COMMON CHEST PATHOLOGIES FROM COMPUTED TOMOGRAPHY (CT) FINDINGS IN ADULT PATIENTS IN BENIN CITY.

BY

CHUKWU CHIOMA

BMS2005180

A RESEARCH PROJECT PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF SCIENCE DEGREE (B.Sc) IN RADIOGRAPHY

DEPARTMENT OF RADIOGRAPHY

SCHOOL OF BASIC MEDICAL SCIENCES

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SUPERVISED BY

Mr. EGBUKICHI V. C.

OCTOBER, 2025.

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CERTIFICATION PAGE

We certify that this project work, "COMMON CHEST PATHOLOGIES FROM COMPUTED TOMOGRAPHY (CT) FINDINGS IN ADULT PATIENTS IN BENIN CITY", was carried out by CHUKWU CHIOMA with matriculation number BMS2005180 of the Department of Radiography.

This work was done under the supervision of:

_____

Mr. EGBUKICHI V.C. DATE

Project Supervisor

_____ _____

Mrs. FANNY IGBINEDION DATE

Head of Department

_____ _____

EXTERNAL EXAMINER DATE

DEDICATION

I dedicate this project work to God Almighty who has always been my helper and source of inspiration and also to my family for their relentless support towards my academics. Furthermore, I want to dedicate this work to my lecturers for their continual impart of knowledge.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to God for his unending love and for everything. Special thanks to my project supervisor (Mr Egbukichi V.C.) for his support and guidance in completing my project work.

My sincere appreciation to my parents for their immeasurable contributions towards my academics.

I specially thank my siblings: Chukwudi, Uchenna, Ifeanyi, and Precious, thank you all for your kind support.

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To my friends: Praise, Chinenye, Frances, Michelle, Favour, Winifred, thank you for being there for me, your kind assistance was immensely supportive to the success of this project work.

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I thank all who have contributed in one way or another to the success of this project work.

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LIST OF ABBREVIATION

ACHD	Adult Congenital Heart Disease
CAP	Community Acquired Pneumonia
CF	Cystic Fibrosis (used in the context of Non-cystic fibrosis bronchiectasis
CHD	Congenital Heart Disease
CHF	Congestive Heart Failure
COPD	Chronic Obstructive Pulmonary Disease
COVID-19	Corona Virus Disease 2019
CT	Computed Tomography
CVDs.	Cardiovascular Diseases
DALY	Disability-Adjusted Life Years
GGO	Ground-Glass Opacity
HF	Heart Failure
HP	Hypersensitivity Pneumonitis
ILD	Interstitial Lung Disease
IVC	Inferior Vena Cava
MSCT	Multislice Computed Tomography
PH	Pulmonary Hypertension
SVC	Superior Vena Cava
TB	Tuberculosis

UBTH University of Benin Teaching Hospital

UCH University College Hospital

WHO World Health Organisation

ABSTRACT

While chest diseases are a leading cause of global mortality, their specific local presentation in many regions remains uncharted. This study aims to address this critical knowledge gap of common chest pathologies in adult patients who did chest CT in Benin city, Nigeria. A retrospective, cross-sectional review was performed on 350 adult chest CT results from University of Benin Teaching Hospital and Raytouch. Patient data was analysed for pathology prevalence, while Chi-square tests explored associations with gender and age. The findings reveal a significant dual burden of disease. Non-communicable diseases were led by lung cancer, the single most common finding (18.29%). This was immediately followed by major infectious diseases: pulmonary tuberculosis (13.43%) and pneumonia (11.43%). Gender-based differences were confirmed ($p=0.008$), with males exhibiting a higher prevalence of pulmonary tuberculosis and bronchiectasis. Notably, 9.43% of all scans contained incidental findings, and 1.71% revealed unexpected tumors or masses. The study's descriptive findings show that certain conditions like lung cancer, followed age trends. The descriptive data did highlight age related patterns for specific illnesses, such as lung cancer but did not find any statistically significant relationship looking at the entire range of pathologies across adult age groups ($p=0.530$). This study is the first to provide a CT-scan based reference for thoracic disease in Benin City. By precisely measuring the challenging overlap of highly prevalent cancers and infectious diseases, this research offers localised, essential evidence that can directly inform regional public health strategies and improve clinical diagnostic procedures.

Keywords: Chest, Pathologies, Findings, Prevalence, Adult.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF STUDY

Computed Tomography (CT) is a radiographic imaging modality that uses radiation and computer technology to produce three-dimensional images for diagnosis and treatment. Chest CT creates cross sectional images in slices to visualize the internal structures of the chest which is made up of chest wall, and its soft tissues. In order to better understand disease variability and further characterise Chronic Obstructive Pulmonary Disease (COPD) phenotypes, chest CT is a non-invasive imaging modality that offers additional insight into structural and pathophysiologic pulmonary parameters (Labaki et al., 2017).

Computed Tomography helps in improved visualization of anatomical structures in the body than older technologies, it improves healthcare practitioners' capacity to diagnose pathologies at levels not overly seen by plain radiography. Due to CT's immense utility, clinical utilisation has increased significantly in the US, rising from about 3 million scans in 1980 to over 62 million in 2006 (Weissman, 2015). The chest houses important structures that functions in breathing, blood transfusion, digestion, and others. Structures in the chest that conduct these functions include the ribs and breastbone, diaphragm, and heart.

Chest diseases affect how the chest works and change the condition of individuals. According to Gossner and Nau (2013), these illnesses include aspiration pneumonia, pulmonary medication

toxicity, and accidental pulmonary embolism. The World Health Organisation (WHO) reports that ischaemic heart disease is the leading cause of death worldwide, accounting for 13% of all fatalities. This disease has had the biggest increase in mortality since 2000, with 2.7 million deaths rising to 9.1 million in 2021 (World Health Organisation (WHO), 2024). According to a WHO research from 2024, the newly discovered Corona Virus Disease 2019 (COVID-19) caused 8.8 million fatalities in 2021, displacing other major causes of mortality by a significant margin. In 2021, stroke and COPD were the third and fourth most common causes of death, accounting for roughly 10% and 5% of all fatalities, respectively, rather than the second and third most common causes in 2019. According to another research by WHO (2024), mortality from other noncommunicable illnesses were also increasing. For example, the number of deaths from lung, tracheal, and bronchus malignancies increased from 1.2 million in 2000 to 1.9 million in 2021, making them the sixth most common cause of death. Therefore, for proper and early diagnosis of these pathologies, Chest CT is required.

According to a study by Labaki et al. (2017), even after controlling for common risk variable like age and smoking, myocardial infarction is more common and has a higher death rate in individuals with COPD. According to the study's findings, chest CT scans have a clear chance of becoming an effective tool in the fight for COPD personalised treatment. Crackles or high inflammatory markers were found to be more common in patients with suspected Community Acquired Pneumonia (CAP) who had a negative chest radiograph but whose chest CT scan showed a parenchymal infiltrate. This suggests that patients will benefit from CT scan when their chest radiograph is normal, even if they have biological markers and clinical signs that suggest CAP (Claessens et al., 2015).

For the treatment of older individuals with thoracic pathology, computed tomography (CT) is crucial. It is often necessary for internist physicians to assess the spread of malignant tumours. The most prominent anomalies include pleurisy, pulmonary arterial hypertension, and parenchymal lung diseases (Gbande et al., 2018). In a retrospective analysis of chest CT imaging findings at University College Hospital (UCH) Ibadan, Adeniji-Sofoluwe et al. (2017) found that, among other lesions like pleural effusion, pneumothorax, anterior mediastinal masses, spondylosis, and aneurysmal dilatation of the ascending aorta, consolidative changes accounted for 77.4% of all patients in the study.

Computed tomography has become a valuable tool for studying the body's anatomy, physiology, and pathology. According to Adeniji-Sofoluwe et al. (2017), it provides better spatial resolution of both soft tissues and skeletal structures.

In different studies shown above among population of a given geographical area, it has been shown how CT findings have helped in correlating common chest pathologies, but in our local area (Benin City), no study of CT findings relating to common pathologies affecting the chest has been recorded. Hence, this study will serve as a starting point for more research down the line.

1.2 STATEMENT OF PROBLEM

An estimate of 17.9 million people die from cardiovascular diseases (CVDs) each year, making them the world's leading cause of mortality. Heart attacks and strokes account for more than four out of five fatalities from CVD, and one-third of these deaths happen too soon in adults under the age of 70 (WHO, 2024). According to WHO (2020) ranking, lungs and airways disease was ranked 14th as there was no actual documentation of the disease in Nigeria. Lung cancer is the top cause of mortalities of all cancer fatalities globally with over 1.76 million mortality rate

in 2018 and over 33,000 fatalities in France and with myocardial infarction being the number one cause of death globally.

Kheiwa et al. (2024) conducted a study on the global prevalence of heart failure (HF) caused by congenital heart disease (CHD) between the year 1990 to 2021 and this study found that there was a significant increase in HF due to increased CHD in adults and even in children but this varies in regions across the world

Based on the reviewed literatures, there are regional variations in chest CT results, which may be due to racial or environmental factors. The common chest lesions found in adult patients who had chest scans in our area are not documented.

1.3 RESEARCH QUESTIONS

1. Which chest conditions are most frequently shown on adult patients' CT scans in Benin City?
2. Do adult patients in Benin City exhibit any gender-related trends in their chest CT results?
3. How often do adult Benin City patients' chest CT scans reveal incidental abnormalities (such benign tumours)?

1.4 HYPOTHESIS

i. Null Hypothesis (Ho): There is no significant relationship between patient's gender and the specific chest pathologies identified on CT scans in adult patients.

ii. Alternative Hypothesis (H1): There is a significant relationship between patient's gender and the specific chest pathologies identified on CT scans in adult patients with certain pathologies being more prevalent in one gender compared to the other.

i. Null Hypothesis (Ho): There is no significant relationship between the age of adult patients and the specific chest pathologies identified on CT scans.

ii. Alternative Hypothesis (H1): There is a significant relationship between the age of adult patients and the specific chest pathologies identified on CT scans.

1.5 AIM OF THE STUDY

The aim of this study is to assess the most common chest pathologies from CT findings in adult patient in Benin city.

Objectives Of The Study

1. To identify the most prevalent chest pathologies among adult patients who underwent chest CT scan.
2. To investigate if there is any gender-based difference in chest pathologies from findings of patients' result.
3. Determine the number of patients that display findings of tumour or masses in Benin City.

1.6 SIGNIFICANCE OF THE STUDY

1. This research will establish a clearer picture of the burden of different respiratory diseases, including infectious diseases (like pneumonia and tuberculosis), chronic conditions (such as COPD and interstitial lung diseases), and neoplastic processes.
2. This study will serve as a baseline for future research investigating trends in chest pathologies over time, the impact of environmental factors, or the effectiveness of specific interventions.
3. This study will also help future researchers look at how things like pollution affect these problems or how well different treatments work.

4. Doing this research in Benin City will help to build local medical knowledge and makes research stronger in the area.
5. The information we find can help doctors figure out what is wrong with patients faster and more accurately.

1.7 SCOPE OF THE STUDY

This study focuses on identifying and analysing the most common chest pathologies through CT scan in adult patients within Benin city, using adult patients of who underwent chest CT scan in University of Benin Teaching Hospital (UBTH) and Raytouch diagnostic centre in Benin city. Cases where chest CT scans were performed for indications other than suspected chest pathology (such as trauma), may be excluded. It considered both contrast enhanced and non-contrast enhanced chest CT scans and a retrospective study of two-year duration was carried out focusing on male and female adult patients.

1.8 OPERATIONAL DEFINITION OF TERMS

Computed Tomography (CT)

This is a radiographic imaging modality that uses radiation and computer to generate cross sectional images of the internal structure of the human body for diagnosis and treatment.

Chest CT

A CT scan mainly focused on the chest region to visualize internal structures such as the lungs, hearts, ribs, and diaphragm for detection of abnormal patterns.

Chest pathologies

Medical conditions affecting the chest area, they include but not limited to pneumonia, chronic obstructive pulmonary disease (COPD), tuberculosis, and lung cancer.

Incidental findings

Unexpected abnormalities detected during the imaging procedure such as benign tumour which were not the primary indication for the scan.

Contrast-enhanced CT

A type of CT scan performed with the use of a contrast agent to improve the visibility of certain tissues, blood vessels, and organs.

Prevalence

The proportion of specific chest diseases found in the study population over a defined study period.

CHAPTER TWO

LITERATURE REVIEW

2.1 CONCEPTUAL REVIEW

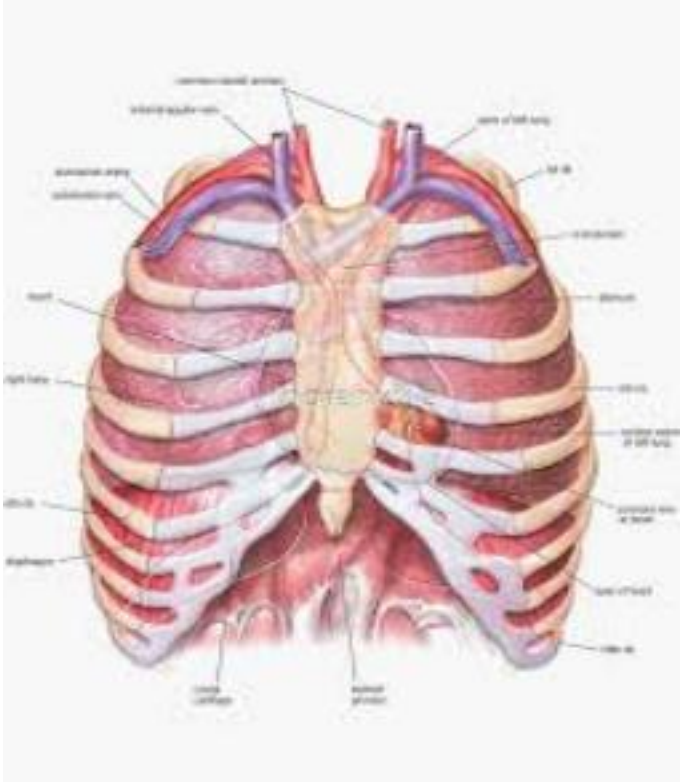
2.1.1 Brief Anatomy Of The Chest

The chest also known as the thorax is part of the axial skeleton of body and it is made up of the thoracic cage, lungs, heart, mediastinum, blood vessels, pleural, oesophagus and others. The

heart and lungs are both essential for life.

Figure 2.1.1: Structure of the chest.

2.1.2 CONTENT OF THE THORAX



2.1.2.1 Thoracic Cage

The thoracic cage is another name for the thoracic skeleton. The main function of this osseocartilaginous elastic cage is to raise and lower the intrathoracic pressure, which allows air to be drawn into the lungs during inspiration and released during expiration. It comprises the sternum anteriorly, thoracic vertebral posteriorly, with the 12 pairs of ribs in both aspects, and the costal cartilages where anterior ribs 1-7 articulate to the sternum.

The sternum which is a flat bone is made up of three parts namely: the manubrium superiorly, body of the sternum and the xiphoid process inferiorly. With the clavicle and scapula superiorly and posteriorly attached to the thoracic cage respectively (Chaurasia, 2018).

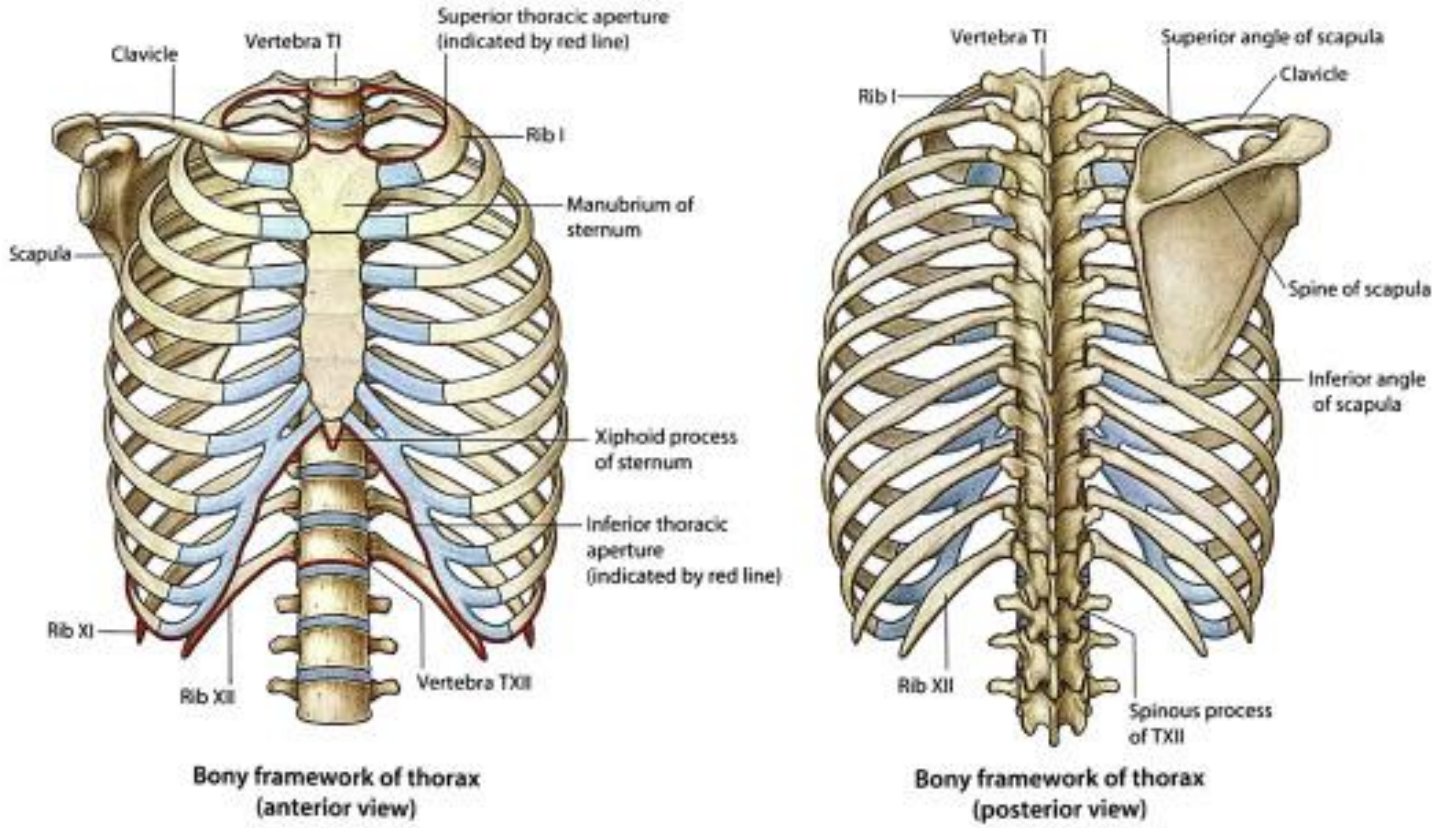


Figure 2.1.2: Anatomy of the bony thorax.

2.1.2.2 Muscles

Certain muscles that cover and/or are linked to the thoracic cage are mostly used to support other areas. Axio-appendicular muscles connect from the bony thorax to the upper limb bones (Moore et al., 2018). The muscles of the thorax are primarily responsible for breathing and also contribute to movements of the upper limb and stabilisation of shoulder girdle. They can be categorised in intrinsic which are the true muscles of the thorax and extrinsic muscles.

The intrinsic muscles are involved in changing the volume of the thoracic cavity during breathing and the are:

Intercostal muscles.

Within the intercostal spaces are the intercostal muscles. The internal and exterior intercostals form the inner and superficial layers, respectively. Since the deepest fibres of the internal intercostals are located close to the intercostal arteries and nerves, they are somewhat referred to as the innermost intercostals, a distinct muscle (Moore et al., 2018)

Subcostal muscles.

These muscles span one or more intercostal spaces and are located in the back of the thoracic wall. When forced expiration occurs, they depress the ribs.

Transversus thoracis

From the posterior portion of the inferior sternum, four or five slips that radiate superolaterally make form the transversus thoracis muscles.

Diaphragm

This is a large dome-shaped muscle that forms the floor of the thoracic cavity and separates it from the abdominal cavity. It is the primary muscle for inspiration.

2.1.2.3 Pleural

A serous membrane called the mesothelium lines the pleura-like peritoneum. It is a liquid lubricant secreted by the lining epithelium. The pleural is made up of 2 layers namely: Parietal and Visceral Pleural. The visceral pleural which is the inner layer of the pleural entirely enclosed the lungs surface with exception of the hilum and the area where the pulmonary ligament attaches. The parietal pleural is the outer layer of the pleural and lines pulmonary cavity walls. It is thicker than the visceral pleural (Singh, 2014).

Pleural cavity

The pleural cavity is a space located between the parietal and the visceral layer. It is filled with a thin fluid which lubricates the pleural surfaces and allows them to move freely. Each lung contain a pleural cavity.

2.1.2.4 Lungs

The thoracic cavity contains a pair of respiratory organ called the lungs. Every lung invaginates the pleural cavity that corresponds to it. The mediastinum separates the left and right lungs. The right lungs has 3 lobes and 2 fissures while the left lobe has 2 lobes and 1 fissure. Each lung has an Apex and a base.

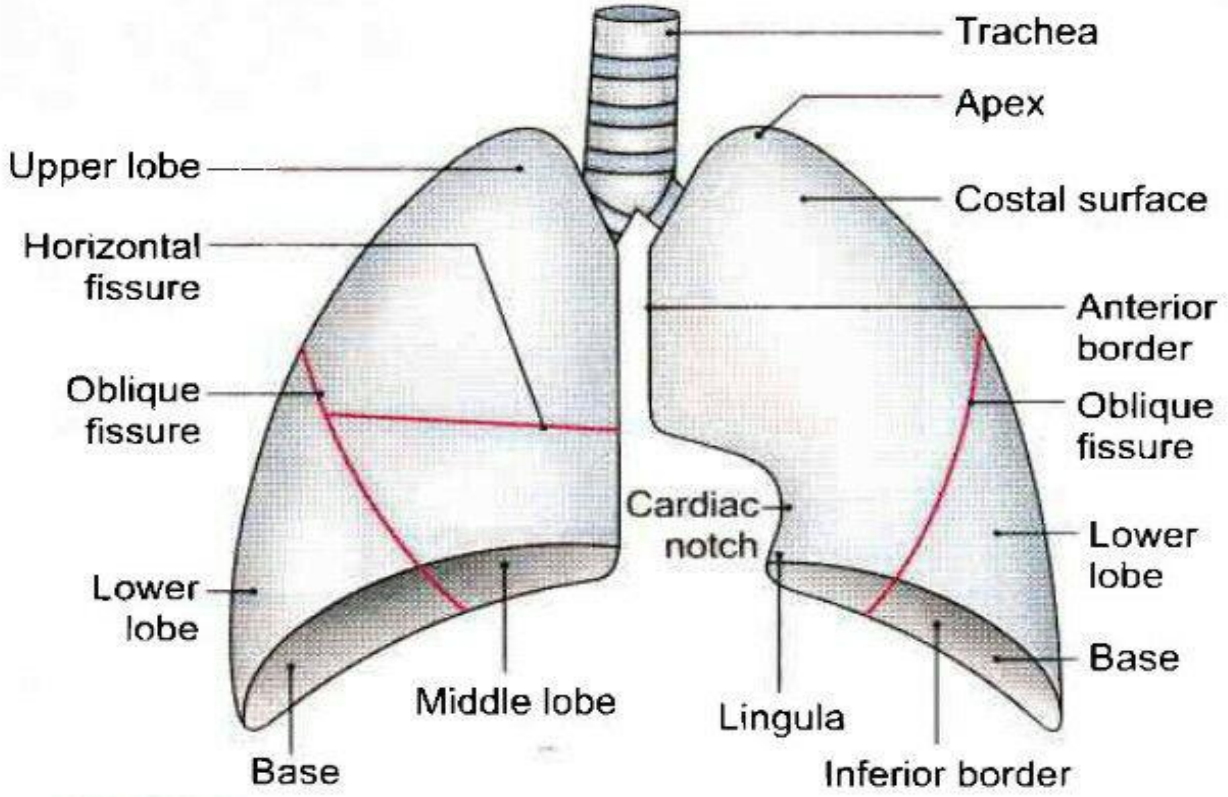


Figure 2.1.3: The lungs. Source(Singh, 2014).

The lungs contain several structures which function in respiration. These structures are represented in the lungs as the bronchial tree because of the inverted tree design starting from the trachea which is the windpipe that carries oxygen or air to the 2 bronchi(left and right). The point where the trachea divides into the left and right bronchus is called the carina.

The right main bronchus divides into 3 lobar bronchi corresponding to the 3 lobes in the right lung, each lobar bronchus for each lobe and the left main bronchus divides into 2 lobar bronchi that also corresponds to the 2 lobes in the left lungs. These lobar bronchi further divides into tertiary (segmented) bronchi which gives off terminal bronchioles. From the terminal bronchioles, the respiratory bronchioles are given off.

The pulmonary segment which is made up of the alveolar ducts, alveolar sacs, and alveoli are where gaseous exchange take place. The alveolar sac enclosed the alveoli that is responsible for exchange of gas (Singh, 2014).

2.1.2.5 The Mediastinum

The middle section of the thoracic cavity is called the mediastinum. With the exception of the lungs, it houses all of the thoracic viscera and structures and is protected on both sides by mediastinal pleura. Superiorly, it extends from the thoracic aperture and inferiorly, to the diaphragm and from the sternum anteriorly to the thoracic vertebral posteriorly. It has 3 compartments for the purpose of description which are the superior, and inferior mediastinum (Moore et al., 2018).

Superior mediastinum

It is bounded the thoracic inlet superiorly, inferiorly by an imaginary transverse thoracic plane, anteriorly by the manubrium of the sternum, posteriorly by the first four thoracic vertebrae, and laterally by the mediastinal pleura on each side. It contains several content which includes: Branches of the aortic arch, left common carotid artery, left subclavian artery, superior vena cava, left and right brachiocephalic vein, left superior intercostal vein, vagus nerve, phrenic nerve, thymus, lymph nodes, trachea, oesophagus, sternohyoid, sternothyroid, and others.

Inferior mediastinum

The pericardium, which surrounds the heart, further divides the inferior mediastinum into three sections. The anterior mediastinum is located in front of the pericardium, and the posterior mediastinum is located behind it. The middle mediastinum is made up of the pericardium and its contents, which include the heart and the roots of its great vessels (Singh, 2014).

1. **Anterior mediastinum:** It is located anteriorly to the pericardium and posteriorly to the sternum. Its primary content are: fat, connective tissue, lymph nodes and the inferior part of the thymus which regresses in adult.
2. **Middle mediastinum:** This is the largest subdivision and central of the inferior mediastinum. It is the most clinically significant part and it contains the heart in the pericardial sac, roots of the large vessels, phrenic nerve and part of the vagus nerve, lymph nodes, left and right primary bronchus and bifurcation of the trachea.
3. **Posterior mediastinum:** It is posterior to the pericardium and diaphragm and anterior to the bodies of the lower eight thoracic vertebrae. It contains the oesophagus, thoracic duct, descending aorta, vagus nerve, azygous, hemizygous veins, posterior mediastinum lymph nodes, sympathetic trunks.

2.1.2.6 The Heart

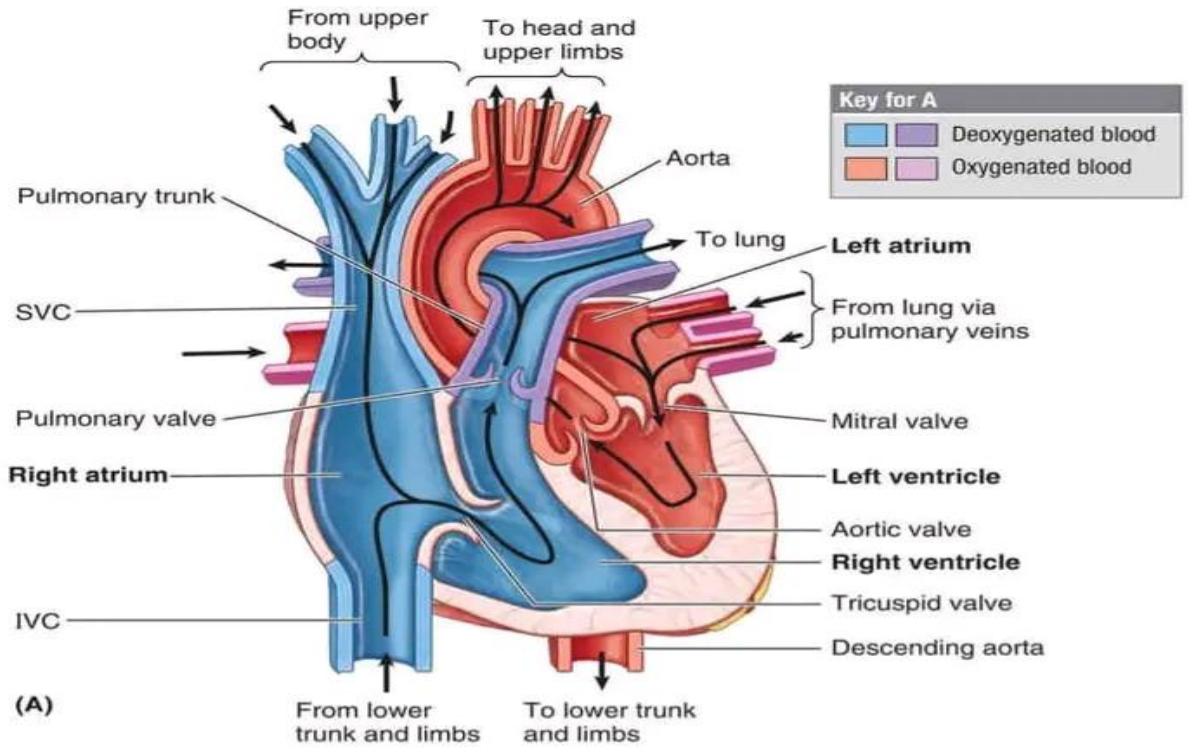
The heart, which is a major organ in the human body, pumps blood to all parts of the body. It is enclosed by the fibroserous sac pericardium and made up of four chambers that work together and they include the right atrium, right ventricle, left atrium, left ventricle.

Right atrium: It is located at the superior right part of the heart and receives deoxygenated blood from all parts of the body. It contains blood vessels such as the superior vena cava (SVC), inferior vena cava (IVC), coronary sinus. Blood enters the right ventricle through the tricuspid valve, this valve help prevent backflow of blood to the right atrium.

Right ventricle: It is located at the inferior left part of the heart and pumps deoxygenated blood received from the right atrium to the lungs through the pulmonary trunk. It is separated from the left ventricle by the interventricular septum.

Left atrium: Forms the superior left part of the heart and located posteriorly. It receives oxygenated blood from the lungs through pulmonary veins and sends it to the left ventricle through the bicuspid valve.

Left ventricle: This chamber of the heart pumps oxygenated blood received from the left atrium to the body through the aorta and it is located at the inferior left part which forms the apex of the



heart.

Figure 2.1.4: The Heart. Source (Moore et al., 2018).

The heart has a specialised type of muscle called the cardiac muscle(myocardium). This muscle is unique to the heart and is responsible for its continuous involuntary pumping action (Chaurasia, 2018).

2.1.2.7 Arterial Supply Of The Thoracic Content

Intercostal arteries

It is made up of arteries that supply the intercostal spaces between the ribs on each side anteriorly and posteriorly. The 10th and 11th intercostal spaces of the anterior ribs are not supplied by any artery.

Internal thoracic arteries

The sternum, forming the anterior part of the thoracic cage, receives its blood supply primarily from these arteries.

Bronchial arteries: They supply the Pulmonary tissues and bronchial trees.

Pulmonary arteries: They supply venous blood to the lungs.

Coronary arteries: These arteries, left and right coronary artery, supply the heart. The ascending aorta give rise to these arteries.

Phrenic arteries: These are group of arteries that supply the diaphragm.

2.1.2.8 Venous Supply Of The Thoracic Content

Intercostal veins: Comprise of both anterior and posterior intercostal veins and they supply each spaces two anterior intercostal veins and one posterior intercostal vein with the exception of the anterior 10th and 11th intercostal spaces.

Azygous vein: The thoracic wall and upper lumbar region are drained by these veins.

Pulmonary vein: .The oxygenated blood leaves the lungs through the pulmonary veins.

Bronchial vein: The deoxygenated blood is taken out from the pulmonary tissue and bronchial tree by the bronchial veins.

Coronary sinus: The heart is drained majorly by this vein into the right atrium.

Anterior cardiac veins: The anterior cardiac veins are tiny veins that run parallel to each other on the right ventricle anterior wall. These veins often open straight into the right atrium via the anterior wall of the ventricle.

Venae cordis minimae: All four of the heart chambers have a large number of tiny, valveless veins called venae cordis minimae that open straight into the cavity.

2.1.2.9 Nerve Supply Of The Thoracic Content

Intercostal nerves: They innervate the thoracic spaces and are from the first eleventh anterior rami of the 12 thoracic spinal nerves.

Parasympathetic fibres of the lungs: They supply the bronchial muscle and tree and causes vascular widening, elevated mucous production, and narrowing of the airways.

Sympathetic fibres of the lungs: They supply the bronchial muscle and tree and causes reduced mucous production, widening of the airways, and vascular narrowing.

Parasympathetic fibres of the heart: The vagus nerve is the source of the parasympathetic fibres. Because they are cardioinhibitory, stimulating them results in heart rate reduction and coronary artery constriction.

Sympathetic fibres of the heart: The upper three to five thoracic spinal segments are the source of the sympathetic fibres. Because of their cardioacceleratory nature, their stimulation raises heart rate and dilates coronary arteries (Singh, 2014).

2.1.3 OVERVIEW OF COMPUTED TOMOGRAPHY

Computed tomography as previously discussed uses ionising radiation to image the internal structure of the human body in three dimension and produces images of good spatial resolution for both soft tissues and skeletal structures. The discovery of this imaging modality was started by a British engineer called Godfrey Hounsfield in the year 1972 (Fosbinder & Orth, 2012). The primary benefits of CT over traditional radiography are the removal of superimposed structures, the capacity to distinguish minute variations in the density of anatomical anomalies and structures, and the higher image quality (Romans, 2011).

Computed tomography has improved in speed and accuracy over time due to continuous improvement in technology starting from the first generation of CT scanner which used two detectors, five minutes scan time, and operated in a translate/rotate system to the seventh generation of CT scanner also called Multislice Computed Tomography (MSCT) that uses multiple detectors that operate at the same time in order to reduce patient radiation exposure due to reduced scan time. Recent CT scanner uses the third generation CT scanner design because of its speed, mechanical simplicity, and image quality.

2.1.3.1 Principle of Computed Tomography

The succession of x-rays, which are a type of electromagnetic radiation, are used to create CT scans. The detectors in the scanner measure the difference between the x-rays that are transmitted through the body and those that are absorbed by it. The scanner emits x-rays at the subject from a range of angles. This is referred to as attenuation. Each one is given a Hounsfield Unit, often known as a CT Number, which is based on the density of the tissue being imaged (Romans, 2011).

2.1.3.2 Components of Computed Tomography Scanner

The Gantry: This is made up of the x-ray tube, detector array, high voltage generator, patient couch. They send data to the computer for image creation and processing after receiving electronic commands from the operating console (Bushong 2012).

Operating Console: All scan parameters, such as choosing the appropriate technical elements, moving the gantry and patient table, and using computer commands to reconstruct and transfer image data for storage in a data file, can be controlled from the console (Fosbinder & Orth, 2012).

The Computer: One special part of the CT system is the computer, which needs to be fast and have enough memory to handle numerous calculations at once. It is used to process, store, and display data.

2.1.3.3 Computed Tomography (CT) Scan in Chest Imaging.

The imaging modality for evaluation of chest disorders is computed tomography (CT). The number of chest CT scans demanded has increased due to the growing clinical spectrum of chest disorders and diseases with thoracic symptoms. As a result, the referring clinician and the radiologist are increasingly required to possess a fundamental grasp of the suggested CT examination for particular individual purposes (Bhalla et al., 2019). According to Ascha et al. (2017), CT is becoming more and more recognised as one of the primary tests for chest imaging. CT has several unique features, including quick scanning, high spatial and temporal resolution, and the capacity to thoroughly assess the cardiopulmonary structures. A thorough assessment of the lung parenchyma and pulmonary circulation is made possible by CT.

It is crucial for the diagnosis of interstitial lung diseases, pulmonary nodules, infections, traumas, and vascular issues. Although there is still a risk associated with radiation exposure, new technology continues to make it safer and more effective in clinical situations.

2.1.4 COMMON CHEST PATHOLOGIES AND SOME OF THEIR MANIFESTATIONS IN CT IMAGING

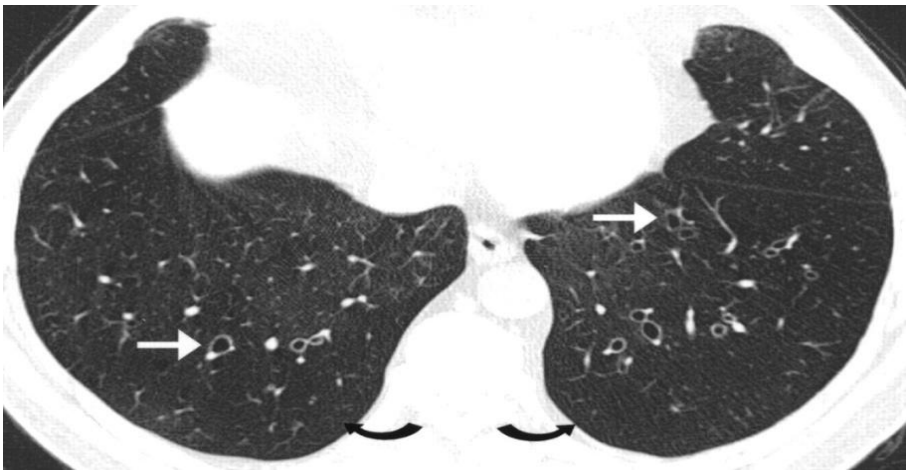
In radiography, the chest radiograph is still one of the most often done tests. For patients who present with coughing, dyspnea, or chest discomfort, it is usually the first radiologic examination performed. Chest radiographs are taken at the critical care unit, emergency department, and after monitoring and support equipment has been installed in a hospital. Chest radiographs are regularly taken as part of yearly physical examinations, before major surgical procedures, and to check for metastatic illness in patients with paraneoplastic syndromes or cancer (Klein & Rosado-de-Christenson, 2019). The most common and economical method for identifying, evaluating, and assessing various thoracic and chest conditions is chest radiography. Usually, a skilled radiologist or doctor reviews the radiograph to determine whether there is a specific abnormalities. Furthermore, computer-aided techniques help radiologists and improve the automation, precision, and speed of the analysis process (Rehman et al., 2023).

According to American College of Radiology, in clinical practice, imaging of the chest is crucial because they help radiologists identify diseases of the airways, pulmonary parenchyma, arteries, mediastinum, heart, pleura, and chest wall. These various conditions can be systematically categorised into inflammatory, infectious.

2.1.4.1 Inflammatory Chest Diseases

Inflammation is a process whereby the body react to stimuli such as injury, hypersensitivity, and infection in order to protect against infections and heal tissues. It results in the lungs by exposure or irritants, pollutants, and allergens. Some examples of inflammatory chest diseases are:

Asthma: This is a chronic inflammation of the lungs' airways, asthma causes tightness in the chest, coughing, and dyspnoea. The condition has no known aetiology, however genetic and environmental factors may contribute to its onset. Asthma may arise from a combination of mechanisms, including autoimmune inflammatory responses and allergic reactions (Gohal et al.,



2024).

Figure 2.1.5: An image showing the asthma sign (Silva et al, 2012).

Asthma makes the bronchi look “cuffed” on CT images because it surrounds them with a ring of elevated density.

Hypersensitivity Pneumonitis: Intolerance Interstitial lung disease (ILD) is a manifestation of Hypersensitivity Pneumonitis (HP), an immune-associated illness that occurs in people prone to it following exposure to one or more known or unknown triggering agents. The disease has a

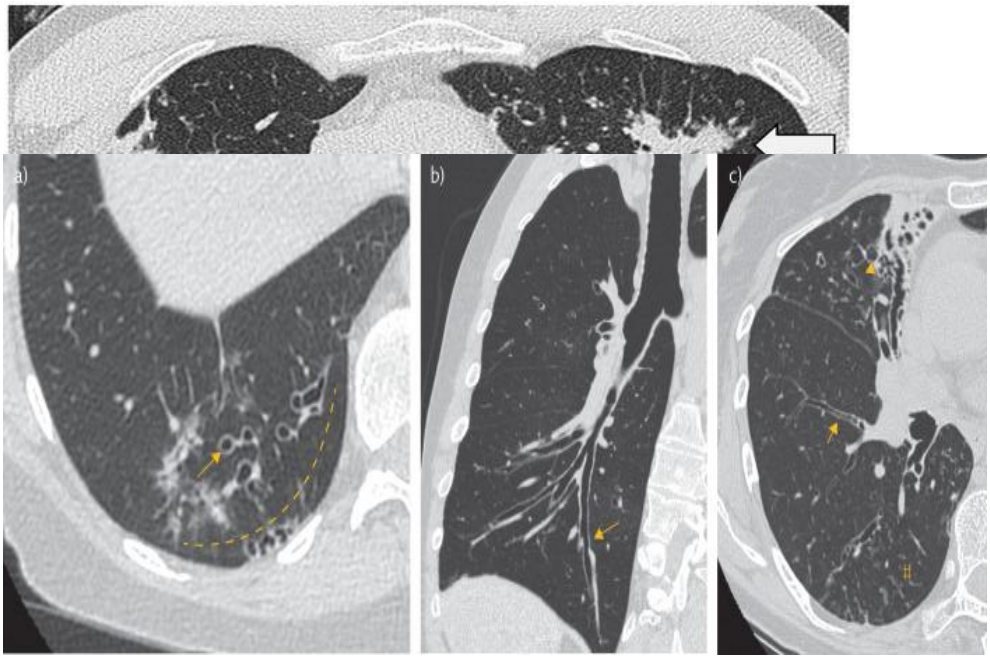
range of radiological and morphological patterns that are probably related to the type of antigen, the degree of exposure, the individual's genetic vulnerability, and the interaction with other harmful variables (Alberti et al., 2021).

Figure 2.1.6: Hypertensive pneumonitis (Torres et al., 2016). Image with a ground-glass opacity (GGO). GGO is a region of the lungs that has a hazy rise in density.

Sarcoidosis: Granulomas, which are tiny collections of immune cells, can develop in a variety of human tissues and organs as a result of sarcoidosis, an inflammatory illness. The function of the afflicted organs may be compromised by these granulomas, which induce inflammation (Waly et

al., 2025).

Figure 2.1.7: Sarcoidosis in a patient CT scan result displaying nodules in the two upper lobes (Bailey et al., 2024).



Bronchiectasis: A chronic lung disease called non-cystic fibrosis (CF) bronchiectasis is characterised by recurring exacerbations, daily coughing, and sputum production. It is brought on by permanent bronchial dilatation and inflammation (Barker & Karamooz, 2025).

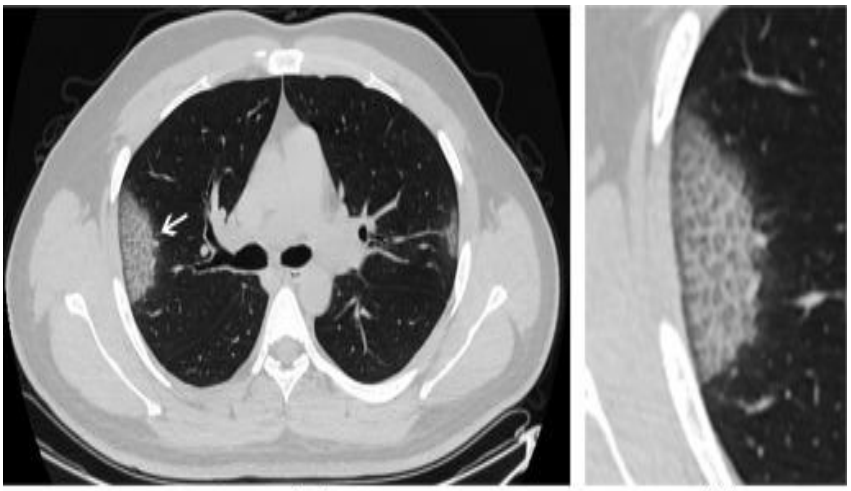
Figure 2.1.8: CT image of Bronchiectasis (Juliusson & Gudmundsson, 2019) .

Image 1a showing thickening of the bronchial walls, 1b showing mucus plugging, and 1c displaying tree-in-bud opacities.

Pneumonia: A set of syndromes that induce infection of the lung parenchyma and are brought on by different organisms are together referred to as pneumonia. In both inpatient and outpatient settings, classification schemata have aided in identifying the common organisms causing each

type of pneumonia and in developing therapeutic guidelines for effective therapy (Jain et al., 2023).

Figure 2.1.9: CT image show pneumonia manifestation. Source(Zhao et al., 2020).



Early CT characteristics of pneumonia include consolidation (uniform increased density), semi-consolidation (appears as mixed density: part ground-glass and part consolidation), and ground-glass opacity (GGO) (veil-like, foggy appearance), (Liu et al., 2020).

Myocarditis: The inflammation of the heart muscle, or myocardium, is known as myocarditis. Other alterations to the cardiac muscle cells, either acute or chronic, may also result from this inflammation. It can impact either large or little portions of the heart muscle, making the heart's ability to pump blood more difficult.

Pericarditis: Pericarditis is the most common pathological disorder affecting the pericardium and is defined as inflammation of the pericardial sac around the heart. This disease, which is thought to affect roughly 30% of cases, can be divided into four categories: acute, chronic, recurrent, and incipient or subacute pericarditis (Dababneh & Siddique, 2023). Its manifestation

in CT images shows thickening of the pericardial and Pericardial effusion.

Figure 2.1.3: Shows Pericardlal effusion (Narang et al., 2022).

Endocarditis: The endocardium, the heart's inner lining, and the valves dividing its four chambers are both inflamed when endocardial disease occurs. It is mostly a bacterial disease with a broad range of symptoms and aftereffects (Yallowitz & Decker, 2023). It shows vegetations, perforation of the valve, and mycotic aneurysm.

Pleurisy: The hallmark of pleurisy is pleural inflammation brought on by a number of causes, such as systemic disorders or primary illnesses. Tachypnea and dyspnoea are two signs and symptoms of pleurisy that can appear rapidly (hyperacute) during crises like a pneumothorax or pulmonary embolism (Khan et al., 2025).

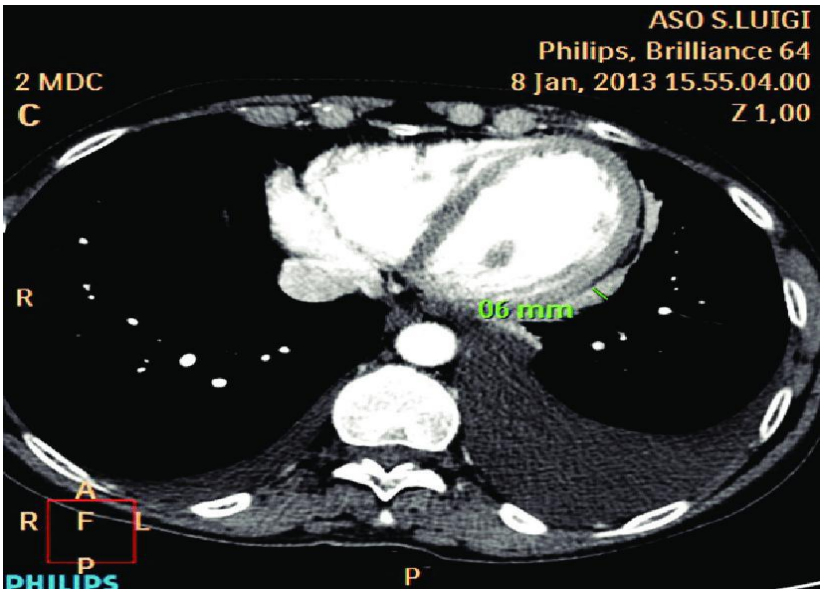
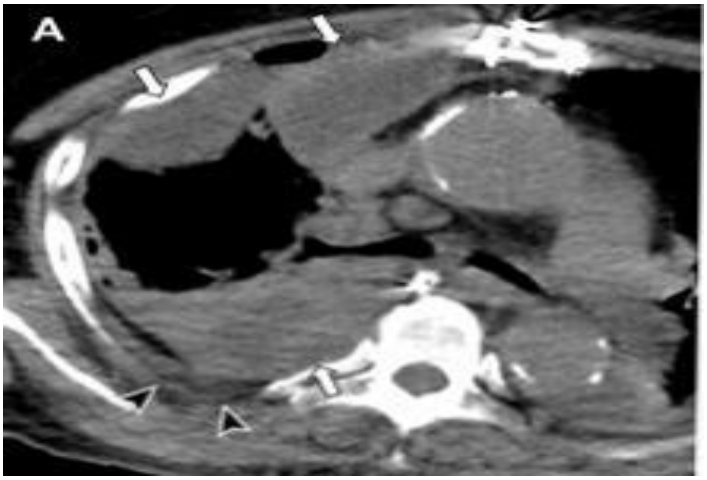


Figure 2.1.3.1: Pleurisy showing thickening of the pleural (Piazzalunga et al., 2020).

Pleural effusion: This is the abnormal collection of fluid in the pleural cavity. It is a prevalent clinical issue that may be a main symptom or a secondary consequence of numerous illnesses



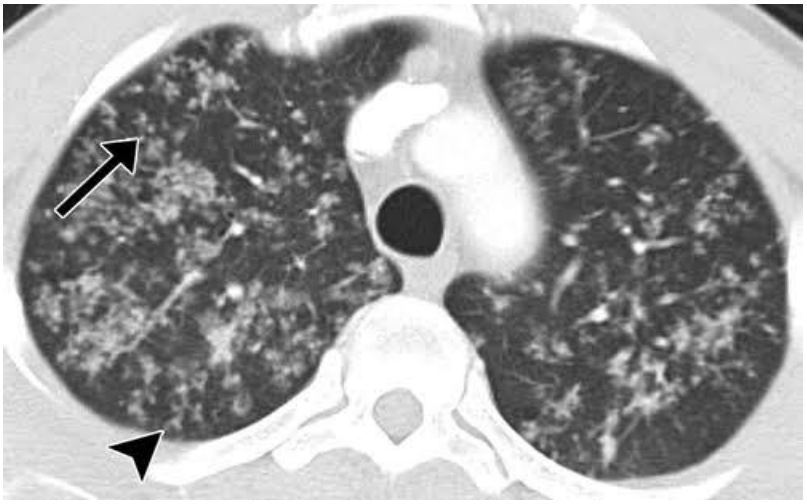
(Adeoye et al., 2017).

Figure 2.1.3.2: Pleural effusion showing CT scan as pleural enhancement or loculation (Yamada et al., 2024).

2.1.4.2 Infectious Chest Diseases

Infectious diseases are caused by bacteria, viruses, fungi, and parasites They have the ability to enter the body, proliferate and interfere with normal body activities, resulting in several symptoms and health problems. Tuberculosis and infuenza are examples of infectious disease (Ferrieri, 2023).

Tuberculosis: Most typically affecting the lungs, tuberculosis (TB) is an infectious disease caused by bacteria. When TB patients cough, sneeze or spit, it spreads via the air. Jilani et al. (2023) state that TB is found throughout the world and that over two billion people, or around 30% of the worldwide population, may be infected with mycobacterium tuberculosis. TB show



as mass, multiple nodules, GGO, consolidation on CT images.

Figure2.1.3.3: Image of TB showing multiple nodules (Nachiappan et al., 2017).

Bronchitis: Inflammation of the bronchial passages causes bronchitis, which manifests as symptoms like a chronic cough and trouble draining mucus. It may be acute, fading away in a

few weeks, or chronic, needing constant care. The chance of developing bronchitis rises by smoking, viral infections, and exposure to irritants

Figure 2.1.3.4: Bronchitis showing increased nodular density (Wang et al., 2025).

Empyema: A bacterial pneumonia and the ensuing buildup of fluid in the pleural space are the most prevalent causes of empyema, an accumulation of pus in the thoracic cavity that results from an infection in the pleural space.

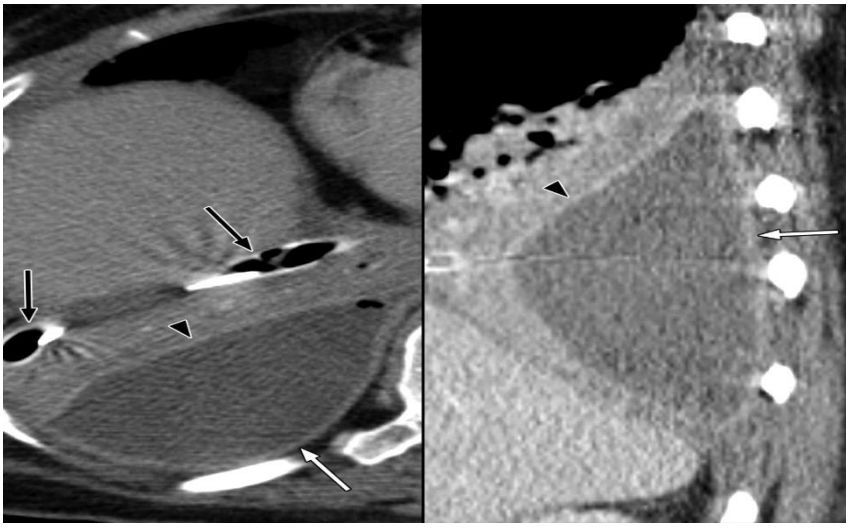


Figure 2.1.3.5: Empyema show split sign on CT image (Walker et al., 2014).

Lung Abscess: In the lung parenchyma, a lung abscess is a region of pus or necrotic material that leads to a cavity. Once a bronchopulmonary fistula forms, an air-fluid level forms inside the

cavity. Acute lung abscesses (less than six weeks) and chronic lung abscesses (greater than six weeks) can be distinguished (Kuhajda et al., 2015).

Figure 2.1.3.6: A CT sagittal image showing loculation in a patient with lung abscess (Boucher et al., 2022).

Rheumatic Heart Disease: This is one of the most common non-communicable infectious conditions in lower and middle income countries. It is a severe cardiac disease and in lower and middle income nations like Nigeria, it is categorised as a neglected disease and it is the only cardiovascular infection that still continues to cause considerable amount of sickness and death (Isezuo et al., 2023).

Rheumatic heart disease show valve narrowing, thickening, calcification, scarring, and pericardial effusion.

2.1.4.3 Neoplastic Chest Diseases

This involve range of conditions characterised by abnormal cells growth in the chest region. It can be benign (non-cancerous) or malignant (cancerous). Lung cancer is the most common chest neoplasm.

Pulmonary Nodules: Computed tomography scans are often used to find pulmonary nodules, which are just small, abnormal spots in the lungs. Most of these spots are harmless, but a few could be cancerous or might become cancerous. Because of this, it is really important to find them early and manage them well (Chen et al., 2024).

Figure 2.1.3.7: Show as dense round, bright white on CT image. Image source (MacMahon et al., 2017).

Lung Cancer: This is an abnormal growth of the tissues in the lung which is mainly malignant. Globally, lung cancer is the most common type of cancer, and it also causes the highest number of deaths and illnesses. Studies have shown a clear link between developing lung cancer and several factors. These include smoking, exposure to certain environmental elements (like

dangerous substances at work, radon gas, air pollution, and radiation), lifestyle choices (such as obesity and diet), and even family history (inherited susceptibility). The exact numbers for lung cancer in Nigeria are not truly known, but are mostly estimated. This is because the data available currently comes mainly from individual hospitals or clinics, rather than from wider studies that collect information from the general population (Okonta et al., 2023).

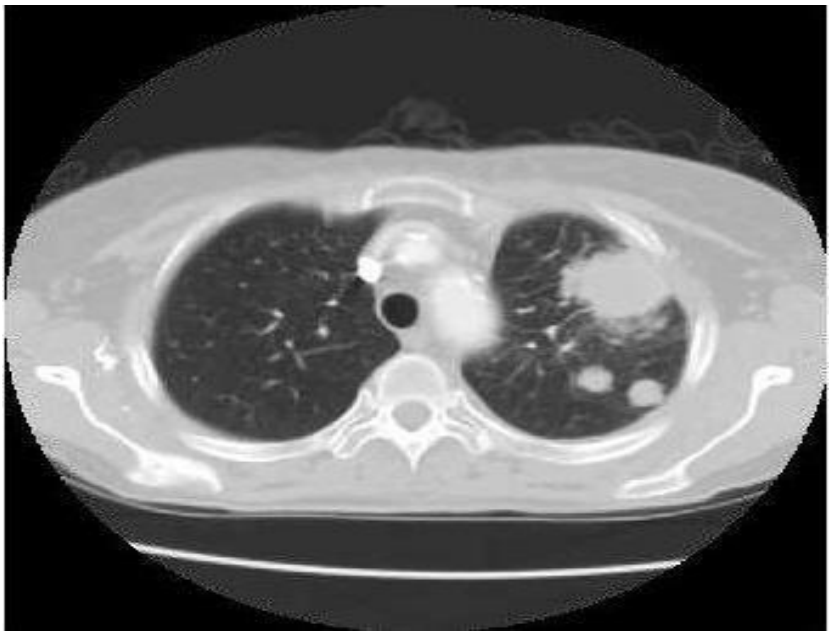


Figure 2.1.3.8: Manifestation of lung cancer on CT image showing nodules of about three centimetre (3cm) and above. Source of image (Widodo et al., 2020).

Other chest pathologies that cannot be classified under the above classification are;

Myocardial Infarction: Commonly called heart attack, myocardial infarction (MI) occurs when the blood supply to a section of the heart muscle is reduced or completely cut off. While some heart attacks may go unnoticed without symptoms, others can be very serious, leading to a sudden decline in heart function and potentially death. According to Buciu et al. (2024), acute

myocardial infarction (AMI) is the most severe and life-threatening form of coronary artery disease. It is a major global cause of death.

Heart Failure: Heart failure (HF) is a medical condition where the heart cannot pump enough blood to meet the body's needs. It is recognised by symptoms like shortness of breath or swelling, along with signs of fluid buildup in the lungs or body, and confirmed by specific blood tests (natriuretic peptides) (Nwako et al., 2025).

Congenital Heart Disease: This is a defect of the structure of the heart and usually occur at birth. The field of adult congenital heart disease (ACHD) is expanding rapidly because more and more people with these conditions are living into adulthood. This is largely thanks to better surgical procedures for newborns and advancements in medical treatments, which have allowed the number of adults with congenital heart defects (CHD) to become greater than the number of children with them (Fabbri & Sahu, 2024).

Hypertensive Heart Disease: Hypertensive heart disease refers to changes in the structure and function of the heart that occur due to sustained high blood pressure. This includes abnormalities in the left ventricle (the main pumping chamber), the left atrium (the chamber that receives blood from the lungs), and the small coronary arteries within the heart muscle (Masenga & Kirabo, 2023).

Pulmonary Hypertension: .Pulmonary hypertension (PH) is a severe condition where the blood pressure in the arteries of the lung is too high. This problem usually gets worse over time, causing serious health issues and making life harder for affected individuals (Ojo et al., 2024).

Chronic Obstructive Pulmonary Disease: Chronic Obstructive Pulmonary Disease (COPD) refers to a collection of lung diseases that make breathing difficult. It is currently the third most

common cause of death worldwide, and the number of people affected by it is growing (Ozoh et al., 2024).

2.1.5 ADULT PATIENT POPULATION CONSIDERATIONS IN CT SCANNING

When considering CT scans for adults, it is important to keep a few things in mind to make sure they are appropriate, safe, and effective. This includes thinking about the radiation involved, how contrast dye is given, any other health conditions the patient might have, factors related to their age, and the ethical aspects of deciding on the scan together with the patient.

2.1.5.1 Radiation Exposure on Adult patients from CT Scan

One of the problems with CT scans for adults is the radiation exposure. Though adults are less sensitive to radiation than children, getting repeated CT scans can lead to accumulation of radiation over time. This piled up exposure increases the risk of developing cancer, especially for individuals who need frequent scans for chronic conditions such as cancer or inflammatory bowel disease.

2.1.5.2 Use of Intravenous Contrast Media

Contrast-enhanced CT scans are very important for checking blood vessels, growths (like tumors), infections, and how well organs are supplied with blood. However, there is still a worry about contrast-induced kidney damage (CIN). To prevent this, doctors can give patients fluids before the scan, use less contrast dye, or choose a safer type of contrast agent.

Adult patients frequently have several long-term health problems, such as diabetes, high blood pressure, or COPD. These conditions often play a role in deciding which medical imaging tests are best for them.

2.2 EMPIRICAL REVIEW

Various studies above have shown the effectiveness of CT scan on chest pathologies including pulmonary infections, lung cancer, and interstitial lung diseases. The main conclusions, approaches, and restrictions of a few chosen international and national research projects are summarised in this study.

According to studies, the rate of death for acute severe asthma ranges greatly by locality and is influenced by a number of factors. A retrospective study by Ibrahim et al. (2023), found that the asthma mortality rate between 2015 and 2019 was 4.8% in the federal teaching hospital, Ido-Ekiti, with older patients having a higher risk of dying compared to younger patients, and that there was a correlation between tobacco smoking and asthma mortality. The study used all patients who presented with asthma between 2015 and 2019, with the exception of patients whose data were incomplete. However, the study was retrospective, had a limited sample size, and was based only on information from one hospital based information on admitted asthma patients.

Pneumonia which is one of above pulmonary infections mentioned accounts for a crucial amount of death in hospitals found in rural areas. It is common in Nigeria and has a high illness and death rate. Ojuawo et al., (2020), used one hundred and two patients in the university of Ilorin who had Community Acquired Pneumonia (CAP) with their consent to conduct a retrospective study on the prevalence of CAP among patients and it was found that the number of mortality due to CAP was higher than that of reported results from previous studies but the study result is based on a particular region in Nigeria and only one hundred and two patients were used, therefore, the limitation of this study.

According to Chen and Li (2024), as people aged, pulmonary sarcoidosis and interstitial lung disorders increases and become more common in the world in terms of disability-adjusted life years (DALY). The most prevalent interstitial lung condition is idiopathic pulmonary fibrosis. The three main non-genetic risk factors for idiopathic pulmonary fibrosis are smoking history, advanced age, and male sex. The limitation of this study is from the fact that the burden of pulmonary sarcoidosis and interstitial lung disorders is underestimated because of in low-income nations and lack of comprehensive disease registries and adequate diagnostic methods.

Wang et al. (2024), used 15 studies of patients from six countries which includes the United states, Germany, Belgium, China, Australia, and Korea and summed up to 437,851,478 individuals from the year 2005 to 2024 using both cross sectional and observational studies to evaluate how often adult patients are diagnosed of bronchiectasis and the study resulted in prevalence of 680 per 100,000 persons which indicates that bronchiectasis is a common disease among adults with a high prevalence in Asia and more common in females than males.

Adeoye et al. (2017) in their study on pleural effusion university of Ilorin teaching hospital used 213 patient records to assess the cause(s) of pleural effusion in patients and they found the most common cause as TB which accounted for 32%, malignancy (29.1%) and pneumonia (15%) with TB more prevalent in males and malignancy more prevalent in females.

In a retrospective study conducted at ERCC Medical Center, Alushi, Nasarawa state by Ashefo (2023), 3029 suspected patients with TB were used to evaluate how the prevalence of TB and the result showed 43.57% in total with a higher prevalence in male (64.90%), 35.09% were females and a prevalence in age was seen in ages 21-30 (26.51%) and 31-40 (24.77%).

According to a retrospective study conducted in two federal hospitals in Niger Delta States in Nigeria by Okonta and Okonta (2023), every patient who was diagnosed of lung cancer from January 2014 to December 2019 were used and the result showed a prevalence of lung cancer in the middle aged and elderly groups with elevated female occurrence.

In a retrospective study conducted June 2022 on global prevalence of myocardial infarction by Salari et al. (2023), twenty two studies were used with a total of 2,982,6717 patients, myocardial infarction was found in 3.8% of patients younger than 60 years and 4.9% of patients older than 60 years. This study was limited to a particular age range due to mismatched age groups in studies used.

A retrospective study by Ojuawo et al. (2019) found that out of 135 patients details that were used, 66 patients had confirmed COPD with 38 of them as non-smokers and 28 of them were exposed to smoke from firewood. Difficulty in breathing and cough were the most prevalent symptoms and this study was conducted at the university of Ilorin teaching hospital, Kwara state, Nigeria.

According to a retrospective study conducted by Ran et al. (2025) on the burden of heart failure globally, 120, 172 sources of data were used to analyse how heart failure is affecting the world and the result showed that there was an increase in the heart failure with COPD, ischemic heart disease, hypertensive heart disease as some of the common causes that led to this increase.

Studies on the phenotyping of hypertensive heart disease (HHD) in sub-Saharan Africa that look at the structure and function of the left ventricle (LV) in patients with essential hypertension (HTN) are scarce. Abiodun et al. (2025) conducted a research on the prevalence of HHD using a cross-sectional study with 1,799 participants in federal medical hospital, Abuja and the study

showed an increase in HHD. These results imply that in order to facilitate the early diagnosis of HHD, the broad use of echocardiography ought to be encouraged.

On a meta-analysis study on how pulmonary hypertension frequently occur in COPD patients globally by Zhang et al. (2022), 38 articles were used and it was concluded that there is a significant increase in PH in COPD patients but this result varies in regions and it was suggested that COPD patients should be examined for PH and check for factors that may increase the risk of PH in order to decrease the burden on patients and environment.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 RESEARCH SETTING

This study was carried out in University of Benin teaching hospital and Raytouch diagnostic centre hospital because they have CT scanning machine and posses trained radiologists and radiographers.

3.2. RESEARCH DESIGN

A retrospective cross-sectional descriptive study was used to carry out this research in selected hospital and diagnostic centre. This involved using pre-existing CT scan results of adult patients

from June 2023 to June 2025 to identify trends in chest abnormalities. This design is suitable for identifying prevalence of diseases in healthcare setting.

3.3 TARGET POPULATION

The target population for this study includes adult patients who underwent chest CT scan at the selected healthcare centres between June 2023 to June 2025 in Benin city. It includes adult patients of ages 18 and above both male and female.

3.4 SAMPLING TECHNIQUE AND SAMPLE SIZE

A stratified random sampling technique was used to collect data of adult patients who did Chest CT scan in Benin city. This technique ensured that a representative sample of men and women across age groups from 18 years was selected to investigate gender-based difference and prevalence of common chest pathologies by creating age categories of both men and women from the specified age group.

SAMPLE SIZE

This includes all adult medical records relating to chest CT scan done from June 2023 to June 2025 with the exception of chest CT scans done for traumatic patients.

3.5 INSTRUMENT OF DATA COLLECTION

The instrument of data collection for this study includes patient medical records and chest CT scan reports. A proforma was used to collect the data. These records were sourced from the radiology departments of selected healthcare institutions in Benin City, where CT services are provided. The CT scan reports contains information such as: type of chest abnormality, location

of abnormality. Information obtained from the patient's medical record include: demographic data (age and gender), clinical history and date of CT scan.

3.6 VALIDITY OF THE INSTRUMENT

The proforma, designed for extracting data from patient records and CT reports, ensured content validity through expert review by my supervisor. This confirmed its clinical use for categorising pathologies of the chest. The instrument was further checked through pilot testing, to ensure consistency and clarity in data gathering by qualified staff. This method verified that the proforma appropriately included all of the data required for this investigation.

3.7 RELIABILITY OF INSTRUMENT

The proforma's reliability was ensured through rigorous measures to guarantee consistent data collection. Clear, detailed guidelines for all data extractors, standardising how information from records and CT reports was classified. A pilot study helped check these instructions and the proforma itself. Assessment of inter-rater reliability was done by having multiple trained personnel independently extract data from a subset of records, ensuring high agreement. This process confirmed the instrument consistently captured accurate information for the study.

3.8 METHOD OF DATA COLLECTION

The method of data collection involved patient data collected retrospectively from existing CT scan records in the healthcare centres selected in Benin City. Patient clinical records was also reviewed to collect significant information on demographics, clinical presentations, and important medical history. This information provided a framework for the CT findings and allowed for analysis of patterns in relation to patient characteristics.

3.9 METHOD OF DATA ANALYSIS

Data collected was thoroughly reviewed and incomplete or duplicate data was removed. Patient's age was categorised and CT findings was classified into appropriate groups. Tables and charts was used to demonstrate the frequency distributions and percentages. Chi-square test was also used to test for relationship between two categorical variables and also test our hypothesis.

The IBM SPSS Version 25 statistical tool was used for this analysis.

3.10 ETHICAL CONSIDERATION

Ethical procedures which include: ethical clearance, confidentiality/Anonymity and avoiding plagiarism was adhered to. To ensure compliance with ethical guidelines and patient privacy regulations, all collected data was anonymised. Identifying information such as names, hospital IDs was removed before data analysis began, ensuring confidentiality.

Ethical clearance was sought from the ethics commission department of University of Benin of Benin Teaching Hospital.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Presentation of Results

This chapter presents the findings derived from the analysis of chest CT scan data from adult patients in Benin City. The results address the research questions, objectives, and hypotheses outlined in the study, offering insights into the prevalence of chest conditions, gender-related trends, incidental abnormalities, and the relationship between age and specific pathologies.

4.1.1 Most Prevalent Chest Pathologies

To address Research Question 1: "Which chest conditions are most frequently shown on adult patients' CT scans in Benin City?" and Objective 1: "To identify the most prevalent chest pathologies among adult patients who underwent chest CT scan," the frequency distribution of findings from the "FINDINGS" column was analysed.

The analysis revealed that the most frequently observed chest conditions on adult patients' CT scans in Benin City are:

i. **Lung cancer:** This emerged as the most prevalent finding, indicating a significant burden.
ii. **Pulmonary tuberculosis:** This ranked as the second most common condition, highlighting its continued presence in the region.
iii. **Pneumonia:** This was the third most frequent pathology identified, underscoring its impact on respiratory health.

The detailed distribution of all identified findings is presented in Table 4.1.

Table 4.1: Most Prevalent Chest Pathologies

Findings	Frequency	Percentage
lung cancer	64	18.29%
pulmonary tuberculosis	47	13.43%
pneumonia	40	11.43%
pleural effusion	34	9.71%
pericardial effusion	25	7.14%
bronchiectasis	23	6.57%
heart failure	18	5.14%
pulmonary empyema	17	4.86%
pericarditis	16	4.57%
chronic bronchitis	13	3.71%
pulmonary embolism	10	2.86%
pulmonary hypertension	9	2.57%
asthma	8	2.29%
emphysema	7	2.00%
pulmonary fibrosis	6	1.71%
breast cancer	5	1.43%
atelectasis	4	1.14%
pneumothorax	4	1.14%
mediastinal mass	3	0.86%
pleural thickening	3	0.86%

pulmonary arterial hypertension	3	0.86%
sarcoidosis	3	0.86%
tuberculosis	3	0.86%
congestive heart failure	2	0.57%
copd	2	0.57%
cystic fibrosis	2	0.57%
lung abscess	2	0.57%
pleural plaques	2	0.57%
asbestosis	1	0.29%
chf	1	0.29%
copd exacerbation	1	0.29%
esophageal cancer	1	0.29%
fungal pneumonia	1	0.29%
mesothelioma	1	0.29%
pleural effusions	1	0.29%
pulmonary oedema	1	0.29%
tuberculosis	1	0.29%
Total	**350**	**100.00%**

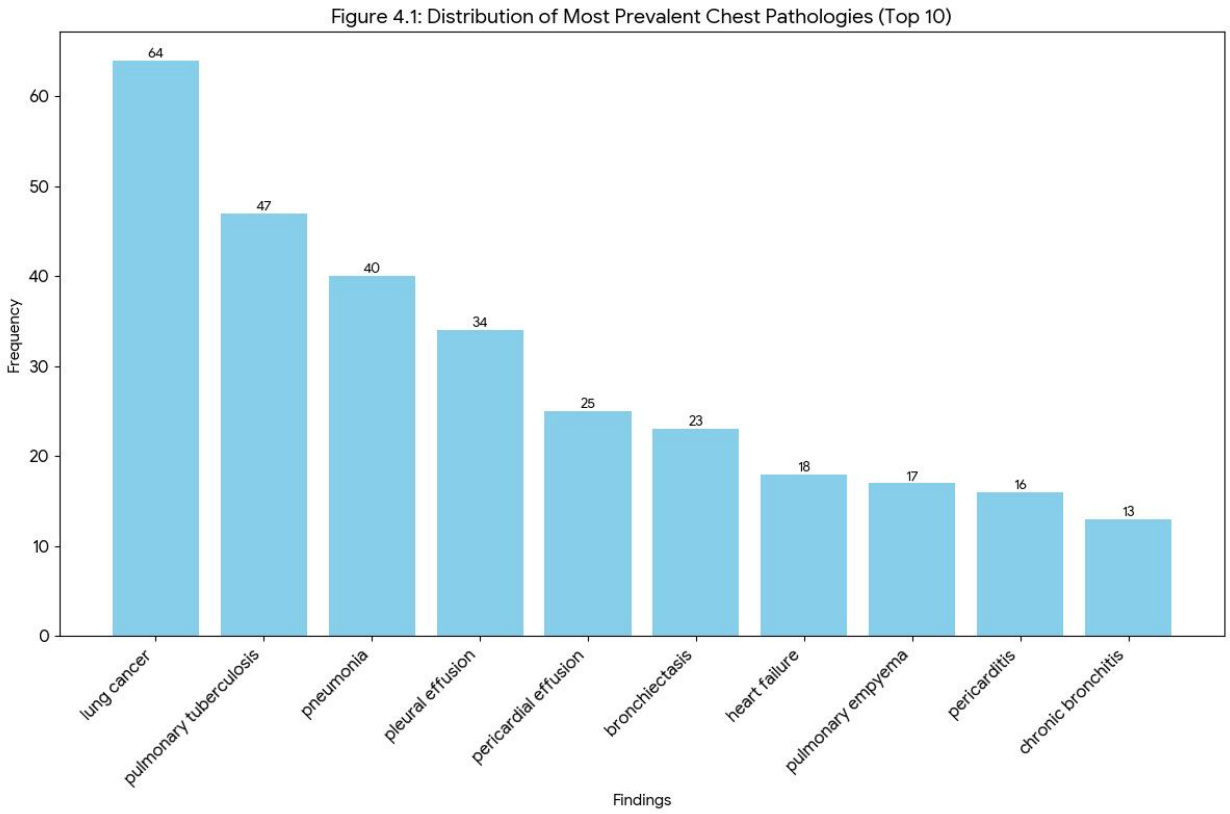


Figure 4. 1: (Distribution of Most Prevalent Chest Pathologies.").

4.1.2 Gender-Related Trends in Chest CT Results

To address Research Question 2: "Do adult patients in Benin City exhibit any gender-related trends in their chest CT results?" and Objective 2: "To investigate if there is any gender-based difference in chest pathologies from findings of patients' result," a Chi-square test of independence was rigorously conducted between patient gender and the identified chest pathologies.

Hypothesis 1 Testing:

i. **Null Hypothesis (H0):** There is no significant relationship between patient's gender and the specific chest pathologies identified on CT scans in adult patients.

ii. **Alternative Hypothesis (H1):** There is a significant relationship between patient's gender and the specific chest pathologies identified on CT scans in adult patients with certain pathologies being more prevalent in one gender compared to the other.

Table 4.2: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	36.120	16	.008

The Chi-square test yielded compelling results, revealing a statistically significant relationship between patient's gender and the specific chest pathologies identified on CT scans (Chi-square statistic = 36.12, p-value = 0.0079, degrees of freedom = 16). This significant p-value (less than 0.05) leads us to confidently reject the null hypothesis, indicating that gender-related trends are indeed present in chest CT results.

Specific gender-based differences observed include:

i. **Breast cancer:** This pathology was exclusively observed in female patients within this dataset, aligning with known epidemiological patterns.

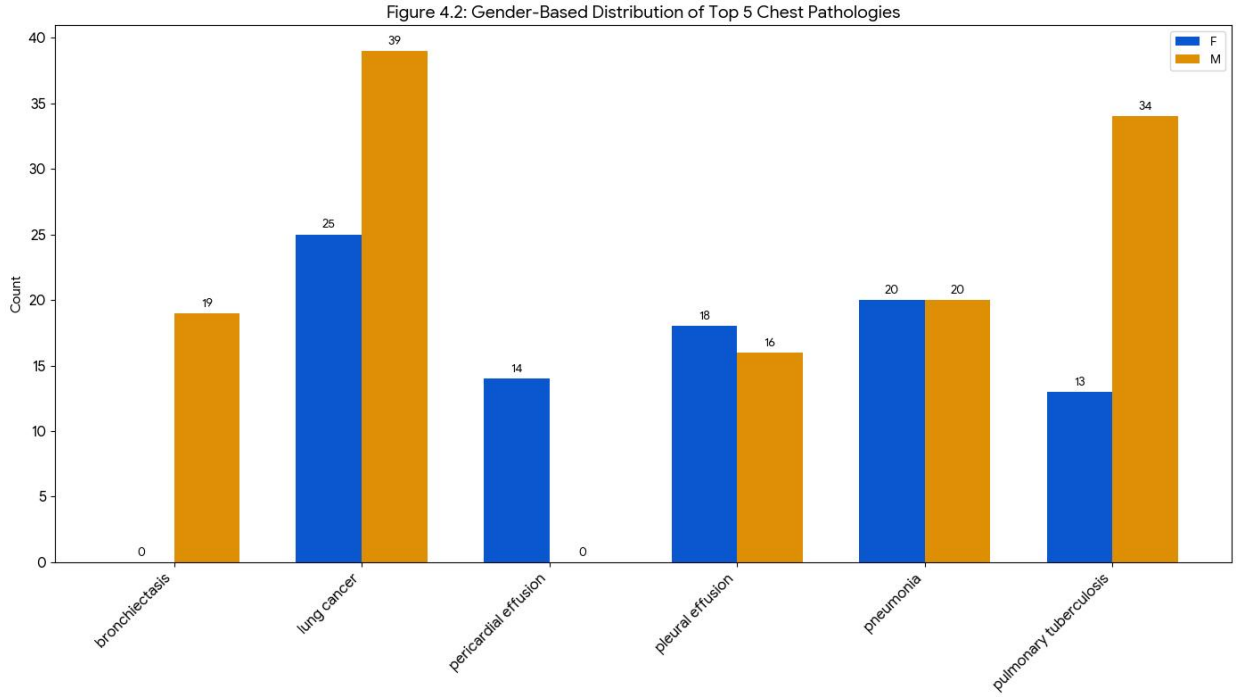
ii. **Bronchiectasis and pulmonary tuberculosis:** These conditions showed a higher prevalence among male patients compared to females, suggesting potential gender-specific risk factors or diagnostic patterns.

The distribution of the top 5 chest pathologies by gender is detailed in Table 2.

Table 4.3: Gender-Based Distribution of Chest Pathologies (Top 5)

Sex	Findings (Top 5)	Count	Percentage within Gender
F	lung cancer	25	15.34%
F	pneumonia	20	12.27%

F	pleural effusion	18	11.04%
F	pericardial effusion	14	8.59%
F	pulmonary tuberculosis	13	7.98%
M	lung cancer	39	20.86%
M	pulmonary tuberculosis	34	18.18%
M	pneumonia	20	10.70%
M	bronchiectasis	19	10.16%
M	pleural effusion	16	8.56%



(Figure 4.2: Gender-Based Distribution of Top 5 Chest Pathologies.).

4.1.3 Incidental Abnormalities (Tumors/Masses)

To address Research Question 3: "How often do adult Benin City patients' chest CT scans reveal incidental abnormalities (such benign tumours)?" and Objective 3: "Determine the number of

patients that display findings of tumour or masses in Benin City," the "INCIDENTAL FINDINGS" column was carefully examined.

Table 4.4: Prevalence of Incidental Findings (N=350)

Finding Category	Frequency (Count)	Percentage
Any Incidental Finding	33	9.43%
Incidental Tumor/Mass	6	1.71%

The analysis revealed the following:

Out of the 350 adult patients included in the dataset, 33 patients (9.43%) presented with some form of incidental finding on their chest CT scans. This indicates that a notable proportion of scans reveal additional, often unexpected, observations.

i. More specifically, a subset of these incidental findings was related to tumors or masses. Six patients (1.71%) had incidental findings that explicitly mentioned tumour, or masses. This provides a focused understanding of the prevalence of such significant incidental observations.

4.1.4 Relationship between Age and Chest Pathologies

To address Hypothesis 2 regarding the relationship between age and specific chest pathologies, a Chi-square test of independence was performed between categorised age groups and the identified chest pathologies.

Hypothesis 2 Testing:

i. **Null Hypothesis (H0):** There is no significant relationship between the age of adult patients and the specific chest pathologies identified on CT scans.

ii. **Alternative Hypothesis (H1):** There is a significant relationship between the age of adult patients and the specific chest pathologies identified on CT scans.

Table 4.5: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	94.300	96	.530

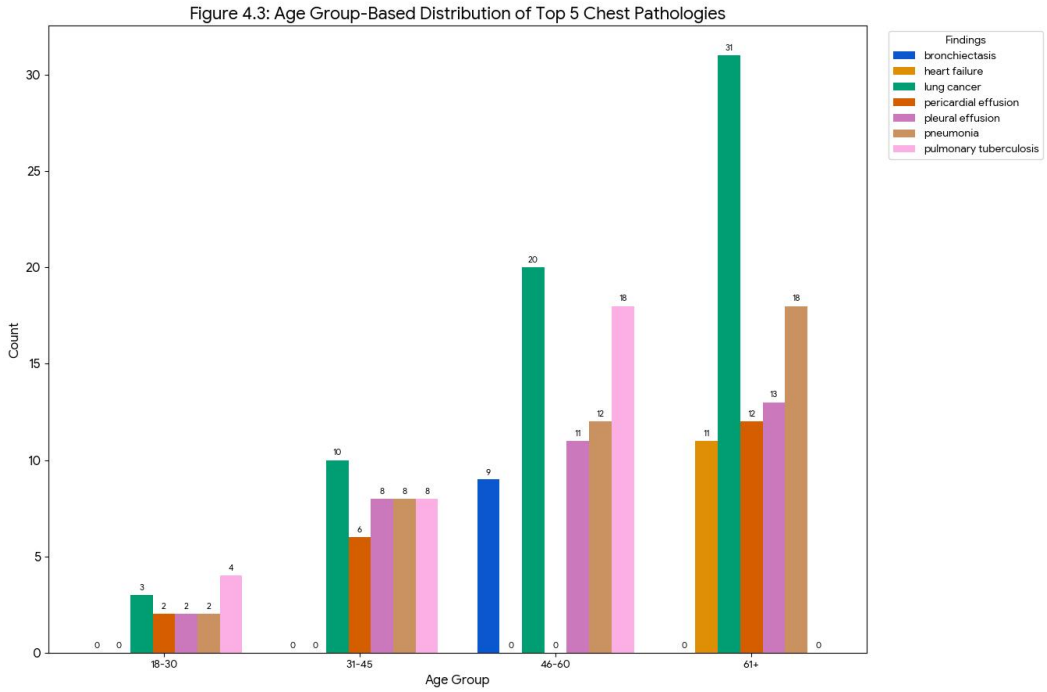
The Chi-square test yielded a Chi-square statistic of 94.30 with a p-value of 0.5299 and 96 degrees of freedom. Critically, since the p-value (0.5299) is considerably greater than the conventional significance level of 0.05, we fail to reject the null hypothesis. This indicates that based on this dataset, there is no statistically significant relationship between the age of adult patients and the specific chest pathologies identified on CT scans. This suggests that these conditions are not disproportionately affecting certain adult age groups within the study population.

The distribution of the top 5 chest pathologies across different age groups is presented in Table 4.6.

Table 4.6: Age Group-Based Distribution of Chest Pathologies (Top 5 Findings)

Age Group	Findings (Top 5)	Count	Percentage within Age Group
18-30	pulmonary tuberculosis	4	23.53%
18-30	lung cancer	3	17.65%
18-30	pneumonia	2	11.76%
18-30	pleural effusion	2	11.76%
18-30	pericardial effusion	2	11.76%
31-45	lung cancer	10	14.93%

31-45	pulmonary tuberculosis	8	11.94%
31-45	pneumonia	8	11.94%
31-45	pleural effusion	8	11.94%
31-45	pericardial effusion	6	8.96%
46-60	lung cancer	20	19.80%
46-60	pulmonary tuberculosis	18	17.82%
46-60	pneumonia	12	11.88%
46-60	pleural effusion	11	10.89%
46-60	bronchiectasis	9	8.91%
61+	lung cancer	31	18.56%
61+	pneumonia	18	10.78%
61+	pleural effusion	13	7.78%
61+	pericardial effusion	12	7.19%
61+	heart failure	11	6.59%



(Figure 4.3: Age Group-Based Distribution of Top 5 Chest Pathologies.)

4.2 Discussion of Findings

This section of this chapter talks about the analytical results presented in section 4.1, contextualizing them within the broader academic and clinical literature reviewed in Chapter Two. The primary goal of this research was to address a significant gap in the local medical literature by being the first study to document the most common chest pathologies from Computed Tomography (CT) findings in adult patients within Benin City. The findings provide a crucial, localised snapshot of the thoracic disease burden, offering a platform to discuss the research questions and hypotheses, and fulfilling the study's core objectives. The discussion is structured around the study's four main analytical pillars: the prevalence of pathologies, gender-related trends, the frequency of incidental findings, and the relationship between age and disease.

4.2.1 The Prevalent Pathologies: A Localised View Of A Dual Burden

The first objective of this study was to identify the most prevalent chest pathologies among adult patients in Benin City. The analysis of the 350 patient scans was definitive, revealing a "Top 10" list of conditions that paints a complex picture of public health in the region (Table 4.1). The three most frequent findings were **lung cancer** (64 cases, 18.29%), **pulmonary tuberculosis** (47 cases, 13.43%), and **pneumonia** (40 cases, 11.43%).

This distribution is perhaps the most significant finding of the entire study. It provides empirical evidence of a dual burden of disease, a term often used to describe a health landscape where the challenges of major non-communicable diseases (NCDs) and infectious diseases co-exist and thrive.

The Pre-eminence of Lung Cancer

The emergence of lung cancer as the single most prevalent finding (18.29%) is an alarming result. This aligns with global trends cited by the World Health Organization (WHO), which noted that lung, tracheal, and bronchus malignancies have seen a dramatic increase, becoming the sixth most common cause of death globally in 2021. The literature review highlighted that while lung cancer is a known global killer , its true prevalence in Nigeria is poorly documented, with most data being estimated from single hospital registries. This study finding of 64 cases, therefore moves beyond estimation and provides a solid, quantifiable baseline for the Benin City population. It confirms that this global scourge is a primary and present challenge for local healthcare providers.

This finding also validates the study's methodological focus on Computed Tomography. CT, with its ability to remove superimposed structures and differentiate minute density variations is the gold standard for detecting the pulmonary nodules and masses characteristic of lung cancer.

The high number of cases found in this retrospective review suggests that many of these diagnoses may have been challenging or impossible to confirm with plain radiography alone, reinforcing the indispensable role of CT in modern thoracic diagnostics.

The Persistent Challenge of Infectious Disease

While cancer leads the list, the high prevalence of **pulmonary tuberculosis** (13.43%) and **pneumonia** (11.43%) underscores that infectious respiratory diseases remain a formidable and deeply entrenched public health challenge. The WHO has long identified TB as a global epidemic, and this study's finding that it is the second most common pathology in Benin City confirms its continued presence. This result resonates strongly with other Nigerian studies; Ashefo (2023), for example, found a high TB prevalence in Nasarawa, and Adeoye et al. (2017) identified TB as the single most common cause of pleural effusion in their cohort in Ilorin.

Similarly, the high frequency of pneumonia (11.43%) reinforces the findings of Ojuawo et al. (2020), who highlighted the significant mortality associated with Community Acquired Pneumonia (CAP) in Ilorin. This study findings support the assertion by Claessens et al. (2015) that chest CT is a vital tool and can identify parenchymal infiltrates indicative of pneumonia even when a traditional chest radiograph appears normal. The CT manifestations described in the literature, such as consolidation and ground-glass opacity (GGO), are precisely what this study's data is built upon.

The Cardiovascular and Chronic Disease Component

Beyond the top three, the remainder of the most prevalent findings reveals a significant burden of cardiovascular and chronic conditions. The high frequencies of **pleural effusion** (9.71%, 4th), **pericardial effusion** (7.14%, 5th), and **heart failure** (5.14%, 7th) are particularly important. These findings often exist in a complex interplay; heart failure is a well known cause of both pleural and pericardial effusions. The literature review pointed to the rising global prevalence of heart failure (HF) and its significant burden. This study's data which also includes 4.57% for pericarditis and 2.57% for pulmonary hypertension, confirms that cardiovascular pathologies are a major reason for and finding on chest CT in Benin City. This reflects the WHO data identifying ischaemic heart disease as the world's leading cause of death and reinforces the call by Abiodun et al. (2025) for better diagnostic access to manage hypertensive heart disease.

Finally, the presence of **bronchiectasis** (6.57%, 6th) and **chronic bronchitis** (3.71%, 10th) highlights the burden of chronic inflammatory and obstructive lung diseases. These findings are consistent with the literature on Chronic Obstructive Pulmonary Disease (COPD) as a major global cause of death. The study by Ojuawo et al. (2019) in Ilorin and the global review by Wang et al. (2024) both support the conclusion that these are common chronic conditions, further complicating the dual burden profile of the Benin City patient population.

4.2.2 Gender-Based Disparities: Confirmation and Contradiction

The second major objective of this study was to test the hypothesis that a significant relationship exists between patient gender and the specific pathologies identified on their CT scans. The Chi-square test of independence yielded a significant result (p=0.008$). This p-value being well below the 0.05 threshold, allows for the confident rejection of the null hypothesis (H0) and the acceptance of the alternative hypothesis (H1). This confirms that gender-related trends are indeed present and statistically significant within the studied cohort.

The importance of this finding is not just in the overall statistic but in the specific trends revealed in Table 4.3, which when compared to the literature, provide both confirmation of established patterns and novel, contradictory findings that warrant further investigation.

Findings Consistent with the Literature

As noted in the results, **breast cancer** was observed exclusively in female patients. While this is an obvious epidemiological fact, its presence in the data serves as a useful internal validity check, confirming the dataset's integrity.

Additionally, this study found that **pulmonary tuberculosis** showed a higher prevalence among male patients. This is a crucial finding that directly and strongly confirms the empirical review. The study by Ashefo (2023) in Nasarawa State, for instance, reported a striking gender divide with 64.90% of TB cases occurring in males and 35.09% in females. The data from Benin City (Table 4.3) reflects this same national trend, with pulmonary tuberculosis being the second most common finding in males (34 cases, 18.18%) but only the fifth most common in females (13 cases, 7.98%). This consistency across different Nigerian regions suggests that the socio-economic, behavioural, or biological factors driving this gender disparity in TB are widespread and persistent.

Novel Findings and Contradictions

What makes this study's gender analysis particularly insightful are the points where it diverges from the existing literature.

First, this study identified **bronchiectasis** as being more prevalent in males. The data in Table 4.3 is stark: 19 cases were recorded in males, making it their fourth most common finding (10.16%), while zero cases were recorded in the top-five list for females. This finding is in direct

contradiction with the large scale meta-analysis by Wang et al. (2024), which stated that bronchiectasis was more common in females on a global scale. This inconsistency is a novel finding. It suggests that the epidemiology of bronchiectasis in Benin City may be driven by localised factors not captured in the global data such as higher rates of specific occupational exposures, different historical infection rates, or other environmental factors specific to the male population in this region.

Second, the data on **lung cancer** presents another compelling contradiction. This study found that while lung cancer was the top finding in both genders, it was more prevalent in males (39 cases, 20.86%) than in females (25 cases, 15.34%), at a ratio of approximately 1.56 to 1. This finding contradicts the retrospective study by Okonta and Okonta (2023) in Niger Delta, which specifically reported an elevated female occurrence of lung cancer. This disagreement is a major discussion point. It raises critical questions about whether the risk factor profile in Benin City (e.g., smoking rates in men) is different from the cohort studied by Okonta and Okonta or if changing environmental factors, such as indoor cooking pollution (a known risk factor for women) are creating different epidemiological patterns in different parts of Southern Nigeria. This inconsistency underscores the vital need for localised research as national or even regional data may not accurately reflect the specific realities of a given city.

4.2.3 The Incidentaloma: Quantifying the Unexpected

The third research objective was to determine the frequency of incidental findings, with a specific focus on tumours or masses. The term incidental finding, as defined in Chapter One, refers to unexpected abnormalities detected during an imaging procedure that were not the primary indication for the scan. This analysis yielded two key statistics:

1. A notable **9.43%** of all adult patients (33 out of 350) presented with some form of incidental finding[39].
2. More specifically, **1.71%** of patients (6 out of 350) had incidental findings explicitly identified as a "tumour," or "mass"[40].

This is a clinically significant result. The 9.43% figure demonstrates that for radiologists in Benin City, nearly one in every ten adult chest CT scans will reveal an incidentaloma, an unexpected observation that requires assessment, documentation, and a clinical decision on follow up. This reinforces the immense diagnostic power and responsibility that come with CT imaging. As the literature states, CT's high quality imaging and removal of superposition mean it detects findings that would be invisible on a plain radiograph.

The 1.71% prevalence of incidental tumours or masses is the most critical part of this finding. This directly relates to the literature on the management of pulmonary nodules. While this study being retrospective could not determine the final diagnosis (benign or malignant) of these six cases, their detection is the crucial first step. The management of such findings is a complex process guided by protocols like the Fleischner Society guidelines. The identification of these six cases in 350 patients sample highlight the vital role of chest CT in the early detection of serious conditions like lung cancer before they become symptomatic. This finding serves as a strong argument for the implementation of standardised departmental protocols at the study centers (UBTH and Raytouch) to ensure that such significant incidental findings are flagged, communicated to the referring physician, and followed up thereby maximising the clinical value of every scan.

4.2.4 Re-evaluating the Complex Relationship Between Age and Pathology

The final analytical component of this study tested the second hypothesis, which assumed a significant relationship between patient age group and the specific chest pathologies identified. The Chi-square test of independence yielded a p-value of 0.530. As this value is considerably greater than the 0.05 significance level, the study must **fail to reject the null hypothesis (H0)**. The statistical conclusion based on this specific test is that there is no significant relationship between the age of adult patients and the overall distribution of chest pathologies in this dataset.

This result is at first glance, highly intuitive and appears to fly in the face of established medical knowledge and a large body of the literature reviewed in Chapter Two. The literature is filled with evidence linking age to specific thoracic conditions:

i. Ibrahim et al. (2023) found that older patients had higher asthma mortality.
ii. Chen and Li (2024) noted that interstitial lung disease and sarcoidosis increase with age.
iii. Okonta and Okonta (2023) directly linked lung cancer to middle aged and elderly groups.
iv. Salari et al. (2023) found a higher prevalence of myocardial infarction in those older than 60.

To resolve this apparent contradiction, a more detailed interpretation of the statistical result is essential. The Chi-square test in this instance was a complex model with 96 degrees of freedom, comparing four age groups against more than 30 distinct pathologies. The non-significant p-value suggests that the combined distribution of all pathologies does not significantly differ between age groups. This is likely a case of statistical dilution, where the very strong age-related trends of some diseases are canceled out or washed out by the different age profiles of other conditions.

The real story is not in the single inferential p-value but in the descriptive data presented in Table 4.6 which in fact, strongly supports the literature.

i. **Lung Cancer:** The data shows a clear, undeniable positive correlation with age. The frequency of lung cancer as top five finding rises dramatically with each successive age bracket. This descriptive trend perfectly corresponds with the literature identifying lung cancer as a disease of aging.

ii. **Heart Failure:** The trend is even more firm. Heart failure does not appear in the top five findings for any age group until the 61+ cohort where it appears with 11 cases. This strongly supports the literature linking cardiovascular diseases like HF and MI to older populations.

iii. **Pulmonary Tuberculosis:** In contrast, TB shows a different profile, peaking in the 46-60 age group (18 cases) and not appearing in the top five for the 61+ group. This different distribution pulls the Chi-square statistic in a different direction than lung cancer, contributing to the non-significant overall result.

The conclusion for this section is twofold. Statistically, the study failed to find a significant relationship for the entire dataset as a whole. However, the data for specific high prevalence pathologies (lung cancer and heart failure) confirms the age-related trends reported in the literature. This suggests that while these conditions are not affecting all adult age groups, they are affecting specific ones just as the literature predicts.

CHAPTER FIVE

CONCLUSION, RECOMMENDATIONS, AND LIMITATIONS

5.1 CONCLUSION

This research highlighted the burden of chest disease in Benin City, a region where despite the advanced diagnostic capabilities of Computed Tomography, a comprehensive documented profile of common chest pathologies was notably absent. The study was founded on the objective of creating a baseline, data driven picture of the conditions affecting the adult population. The CT findings of 350 patients was analysed. This study can confidently conclude that it has achieved its primary objectives, yielding insights that are both significant and in some cases, unexpected.

The conclusion drawn from this work Is that the adult patient population in Benin City faces a dual burden of disease. The data identifies lung cancer, a major non-communicable disease as the single most prevalent pathology. Simultaneously, infectious diseases specifically pulmonary tuberculosis and pneumonia, remain as the second and third most common findings. This demonstrates that the healthcare system is not fighting a battle on one front, but on two parallel ones: the rising of chronic, lifestyle, and environment related diseases, and the persistent challenge of infectious respiratory conditions.

This study successfully rejected the null hypothesis regarding gender, confirming that statistically significant gender-based trends exist. While the higher prevalence of tuberculosis in men aligned with national data, the study revealed patterns for bronchiectasis and lung cancer that directly contradicted broader literature, highlighting the value of localised research.

With nearly one in ten patients presenting with an unexpected finding and a notable percentage of those being potential tumors or masses. This study concludes that the role of the radiologist extends far beyond answering the initial clinical question. Every scan is an opportunity for active diagnosis and the data underscores the need for large clinical systems to manage these incidental discoveries effectively.

Finally, while the statistical test did not find a significant relationship between age and the entire line of pathologies, a deeper look at the descriptive data leads to a more refined conclusion. For the most critical diseases namely lung cancer and heart failure the data clearly showed a powerful correlation with advancing age, a finding that strongly supports the established medical literature.

This research has successfully shown the burden of chest pathologies in Benin City, it provides the first CT-based research for the region, serving as a baseline for future clinical work, public health initiatives, and academic inquiry.

5.2 RECOMMENDATIONS

Based on the conclusion drawn from the data analysis and their discussion, it is recommended that:

1. There should be a standardised reporting in incidental findings.
2. Targeted lung cancer awareness programmes and campaigns should be launched.
3. The geographic scope of research should be expanded.
4. Infectious disease existing programmes should be strengthened.
5. There should be increased access to medical records for research purposes and grants, approvals should be given to medical researches especially at the undergraduate level to encourage interest in medical researches.

5.3 LIMITATIONS OF THE STUDY

1. The refusal of most hospitals to grant approval for access to patient medical records was a major setback to the success of this research work.
2. The inadequacy of information available on patients' records made collection of relevant data difficult.
3. Lack of funding (grants, etc) was a discouragement.

5.4 SUGGESTIONS FOR FURTHER STUDIES

1. Evaluation of chest CT findings in pediatrics patients
2. Impact of socioeconomic and health factors in patients with common chest pathologies who had chest CT
3. Comparison between Chest Magnetic Resonance Imaging (MRI) and Chest CT in diagnosing chest pathologies

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APPENDIX I

PRO FORMA FOR DATA COLLECTION

The table below is a pro forma that was used in the data collection of the project topic titled "Common chest pathologies from Computed Tomography (CT) findings in adult patients in Benin City".

S/N	Age	Sex	Clinical history	Findings	Regions involved	Incidental findings
1						
2						
3						

Explanation of columns

1. S/N: Serial number for easy tracking.
2. Age: Patient's age at the time of the scan.
3. Sex: Male/Female.
4. Clinical history: Relevant medical or chest pathological history.
5. Findings: Observations noted on the CT image (example, pleural effusion).
6. Regions involved: Chest regions affected (example, pleural cavity).
7. Incidental Findings: Unexpected abnormalities not related to the primary reason for imaging.

HEALTH RESEARCH ETHICS COMMITTEE (HREC)

UNIVERSITY OF BENIN TEACHING HOSPITAL

P.M.B. 1111 BENIN CITY NIGERIA Telephone: 052-600418 Website: ubth.org

CHIEF MEDICAL DIRECTOR
Prof. Darlington E. Obaseki
E-mail: darlobaseki@gmail.com

DIRECTOR OF ADMINISTRATION
Jim Uwadie, Esq

CHAIRMAN
Prof. (Mrs.) Antoinette N. Ofili

HREC OFFICE:
Committee email: ubthresearchethics@gmail.com
Registration Number:
NHREC-UBTH-HREC/24/12/2022B

PROTOCOL NUMBER: ADM/E 22/A/VOL.VII/2025/178

PROPOSAL TITLE: "COMMON CHEST PATHOLOGIES FROM COMPUTED TOMOGRAPHY (CT) FINDINGS IN ADULT PATIENTS IN BENIN CITY"

PRINCIPAL INVESTIGATOR(S): CHUKWU CHIOMA

DEPARTMENT/INSTITUTION: DEPARTMENT OF RADIOGRAPHY, SCHOOL OF BASIC MEDICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, EDO STATE

DATE CONSIDERED: AUGUST 19TH, 2025

DECISION OF THE COMMITTEE: APPROVED

THIS APPROVAL DATES 6/8/2025 TO 5/8/2026. IF THERE IS DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

REMARK:

CHAIRMAN: PROF. (MRS) A.N. OFILI **SIGNATURE & DATE** A.N.O. 19/08/2025

SUPERVISOR (S): MR. EGBUKICHI VICTOR CHIMEZIE

DECLARATION BY INVESTIGATOR(S):

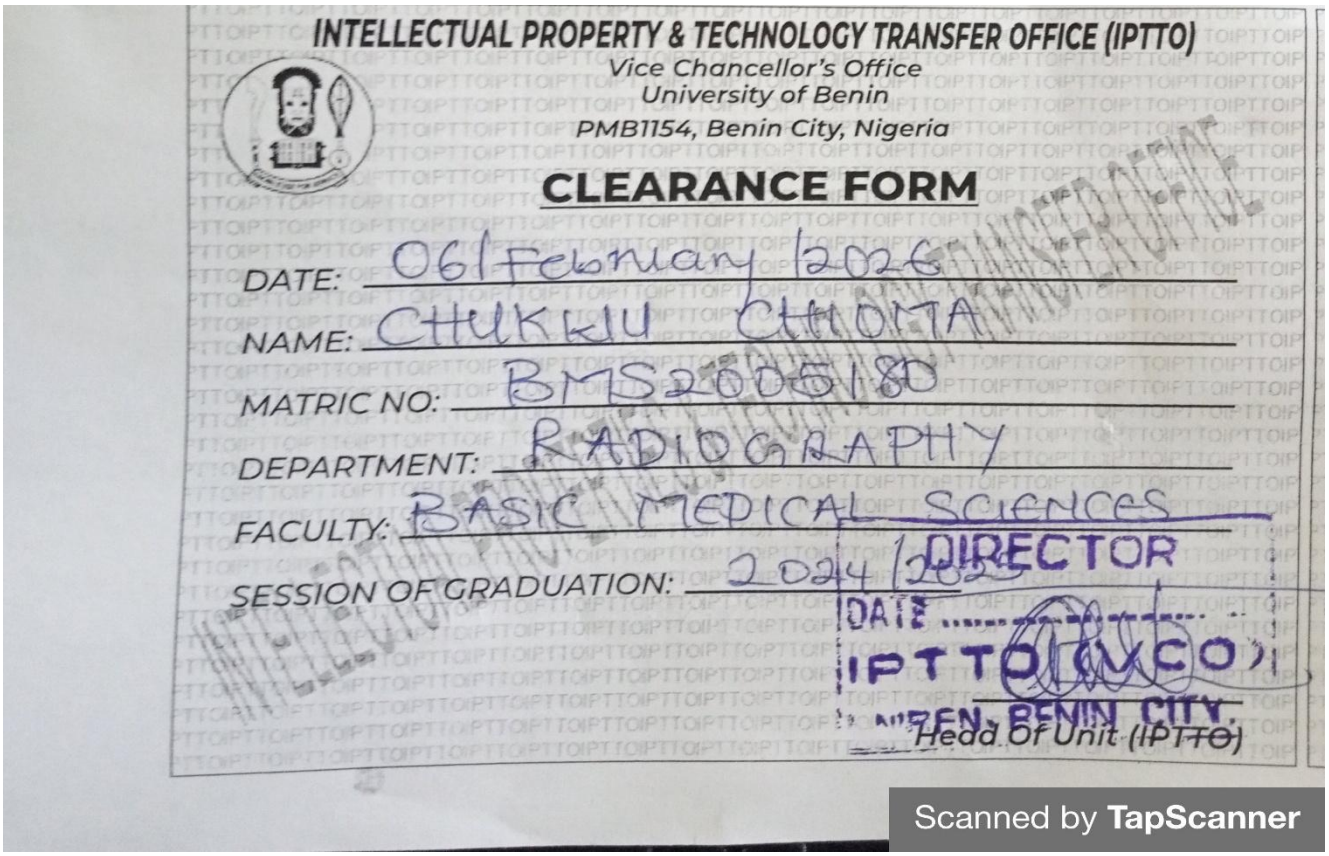
PROTOCOL NUMBER (please quote in all enquiries)

Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study. In multiyear research, endeavor to submit your annual re-port to the HREC early in order to obtain renewal of your approval and avoid disruption of your research. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code. The HREC reserves the right to conduct compliance visit your research site without previous notification

Signature & Date.....

APPENDIX II

APPENDIX III



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Vice Chancellor's Office
University of Benin
PMB1154, Benin City, Nigeria

CLEARANCE FORM

DATE: 06 February 2026

NAME: CHUKWU CHIOMA

MATRIC NO: BMS2005180

DEPARTMENT: RADIOGRAPHY

FACULTY: BASIC MEDICAL SCIENCES

SESSION OF GRADUATION: 2024/2025

DIRECTOR
DATE .....
IPTTO (VCO)
UNIBEN, BENIN CITY.
Head Of Unit (IPTTO)

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