

Measurements of Main Pulmonary Artery in Adults and Geriatric age group individuals

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Abstract

Aim: To determine normal diameters of main and right & left pulmonary arteries, using Computed Tomography in Indian scenario.

Materials and Methods: The study, conducted over 6 months, consisted of 100 subjects which qualified our inclusion criteria. Subjects were divided according to Age and Sex. Their respective measurements of MPA and Right & Left PA were taken and analyzed.

Results

Adults Geriatrics Males Females

MPA 22.5 (SD = 2.2)22.9 (SD = 3.2)22.6 (SD = 2.6)22.7 (SD = 2.7)

Right PA 16.2 (SD = 2.5)17.7 (SD = 2.7)17.1 (SD = 2.7)16.4 (SD = 2.6)

Left PA 16.1 (SD = 2.0)17.8 (SD = 3.1)16.9 (SD = 2.7)16.5 (SD = 2.4)

Conclusion: Our findings are an important beginning of a more complete understanding of normal values of mean MPA diameter in Indian Population which differ from references we follow.

Keywords: geriatric age, Computed Tomography, Pulmonary Artery

Introduction

The range of the diameters of normal pulmonary arteries (PA) in Indian Population is not fully described in the current literature. Contrast-enhanced computed tomography (CECT) of the lungs might be used for measuring the diameters of PAs.^[1, 2] Without knowing the actual upper and lower limits of normal PA diameters, it is usually very hard to claim that a PA is enlarged. Normal values could be established as a function of a number of variables (age & sex), which would then enable a good estimate for the normal range of the main PA diameter in a certain individual. The purpose of this study was -

To determine the normal diameters of Main Pulmonary Artery, Right Pulmonary Artery and Left Pulmonary Artery, using Computed Tomography in Indian population.

Divide the outcomes under different groups –

Males

Females

Adults

Geriatrics

Materials and Methods

Study was done over a period of six months from July 2019 to December 2019

Total of 100 subjects

- 55 Males
- 45 Females
- 62 Adults (18-65 years)
- 38 Geriatrics (>65 years)

Patients were excluded if there was a history of:

1. Cardiac or thoracic disease associated with an elevation in either pulmonary flow or pulmonary pressure;
2. Mediastinal disease;
3. Chest or mediastinal radiation therapy.

Contiguous 5 mm slices were obtained using a Siemens Somatom Emotions 16 slice MDCT scanner with a 15 s breath-hold spiral technique 1.5 mm reconstruction interval.



Fig 1

CECT examinations were performed with breath holding to evaluate the thorax and the upper abdomen from the level of the supraclavicular area through the upper pole of the right kidney. Scanning began 20 s after the start of contrast

material injection. Nonionic contrast material (average volume 90 ml, concentration 300 mg I/ 100 ml) was administered by a power injector at a rate of 3 ml/s via an 18-gauge plastic angiocath inserted into a cubital vein.



Fig 2

Images were subsequently reviewed on an independent workstation at standardized mediastinal window settings

(WW: 350/WL:50). The widest diameter perpendicular to the long axis of the main pulmonary artery was measured at

the level of the pulmonary artery bifurcation. The diameters of the right and left PAs were measured at the widest portion, 2 cm before the branching of the lobar arteries.

The Kolmogorov-Smirnov test was used to test the normality of the data distribution. Assessment was made by the Mann-Whitney U test for testing statistical differences between the medians. Correlations were calculated by means of Pearson's correlation test.

Results

The mean Main Pulmonary Artery diameter of the Entire Subject Population was 22.6 ± 2.6 mm (minimum 17.1 mm, maximum 30.8 mm). The mean Right Pulmonary Artery diameter of the Entire Subject Population was 16.8 ± 2.7 mm

(minimum 11.3 mm, maximum 25.5 mm). The mean Left Pulmonary Artery diameter of the Entire Subject Population was 16.7 ± 2.6 mm (minimum 12.3 mm, maximum 29.0 mm).

The main PA, right PA and left PA diameters of the subjects showed a normal distribution. The main PA, right PA, left PA diameters within each gender and age group also showed a normal distribution.

In a normally distributed population, when upper and lower extreme values are discarded (lower 2.5% and upper 2.5%), the remaining 95% values might be considered as normal values. Thus, we found the normal range of upper and lower limits of the diameters to be 28.1 and 17.3 mm (main PA), 22.3 and 11.4 mm (right PA), and 22.1 and 11.5 mm (left PA).

Table 1

Main Pulmonary Artery			
Males	22.6 ± 2.6 mm (min. 17.1 mm, max. 30.8 mm)	Adults	22.5 ± 2.2 mm (min. 18.1 mm, max. 27.2 mm)
Females	22.7 ± 2.7 mm (min. 18.1 mm, max. 29.4 mm)	Geriatrics	22.9 ± 3.2 mm (min. 17.1mm, max. 30.8 mm)

Table 2

Right Pulmonary Artery			
Males	17.1 ± 2.7 mm (min. 11.3 mm, max. 25.5 mm)	Adults	16.2 ± 2.5 mm (min. 11.3 mm, max. 22.8 mm)
Females	16.4 ± 2.6 mm (min. 12.6 mm, max. 22.8 mm)	Geriatrics	17.7 ± 2.7 mm (min. 11.1 mm, max. 25.5 mm)

Table 3

Left Pulmonary Artery			
Males	16.9 ± 2.7 mm (min. 12.8 mm, max. 29.0 mm)	Adults	16.1 ± 2.0 mm (min. 12.3 mm, max. 21.0 mm)
Females	16.5 ± 2.4 mm (min. 12.3 mm, max. 22.5 mm)	Geriatrics	17.8 ± 3.1 mm (min. 13.7 mm, max. 29.0 mm)

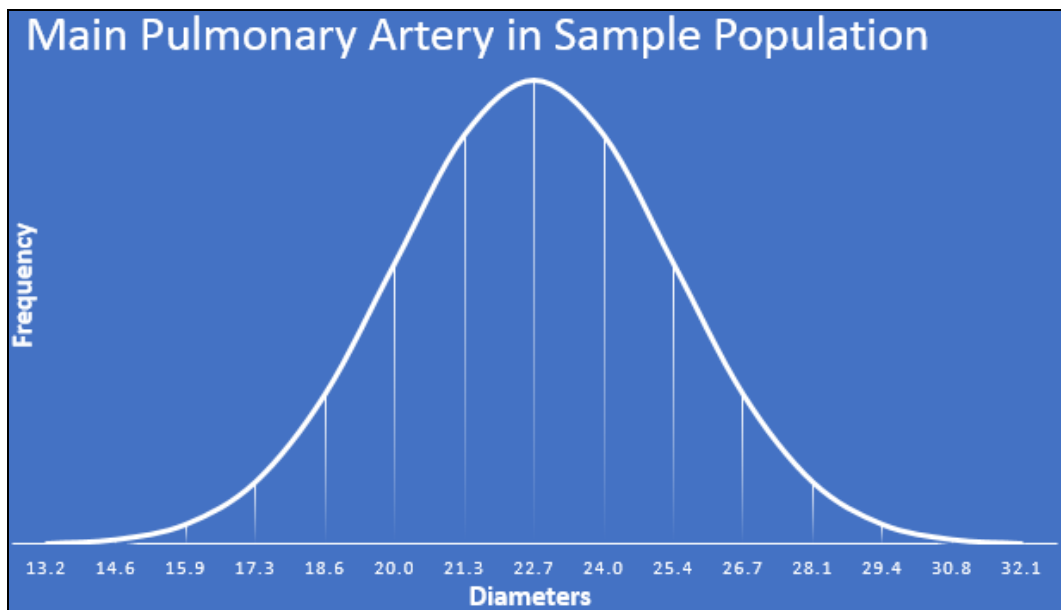


Fig 3

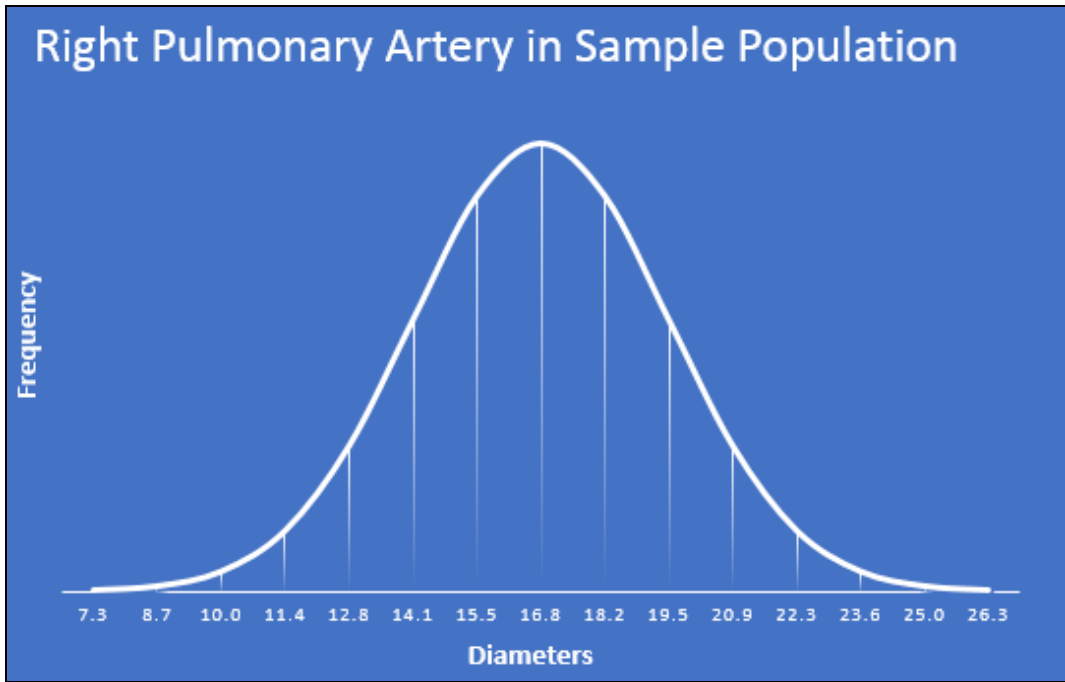


Fig 4

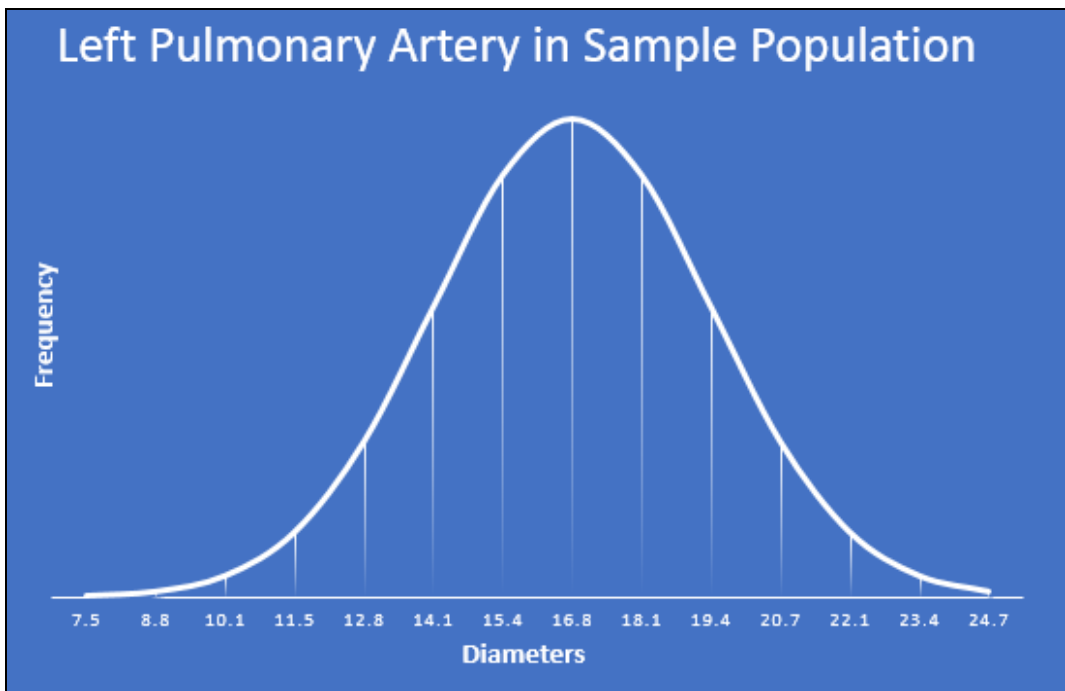


Fig 5

Discussion

Pulmonary hypertension is used to describe an increase in the pressure of the pulmonary artery, and may be defined as a mean pulmonary artery pressure of greater than 25mmHg. This may occur as a result of heart problems such as heart failure, lung or airway disease such as COPD or scleroderma, or thromboembolic disease such as pulmonary embolism or emboli seen in sickle cell anemia.

As can be measured on a CT scan, a diameter of more than 29 mm diameter is often used as a cut-off to indicate pulmonary hypertension [3]. In previous studies in which chest CT was used to investigate mPA in a reference group, the mean mPA ranged from 24.2 mm to 27.2 mm [4, 5, 6, 7]

In our group of healthy individuals, the mean mPA was found to be 22.6 mm. In addition, diameters of right and left

PA showed a normal distribution, and we calculated the normal upper and lower limits by discarding the upper and lower extreme 2.5% values. Although PA diameters were determined by CT in previous studies but to our best knowledge, we could not find current literature indicating PA diameters in Indian Population.

When we analyzed male and female subject populations separately, we found a normal Gaussian distribution of the diameters of the main, right, and left PAs in both groups. This finding prompted us to evaluate the PA diameters separately for each gender plus adults and geriatric age group individuals.

With the view of the interpretation of the study, we got an inference that-

The mean Main Pulmonary Artery diameter is almost equal

in both males and females regardless of the age group. With advancing age, the mean Main Pulmonary Artery diameter tends to increase. The mean Right Pulmonary Artery diameter is larger in males as compared to females. As with the Main Pulmonary Artery, the Right Pulmonary Artery also tends to increase in diameter with advancing age. The same implies for the Left Pulmonary Artery, that the diameter is more in males as compared to the females. And the Left Pulmonary Artery diameter also tends to increase with advancing age.

Our results are not consistent with the prior studies and we extend the literature by providing sex-specific and age specific CT normative values for mPA diameter in Indian Population.

Conclusion

Based on our findings, the normal diameters of the main, right, and left PA diameters range between 17.3 to 28.1, 11.4 to 22.3, and 11.5 to 22.1 respectively, in healthy Indian Population.

Our findings are an important beginning of a more complete understanding of normal values of mean MPA diameter in Indian Population which differ from references we follow.

Enlarged mPA is associated with multiple Cardio vascular diseases risk factors and prevalent Cardio vascular diseases as well as with dyspnea therefore understanding of the variability of PA measurements is important and how they may correlate with cardiopulmonary disease.

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