

A Cross Sectional Analysis of Correlation of Heart Diameter and Cardio-Thoracic Ratio with Body Habitus for Evaluating Cardiac Enlargement: An Institutional Based Study

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Received: 24-04-2021 / Revised: 12-06-2021 / Accepted: 03-08-21

Abstract

Background: The present study was conducted for assessing the correlation of Heart Diameter and Cardio-Thoracic Ratio with Body Habitus for Evaluating Cardiac Enlargement. **Materials & Methods:** A total of 100 subjects were enrolled for the present study. All the patients were within the age range of 20 to 65 years. A postero-anterior chest radiograph was obtained followed by transverse Thoracic Diameter measurement. The transverse diameter of heart was the sum of maximum projections with the right and left heart borders. Heart Diameter and Cardio-Thoracic Ratio with Body Habitus was assessed. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. **Results:** Mean CTR among subjects with less than 30 years of age, 30 to 50 years of age and 51 to 65 years of age was 42.1%, 44.6% and 46.2% respectively. Mean HD among subjects with less than 30 years of age, 30 to 50 years of age and 51 to 65 years of age was 11.8 cm, 12.8 cm and 14.6 cm respectively. Mean CTR among males and female subjects was 43.2% and 44.1% respectively. Mean HD among males and females was 12.3 cm and 13.2 cm respectively. Mean CTR among subjects with BMI of less than 25 Kg/m², 25 to 29.9 Kg/m² and 30 & above Kg/m² was 44.6%, 45.9% and 46.1% respectively. Mean HD among subjects with BMI of less than 25 Kg/m², 25 to 29.9 Kg/m² and 30 & above Kg/m² was 12.3 cm, 13.9 cm and 14.1 cm respectively. **Conclusion:** Age was found to be significant predictor of cardiac enlargement as measured by Heart Diameter and Cardio-Thoracic Ratio with Body Habitus. Although non-significant, gender and BMI were also found to show considerable association with cardiac enlargement.

Key words: Cardio-Thoracic Ratio, Cardiac Enlargement

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Introduction

Despite the invention of newer imaging techniques like computerized tomography scan (CT scan) or Magnetic Resonance Imaging (MRI) available to modern clinicians, the chest x-ray remains a simple, easy and inexpensive and good informative tool for evaluation of transverse thoracic diameter (TD), maximum heart diameter (HD) and Cardio-thoracic ratio (CTR), which can give fairly accurate idea of heart size[1-3].

Chest x-rays are a simple, quick and economical tool for determining the transverse thoracic diameter, maximum diameter of heart. The Cardiothoracic ratio is the ratio of transverse cardiac diameter to the transverse chest diameter on a PA chest film. Recently interest is growing in the use of CTR as a tool in clinical evaluation in patients and used as a screening method to detect enlargement of heart. An abnormal heart size in comparison to age, gender and body habitus may show initial signs of underlying cardiac etiology in routine Chest radiographs[4-6]. Hence; the present study was conducted for assessing the correlation of Heart Diameter and Cardio-Thoracic Ratio with Body Habitus for Evaluating Cardiac Enlargement.

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Materials & methods

The present study was conducted for assessing the correlation of Heart Diameter and Cardio-Thoracic Ratio with Body Habitus for Evaluating Cardiac Enlargement. A total of 100 subjects were enrolled for the present study. All the patients were within the age range of 20 to 65 years. Subjects with sign of any cardiac, lung disease or any abnormality of thoracic cage were excluded. Complete demographic and clinical details of all the subjects were obtained. Anthropometric variables were assessed. A postero-anterior chest radiograph was obtained followed by transverse Thoracic Diameter measurement. The transverse diameter of heart was the sum of maximum projections with the right and left heart borders. Heart Diameter and Cardio-Thoracic Ratio with Body Habitus was assessed. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Univariate regression curve was used for evaluation of level of significance.

Results

In the present study, a total of 100 subjects were enrolled. Mean age of the subjects was 42.3 years. Out of 100 subjects, 50 were males and 50 were females. Mean CTR among subjects with less than 30 years of age, 30 to 50 years of age and 51 to 65 years of age was 42.1%, 44.6% and 46.2% respectively. Mean HD among subjects with less than 30 years of age, 30 to 50 years of age and 51 to 65 years of age was 11.8 cm, 12.8 cm and 14.6 cm respectively. Significant results were obtained while correlating CTR values and HD values with age group. Mean CTR among males and female subjects was 43.2% and 44.1% respectively. Mean HD among males and females was 12.3 cm and 13.2 cm respectively. Non-Significant results were obtained while correlating CTR values and HD values

with gender. Mean CTR among subjects with BMI of less than 25 Kg/m², 25 to 29.9 Kg/m² and 30 & above Kg/m² was 44.6%, 45.9% and 46.1% respectively. Mean HD among subjects with BMI of less

than 25 Kg/m², 25 to 29.9 Kg/m² and 30 & above Kg/m² was 12.3 cm, 13.9 cm and 14.1 cm respectively. Non-significant results were obtained while correlating CTR and HD values with BMI.

Table 1: CTR and HD values according to age group (years)

Age group	CTR (%)	HD (cm)
Less than 30	42.1	11.8
30 to 50	44.6	12.8
51 to 65	46.2	14.6
p- value	0.00 (Significant)	0.01 (Significant)

Table 2: CTR and HD values according to gender

Gender	CTR (%)	HD (cm)
Males	43.2	12.3
Females	44.1	13.2
p- value	0.121	0.326

Table 3: CTR and HD values according to BMI (Kg/m²)

BMI (Kg/m ²)	CTR (%)	HD (cm)
Less than 25	44.6	12.3
25 to 29.9	45.9	13.9
30 and above	46.1	14.1
p- value	0.769	0.682

Discussion

Despite the invention of newer imaging techniques like computerized tomography scan (CT scan) or Magnetic Resonance Imaging (MRI) available to modern clinicians, the chest x-ray remains a simple, easy and inexpensive and good informative tool for evaluation of transverse thoracic diameter (TD), maximum heart diameter (HD) and Cardio-thoracic ratio (CTR), which can give fairly accurate idea of heart size[6-8]. An enlarged heart may or may not be indicative of underlying cardiac disease; other way round a normal sized heart does not guarantee the absence of cardiac disease. But still then an enlarged heart in respect of age, sex and body habitus may give the first hint of underlying cardiac disease in routine Chest X-ray. Heart size in the absence of concurrent skeletal or chest deformity or underlying lung disease is assumed to be related to the habitus of the patient. Results of previous research papers depict the racial differences as a function of body habitus. Several studies also show the variation of heart size in different racial groups[7-9]. The present study was conducted for assessing the correlation of Heart Diameter and Cardio-Thoracic Ratio with Body Habitus for Evaluating Cardiac Enlargement. In the present study, a total of 100 subjects were enrolled. Mean age of the subjects was 42.3 years. Out of 100 subjects, 50 were males and 50 were females. Mean CTR among subjects with less than 30 years of age, 30 to 50 years of age and 51 to 65 years of age was 42.1%, 44.6% and 46.2% respectively. Mean HD among subjects with less than 30 years of age, 30 to 50 years of age and 51 to 65 years of age was 11.8 cm, 12.8 cm and 14.6 cm respectively. Significant results were obtained while correlating CTR values and HD values with age group. Mean CTR among males and female subjects was 43.2% and 44.1% respectively. Mean HD among males and females was 12.3 cm and 13.2 cm respectively. Non-Significant results were obtained while correlating CTR values and HD values with gender. Browne RF et al extracted the two-dimensional (2D) cardiothoracic ratio from digital chest radiographs using image analysis software on a Magic View 300 system. One hundred patients undergoing radionuclide ventriculography and concurrent digital PA chest radiography using a commercial selenium detector system were studied. The 2D cardiothoracic ratio was extracted by defining a region of interest around the cardiac and thoracic areas and calculating a ratio of the two-pixel counts obtained. The 2D ratio could be achieved on all radiographs after image manipulation. The traditional linear cardiothoracic ratio showed an inverse correlation with left ventricular ejection fraction. The 2D cardiothoracic ratio showed an improved correlation. Assuming that a left ventricular ejection fraction of 55% or more indicates normal cardiac function, the normal 2D

cardiothoracic ratio is 0.23 or less and a ratio of 1:4 is suggested. The ratio of cardiac and thoracic area correlates better with cardiac function as assessed by left ventricular ejection fraction than the traditional linear cardiothoracic ratio[10]. In the present study, mean CTR among subjects with BMI of less than 25 Kg/m², 25 to 29.9 Kg/m² and 30 & above Kg/m² was 44.6%, 45.9% and 46.1% respectively. Mean HD among subjects with BMI of less than 25 Kg/m², 25 to 29.9 Kg/m² and 30 & above Kg/m² was 12.3 cm, 13.9 cm and 14.1 cm respectively. Non-significant results were obtained while correlating CTR and HD values with BMI. Mandal D et al assessed the correlation of Heart Diameter and Cardio-Thoracic Ratio with Body Habitus for Evaluation of Cardiac Enlargement in a Population of Bankura District of West Bengal. 850 people meeting the deserved criteria are chosen. Chest x-rays are taken. Body weight and body height are measured. We calculate the TD, CTR, BMI and BSA from the measured data. Their study revealed that there is strong correlation of weight, height, BMI and BSA with Heart Diameter (HD) and poor correlation of the above parameters with CTR. They concluded that Cardio-thoracic ratio is less affected by the body habitus changes as mentioned above; so CTR is better indicator in predicting cardiac enlargement than HD in routine x-rays[11]. Hammermeister KE et al demonstrated a sensitivity and specificity of the CTR of ≥ 0.5 to detect left ventricular enlargement of 88% and 41%, while those to detect reduced ejection fraction were 86% and 35%, respectively. Chon SB et al found the sensitivity and specificity of CTR to diagnose congestive cardiomegaly with the criterion of ≥ 0.5 was 61% and 54% respectively, showing lower sensitivity and slightly higher specificity. Schlett CL et al reported interesting data. They showed that the cardiac diameter, but not the CTR, was significantly correlated with the left ventricular size, the well-known predictor of cardiovascular morbidity and mortality[12-14]. A Cross Sectional Analysis of Correlation of Heart Diameter and Cardio-Thoracic Ratio with Body Habitus for Evaluating Cardiac Enlargement: An Institutional Based Study

Conclusion

Age was found to be significant predictor of cardiac enlargement as measured by Heart Diameter and Cardio-Thoracic Ratio with Body Habitus. Although non-significant, gender and BMI were also found to show considerable association with cardiac enlargement.

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Conflict of Interest: Nil

Source of support: Nil