بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

Sudan University of Science &Technology

College of Graduate Studies

Role of High Resolution Computed Tomography in Diagnosing Lung Diseases

دور الأشعة المقطعية المحوسبة عالية الدقة في تشخيص امراض الرئة

A Thesis Submitted for partial Fulfillment of the requirement of MSc. Degree in Medical Diagnosis Radiology

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2020

الآية

قال تعالى:

(وقل ربي زدني علما)

صدق الله العظيم

(طه الآية 114)

DEDICATION

To my parent did everything's for me

To My Colleague & Teacher

To Everyone Contribute to Complete This Thesis

ACKNOWLEDGEMENT

I would like to express my grateful to my main supervisor Dr.Assma Ibrahim Ahmed Elamin for her close supervision guidance , encouragement to Complete and understanding of the Subject

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Lists of Abbreviations

HRCT	High Resolution Computed Tomography
CT	*Computed Tomography*
SPSS	*Statistical Packages of Social Science*
T.B	*Tuberculosis Bacilli*
MDCT	*Multidetectors Conputed Tomography*
MIP	*Maximum Intensity Projection*
MinIP	*Minimum Intensity Projection*
CF	*Cystic Fibrosis*
HMD	*Hyaline Membrane Disease*

Abstract

This study was conducted in AlSAHA specialist hospital in the radiology department in Khartoum from September 2019 to November2019.

Descriptive cross sectional study designed to evaluate lung abnormalities by using high resolution computed tomography, the data was collected from 49 patient 24 male and 25female,aged between20-90year classified and analyzed using SPSS.

The study found the most common lung abnormalities were : pleural effusion(30.6%),pneumonia(18.4%),Bronchiectasis(16.3),CAlung(12.2%),Bronchitis(10..2),T.B(8.2%),Emphysema(2%)and hem pneumothorax(2%)) .Also study found there is no significant between the age and the lung abnormalities (*P-value* = 0.1), and there is no significant between the lung abnormalities and gender(*P-value* = 0. .694).

The study concluded to: The Pleural Effusion is most prevalent abnormalities by (30%) and hem pneumothorax is less prevalent (2%) .The study concluded there is no significant between the lung abnormalities and age ,and lung abnormalities and gender. Finally HRCT has an important role in diagnosis lung abnormalities

This study recommended to perform more study in different Sudan States , that help in analytic studies Take clinical sign to find the relation with lung abnormalities

المستخلص

هذه دارسه وصفية مقطعيه اجريت في مستشفى الساحة التخصصي في الخرطوم في الفترة من اكتوبر2019 الي نوفمبر 2019,باستخدام جهاز الأشعة المقطعية (نيو سوفت) بعدد16شريحة ,واجريت الدراسة في عدد49 مريض بينهم 24رجل و25امراه ,تتراوح اعمارهم بين 25 الي 90 سنه ,وتم تحليل المعلومات باستخدام برنامج الحزم الإحصائية
SPSS الإحصائية للعلوم الاجتماعية

مشكلة البحث في ايجاد وسيله تشخيصيه تفرق بين الاعضاء السميكة والامراض التي تحتها . النتائج التي ظهرت في هذه الدراسة كانت على النحو التالي : الانصباب البلوري بنسبة 30.6(%) ,الالتهاب الرئوي بنسبة (18.4%) ,التهاب القصبات الهوائية بنسبة (16.3) وسرطان الرئة بنسبة (12.2%) ,التهاب الشعب الهوائية(10.2%) ,النفاخ الرئوي (2%) والاسترواح الصدري او الانكماش الرئوي(2%) . واوجدت هذه الدراسة انه لا توجد علاقه بين امراض الرئة والعمر , حيث ان القيمة الإحصائية تساوي 0.1 (>005) , واوجدت ايضا انه لا توجد علاقة بين امراض الرئة والجنس حيث ان القيمة الاحصائية كانت تساوي 0.694.

ختام هذه الدراسة هو ان مرض الانصباب البلوري هو ان مرض الانصباب البلوري هو الاكثر انتشارا بنسبة30% وان مرض الاسترواح الرئوي هو الاقل انتشارا بنسبة2% , وانه لا توجد علاقة بين امراض الرئة وبين العمر والجنس . وفي الختام خلصت هذه الدراسة الى ان الاشعة المقطعية المحوسبة عالية الدقة ذات اهمية كبرى في تشخيص امراض الرئة.

نوصي من خلال هذه الدراسة بعمل مزيد من الابحاث في مناطق مختلفة وولايات مختلفة لمعرفة الامراض الاكثر انتشارا , وبالتالي عمل دراسه تحليليه . ونوصي مستقبلا بأخذ العلامات السريرية لمعرفة مدى ارتباطها بكل مرض

Chapter One

1-1 Introduction:

High resolution computed tomography (HRCT) imaging of the lungs in well-established for diagnosing and managing many pulmonary diseases. Optimal methods of acquisition and interpretation of HRCT images require knowledge of anatomy and pathophysiology, as well as familiarity with the basic physics and techniques of computed tomography. This parameter outlines the principles for performing high-quality HRCT of the lung. (Lois E. Romans2010).

HRCT is the use of thin section CT images (0.625mm to 1.5mm slice thickness) with a high spatial frequency reconstruction algorithm, to detect and characterize diseases that affect the pulmonary parenchyma and small airways. Following the development and widespread availability of multidetector CT (MDCT) scanners capable of acquiring near isotropic data throughout the entire thorax in a single breath hold, two general approaches are available for acquiring HRCT images. The first and more traditional method entails obtaining axial HRCT images spaced at 10mm to 20mm intervals throughout the lungs. The second method uses the ability of MDCT scanners to provide volumetric single breath hold datasets allowing spaced, contiguous, and\or overlapping HRCT images to be reconstructed. With MDCT, the volumetric data enables multilane thin section HRCT reconstruction, which facilitates evaluation of the distribution of diffuse lung disease and the application of post processing techniques such as maximum intensity projection (MIP), minimum intensity projection (minIP), and software that uses volumetric data for quantification of features in the lung and airways. Optimal performance of HRCT studies requires familiarity

with the advantages and disadvantages of each HRCT method, with the choice between these approaches reflecting available equipment, clinical indication. And radiation dose consideration. (W. Richard Webb, 2014).

With both methods, image data are routinely acquired at suspended full inspiration with patients in the supine position. Additional options, useful in many cases, include obtaining inspiratory prone images to differentiate posterior lung disease from dependent atelectasis and end expiratory images to evaluate for air trapping.

The main objective of HRCT is to detect, characterize, and determine the extent of diseases that involve the lung parenchyma and airways. (W. Richard Webb, 2014).

The indications for the use of HRCT of the lungs include, but are not limited to Evaluation of known or clinically suspected diffuse lung disease that is incompletely evaluated on standard chest CT or chest x-ray or that which is chest X-ray occult ,evaluation of suspected small airway disease , quantification of the extent of diffuse lung disease for evaluating effectiveness of treatment ,guidance in selection of the most appropriate site for biopsy of diffuse lung disease ,there are no absolute contraindications to HRCT of the lungs. As with any imaging procedure, the benefits and risks should be considered prior to thoracic CT performance. (W. Richard Webb, 2014).

1-2 Problem Statement:

Chest radiography demonstrated most of chest pathology , but the main problem arise when there an overlapped of pathology with dense structures and when there is a very small lesion which difficult to demonstrate on radiography. Also lack of knowledge of HRCT.

1-3 Objectives:

1.3.1.General objectives:

Role of High Resolution Computed Tomography in evaluation Lung lesions.

1.3.2. Specific Objectives:

- To identify importance of high resolution computed tomography in diagnosing lungs disease.
- To correlate the relation between the age and lung pathologies
- To Correlate the relation between the gender and lung pathologies.

1- 4Overview of the Study;

This study consists of five chapters, Chapter one, which is an introduction, deals with theoretical frame work of the study. It presents the statement of the study problems, objectives . Chapter two includes theoretical the study, background material for thesis, and literature review (previous studies). Chapter three deals with material and method used to evaluate diagnostic accuracy of HRCT of lungs disease.

Chapter four deal with (result) data presentation, Chapter five discusses the data (discussion), analysis, conclusion, recommendation, reference and appendix.

Chapter Two

Theoretical background and Literature review

2-1 Anatomy of the Lung:

The human lungs are a pair of large, spongy organs optimized for gas exchange between our blood and the air. Our bodies require oxygen in order to survive. The lungs provide us with that vital oxygen while also removing carbon dioxide before it can reach hazardous levels.

If the inner surface of the lungs could be stretched out flat, they would occupy an area of around 80 to 100 square meters – about the size of half of a tennis court.The lungs also provide us with the air we need in order to speak, laugh at jokes, and sing.

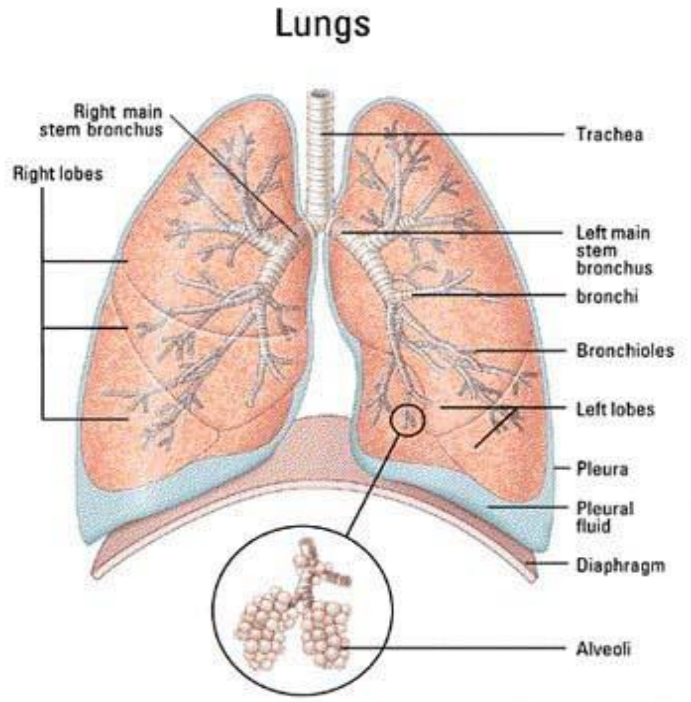

Figure2-1 Show the surface anatomy of the thoracic cavity (lumen learn2019)

2-1-1Pleura:

The pleura are double-layered serous membranes that surround each lung. Attached to the wall of the thoracic cavity, the parietal pleura forms the outer layer of the membrane. The visceral pleura forms the inner layer of the membrane covering the outside surface of the lungs. Between the parietal and visceral pleura is the pleural cavity, which creates a hollow space for the lungs to expand into during inhalation. Serous fluid secreted by the pleural membranes lubricates the inside of the pleural cavity to prevent irritation to the lungs during breathing. External Anatomy occupying most of the space within the thoracic cavity, the lungs extends laterally from the heart to the ribs on both sides of the chest and continue posteriorly toward the spine. 0ach soft, spongy lung is roughly cone-shaped with the superior end of the lung forming the point of the cone and the inferior end forming the base. The superior end of the lungs narrows to a rounded tip known as the apex. The inferior end of the lungs, known as the base, rests on the dome-shaped diaphragm. The base of the lungs is concave to follow the contour of the diaphragm. The left lung is slightly smaller than the right lung because 2/3 of the heart is located on the left side of the body. The left lung contains the cardiac notch; an indentation in the lung that surrounds the apex of the each lung consists of several distinct lobes. The right lung (the larger of the two) has 3 lobes – the superior, middle, and inferior lobes. The horizontal fissure separates the superior lobe from the middle lobe, while the right oblique fissure separates the middle and inferior lobes. The smaller left lung only has 2 lobes – superior and inferior – separated by the left oblique fissure. (Susan Standring PhD DSc2008).

2-1-2 Bronchi :

Air enters the body through the nose or mouth and passes through the pharynx, larynx, and trachea. Just before reaching the lungs, the trachea then splits into the left and right bronchi – large, hollow tubes made of hyaline cartilage and lined with ciliated pseudo stratified epithelium. The hyaline cartilage of the bronchi forms incomplete rings shaped like the letter “C” with the open part of the ring facing toward the posterior end of the bronchi. The rigid hyaline cartilage prevents the bronchi from collapsing and blocking airflow to the lungs. Pseudostratified epithelium lines the inside of the hyaline ring and connects the unfinished ends of the ring to form a hollow tube shaped like the letter “D” with the flat part of the tube facing the posterior direction. Each lung receives air from a single, large primary bronchus. As the primary bronchi enter the lungs, they branch off into smaller secondary bronchi that carry air to each lobe of the lung. Thus, the right bronchus branches off into 3 secondary
bronchi while the left lung branches off into 2 secondary bronchi. The secondary bronchi further branch into many smaller tertiary bronchi within each lobe. The secondary and tertiary bronchi improve the efficiency of the lungs by distributing air evenly within each lobe of the lungs. The pseudostratified epithelium that lines the bronchi contains many cilia and goblet cells. Cilia are small hair-like cellular projections that extend from the surface of the cells. Goblet cells are specialized epithelial cells that secrete mucus to coat the lining of the bronchi. Cilia move together to push mucus secreted by the goblet cells away from the lungs. Particles of dust and even pathogens like viruses, bacteria and fungi in the air entering the lungs stick to the mucus and are carried out of the respiratory tract. In this way mucus helps to keep the lungs clean and free of disease. Many small bronchioles

branch off from the tertiary bronchi. Bronchioles differ from bronchi both in size (they are smaller) and in the composition of their walls. While bronchi have hyaline cartilage rings in their walls, bronchioles are made of elastin fibers and smooth muscle tissue. The tissue of the bronchiole walls allows the diameter of bronchioles to change to a significant degree. When the body requires greater volumes of air entering the lungs, such as during exercise, the bronchioles dilate to permit greater airflow. In response to dust or other environmental pollutants, the bronchioles can constrict to prevent the pollution of the lungs. (Susan Standring PhD DSc2008) The bronchioles further branch off into many tiny terminal bronchioles. Terminal bronchioles are the smallest air tubes in the lungs and terminate at the alveoli of the lungs. Like bronchioles, the terminal bronchioles are elastic, capable of dilating or contracting to control airflow into the alveoli. Alveoli are the functional units of the lungs that permit gas exchange between the air in the lungs and the blood in the capillaries of the lungs. Alveoli are found in small clusters called alveolar sacs at the end of the terminal bronchiole. Each alveolus is a hollow, cup-shaped cavity surrounded by many tiny capillaries. (Henry Gray 2008). The walls of the alveolus are lined with simple squamous epithelial cells known as alveolar cells. A thin layer of connective tissue underlies and supports the alveolar cells. Capillaries surround the connective tissue on the outer border of the alveolus. The respiratory membrane is formed where the walls of a capillary touch the walls of an alveolus. At the respiratory membrane, gas exchange occurs freely between the air and

blood through the extremely thin walls of the alveolus and capillary. Septal cells and macrophages are also found inside the alveoli. Septal cells produce alveolar fluid that coats the inner surface of the alveoli. Alveolar fluid is

extremely important to lung function, as it is a surfactant that moistens the alveoli, helps maintain the elasticity of the lungs, and prevents the thin alveolar walls from collapsing. Macrophages in the alveoli keep the lungs clean and free of infections by capturing and phagocytizing pathogens and other foreign matter that enter the alveoli along with inhaled air. (Susan Stand ring PhD DSc2008).

2-1-3PulmonaryVentilation:

Our lungs receive air from the external environment through the process of negative pressure breathing. Negative pressure breathing requires a pressure differential between the air inside the alveoli and atmospheric air. Muscles surrounding the lungs, such as the diaphragm, intercostal muscles, and abdominal muscles, expand and contract to change the volume of the thoracic cavity. Muscles expand the thoracic cavity and decrease the pressure inside the alveoli to draw atmospheric air into the lungs. This drawing air into the lungs.

This drawing air into the lungs is known as inhalation or inspiration. Muscles can also contract the size of the thoracic cavity to increase the pressure inside of the alveoli and force air out of the lungs. This process of pushing air out of the lungs is known as exhalation or expiration, normal breathing involves several different mechanisms. (Susan Stand ring PhD DSc2008) .

2-2Physiology :

Air inhaled during respiration passes through the upper respiratory tract and trachea on its way to the lungs. At the inferior end of the trachea, the primary bronchi separate to carry air to each lung. In the right lung, the air from the right primary bronchus is further divided between the three lobes by the secondary bronchi. The right superior lobar bronchus carries air to the

right upper lobe, where it spreads through the tertiary bronchi into each of the bronchopulmonary segments. Each segment is filled with many tiny bronchioles, which spread throughout the lung tissue and further branch into terminal bronchioles. All of the terminal bronchioles end in a bunch of cup-like structures known as alveoli. Each alveolus is made of simple squamous epithelium surrounded by tiny capillaries. When air reaches the alveoli, the walls are so thin that gases diffuse along their concentration gradients between the blood in the capillaries and the air inside the alveoli. Oxygen, which is in a higher concentration in the air, diffuses into the blood to be carried to the body's tissues. Carbon dioxide, which is in a higher concentration in the blood, diffuses into the air to be removed from the body during exhalation.(Michael McKinley and etal 2014 **) .**

2.3 Lung pathology:-

2.3.1 cystic fibrosis(CF):

Is congenital disorder resulting from agenetic defect transmitted as an autosomal recessive gene that affects the function of the exocrine glands. .in the respiratory system, evidence suggests that the lungs are histologically normal at birth.(Radiographic pathology)

2.3.2. Hyaline Membrane Disease(HMD)

Is congenital disease Also known as respiratory distress syndrome (RDS), hyaline membrane disease affects infants and is disorder of premature infants or those born at less than a 37-week gestation. .(Radiographic pathology).

2.3..3 Tuberculosis:

The histological hallmark is cosseting granulomata with langhan, s type giant cells. The granuloma is a rounded collection of macrophages and lymphocytes containing multinucleated giant cells, the nuclei of which are

arranged at the periphery in a horse-shoe shape; Acid bacilli can sometimes be demonstrated by the Zehil-Neelson stain on tissue has a much high incidence of large areas of case ting necrosis. Otherwise, primary and secondary TB is histological similar. (Lynch,1990)

2.3.4 Lung Cancer:

Lung cancer is a type of cancer that begins in the lungs. Lung cancer is leading cause of cancer death, claims more lives each year than do colon, prostate, ovarian and breast cancers combined. People who smoke have the greatest risk of lung cancer. The risk of lung cancer increases with the length of time and number of cigarettes smoked. If you quit smoking, even after smoking for many years, you can significantly reduce your chances of developing lung cancer. Lung cancer typically doesn't cause signs and symptoms in its earliest stages. Sign and symptoms of lung cancer typically occur only when the disease is advanced. Sign and symptoms may include coughing up blood, even a small amount, shortness of breath, chest pain, wheezing, loss of weight, bone pain and headache. (Lynch,1990)

2.3.5 Emphysema:

This is defining as abnormal, permanent enlargement of air spaces distal to the terminal bronchioles, due to destruction of alveolar walls and without fibrosis. It is classified as follows:

-centriacinar emphysema involves primarily the respiratory bronchioles and is the most common type. It is the type seen in cigarette smokers.

- Panacea emphysema involves the entire acnes. It is one-twentieth as common as ventricular emphysema. It is the type seen in alpha 1- antitrypsin deficiency

- Parietal emphysema involves the distal part of the lobule. Extensive involvement of the lung is rare. Some cases of spontaneous pneumothorax may be due to this type of emphysema

- Irregular emphysema is associated with scarring and has no particular relationship to the acnes

2.3.6 Chronic bronchitis:

These histological features are chronic inflammation of bronchi with hyperplasia of goblet cells and mucus glands. The Reid index measures the gland to wall ratio (normally glands are one_ third of wall thickness as measured from epithelial basement membrane to cartilage). (Ieslie,2004)

2.3.7 Bronchiectasis:

The airways are abnormally and permanently dilated with variable amount of mucus and inflammation. Superimposed infection may be present e.g., aspergillosis.

- In cystic fibrosis the changes are diffuse often with green yellow mucous impaction

- In kartagener, s sundromes, lack of dieninarms in cilia can be seen by electron microscopy.

- Post-infectious bronchiectasis may be localized or diffuse depending on location and extent of primary disease.(Lynch,1990).

2.3.8 Pleural Effusion

A pleural effusion is an abnormal amount of fluid around the lung. In pleural effusion, fluid accumulates in the space between the layers of pleura. Normally,

only teaspoons of watery fluid are present in the pleural space, allowing the lungs to move smoothly within the chest cavity during breathing. Numerous medical conditions can cause pleural effusion like congestive heart failure, pneumonia, liver cirrhosis, cancer pulmonary embolism. Excessive fluid may accumulate because the body does not handle fluid properly such as liver and kidney disease. The fluid in pleural effusion also may result from inflammation. Pleural effusion often no symptom. Symptoms are more likely when a pleural effusion is moderate or large-sized, or if inflammation is present. (Lynch,1990)

2.3.9 Consolidation:

Consolidation of the lung is simply a "solidification" of the lung tissue due to accumulation of solid and liquid material in the air space that would have normally been filled by gas. It is also known as pulmonary consolidation. The most common cause of consolidation is pneumonia; inflammation of the lung as cellular debris, blood cells and exudates collects in the alveoli of the lung. (Ies li,2004)

2-4 Computed tomography (CT):

Computed tomography (CT) is a medical imaging method employing tomography and digital geometry processing it use constant three-dimensional image of the inside of an object from a large series of two-dimensional x-ray images taken around a single axis of rotation (serum).

The primary purpose of CT is to produce a two- dimensional representation of the linear x-ray attenuation coefficient distribution through a narrow planner cross section of the human body .the resultant image delineates various structures within the body, showing the relative anatomic relationship (Lois E. Romans2010).

The physical principle of the CT includes the three processes referred to as Data acquisition, Data processing, and Image display.

Data acquisition Refer to systemic collection of information from the patient to produce the CT image .The two method of data acquisition is slice-by-slice data acquisition and volume data acquisition (Lois E. Romans2010).

In conventional slice-by-slice data acquisition, data are collected through different beam geometries to scan the patient. Essentially, the x-ray tube rotates round the patient and collects data from the first slice. The tube stops and the patient moves into position to scan next slice .The process continues until all slices have been individually scanned (Lois E. Romans2010).

In volume data acquisition, special beam geometry referred to as spiral or helical geometry is used to scan a volume of tissue rather than one slice at a time .In spiral or helical CT, the x-ray tube rotates around the patient and traces a spiral\helical path scan an entire volume tissue while the patient holds a single slice per one revolution of x-ray tube. More recently, multi-slice spiral \helical CT has become available for faster imaging patients .It generates multiple slices per one revolution of the xray tube (Lois E. Romans2010). Essentially constitutes the mathematical principles involved in ct. data processing in a three-step process. First, the raw data undergo some form of pre-processing, in which correction are made and some reformatting of data occurs (Lois E. Romans2010).

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The gray scale image is display on a cathode ray tube (CRT), or television monitor, which is an essential component of the control or viewing console. In some scanner there are two monitors, one for text information and one for images (Lois E. Romans2010).

The instrumentation : a modern CT facility consist of a scanning gantry that include the collimated x-ray source, the detectors, the computer for data acquisition ,the image reconstruction system, motorized patient – handling table and the CT viewing console . The major technical difference between various commercial scanner lies in the gantry design and the number and type of x-ray detectors used (Lois E. Romans2010).

Figure2-2 Show Modern CT machine

2-4-1 High-resolution computed tomographies:

High-resolution computed tomography (HRCT) is computed tomography (CT) with high resolution. It is used in the diagnosis of various health problems, though most commonly for lung disease. It involves the use of special computed tomography scanning techniques to assess the lung parenchyma.

2-4-2 Technique;

To understand the advantages of HRCT, it is necessary to discuss the technique currently in use for obtaining high quality thin-section images of the lung parenchyma. HRCT relies on the use of thin collimation and image reconstruction with a high spatial frequency algorithm. In most scanner system, 1 to 1.5 mm collimation can be obtained and should be used routinely for HRCT. Five to eight slices with thin collimation should be obtained at different anatomic levels of the lung. Currently, there is no standard recommendation with regard to the use of a 1 cm, 2 cm, or 3 cm intersection gap. Scanning should be performed using a field of view large enough to encompass both lungs (35-40 cm). Retrospective targeting of the image reconstruction to a single lung or an even smaller portion of the pulmonary parenchyma increases spatial resolution, but, in most cases, does not add additional information. For 23 image photography, one should keep in mind that larger images are generally much easier to read. We, therefore, use a 6 on 1 format. It should be emphasized that although the manner in which images are photographed does not affect the actual spatial resolution of an image, the use of proper settings for window level and width is important for accurate interpretation. Currently, there are no "correct" window settings for image photography. Nevertheless certain window setting have gained acceptance throughout the radiological community. It is advantageous to use a double window with one

window setting at -450/1,500 hounsfield units and a "lung density" window of -700/1,000 hounsfield units. Choosing different window levels and widths can be advantageous for specific cases. Because numerous patients demonstrate increased densities in the dependent portion of the lung, representing hypostasis and/or atelectasis, it is wise to evaluate patients not only in the supine position but also in the prone position to differentiate physiological densities from signs of diffuse lung disease. In general, HRCT images are obtained at full inspiration. In patients with suspected airway disease, additional ct scans should be obtained during expiration to facilitate detection of air trapping. The radiation does associated with HRCT scans is significantly less that associated with conventional CT. with HRCT, the mean skin radiation dose for scanning at 10 mm intervals is around 4 mGY, and for scanning at 20 mm intervals, around 2 mGY , respectively. (Lynch,1990).

2-5 Previous Study;

_Hager(2016) Conducted study in sudan tudy designed to detection of lung abnormalities using High Resolution Computed Tomography in diagnosis lung disease which cause chest pain, shortness of breathing and other signs and symptoms related to respiratory system and to correlated the findings to age, gender and the feature of disease.

The study main finding diagnosis was bronchoectasis 26%, mets 22%, fibrosis 18%, tuberculosis 14%, pneumothorax 12% and others 8%. The study conclude that bronchoectasis is the main disease that affects the lungs and changes the tissues and airways of respiratory system

_Another study was conducted by Sabla(2017), ,the study was aimed to demonstrate the HRCT of chest is the most accurate noninvasive imaging method of evaluating lung disease and has improved our understanding of the patterns and pathology of many pulmonary diseases ,the data was collected from 55 patients classified and analyzed using SPSS .The study found the most common clinical

indication is cough (29.1%), the result was showed that the HRCT can diagnosis the most common causes of cough from TB (31.25%) , The most common finding in HRCT is normal result (21.8%).and males 32 (58.2%) were more affected than females 23(41.8%) the most age group affected was (53.5-65.5) with high percentage (25.5%) and the study conclude that there were main role of HRCT in diagnostic lungs disease ,all patient with the chest disease should undergo HRCT in order to detect the morphology and function of the lung.

-Sara(2018) conducted study to finding x-ray and high resolution computed tomography in lung diseases. The problem of study was when took the chest x-ray there on overlapped of pathology with dense structure and HRCT is the test performed by taken thin section that result a few image representative of lung in general. HRCT don't taken image of the whole lung because using widely spaced thin section . Methods: Retrospective cross sectional study Descriptive, 50 patients come to x-ray department for check up chest by xray and HRCT when suspected lung disease, Male and female. Were examined in Moaalem medical center, during the period from (January 2018 to march 2018). The variable collected from patients include Gender, age, sigin and symptoms, clinical diagnostic, x-ray finding and HRCT finding.Result: the majority of samples were males greater than females, males 26 (52%) and females 24 (48%). In this study peak incidence was among the age between (years of age presenting(2%). The cough is the most sign and symptoms with 21 patient(42%). Most patient had suspected clinical diagnostic (consolidation) of 13 patient (26%). In x-ray finding about 18 patient (36%) was saw pleural effution when those patient did HRCT we saw 13 patitent (26%) scloratic changes with pleural effution. Finally the study showed HRCT is golden modalities in lung interstitial disease combinations of modality enhance finding.

Chapter Three

Material and Methods

3.1 Materials:

-Neuosoft CT machine (16Slice-1.5mmSlice thickness) in Alsaha Specialist Hospital.

3.2 Method :

3.2.1. Technique used

Patient position: supine arms elevated above head, feet first or head first.

Tomogram AP: from lung apices to below diaphragm.

Breathing: breath hold in inspiration (single breath hold).

Technical parameters: pitch 1, slice thickness1.5 mm (.9mm) lesions.

Filming parameters: soft tissue window and lung window

3.2.2 Area and Duration of the study:

The Study was performed in the department of radiology in Alsaha Specialist Hospital in Khartoum In period From (October to Novembers2019).

3.2.3study variable:

The variable that collected from patient include gender, age, clinical sign, symptoms, and CT finding.

3.2.4 data collection:

Data collected according to work sheet (appendix) include all above variable data.

3.2. .4 data analysis :

The data was analyzed by SPSS ((statistical package of the social science).

Chapter four

Results

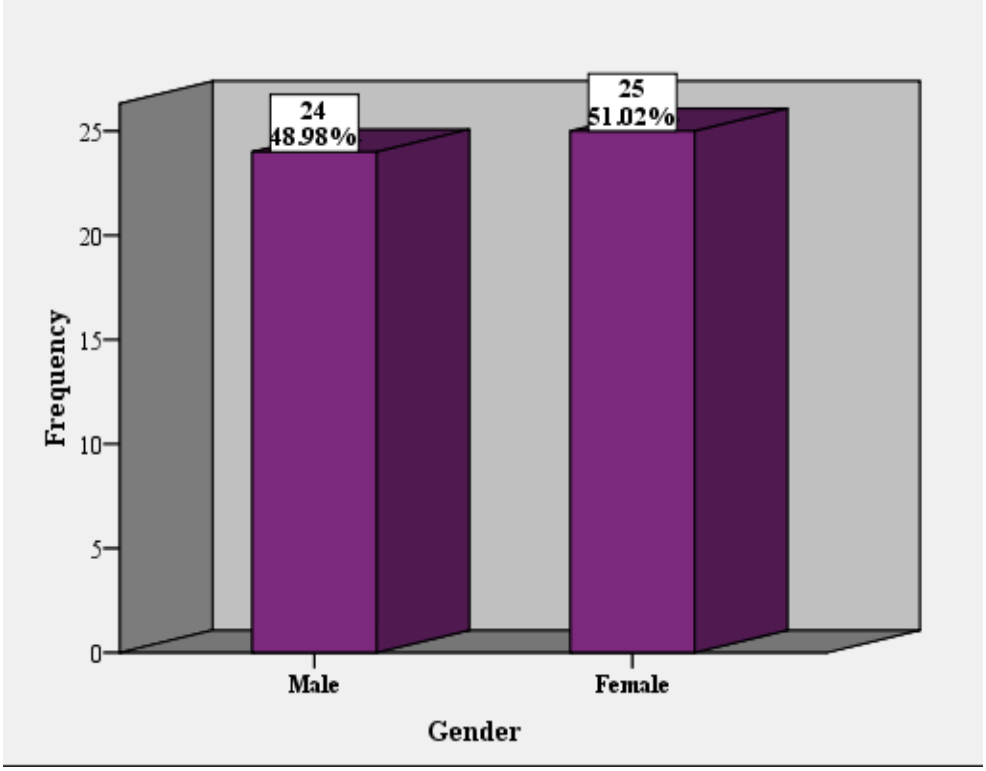

Figure 4.1: Distribution of gender

Table4.1: Show Age Group * Diagnosis Cross tabulation

	Mean	Median	STD	Min	Max
Age	54.55	60	18.82	26	88

Table4.2: Show Age Group * Diagnosis Cross tabulation;

Age groups	Frequency	Percent
25-35 years	11	22.4
6-45 years	7	14.3
6-55 years	5	10.2
6-65 years	12	24.5
6-75 years	6	12.2
6-85 years	5	10.2
6-95 years	3	6.1
Total	49	100.0

Table 4.3: Distribution of lung abnormalities

Lung abnormalities	Frequency	Percent
Pneumonia	9	18.4
Hem pneumothorax	1	2.0
Bronchiectasis	8	16.3
CA lung	6	12.2
Pleural Effusion	15	30.6
T.B	4	8.2
Emphysema	1	2.0
Bronchitis	5	10.2
Total	49	100.0

Table 4.4: The association between lung abnormalities and gender

Lung abnormalities	**Gender**		**Total**
	Male	Female	
Pneumonia	4(8.2%)	5(10.2%)	9(18.4%)
hem pneumothorax	1(2.0%)	0(.0%)	1(2.0%)
Bronchiectasis	5(10.2%	3(6.1%	8(16.3%)
CA lung	3(6.1%	3(6.1%	6(12.2%)
Pleural Effusion	5(10.2.1 %	5(20.4.2 %	15(30.6. %)
T.B	3(6.1%)	1(2.0%)	4(8.2%)
Emphysema	1(2.0%)	0(.0%	1(2.0%)
Bronchitis	2(4.1%)	3(6.1%)	5(10.2%)
Total	24(49.0 %)	25(51.0 %)	49(100.0 %)

P-value = 0. .694

Table 4.5: The association between age and lung abnormalities

Lung abnormalities	**Age groups**							**Total**
	25-35 years	36-45 years	46-55 years	56-65 years	66-75 years	76-85 years	86-95 years	
Pneumonia	3 (6.1%)	3(6.1%)	1 (2.0%	1(2.0%)	1(2.0%)	0(.0%)	0(.0%)	9(18.4%)
hem pneumothorax	1(2.0%)	0(.0%)	0 (.0%)	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(2.0%)
Bronchiectasis	2(4.1%)	2(4.1%)	0 (.0%)	1(2.0%)	2(4.1%)	1(2.0%)	0(.0%)	8(16.3%)
CA lung	1(2.0%)	0(.0%)	1 (2.0%)	2(4.1%)	0(.0%)	1(2.0%)	1(2.0%)	6(12.2%)
Pleural Effusion	1(4%)	2(4.1%)	1 (2.0%)	6(12.2%)	2(4.0%)	2(4.1%)	1(2.0%)	15 (30.6%)
T.B	3(6.1%)	0(.0%)	0 (.0%)	0(.0%)	0(.0%)	1(2.0%)	0(.0%)	4(8.2%)
Emphysema	0(.0%)	0(.0%)	0 (.0%)	0(.0%)	0(.0%)	0(.0%)	1(2.0%)	1(2.0%)
Bronchitis	0(.0%)	0(.0%)	2 (4.1%)	2(4.1%)	1(2.0%)	0(.0%)	0(.0%)	5(10.2%)
Total	11(24.3.2%)	7(14.3%)	5(10.1%)	12(24.4%)	6(12.1%)	5(10.1%)	3(6.%)	49(100.0%)

P-value = 0.1

Chapter five

Discussion, Conclusion and Recommendation

5-1 Discussion:

This study was cross sectional, hospital based study aimed to evaluate the characteristic of lung disease by high resolution computed tomography In which 49 cases were diagnosed, 24 (49%) were males and 25 (51%) were females (figure 4.1), mostly within age group 56-65 years (table 4.1) and had pleural effusion as in table{ 4.2}.

In this study the highest percentage of lung abnormalities are finding in pleural effusion(30.6%),pneumonia(18.4%),Bronchiectasis(16.3),CAlung(12.2%),Bronchi tis(10..2),T.B(8.2%),Emphysema(2%)and hem pneumothorax(2%) table 4.2

In this study there was no association (*p-value* = ≤.05) between age and lung abnormalities as explained in table 4.3.

There was no significant association (*p-value* = ≤.05) between gender and lung abnormalities as explained in table 4.4.

5-2 Conclusion:

The study concluded that there were main role of HRCT in diagnosis lungs disease. Computed tomography availability , relatively low cost no need to contrast material .

HRCT is the golden modalities in diagnosis interstitial lung disease

The result in this study are agree with SABLA(2017),Pleural effusion is most common pathology(30.6) and less pathology are emphysema and T.B(2%).

5-3 Recommendation:

HRCT must be must be preceded by chest x-ray

Further studies with large samples should be done,more study need to be conducted to approximate views between studies.

HRCT is recommended to detect or evaluate specific problems or diagnosis, such as metastatic lesions, pulmonary nodules, emphysema, bronchiectasis, and intestinal lung diseases .

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Appendices

Appendix 1

Data Sheet Collection

Patient ID	Age	Gender	Diagnosis

Appendix 2

Neuosoft CT machine

Appendix(3)

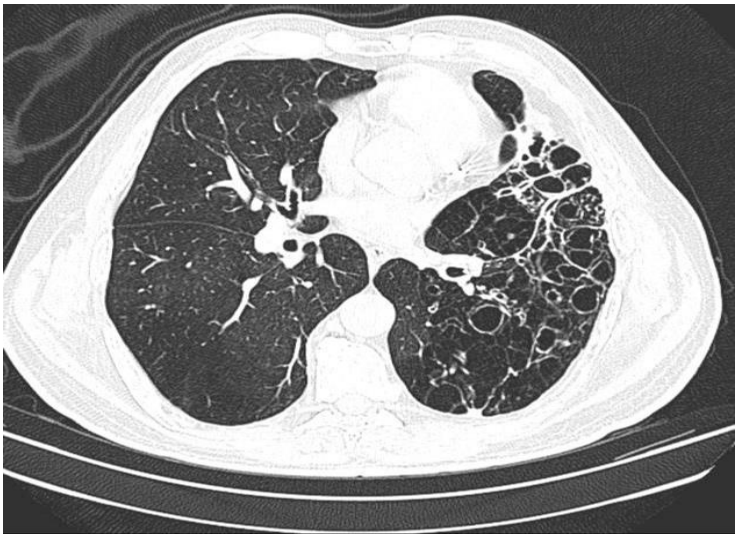

Image Show; HRCT show bronchiectasis

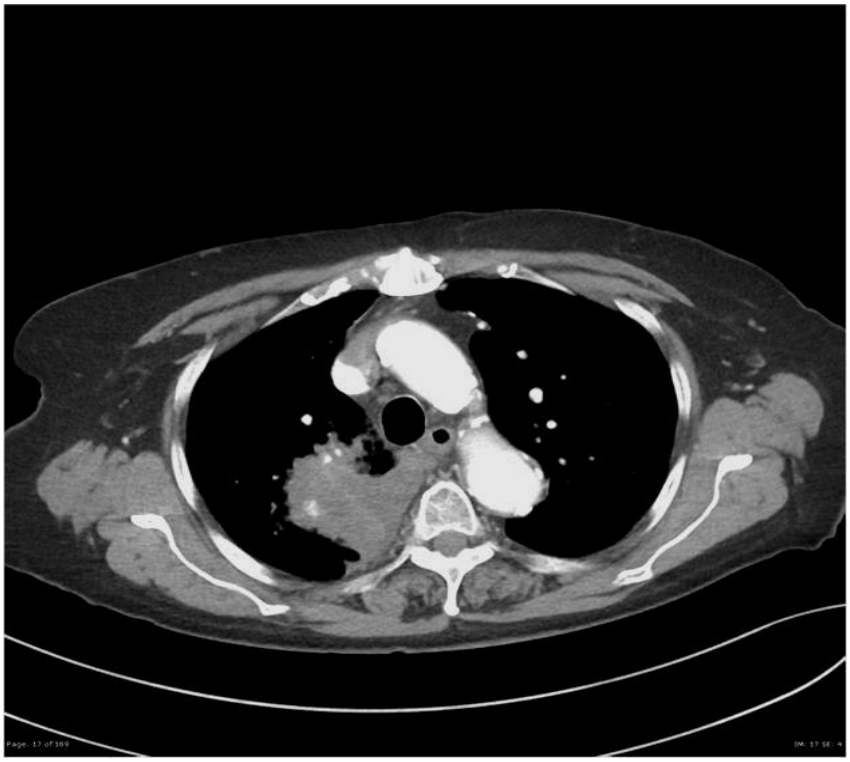

Image Show; CA lung

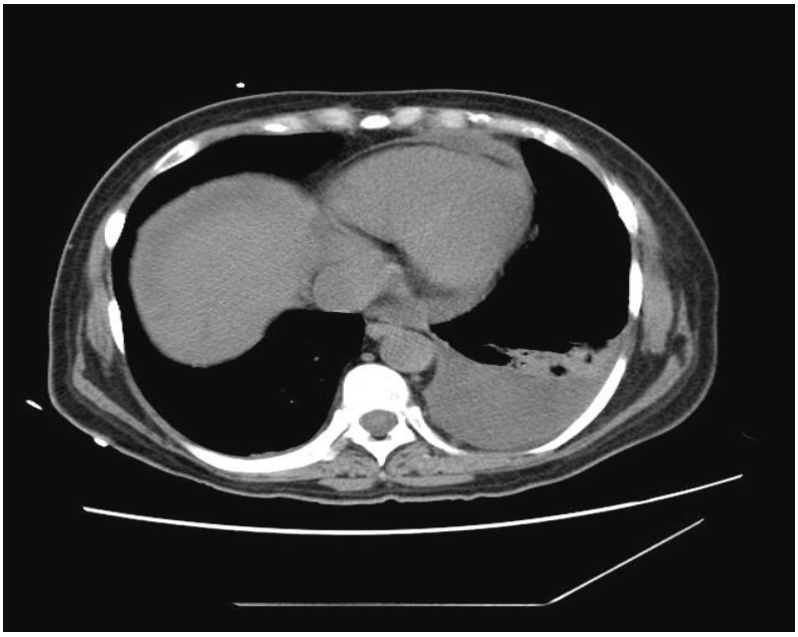

Image show: Pleural Effusion

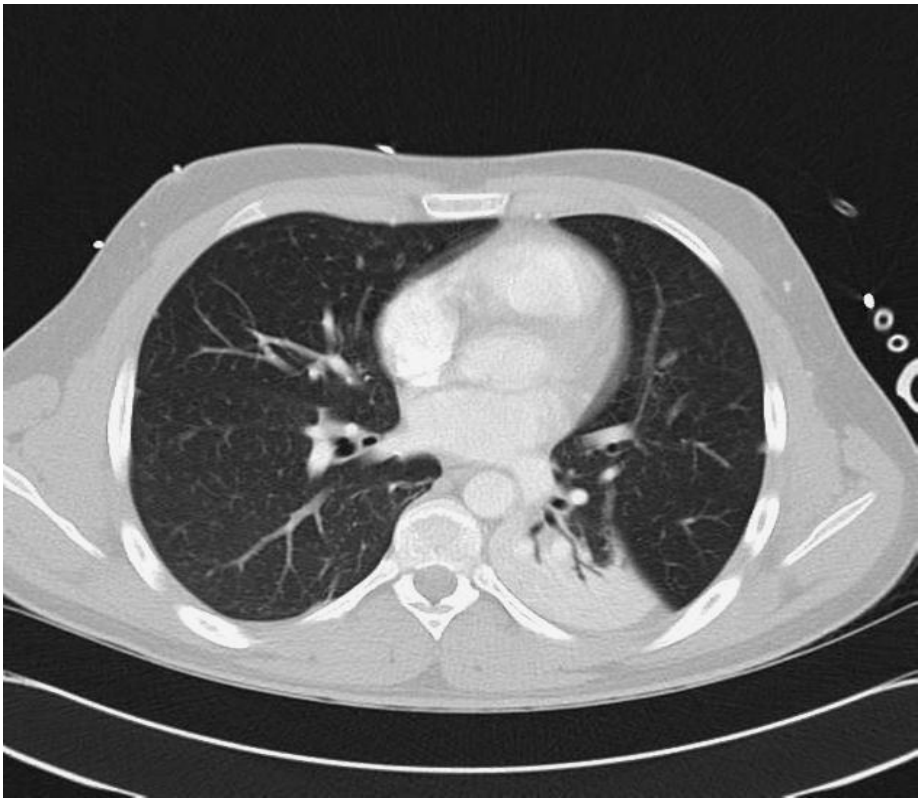

Image Show; Aspiration pneumonia