter diameter.5 The dimensions of the coronary artery were measured as a function of the catheter diameter and the absolute diameter in millimeter(mm) was calculated by automated software analysis. No
and Caucasians (Table 2).

The proximal vessel size in relation to BSA in the present study was not statistical significant when indexed to BSA, the size of the proximal coronary segments of our study, unadjusted for BSA, difference between Indians and Caucasians. The diameter of vessels in males and females was taken together the significant difference with Caucasian arteries being larger. (p value < 0.05).

However when indexed to BSA, there was no statistical significance in all these tests was assumed at a value < 0.05.

3. Results

We studied 229 patients out of which 121 were males and 108 females and the mean age of the patients was 51.70 ± 9.35 years (range 23–76 years). Physical and demographic parameters were assessed. The average weight was 67.16 ± 6.31 kg (range 80.00–48.00 kg), height was 165.18 ± 6.80 cm (range 182.00–139.00 cm) and BMI was 24.59 ± 1.48 kg/m² (range 31.30–21.26 kg/m²). Mean body surface area was 1.75 ± 0.11 m² (range 1.36–1.99 m²).

The right coronary artery was dominant in 59.83%, with co-dominance in 23.14% and left dominance in 17.03%. When the diameter of proximal coronary system was larger in males compared to females without reference to the BSA (Chart 1). The coronary artery diameter indexed to body surface area of left main, proximal LAD, proximal RCA and proximal LCX were 2.34 ± 0.28 mm, 1.87 ± 0.21 mm, 1.83 ± 0.22 mm and 1.70 ± 0.23 mm respectively. Our study showed that when the size of the vessel, was indexed to the BSA, there was no statistical significant difference between males and females (p value > 0.05) (Table 1).

The proximal vessel size in relation to BSA in the present study was compared to other studies to find if there was a significant difference between Indians and Caucasians. The diameter of proximal coronary segments of our study, unadjusted for BSA, when compared to Caucasians, showed statistical significant difference with Caucasian arteries being larger. (p value < 0.05).

However when indexed to BSA, the size of the proximal coronary system was not statistical significant different between Indians and Caucasians (Table 2).

4. Discussion

The dimensions of the coronary arteries are highly variable in the normal population. The determinants of coronary artery size are not well understood. Genetic factors undoubtedly play an important role. Age, sex, body weight, BSA, weight of the heart and ethnic/racial factors have all been correlated with the coronary artery anatomy in various studies. Many of these studies were either injection studies in post mortem specimens or dissection studies. There have been numerous reports on the size of coronary arteries in post mortem studies. Several correlations between heart weight & lumen size of the coronary arteries have been made from these studies. The inherent fallacy of these studies has however been the various factors involved in the procurement, preservation, fixation & analysis of the epicardial coronary arteries thereby vitiating, the validity of these observations in estimating the true dimension of coronary arteries.

There have been very few estimates of normal (undiseased) coronary artery size during life based on visual estimates or electronic caliper measurements from cine-angiographic films. In this prospective study we attempted to establish a database for normal dimensions of the coronary artery segments during life by using quantitative coronary angiography and also to compare the dimensions in Indians without coronary artery disease with western estimates of coronary artery size.

Quantitative coronary angiography (QCA) has been developed with the purpose of geometric assessment of epicardial coronary artery abnormalities since visual interpretation of coronary angiograms is inherently flawed & observer dependent. Several studies have validated the accuracy of digital quantitative estimation of coronary dimensions.
We applied the principles of quantitative coronary angiography for assessment of angiographically normal coronary artery segments in 229 patients who had undergone cardiac catheterization & angiography for evaluation of symptoms suggestive of coronary artery disease.

Coronary artery size in Indians has been reported to be significantly smaller when compared to that of the western population. This has been attributed to body habitus, build & BSA. Lip et al.9 and Dhawan et al.6, reported that though the unadjusted angiographically estimated mean diameters of various coronary artery segments in the western population among Caucasians were higher than those of Indian Asians, there was no statistically significant difference when the same values were compared and expressed as mean coronary artery diameter per unit BSA. They concluded that the smaller size of the coronaries in Indian Asians is attributable to their smaller BSA. Similar findings have been reported by Dhawan et al.5 who compared the cross sectional coronary area derived from angiographically estimated coronary diameter among Asian and Caucasian patients.

In our study it was found that male patients had statistically significant larger coronary artery dimensions compared to that of females unadjusted for individual body surface area (p value < 0.05). When the vessel diameter was indexed to BSA there was no statistical difference between male and female (p value > 0.05). This finding contradicts the traditional belief of females having smaller coronary artery compared to males. Our findings differ from the finding of Elagovan et al.3 who have found that females have smaller dimension of coronary artery after correction for BSA. Dhall et al. is also studied histomorphic analysis of human coronaries and found similar findings. Even O’Connor NJ et al. found that females have smaller coronary artery diameter and related to more perioperative mortality.11

The computed value of proximal coronary artery diameter unadjusted for individual body surface area in the present study when compared to Caucasians showed that Caucasians have larger coronary artery dimensions than Indians but when the proximal vessel diameter was indexed to BSA there was no statistical significant difference between Indians and Caucasians (p value > 0.05). This finding is in concordance with the observations of Lip et al.9

5. Conclusions

We found that the indexed size of coronary arteries in Indian males and females is the same. The traditional belief of Indians having smaller coronary arteries is not entirely true. We found that coronary artery size when indexed to BSA was not statistically different in Indians as compared to Caucasians. It is also independent of gender. Indians have small size coronary artery because of their smaller body surface area. This has great relevance to the performance and results of interventional procedures like angioplasty and coronary artery bypass graft surgery.

References

1. Leung Wing-Hung, Michael L. Stadius and edwin I alderman determinants of normal Coranary artery dimensions in humans. Circulation. 1991;84:2294–2306.
2. Theodore Dodge J, Greg Brown B, Bolson Edward L, Harold T. Dodge Lumen diameter of normal human coronary arteries: influence of age, sex, anatomic variation, and left ventricular hypertrophy or dilatation. Circulation. 1992;86:232–246.
3. Elangovan C, Jaganathan V, alageshan R, et al. Clinical and anthropometric correlation of normal Coronary artery dimensions.Indian Heart J. 2005;57:381–425 [5].
4. Saikrishna Cheemalapati, Talwar Sachin, Gulati Gurpreet, Kumar Arkalgud Sampath. Normal coronary artery dimensions in Indians. Ind J Thorac Cardiovasc Surg. 2006;22:159–164.
5. Hermiller JB, Cusma JT, Spero LA, Fortin DF, Harding MB, Bashore TM. Quantitative and qualitative coronary angiographic analysis: review of methods, utility and limitations. Cathet Cardiovvasc Diagn. 1992;25(February (25)):110–131.
6. Dhawan J, et al. Are Asian coronary arteries smaller than Caucasian: a study on angiographic coronary artery size estimation during life. Int J Cardiol. 1995;49:267–269.
7. Skelton NT, Kisslo KR, Mikat ME, Bashore MT. Accuracy of digital angiography for quantitation of normal coronary luminal segments in excised, perfused hearts. Am J Cardiol. 1987;59:1261–1265.
8. Lip GYH, et al. Do Indo-Asians have smaller coronary arteries? Postgrad Med J. 1999;75(August (4)):463–466.
9. Dhall U, Chaudhary S, Sirohiwal BL. Histomorphometric analysis of Coronary arteries: sexual dimorphism. J Anat Soc India. 2003;52(2):144–146.
10. O’Connor NJ, Morton JR, Birkmeyer JD, Olmstead EM, O’Connor G. Effect of coronary artery diameter in patients undergoing coronary bypass surgery: northern New England Cardiovascular Disease Study Group. Circulation. 1996;93(4):652–655 [Feb 15].

Further reading

8. Vogel RA. The radiographic assessment of coronary blood flow parameters. Circulation. 1985;72(3):60–65.