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PULMONARY ARTERY DIAMETER COMPARISON UNDER CT SCAN IN NICOTINE USERS AND NON-USERS

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Abstract:
High-Resolution Computed Tomography (HRCT) has emerged as an indispensable tool in diagnosing and managing various pulmonary diseases. Since its inception in the 1970s, HRCT has undergone significant advancements, particularly with the advent of Multi-Detector CT (MDCT) scanners. This abstract aims to provide a comprehensive overview of HRCT, focusing on its principles, techniques, and applications.
The fundamental principle underlying HRCT lies in its ability to acquire thin-section CT images with high spatial resolution, enabling the detection and characterization of diseases affecting the lung parenchyma and airways. Unlike conventional radiography, HRCT offers cross-sectional images without superimposition of structures, thus providing clearer visualization of abnormalities. Additionally, HRCT exhibits superior sensitivity to subtle differences in X-ray attenuation, making it a preferred modality for pulmonary imaging.
MDCT scanners have revolutionized HRCT by allowing the acquisition of volumetric data in a single breath hold. This advancement enables the reconstruction of spaced, contiguous, and overlapping HRCT images, facilitating multi-planar reconstruction and thin-section HRCT evaluation. Moreover, post-processing techniques such as maximum intensity projection (MIP) and minimum intensity projection (minIP) further enhance the diagnostic utility of HRCT.
The primary objective of HRCT is to detect, characterize, and determine the extent of diseases involving the lung parenchyma and airways. From fibrotic lung diseases to obstructive conditions, HRCT plays a pivotal role in accurate diagnosis and treatment planning. Quantitative CT, an emerging technique, utilizes standardized protocols for the quantification of lung features, providing valuable insights into disease progression and response to therapy.
Historically, HRCT utilized non-contiguous inspiratory thin-section images, albeit with limitations in diagnostic accuracy. However, with the widespread availability of MDCT scanners, HRCT is predominantly performed using isotropic data acquisition, optimizing diagnostic yield while minimizing radiation exposure.
In conclusion, HRCT represents a cornerstone in pulmonary imaging, offering unparalleled resolution and diagnostic accuracy. With ongoing technological advancements and standardized protocols, HRCT continues to evolve as an indispensable tool in the diagnosis and management of pulmonary diseases. This abstract provides a comprehensive insight into the principles, techniques, and applications of HRCT, highlighting its pivotal role in modern healthcare practice.
KeyWords- HRCT,MDCT,COPD,MinIP, Lung parenchyma

Introduction

A Compound Tomography (CT) image is a representation of the anatomy of a thin section of the body that is created by combining images from several measurements of X-ray absorption taken around the perimeter of the body. The two ways that these CT images are different from traditional film protection are: (a) They obtain a cross-sectional image without the superimposition of structures, whereas plain x-rays have this feature; and (b) They are at least ten times more sensitive to subtle variations in X-ray attenuation than plain film screen projection.
In 1972, Godfrey Hounsfield of EMI, UK, invented the first CT scanner. CT has advanced significantly and become more technologically sophisticated since then. In 1979, Alan Cormack (USA) and Sir Godfrey Hounsfield (UK) were awarded the Noble Prize in medicine for developing the CT scanner.The primary goal of HRCT is to identify, describe, and quantify disorders affecting the airways and lung parenchyma. Using a high spatial frequency reconstruction method and thin-section CT images (<1.5 mm slice thickness), HRCT is a diagnostic tool for pulmonary parenchyma and small airway disorders. The advent of multi detector CT (MDCT) scanners, which

can obtain near isotropic data over the whole thorax in a single breath hold, has led to their widespread availability.MDCT is typically used for HRCT.

This makes it possible to collect volumetric single breath-hold data sets, which in turn makes it possible to rebuild dispersed, contiguous, and/or overlapping HRCT images. The volumetric data from MDCT allows for thin section HRCT reconstruction and multi planer reconstruction (MPR), which makes it easier to assess the distribution of diffuse lung disease. Assessing the presence of concurrent localized lung illness and using post-processing methods,example are software that quantifies characteristics in the lungs and airways using volumetric data and maximum intensity projection (MIP) and minimum intensity projection (minIP). Quantitative CT is becoming a useful method for assessing the severity of obstructive and fibrotic lung disorders; nevertheless, it needs certain standard operating procedures, which are outside the scope of this discussion. Non-contiguous inspiratory thin-section pictures taken across the lungs at intervals of 10–20 mm were employed in an earlier HRCT technique. Although this technique significantly lowers radiation exposure, its diagnostic use is somewhat constrained, and it would only be partially useful in identifying people who may be at risk for diffuse lung disease. Patients are usually placed in the supine posture while HRCT images are being taken at suspended full inspiration. Extra choices, helpful in a lot of situations.

One of the main causes of morbidity and death globally, chronic obstructive pulmonary disease (COPD) has a significant and expanding economic and social cost.[35]Chronic inflammation and irreversible airflow obstruction, involving structural alterations in the lung, are its defining features.[36]The biggest contributing factor to the onset of COPD is tobacco use. That being said, not every COPD sufferer has smoked in the past. 10% to 12% of people with COPD are thought to have never smoked, and as few as 50% of cases globally are linked to smoking[37]. 38In other words, never smokers also experience irreversible airway restriction. 23.3% of participants in the global Burden of Obstructive Lung Disease (BOLD) study, which is population-based and conducted internationally, had Global Initiative for Chronic Obstructive Lung Disease (GOLD).

Pulmonary artery Diameter:-

In healthy persons, the usual mPA and Ao are 25.9 mm and 30.0 mm, respectively, and the mean mPA/Ao ratio is 0.87 in healthy individuals. In patients who smoke regularly, the range of their pulmonary artery diameter (mPA) is 26.0 mm, $P<0.001$. At the point of the pulmonary artery bifurcation, a transverse picture was used to evaluate the ascending aorta and pulmonary artery. Using a computer caliper, measure the largest width parallel to the main pulmonary artery's long axis to determine the vessel diameter (Fig.). The main pulmonary artery (PA) bifurcation level, which is perpendicular to the vascular wall, is normally where the PA measurement is taken.

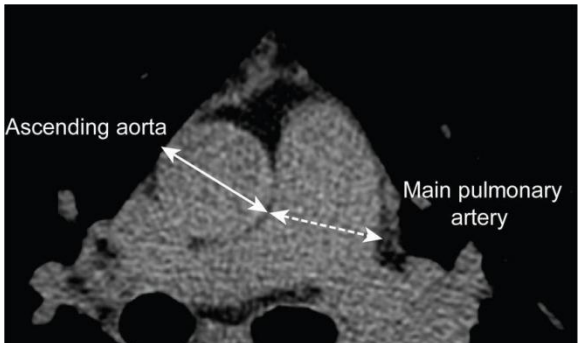


Fig No.3 : Pulmonary artery

Aim and Objective :-

Aim :-
The aim of the study is to assess pulmonary diameter in smoker and non- smoke.

Objectives:-

- To determine the of pulmonary artery diameter in smokers versus non-smokers
- To study pulmonary artery diameter in smokers and non- smokers according to age.

Materials and Methods :-

TYPE OF STUDY:

An Prospective Observational study will be carried forward in Department of Radio-Imaging & Diagnosis of Subharti Medical College, Chhatrapati Shivaji Subharti Hospital, Swami Vivekanand Subharti University, Meerut, UP.

Study Area:

Patients coming to Chhatrapati Shivaji Subharti Hospital, Subharti Medical College will be taken for the study.

Study Duration: - This study conducted at time period of 6 months in department of radio diagnosis & imaging at Chhatrapati Shivaji Subharti Hospital.

INCLUSION CRITERIA:

- All patients undergoing CT Chest with or without history of smoking.
- Patient with suspected Chest discomfort.

EXCLUSION CRITERIA:

- Pregnancy.
- Uncooperative and unstable patients.
- Patients who didn't give consent.

Observation :

The present study ―Comparison of Pulmonary Artery Diameter in Smokers and Non-Smokers by Multi Slice CT Scan‖ deals with the actual finding of the measurement of pulmonary artery in the HRCT Chest or NCCT Chest and CECT Chest examination. The study subjects were suspected cases of Chest disease (based on history) referred from emergency, OPD and other wards for HRCT Chest or NCCT Chest to the department of Radio-diagnosis and Imaging Chhatrapati Shivaji, Subharti Hospital, Subharti Medical College, Meerut. The findings have been derived from primary data taken from the analysis of images of the patients in the main workstation of the CT scan. This study was undertaken with the aim of measurement pulmonary artery in smokers and non-smokers according gender and size on the basis of different age group of patients, evaluate the role of non-contrast and contrast enhance CT in the patients of Chhatrapati Shivaji, Subharti Hospital who were referred for HRCT Chest or NCCT Chest. This prospective study was done on total 100 patients and the study was conducted from 6 months . The findings are described below with the appropriate tables, charts and graphs below. An informed consent was obtained from each of the patient before they were subjected for evaluation.

On the basis of inclusion criteria a total 100 patients of both sex and different age group, were included in the present prospective study.

Result :

This study was conducted among 100 participants. It includes 50% smokers and 50% non smokers. Age of the participants ranged from 18 to 86 years with mean 51.9 + 17.3.

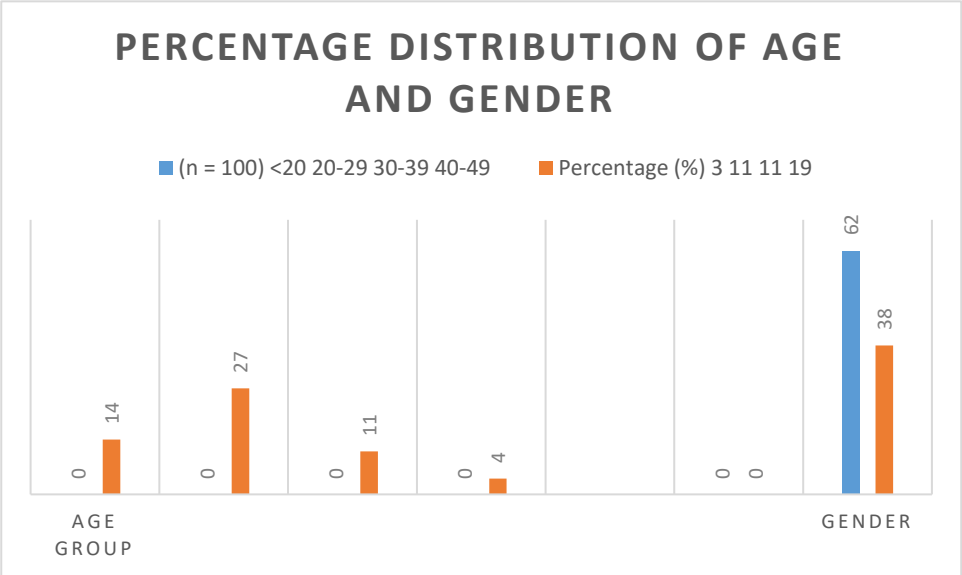
Table 1: Descriptive Statistics for age

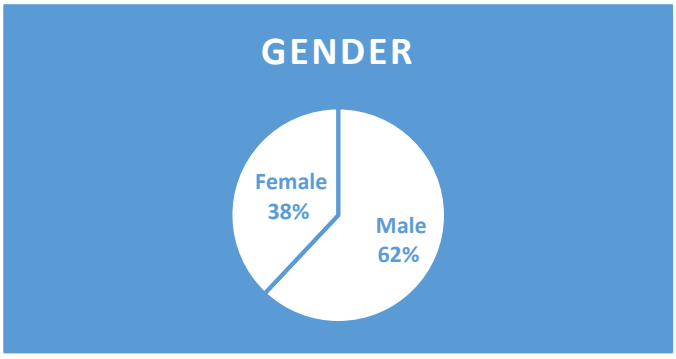
(n = 100)	Range	Mean	S.D.
Age (Years)	18 to 86	51.9	17.3

Table 2: Percentage distribution of age and gender

Age Group	(n = 100)	Percentage (%)
	<20	3
	20-29	11
	30-39	11
	40-49	19
	50-59	14
	60-69	27
	70-79	11
	80-89	4

Gender	Male	Female
	62	38



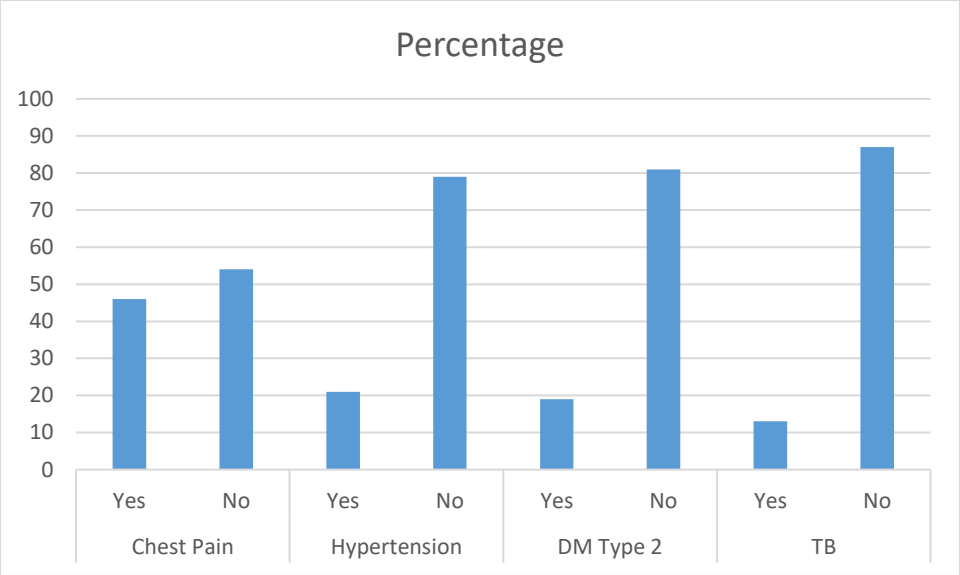


Gender Distribution

The majority of the patients were in the age group 60-69 years (27%) followed40-49 (19%), 50-59 (14%), 20-29 (11%), 30-39 (11%), 70-79 (11%), 80-89 (4%), and < 20 (3%). Most of the cases were males (62%) and 38% were females.

Table 5: Patient history

Patient History		Percentage
Chest Pain	Yes	46
	No	54
Hypertension	Yes	21
	No	79
DM Type 2	Yes	19
	No	81
TB	Yes	13
	No	87



The reported patient history was Chest pain (46%), Hypertension (21%), type 2 diabetes (19%) and TB (13%)

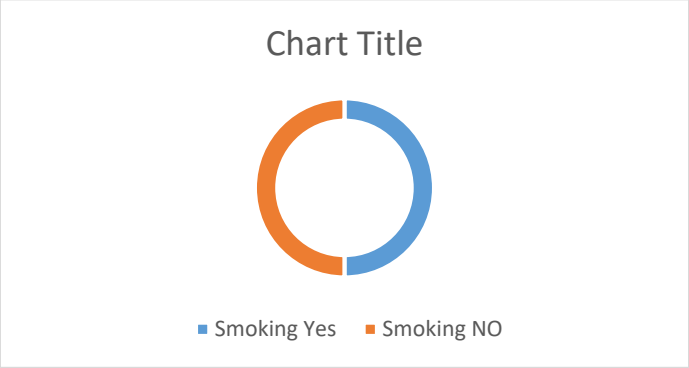
Table 6: Descriptive Statistics for kVp, mAs, and pulmonary artery diameter

(n = 100)	Range	Mean	S.D.
KVp	120 to 140	123.0	7.2
Mas	218 to 494	314.3	91.3
Pulmonary artery diameter	20 to 30.6	25.1	2.6

The kVp ranged from 120 to 140 with mean 123.0 + 7.2, mAs ranged from 218 to 494 with mean 314.3 + 91.3; and pulmonary artery diameter ranged from 20 to 30.6 with mean 25.1 + 2.6.

Table 7 : Smoking Percentage

Smoking	Yes	50%
	NO	50%

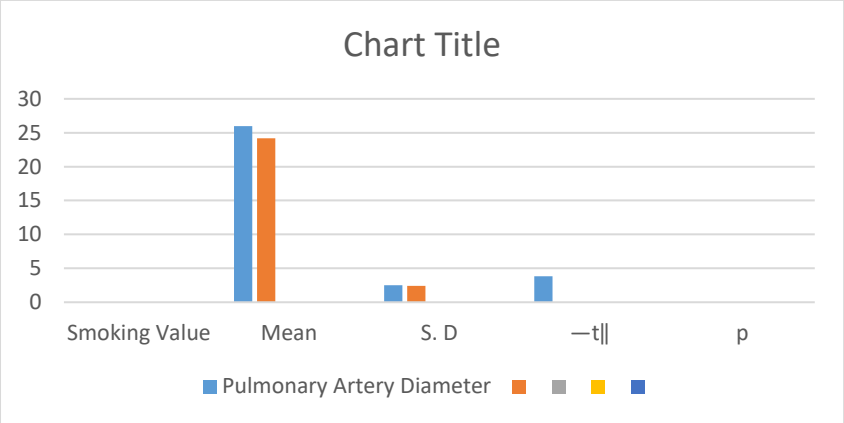


This study includes 50% smokers and 50% non smokers.

Table 8: Comparison of pulmonary artery diameter in smokers versus non-smokers.

	Smoking Value	Mean	S. D	—t‖	p
Pulmonary Artery Diameter	Yes	26	2.5	3.815	<0.001*
	No	24.2	2.4		

(—t‖ = Independent sample —t‖ test; * Significant)



The Independent sample —t‖ test was used to compare pulmonary artery diameter according to smoking. There was a difference ($p < 0.05$) in pulmonary artery diameter between smokers and non smokers.

Table 9: Comparison of age according to smoking

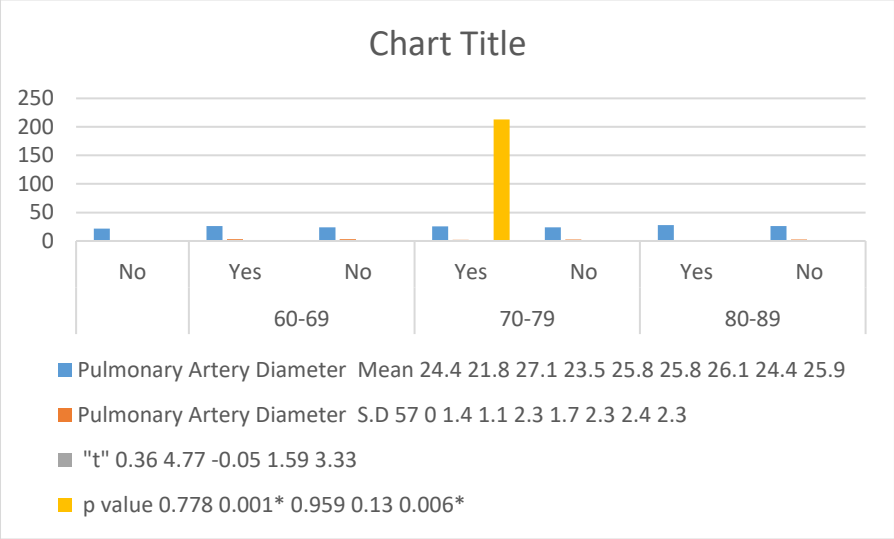
< 20		Yes		No		Likelihood ratio	p value
		N	%	N	%		
< 20		2	4	1	2		
Age group	20-29	4	8	7	14		
	30-39	2	4	9	18	8.22	0.314
	40-49	9	18	10	20		
	50-59	9	18	5	10		
	60-69	16	32	11	22		
	70-79	6	12	5	10		
	80-89	2	4	2	4		

The Likelihood ratio test was used to compare age according to smoking. There was no difference ($p > 0.05$) in age according to smoking.

Table 10: Comparison of pulmonary artery diameter in smokers and non- smokers according to age.

Age	Smoking	Pulmonary Artery Diameter		"t"	p value
		Mean	S.D		
< 20	Yes	24.4	57	0.36	0.778
	No	21.8	0.0		
20-29	Yes	27.1	1.4	4.77	0.001*
	No	23.5	1.1		
30-39	Yes	25.8	2.3	-0.05	0.959
	No	25.8	1.7		
40-49	Yes	26.1	2.3	1.59	0.130
	No	24.4	2.4		
50-59	Yes	25.9	2.3	3.33	0.006*
	No	21.9	1.6		
60-69	Yes	26.0	2.9	1.55	0.133
	No	24.2	3.0		
70-79	Yes	25.7	2.2	1.34	0213
	No	23.7	2.6		
80-89	Yes	27.9	0.3	1.00	0.425
	No	26.0	2.8		

(—t‖ = Independent sample —t‖ test; * Significant)



The Independent sample —t‖ test was used to compare pulmonary artery diameter in smokers and non- smokers according to age. There was a difference ($p < 0.05$) in pulmonary artery diameter in smokers and non- smokers according to age groups: 20-29 as well as 50-59.

Discussion:-

A prospective observational study using a GE Discovery RT 16 slice RTCT scanner, "Comparison of Pulmonary Artery Diameter in Smokers and Non-Smokers by Multi Slice CT Scan" is now underway. The study was conducted on 100 patients in the radiodiagnosis and imaging department who were referred from the Chhatrapati Shivaji Subharti Hospital, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, Emergency, OPD, CARDIO, MEDICINE, MICU, MMWI, EW, GW, FMWI, ENT, MICU, MW, PVT, RMW, SICU, SW, and TB departments.

My study's objective is to assess the pulmonary artery in smokers and non-smokers according to various age groups. In order to perform this study, a total of 100 patients were enrolled, of whom 62% were men and 38% were women. The age range of the cases was 18 years old as the minimum and 86 years old as the maximum. In the current study, 50 patients were smokers and 50 patients were non-smokers.

The patients were between the ages of 18 and 86, with a mean age of 51.9 + 17.3. The age group of 60-69 years comprised 27% of the total patients, with the remaining age groups being 40-49 (19%), 50-59 (14%), 20-29 (11%), 30-39 (11%), 70-79 (11%), 80-89 (4%), and < 20 (3%). 38% of the patients were female, while 62% of the cases included men.The participants in this study have been categorized based on departmental referrals. RMW accounted for 28% of the patients, with TB (13%), MICU (12%), EW (10%), MW (8%), GMW (7%), GW (5%), MEDICAL (4%), PVT (4%), SICU (3%), ENT (2%), CARDIO (1%), FMWI (1%), MMWI (1%), and SW (1%), constituting the remaining patient populations. There are 50% smokers and 50% non-smokers in this study. The patients' ages varied from 18 to 86 years old, 51.9 + 17.3 on average.

Ages 60–69 accounted for 27% of the patient population, followed by 40–49 (19%). 50–59(14%), 20–29(11%), 30-39(11%), 70–79(11%), 80–89(4%), and less than twenty (3%). 38% of the patients were female, while 62% of the cases included men.

Type 2 diabetes (19%), hypertension (21%), and chest discomfort (46%), according to the patient history, were documented and tuberculosis (13%).

The pulmonary artery diameter ranged from 20 to 30.6 with mean 25.1 + 2.6, the kVp ranged from 120 to 140 with mean 123.0 + 7.2, and the mAs ranged from 218 to 494 with mean 314.3 + 91.3.

The Independent sample ―t‖ test was used to compare pulmonary artery diameter according to smoking. There was a difference ($p < 0.05$) in pulmonary artery diameter between smokers and non smokers. The Likelihood ratio test was used to compare age according to smoking. There was no difference ($p > 0.05$) in age according to smoking. The Independent sample ―t‖ test was used to compare pulmonary artery diameter in smokers and non- smokers according to age. There was a difference ($p < 0.05$) in pulmonary artery diameter in smokers and non-smokers according to age groups: 20-29 as well as 50-59.

Conclusion:

The preferred examination method for this investigation is CT chest imaging since it can be completed fast, is widely accessible, and typically does not require auxiliary studies utilizing other imaging technologies. The main applications of CT are when high frequency resolution in CT chest examinations are required.

In the trial, there was no discrimination based on the patient's gender. This investigation involved 100 patients in all, of which 38 were female and 62 were male.

Patients' ages were divided into age groups every nine years, and smokers' pulmonary artery diameter was used to classify patients in each age group.(Reduction to Growth)age bracket Mean < 20 years is 24.4 + 5.7 Mm, whereas mean < 70-79 years is 25.7 + 2.2 Mm.

Mean age is 25.8 + 2.3 Mm for 30–39 years, 25.9 + 2.3 Mm for 50–59 years, and 26.0 + 2.9 Mm for 60–69 years. Years 40–49 mean 26.1 + 2.3 Mm, Years 20–29 mean 27.1 + 1.4 Mm, and Years 80–89 mean 27.9 Mm.+ 0.3 millimeters.

and the age group of non-smoking patients (decrease to increase). Between < 20 years mean 20–29 years mean 23.5 + 1.1 Mm, 70–79 years mean 21.8 + 0.0 Mm, 50–59 years mean 21.9 + 1.6 Mm 30–39 years old, 60–69 years old, 40–49 years old, and 24.2 + 3.0 Mm are the averages. years, 25.8 + 1.7 Mm, and 80-89 years, 26.0 + 2.8 Mm, respectively. Using the One-way ―t‖ test,Compare the pulmonary artery diameter by age between smokers and nonsmokers. The pulmonary artery diameters of smokers and non-smokers differed ($p < 0.05$).

The participants in this study were split based on the diameter of the pulmonary artery in Comparing smokers with non-smokers. The mean pulmonary artery diameter among smokers was 26.0 + 2.5 Mm.

Pulmonary artery diameter mean in non-smokers: 24.2 + 2.4 Mm. To comparison was done using the t test Diameter of the pulmonary arteries in relation to smoking. A significant difference ($p < 0.05$) was seen in diameter of the pulmonary arteries in smokers and non-smokers.

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