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Original Research Article

Luminal diameters of major coronary arteries

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ABSTRACT

128 human hearts including 70 males and 58 females in all age groups were used for the present study. Coronary arteries were dissected out from all the human hearts. The luminal diameter was studied in all the four major coronary arteries, namely, right coronary artery (RCA), left coronary artery (LCA), left anterior descending artery (LAD) and left circumflex coronary artery (LCX) in both the sexes. The histological sections were stained with H & E stain and the diameter was measured with the help of ocular micrometer. Among the four major coronary arteries luminal diameter is found to be more in LCA followed by LAD, RCA and LCX. Luminal diameter was found to be more in males as compared to females in all the four major coronary arteries. The data of present study can be useful for doing any instrumentation of coronary artery.

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1. Introduction

The study of the coronary circulation has been a topic of special interest to the physician throughout the ages. The coronary arteries occupy a unique position in the vascular system, since they supply the heart with oxygen and metabolic fuels required to circulate the blood. They are the first branches of the aorta and are exposed to wide fluctuations of pressure and flow.

Coronary arteries continue to increase throughout their life. This enlargement possibly represents dilatation or loss of elasticity rather than continued growth, at least in the older age groups.¹ Diameter of coronary arteries in both the sexes also differs in each age group. According to Levy et al. (1992),² aging is responsible for increase in the calibre of the arterial lumen which partially compensates for the effects of atherosclerosis-induced arterial wall rigidity on vascular compliance. So it is imperative to have an idea of normal luminal diameter in different age groups in both the

sexes to assess atherosclerotic changes in the arterial wall and for instrumentation of the artery.

2. Material and Methods

The coronary arteries from 128 human hearts including 70 males and 58 females were dissected out. Obtained from dissection hall cadaver and medico legal post-mortems done within 6 hours of death. The study was carried out in the histology laboratory, department of anatomy, GMC Nagpur after taking prior permission from local ethical committee of GMC Nagpur. Hearts showing no obvious pathological changes of atherosclerosis in the segment of vessels were selected from both sexes and from all age groups. The study material was divided in 8 age groups with a range of 10 years.

Tissue samples were obtained from right coronary artery (RCA) left anterior descending coronary artery (LAD) and left circumflex coronary artery (LCX) 5mm from their origin and left coronary artery stem (LCA). Multiple paraffin blocks were prepared and 7-8 micron thick sections

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were obtained. The slides were stained with H&E stain.³

Luminal diameter of all the coronaries were measured with the help of ocular micrometer circumferentially at 4 different places along the planes at 90° to each other and then their mean was taken as a reading for the respective artery.

3. Observations

The measurements of the luminal diameter of RCA, LCA, LAD and LCX in both the sexes have been expressed in graph I-IV.

It is observed that luminal diameter in males is more as compared to females in all the four coronary arteries.

In the present study the mean luminal diameter of all the major coronary arteries was found to be increased with increasing age.

It is also observed that among coronary arteries, the diameter is more in left coronary artery trunk followed by left anterior descending artery, right coronary artery, left circumflex coronary artery.

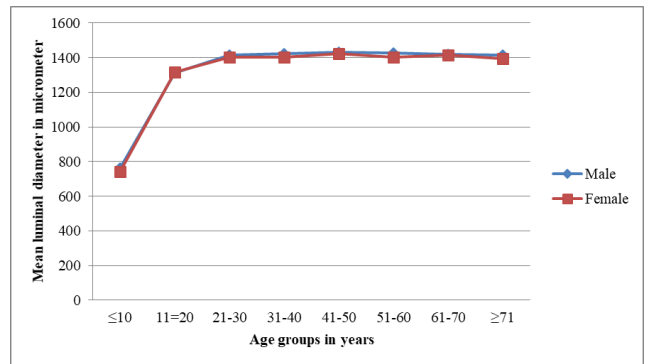


Fig. 3: Line diagram showing mean luminal diameter of left anterior descending coronary artery in males and females in different age groups

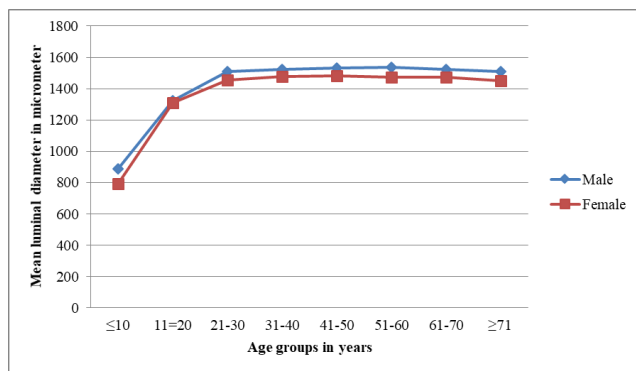


Fig. 1: Line diagram showing mean luminal diameter of right coronary artery in males and females in different age groups

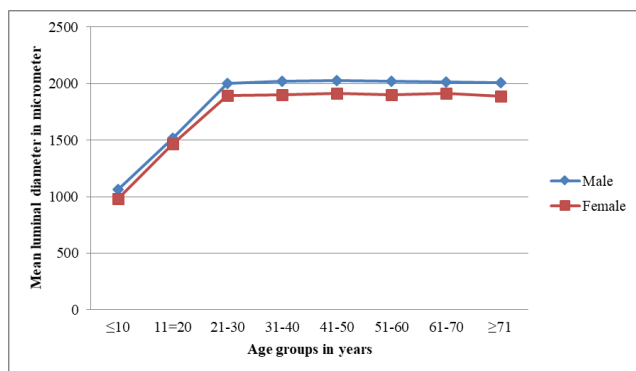


Fig. 2: Line diagram showing mean luminal diameter of left coronary artery in males and females in different age groups

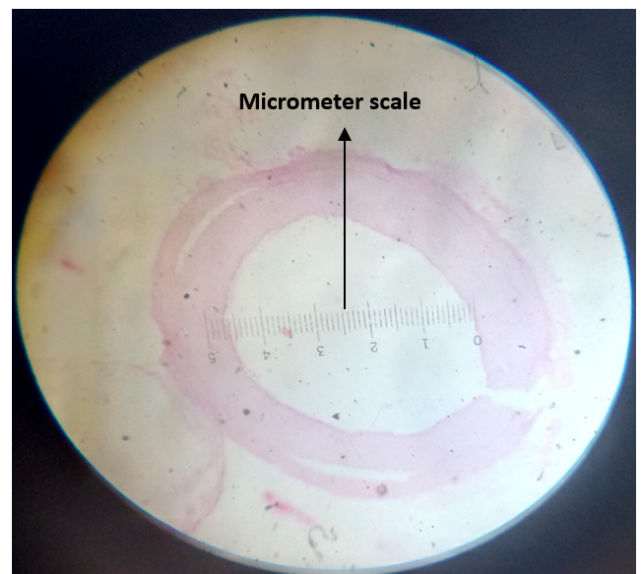


Fig. 4: Photograph showing micrometer scale

4. Discussion

In the present study the mean luminal diameter was more in males as compared to the females in all the major coronary arteries. Similar sexual difference was also observed by Dhall et al (2003)⁴ and Deopujari Rashmi et al (2010).⁵

Macalpin et al (1973)⁶ reported that differences in lumen calibre between men and women could be acceptably resolved when total coronary area was normalised to body surface area. On the contrary Dodge et al (1992)⁷ observed that women had smaller epicardial arterial diameter than men even after normalization for body surface area. The sex differences in lumen diameter disappeared when coronary size was adjusted for heart weight. (Robert and Robert 1980).⁸

In the present study the mean luminal diameter of all the major coronary arteries was found to be increased

with increasing age. Similar type of increase in luminal diameter with age was also reported by Deopujari Rashmi et al (2010),⁵ who stated that there is direct correlation of luminal diameter with advancing age.

Ehrich, de la Chapelle, and Cohn (1931)¹ reported that, it was somewhat unexpected to find the size of the coronary artery increasing throughout life. A similar type of increase was noted by them in other vessels also. They stated that enlargement of the artery possibly represents dilatation or loss of elasticity rather than continued growth, at least in the older age groups. According to Levy et al (1992),² aging is responsible for increase in the calibre of the arterial lumen which partially compensates for the effects of atherosclerosis-induced arterial wall rigidity on vascular compliance.

Maximum mean luminal diameter of adult male was found to be 1536.4 μm (1.54 mm) in right coronary artery, 2027.5 μm (2.03 mm) in left coronary artery, 1625 μm (1.62 mm) in left anterior descending coronary artery and 1432 μm (1.43 mm) in left circumflex coronary artery. Similarly the maximum mean luminal diameter of adult female was found to be 1484.4 μm (1.48 mm) in right coronary artery, 1912.5 μm (1.91) in left coronary artery, 1539 μm (1.54 mm) in left anterior descending coronary artery, 1423.1 μm (1.42 mm) in left circumflex coronary artery. Thus, the mean luminal diameter is maximum in left coronary artery followed by left anterior descending coronary artery, right coronary artery and left circumflex coronary artery. Turner and Navratnam (1996)⁹ and Okumura et al (2004)¹⁰ claimed that the calibre of the coronary arteries in both, main stems and larger branches, range between 1.5 and 5.5 mm at their origins however, results of the present study are closer to the lower limit of the mentioned range.

Findings of the present study is supported by the observations made by Podesser et al (1998)¹¹ who, in an autopsy study on Austrian population, indirectly gave the luminal diameter of coronary arteries to be 0.02 – 2.20 mm. Explanation to the narrow lumen might be that the calibre of coronary arteries in this part of world are less because of comparatively small stature and physique of Asian population as compared to that of west. Taller men have larger luminal diameters of coronary arteries Clarkson et al. (1994).¹²

The luminal diameter of left anterior descending coronary artery in the present study is greater than right coronary artery followed by left circumflex artery which is similar to the observations made by Dhall et al. (2003)⁴ and Waller B. F. (1992).¹³ However, according to Quazi et al. (2013)¹⁴ the luminal diameter of right coronary artery is greater than left anterior descending coronary artery. The larger luminal diameter of right coronary artery in his study may be because of geographic / ethnic variation in histological structure of coronary arterial wall.

5. Conclusion

Age is a non modifiable risk factor for atherosclerosis. Changes in coronary artery are bound to occur with advancing age particularly the lumen and wall of the artery. The present study showing normal changes that happens in the diameter of coronary artery with increasing age can be used as baseline data for risk assessment of atherosclerosis in this region. The calibers of coronary arteries in this part of the world are lesser as compared to that of west indicating different atherosclerotic burden in different populations and because of the comparatively small stature and physique of Asian population as compared to that of western population. Pathophysiological mechanism operating in coronary vessels seems to be different in two sexes leading to differences in the clinical profile of the disease. The present study showing differences in the diameter of coronary arteries in two sexes throws some light on these pathophysiological mechanisms. Present study can also be useful for doing any instrumentation of coronary artery like coronary artery angiography.

6. Source of Funding

Self.

7. Conflict of Interest

None.

8. Ethical Clearance

Done by local ethical committee of government medical college Nagpur.

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