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## Radiographic Study On Aortic Knuckle In An Normal Population: A Hospital Based Cross-Sectional Study.

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### ABSTRACT

Chest radiography is an important method of imaging, providing an cheap, accessible and effective diagnostic tool. Aortic knuckle is an important finding in chest radiography. Aortic knuckle enlargement suggests underlying cardiovascular comorbidity including diabetes mellitus and hypertension. To analyze the contribution of aortic knuckle to left cardiac outline in normal population and compare among male and female population in Postero-anterior (PA) chest radiography. Postero-anterior (PA) chest radiography of 648 individuals between the ages of 18 to 75 years were evaluated. Curved length of aortic knuckle (AKC) and total length of left cardiac outline (LCOT) were studied and contribution of aortic knuckle to left cardiac outline in normal male and female population . Statistical analysis was carried out with the help of IBM-SPSS (IBM Corporation) and Microsoft Excel. Curved length of aortic knuckle (AKC) and total length of left cardiac outline (LCOT) were analyzed to compare normal population with those with cardiovascular comorbidity. The mean contribution of aortic knuckle to left cardiac outline was 18.7% and 18.4% in male and female respectively. Simple measurement of aortic knob in PA chest x-ray may help in predicting cardiovascular comorbidity.

**Keywords:** Aortic knuckle, Comorbidity, Diabetes, Hypertension, Radiography

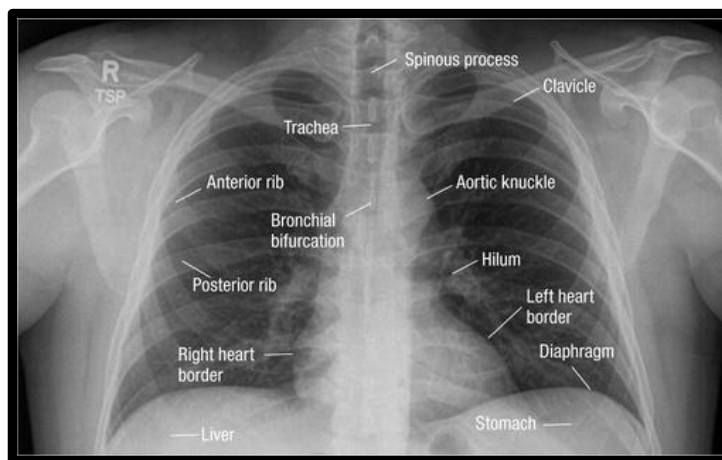
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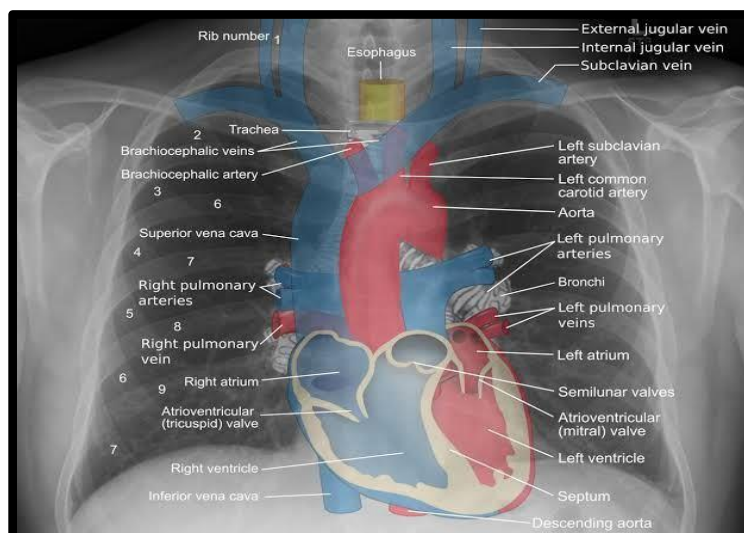
## BACKGROUND

Chest radiography is an important modality of imaging, providing an cheap, easily accessible and effective diagnostic tool for various pathology involving the cardio-thoracic region [1]. Aortic knuckle is an important finding in postero-anterior (PA) chest X-ray, its enlargement suggests preexisting cardiovascular comorbidity such as diabetes mellitus and hypertension. The aortic knuckle refers to the chest X-ray appearance of the distal part of aortic arch as it curves posterolaterally to continue as the thoracic aorta. It is seen as a laterally projecting bulge in the left cardiac outline on PA chest x-ray, as the medial aspect of the aorta cannot be seen separate from the mediastinum [2, 3]. The aortic knuckle is enlarged due to increased pressure flow in aorta or changes in the elasticity of its wall and resulting in the thickening of the elastic fibre and smooth muscles in the tunica media of arterial wall [4]. Prominence of aortic knob is seen in systemic hypertension, aortic stenosis, cystic medial necrosis of aorta, coarctation of aorta, aortic dissection and aortic aneurysm. Systemic hypertension and diabetes mellitus are the most common cardiovascular comorbidity resulting in enlarged aortic knuckle [4, 5].

**Figure 1: Demonstration of aortic knuckle in chest X-ray PA view [6]**



**Figure 2: Formation of aortic knuckle by arch of aorta [7]**



The appearance of the aortic knuckle exclusively a feature of PA chest x-ray and not an anatomic entity [8]. The enlarged aortic knuckle does not indicate a definitive diagnosis of cardiovascular comorbidity, but such a enlargement in chest radiography provides an preliminary investigating diagnostic tool to predict cardiovascular comorbidity [9]. No studies are done to estimate the

contribution of aortic knuckle to left cardiac outline, that indirectly provides the knowledge of the enlargement of aortic knuckle [10, 11].

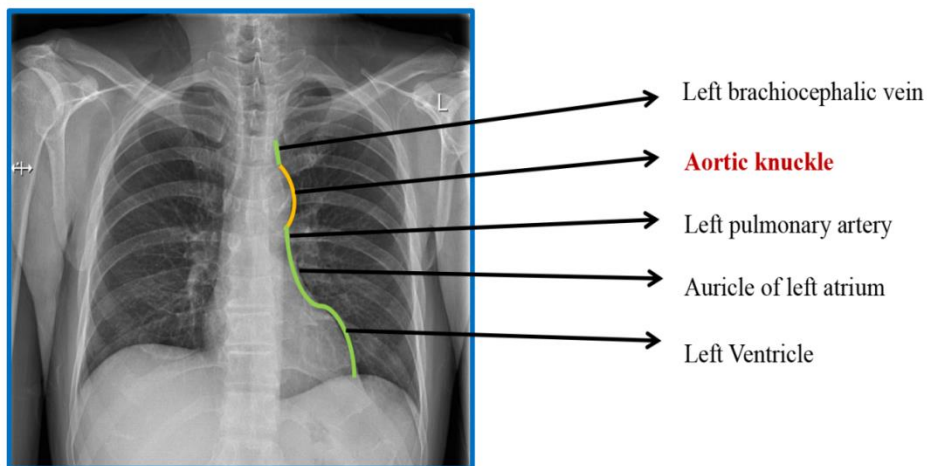
**Aims and objectives**

To analyze the contribution of aortic knuckle to left cardiac outline in normal population and compare among male and female population in PA chest x-ray.

**MATERIALS AND METHODS**

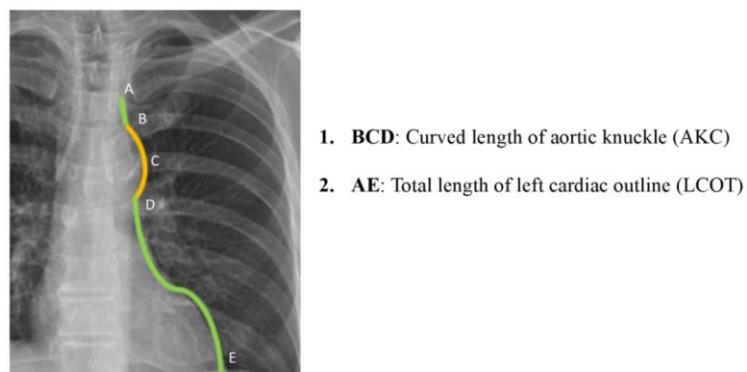
A descriptive cross-sectional study was conducted in the department of anatomy, Bangalore Medical College and Research Institute, Bangalore, India for a period of 1 year. A total of 578 posteroanterior (PA) chest radiographs from 312 normal male individuals and 266 normal female individuals were randomly selected and evaluated. Radiography of both males and females in the age group 18-75 years were included. The radiographs of individuals with cardiovascular comorbidity, musculoskeletal deformity and trauma involving thoracic region were excluded. The accurate measurements were performed using the digital software available on the computed visual radiographic system. The parameters measured in the present study are curved length of aortic knuckle (AKC) and total length of left cardiac outline (LCOT). The curved length of aortic knuckle is the measurements of aortic knuckle contributing to left cardiac outline. Other structures contributing to left cardiac outline from cranial to caudal aspect are left brachiocephalic vein, left pulmonary artery, auricle of left atrium and left ventricle.

**Figure 3: Structures contributing to left cardiac outline**



Statistical analysis was carried out using IBM-SPSS software and Microsoft excel. The percentage contribution of aortic knuckle to left cardiac outline in normal and comorbid individuals was evaluated and demonstrated using simple bar diagram.

**Figure 4: Measurements of Aortic Knuckle**



**RESULTS**

The curved length of aortic knuckle (AKC) and total length of left cardiac outline (LCOT) was measured in 312 male and 266 female individuals and were proportionately compared.

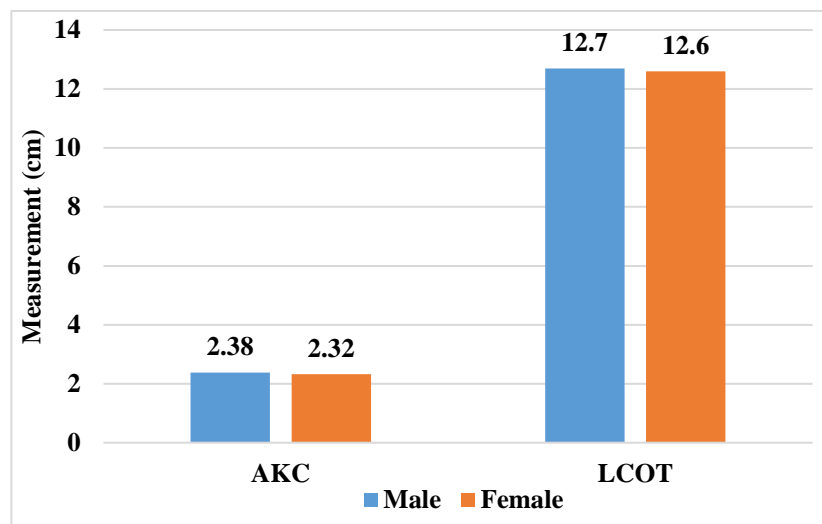
**Normal male population:** The mean value of curved length of aortic knuckle (AKC) in PA view of chest radiography was 2.38 cm and the total length of left cardiac outline (LCOT) was 12.7 cm. The Mean contribution of aortic knuckle to left cardiac outline in PA view of chest X-ray in normal individuals was 18.7 %.

**Normal female population:** The mean value of curved length of aortic knuckle (AKC) in PA view of chest radiography was 2.32 cm and the total length of left cardiac outline (LCOT) was 12.6 cm. The Mean contribution of aortic knuckle to left cardiac outline in PA view of chest X-ray in normal individuals was 18.4 %.

**Table 1: Measurements of curved length of aortic knuckle (AKC) and total length of left cardiac outline (LCOT)**

	AKC (cm)	LCOT (cm)
Normal males	2.38	12.7
Normal females	2.32	12.6

**Figure 5: Bar diagram contrasting AKC and LCOT in male & female population**



**DISCUSSION**

Posteroanterior chest radiography is an easily accessible imaging modality that has not been seldom utilized to its potential as a predictor of cardiovascular morbidity. No studies has been done to evaluate the contribution of aortic knuckle to left cardiac outline. Numerous studies are done on various other measurements of the aortic knuckle such as width of aortic knuckle, straight length of aortic knuckle and aortic knuckle index. Studies done on measurements of aortic knuckle such as straight length of aortic knuckle and width of aortic knuckle showed higher values in patients suffering from cardiovascular comorbidity such as hypertension and diabetes mellitus [5, 9, 12]. The present study after the research had evaluated not much variation in contribution of aortic knuckle to left cardiac outline in male and female population.

**CONCLUSION**

Curved length of aortic knuckle (AKC) and total length of left cardiac outline (LCOT) was measured and proportionate comparison was done between normal and comorbid individuals. The mean contribution of aortic knuckle to left cardiac outline in normal male and female individual was 18.7 % and

18.4 % respectively. Community based study has to be done to assess the true contribution of aortic knuckle to left cardiac outline in chest radiography. A simple imaging modality such as PA chest radiography can be used as an preliminary investigation for assessing cardiovascular comorbidity.

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