Sudan University of Science and Technology

College of Graduate Studies

A study of Pulmonary Embolism in Sudanese Patients by using Computer Tomography

دراسة الجلطة الرئوية لدى المرضى السودانيين باستخدام التصوير بالاشعة المقطعية المحوسبة

A Research submitted for partial fulfillment for the Requirements of M.Sc. degree in Diagnostic Radiologic Technology

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الآيــة

قال تعالى :

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ)

صدق الله العظيم

سورة العلق(الآية 1)

Dedication

This thesis is proudly dedicated to ……

All my beloved family

My mother "Intisar"

My father "Sheikh Eltayeb"

My brothers specially "Mustafa"

My sisters and my best friend "Batoul"

Thanks for your endless love, sacrifices, prayers, supports and advices

Acknowledgments

First and foremost, praises and thanks to god, the Almighty, I would like to thank my supervisor **Dr. Mona A. Mohammed** for her support, outstanding guidance.

Special thanks to **Dr. Sohayb Mohammed Salih** for his help and everyone participated in this work by any way encourages either advising or appreciating our research.

I would like to thank my family, specially my parents, for their encouragement, patience, and assistance over the years. We are forever indebted to our parents, who have always kept me in their prayers.

Abstract

This is descriptive cross section study, the general objectivee is to study the pulmonary embolism using multi detectors computerized tomography (MDCT). used CT scan for evaluate pulmonary embolism by using contrast agent this give a chance for different location of pulmonary embolism to be clearly demonstrated. This study was be commenced on the time period from September to October 2021 in Almoalem hospital, royal care hospital within CT scan departments in Khartoum. Fifty Sudanese patients underwent for CTPA .The data was collected and analyzed by statistical package for social science and correlation person's coefficient (SPSS).

The results concluded that the female are more likely to develop PE than male, The age group at highest risk of pulmonary embolism is between 61-70 years old, and The hypertensive patients are more likely to develop pulmonary embolism than the diabetic patients. The common type of pulmonary embolism is distal PE, and the saddle embolism is the rarest type. We found that there is a relationship between the site of PE and the gender of patient, the women have higher rates of pulmonary embolism in the right pulmonary artery and bilaterally, and the men effected more bilaterally and in the left pulmonary artery .

For further study it's recommended to use other investigations to support the diagnosis.

المستخلص

هذه دراسة وصفية مقطعية ، تهدف الى دراسة الانسداد الرئوي باستخدام التصوير المقطعي المحوسب متعدد الكاشفات , (MDCT) يستخدم التصوير المقطعي المحوسب لتقييم الانسداد الرئوي باستخدام عامل التباين وهذا يعطي فرصة لتوضيح مواقع مختلفة للانسداد الرئوي بوضوح .

بدأت هذه الدراسة في الفترة الزمنية من سبتمبر إلى أكتوبر 2021 في مستشفى المعلم ، مستشفى رويال كير ضمن أقسام الأشعة المقطعية بالخرطوم. خضع خمسون مريضاً سودانياً لفحص CTPA ، وتم جمع البيانات وتحليلها بواسطة الحزمة الإحصائية للعلوم الاجتماعية ومعامل الارتباط الفردي .(SPSS) ولخصت النتائج إلى أن الإناث أكثر عرضة للإصابة بـ الانسداد الرئوي من الذكور ، وأن الفئة العمرية الأكثر عرضة للإصابة بالانسداد الرئوي هي بين 61-70 عامًا ، ومرضى ارتفاع ضغط الدم هم أكثر عرضة للإصابة بالانسداد الرئوي من مرضى السكري. النوع الشائع من الانسداد الرئوي هو الانصمام الرئوي في الاوعية الطرفية ، وانصمام السرج هو النوع الأكثر ندرة .وجدنا أن هناك علاقة بين موقع الانسداد الرئوي وجنس المريض ، النساء لديهن معدلات أعلى من الانسداد الرئوي في الشريان الرئوي الأيمن ومن الجانبين ايضا ، والرجال يصابون بالانسداد في الشريان الايسر ومن الجانبان ايضا .

في الدراسات القادمة يوصى باستخدام فحصوصات آخرى لدعم التشخيص .

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List of abbreviations

DVT	Deep vein thrombosis
PE	Pulmonary embolism
CT	Computerized tomography
CTPA	Computerized tomography for pulmonary angiogram
MDCT	Multi detector Computerized tomography
SPECT	Single photon emission Computerized tomography
HRCT	High resolution Computerized tomography
ROI	Region of interest
DM	Diabetes mellitus
HTN	Hypertension
SPIR	SUMASRI Institutional Review Board

Chapter one

Chapter One

1.1 Introduction

Pulmonary embolism is a common and potentially lethal condition. Most patients who succumb to pulmonary embolism do so within the first few hours of the event. Ten percent of PE is fatal in the first hour (Kearon, 2003). Mortality rate of diagnosed and treated pulmonary embolism ranges from 3 to 8%, but increases to about 30% in untreated pulmonary embolism.[1]Most of the deaths occur when the diagnosis is delayed or never made. Despite diagnostic advances, delays in pulmonary embolism diagnosis are common and represent an important issue (Ozsu et al., 2011).

A pulmonary embolism is also characterized as central or peripheral, depending on the location or the arterial branch involved. Central vascular zones include the main pulmonary artery, the left and right main pulmonary arteries, the anterior trunk, the right and left interlobar arteries, and lobar arteries. A pulmonary embolus is characterized as massive when it involves main pulmonary arteries or when it results in hemodynamic compromise. Peripheral vascular zones include the segmental and subsegmental arteries (Ozsu et al., 2011).

The most important conceptual advance regarding pulmonary embolism over the last several decades has been the realization that pulmonary embolism is not a disease; rather, pulmonary embolism is a complication of venous thromboembolism. Pulmonary embolism is present in 60–80% of patients with DVT and more than half these patients are asymptomatic (Tapson, 2008).

Clinical signs and symptoms for pulmonary embolism are nonspecific; therefore, patients suspected of having pulmonary embolism because of unexplained dyspnea, tachypnea, or chest pain or the presence of risk factors for pulmonary embolism must undergo diagnostic tests until the diagnosis is ascertained or eliminated or an alternative diagnosis is confirmed.

Further, routine laboratory findings are nonspecific and are not helpful in pulmonary embolism, although they may suggest another diagnosis. However with the advent of spiral CT pulmonary angiogram (CTPA), there is now an increased recognition of this entity in India. In spite of rapid advances in the diagnosis and management of PE, it is still unreported from India. Most of the reports are limited to autopsy reports and short case series (Iles, 2003).

1.2 Problem of the Study

Pulmonary embolism (PE) is a potentially life threatening condition requiring adequate diagnosis and treatment. Computed tomography pulmonary angiography (CTPA) is excellent for including and excluding PE, therefore CT is the first-choice diagnostic imaging technique in patients suspected of having PE. Due to its wide availability and low invasiveness, CTPA tends to be overused.

1.3 Objectives of the study

1.3.1 General Objective

To study the pulmonary embolism using Multi Detectors Computerized Tomography (MDCT) in Khartoum state.

1.3.2 Specific Objectives

1. To identify the common gender who have a pulmonary embolism**.**
2. To identify the common age group that have a highly incidents rate by a Pulmonary embolism.
3. To determine the common side effect of pulmonary emboli.
4. To determine the effected vessels by the pulmonary emboli.
5. To determine the medical history of patient.

1.4 Justification

To exclude pulmonary artery occlusion by using MDCT. Because pulmonary embolism is common disease.

1.5 Hypothesis

In Sudan use CT scan for identify pulmonary embolism by using contrast agent this give a chance for different location of pulmonary embolism to be clearly demonstrated.

Chapter two

Chapter Two

Theoretical Background and Previous Studies

2.1 Anatomy of the Lung

The lungs are located in the chest on either side of the heart in the rib cage. They are conical in shape with a narrow rounded apex at the top, and a broad concave base that rests on the convex surface of the diaphragm (Philo, 2009). The apex of the lung extends into the root of the neck, reaching shortly above the level of the sternal end of the first rib. The lungs stretch from close to the backbone in the rib cage to the front of the chest and downwards from the lower part of the trachea to the diaphragm (Philo, 2009).

The left lung shares space with the heart, and has an indentation in its border called the cardiac notch of the left lung to accommodate this (Patel and Pinto, 2013).The front and outer sides of the lungs face the ribs, which make light indentations on their surfaces. The medial surfaces of the lungs face towards the centre of the chest, and lie against the heart, great vessels, and the carina where the trachea divides into the two main bronchi (D'Antoni, 2016).

Both lungs have a central recession called the hilum at the root of the lung, where the blood vessels and airways pass into the lungs.[(5)] There are also bronchopulmonary lymph nodes on the hilum (D'Antoni, 2016).

The lungs are surrounded by the pulmonary pleurae. The pleurae are two serous membranes; the outer parietal pleura lines the inner wall of the rib cage and the inner visceral pleura directly lines the surface of the lungs. Between the pleurae is a potential space called the pleural cavity containing a thin layer of lubricating pleural fluid. Each lung is divided into lobes by the infoldings of the pleura as fissures. The fissures are double folds of pleura that section the lungs and help in their expansion (Anbusudar and Dhivya, 2016).

The main or primary bronchi enter the lungs at the hilum and initially branch into secondary bronchi also known as lobar bronchi that supply air to each lobe of the lung. The lobar

bronchi branch into tertiary bronchi also known as segmental bronchi and these supply air to the further divisions of the lobes known as bronchopulmonary segments. Each bronchopulmonary segment has its own (segmental) bronchus and arterial supply (Arakawa et al., 2000). Segments for the left and right lung are shown in the table (Jones, 2021). The segmental anatomy is useful clinically for localizing disease processes in the lungs (Jones, 2021).

A segment is a discrete unit that can be surgically removed without seriously affecting surrounding tissue (Baker, Tortora and Nostakos, 1976).

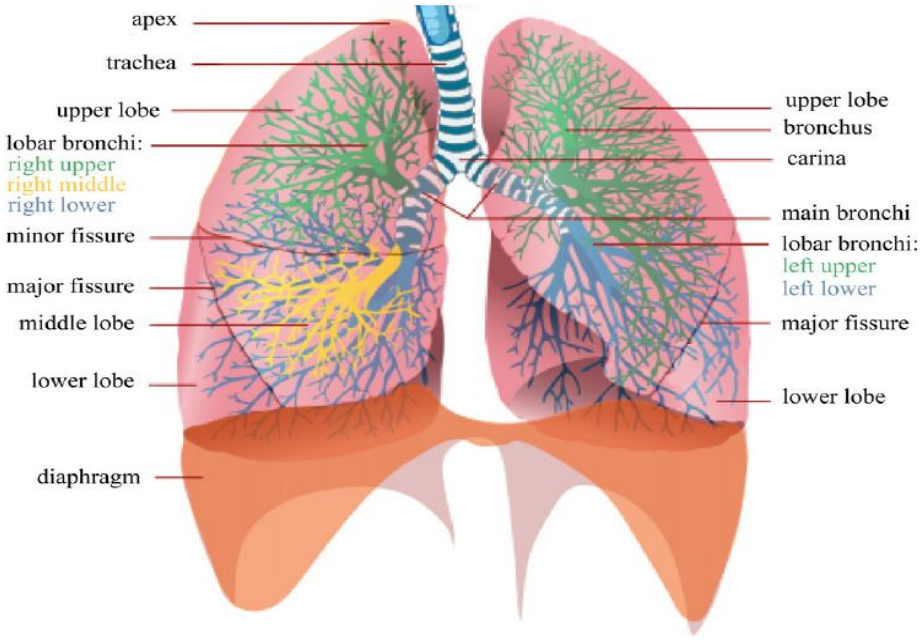

Figure (2.1): *A schematic drawing of the lungs and airway tree in which several anatomical structures are indicated* (Jones, 2021)..

2.2 Physiology

2.2.1 Pulmonary Circulation

The pulmonary circulation is the portion of the circulatory system which carries deoxygenated blood away from the right ventricle of the heart, to the lungs, and returns oxygenated blood to the left atrium and ventricle of the heart (Ashton, 2009) .

The earliest human discussions of pulmonary circulation date back to Egyptian times. Human knowledge of pulmonary circulation grew gradually over centuries, and scientists Ibn al-Nafis, Michael Servetus, and William Harvey provided some of the first accurate descriptions of this process (Masic, 2010).

2.2.1.1 Pulmonary Veins

Two main pulmonary veins emerge from each lung hilum, receiving blood from three or four bronchial veins apiece and draining into the left atrium. An inferior and superior main vein drains each lung, so there are four main veins in total (Quinn, 2008).

At the root of the lung, the right superior pulmonary vein lies in front of and a little below the pulmonary artery; the inferior is situated at the lowest part of the lung hilum, Behind the pulmonary artery is the bronchus (Androulakis et al., 2000).

2.2.1.2 Pulmonary Artery

The main pulmonary artery splits into the right and the left main pulmonary artery (Bors, MD and Elharake MS4, 2017). The left main pulmonary artery is shorter and somewhat smaller than the right, passes horizontally in front of the descending aorta and left bronchus to the root of the left lung. Above, the left main pulmonary artery is connected to the concavity of the proximal descending aorta by the ligamentum arteriosum (Cheitlin, 1973). It then divides into two lobar arteries, one for each lobe of the left lung. The right main pulmonary artery follows a longer and more horizontal course as it crosses the mediastinum (Cheitlin, 1973). It passes underneath the aortic arch, behind the ascending aorta, and in front of the descending aorta (Cheitlin, 1973). It courses posterior to the superior vena cava and in front of the right bronchus. Upon reaching the hilum of the right lung the right main pulmonary artery divides into two branches:

1. Truncus anterior — supplies blood to the right upper lobe.

2. Interlobar artery — inferior and larger branch, supplies blood to the middle and inferior lobes of the lung (Cheitlin, 1973).

The right and left main pulmonary arteries give off branches that roughly correspond to the lung lobes, and can in such cases be termed lobar arteries. The lobar arteries branch into segmental arteries (roughly 1 for each lobe segment), which in turn branch into subsegmental pulmonary arteries (Silitongo, Bowa, Kafumukache and Erzingatsian, 2015).These eventually form interlobular arteries (Otani et al., 2016).

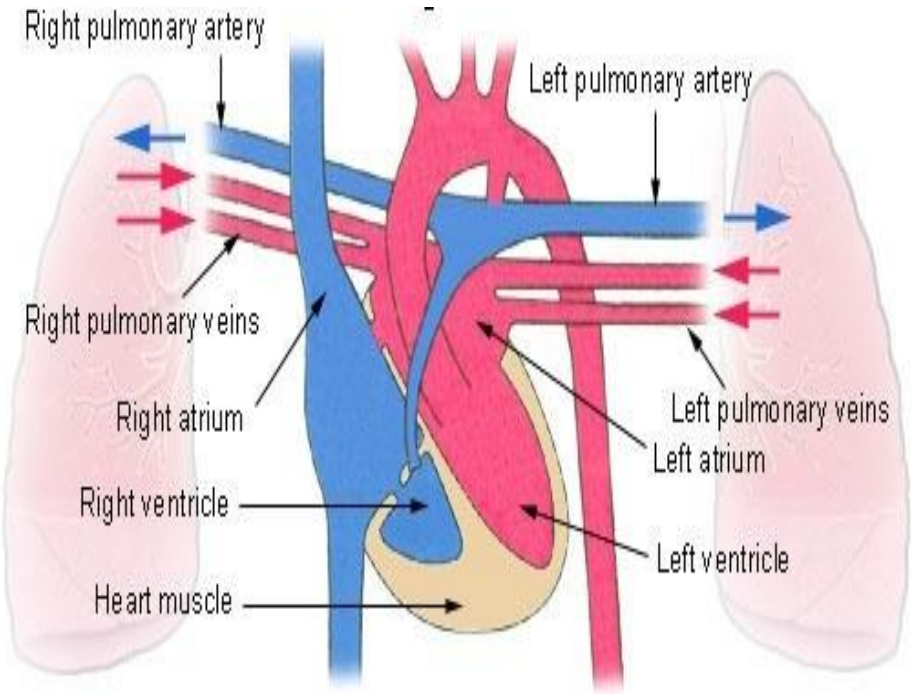

Figure (2.2): *Human pulmonary circulation* (Ashton, 2009).

2.3 Pathology of Pulmonary Vascular Diseases

2.3.1 Pulmonary Vascular Disease Associated With Schistosomiasis

1. Acute Pulmonary Schistosomiasis

Acute pulmonary schistosomiasis is also called Katayama syndrome. It appears a few weeks after infection and is due to proinflammatory cytokines and immune complexes induced by migrating schistosomula and egg deposition (de Jesus et al., 2002). It is most likely to occur in nonimmune hosts, particularly visitors to endemic regions (Schwartz, 2002).The main presentations are nocturnal fever, cough, dyspnea, myalgia, headache, and abdominal

tenderness. This nonspecific presentation is most likely to be misdiagnosed, but the history of water contact 14 to 84 days before presentation of clinical symptoms can clinch the diagnosis. Chest radiography usually shows diffuse pulmonary infiltrates. Eosinophilia is seen in all patients, as well as increases in serum tumor necrosis factor (de Jesus et al., 2002).

2. The Chronic Pulmonary Diseases of Schistosomiasis

Chronic pulmonary disease is more common in endemic areas and may present as asthma but, more important, pulmonary vascular disease that can result in pulmonary hypertension and right heart failure (cor pulmonale). The latter is one of the debilitating and fatal sequelae of infection (Martinez, 1998)

2.3.2 Pulmonary Vascular Disease Associated With Hemolytic Anemia

Pulmonary hypertension has been reported in various forms of chronic inherited hemolytic anemias like sickle cell anemia, various forms of thalassemia, hereditary spherocytosis, and some forms of microangiopathic hemolytic diseases such as thrombotic thrombocytopenic purpura and hemolytic uremic syndrome (Labrune et al., 1999). The precise cause and pathobiology of pulmonary hypertension in patients with hemolytic anemias have not been well defined. Chronic intravascular hemolysis may disturb nitric oxide bioavailability, promoting endothelial dysfunction, smooth muscle dystonia, enhancement of coagulopathy, and increased oxidant and inflammatory stress, all of which will lead to the development of proliferative changes seen in patients with pulmonary hypertension (Hsu et al., 2006).

2.3.3 Pulmonary Vascular Disease Associated With Cardiac Diseases

Rheumatic valvular heart disease, mainly mitral valve disease, is one of the major causes of pulmonary vascular disease. Although this condition is almost disappearing in the developed world, it is still very prevalent in the developing world. Pulmonary vascular disease is a major complicating factor for patients with congenital heart defects, mainly those with left-

to-right shunts. The major problem in the developing world is late diagnosis and surgical repair (Essop and Nkomo, 2005).

2.3.4 Pulmonary Embolism

Is a clot of material (an embolus) that blocks blood from getting to the lungs. It is usually caused by a blood clot that starts somewhere else in the body and travels to the lungs. However, it can also be caused by clumped cancer cells, fat, or bone. Rarely, while giving birth; a woman can get a clot of amniotic fluid (Armstrong et al., 2017).

2.3.4.1 Symptoms

Symptoms of a pulmonary embolism start suddenly, as soon as the clot starts blocking blood flow to the lungs. Blood is supposed to pick up oxygen in the lungs and then carry that oxygen to the rest of the body. If blood cannot get through to the lungs, it cannot pick up oxygen or deliver it to the body. Every part of the body needs blood and oxygen to survive. Often, the first sign of a pulmonary embolism is syncope (fainting), because the brain is not getting enough blood and oxygen. Other symptoms include: (Mulkareddy and Simon, 2020).

1. Chest pain that feels like a knife sticking into the chest. The pain is often worse when the person breathes in.
2. Trouble breathing
3. Hemoptysis (coughing up blood)
4. Low oxygen saturation (because the body is not getting enough oxygen) (Mulkareddy and Simon, 2020).

2.3.4.2 Risk factors

Deep vein thrombosis – a blood clot in a large vein, like a leg vein – is a risk factor for pulmonary embolism, There are many risk factors that make it more likely for a person to get a pulmonary embolism. For example:

1. Smoking.

2. A type of abnormal heart rhythm called atrial fibrillation (“A-fib”)
3. Recent surgery (after surgery, the body’s blood clotting system works harder than usual, to help heal the body. If clots travel to the lungs, they can cause a pulmonary embolism)
4. Being paralyzed, bedridden, or not able to move around very much
5. Sitting in one place for a long time, like on a long airplane flight (this makes the blood pool in the legs; if a blood clot forms in the leg, it can travel through the blood vessels to the lungs)
6. Recent fracture of one of the long bones in the leg (because having a broken leg makes it harder to move around; also, clots of fat from the bone marrow can escape from the broken bone and travel to the lungs)
7. High levels of estrogen because of pregnancy or some birth control pills
8. Having had a deep vein thrombosis (DVT) – a blood clot in a large vein– before
9. Certain kinds of cancer (some kinds can cause extra blood clotting)
10. Being overweight or obese (Froehling, 2007).

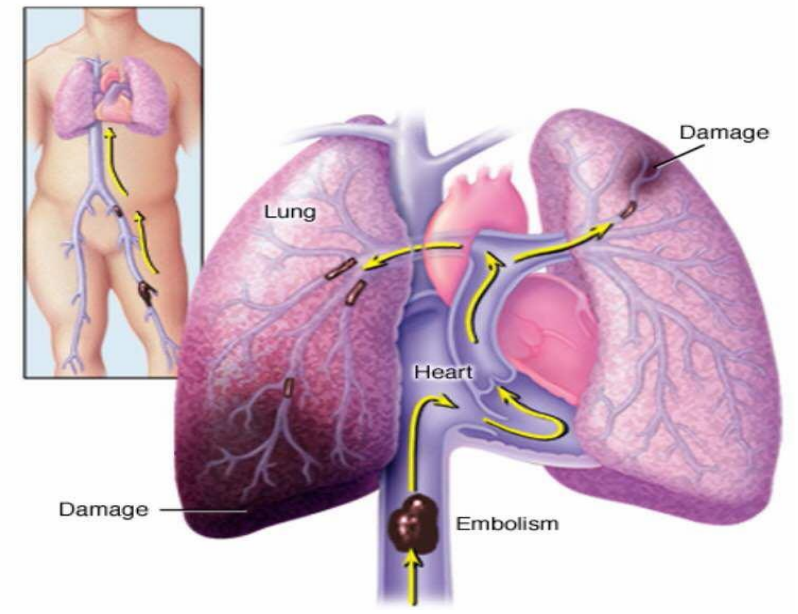

Figure (2.3): *A diagram shows the mechanism of initiation of pulmonary emboli* (Remy-Jardin et al., 1998).

2.4 Radiological Investigation For PE

2.4.1 Chest x-ray

Chest X-rays are often done on people with shortness of breath to help rule-out other causes, such as congestive heart failure and rib fracture. Chest X-rays in PE are rarely normal (Worsley et al., 1993).

2.4.2 Ventilation/Perfusion Scan

Ventilation-perfusion scintigraphy:

(A) After inhalation of 20 mCi of Xenon-133 gas, scintigraphic images were obtained in the posterior projection, showing uniform ventilation to lungs.

(B) After intravenous injection of 4 mCi of Technetium-99m-labeled albumin, scintigraphic images shown here in the posterior projection. This and other views showed decreased activity in multiple regions.

A ventilation/perfusion scan (or V/Q scan or lung scintigraphy) shows that some areas of the lung are being ventilated but not perfused with blood (due to obstruction by a clot) (Guttman, 2012). This type of examination is as accurate as multislice CT, but is less used, due to the greater availability of CT technology. It is particularly useful in people who have an allergy to iodinated contrast, impaired renal function, or are pregnant (due to its lower radiation exposure as compared to CT) (Scarsbrook and Gleeson, 2007).The test can be performed with planar two-dimensional imaging, or single photon emission tomography (SPECT) which enables three-dimensional imaging (Stein et al., 2009).

2.4.3 CT Pulmonary Angiography

CT pulmonary angiogram (CTPA) is a medical diagnostic test that employs computed tomography (CT) angiography to obtain an image of the pulmonary arteries, Its main use is to diagnose pulmonary embolism (PE) (Fedullo and Tapson, 2003).

Modern MDCT (multi-detector CT) scanners are able to deliver images of sufficient resolution within a short time period, such that CTPA has now supplanted previous methods of testing, such as direct pulmonary angiography, as the gold standard for diagnosis of pulmonary embolism (Apfaltrer et al., 2011).

2.4.3.1 Technique Used

Axial images, Patient supine, Feet first, arms raised, Scan from above lung apices to below diaphragm routinely 1– 3mm cuts (Anderson et al., 2007).intervals, depending on the nature of the scanner (single- versus multidetector) (Anderson et al., 2007).

An intravenous cannula is required for the administration of iodinated contrast. The typical dose is 30-40g of iodine (corresponding to 20-30 cc of 370 mg/ml iodine solution) (Saleem, Vaidya Nathan and Chowdhury, 2015). However, for patients at high risk of contrast-induced nephropathy, it is possible to reduce the required amount of contrast using dual energy CT. With such a protocol, only 7-10g of iodine (20-30 cc of 370 mg/ml iodine solution) may be needed (Saleem, Vaidyanathan and Chowdhury, 2015).

2.4.3.2 Contraindications

CTPA is less desirable in pregnancy due to the amount of ionizing radiation required, which may damage the breasts, which are sensitive during pregnancy and the effects of iodine on the fetus (Drucker et al., 1998).

CTPA is also contraindicated in known or suspected allergy to contrast media or in kidney failure (where contrast agents could worsen the kidney function) (Anderson et al., 2007).

2.4.3.3 Feature of PE in CT Scan

On CTPA, the pulmonary vessels are filled with contrast, and appear white. Any mass filling defects (embolus or other matter such as fat) appears darker. Ideally, the scan should be complete before the contrast reaches the left side of the heart and the aorta, as this may mean

contrast has drained from the pulmonary arteries, or require a larger dose of contrast media (Hoey et al., 2011).

2.5 Previous Studies

- A study conducted by *Robert, etal, (2010)* aimed the differences in clinical presentation of pulmonary embolism in women and men, the analyzed data concluding that from a total of 3414 outpatients with suspected PE. The study population comprised 1940 women (57%; mean age 60 ± 17) and 1474 men (43%; mean age 60 ± 20). The diagnosis of PE was confirmed in 773 patients (22.6%): 432 out of 1940 women and 341 out of 1474 men (22.3% vs. 23.1%; P = 0.55). Thromboembolic risk factors, symptoms and clinical signs according to gender are presented personal or family history of venous thromboembolism, or varicose veins was more commonly found in women. Among PE diagnosed by CT, the most proximal level was troncular in29%, lobar in 37%, segmental in 30% and multiple subsegmental in 4%, without17 any significant difference between genders. However, the proportion of PEassociatedproximal DVT was higher in men than in women: 43% of mencompared with 33% of women had an associated proximal DVT (P = 0.009) (ROBERT-EBADI et al., 2010)

- A study conducted by *M.T, etal, (2014)* aimed to study 313 PE patients; 56% were women and the median age was 70 years (interquartile range 53-78 years). Central PE accounted for 68% of cases; segmental and subsegmental PE, for 25% and 7%. Patients with subsegmental PE was younger had lower comorbidity and none of them presented proximal DVT (Table 1). Patients in the subsegmental PE group included 10 (45%) with single PE and 12 (55%) with multiple PE. Prevalence of sub segmental PE was 7%, similar to that reported by other authors.5 No significant gender difference was found in terms of the extent of the disease; however, the proportion of women is slightly higher in our sample. The age of patients with sub segmental PE was lower than that of patients with central and segmental PE. The difference could be related to hyper coagulation and the changes in vascular endothelium that come with aging19: these could facilitate the extent of thrombi in older patients, especially

considering that no age difference was found in the prevalence of risk factors for PE (García-Sanz et al., 2014).

- A study conducted by *Horlander et al., (2003)* aimedthe development of PE is not restricted to a particular gender. There is no consensus regarding any specific gender conferring a higher risk of developing PE.The race of the patient also plays a significant role in inducing PE, whereby its incidence appears to be considerably higher in the black population compared to the white population (Horlander, Mannino and Leeper, 2003)..

- A study conducted by *Silverstein et al., (1998)* aimed that A 25-year analysis by demonstrated that the elderly tend to have a higher rate of occurrence of PE. One theory proposes that the cumulative risk factors that patients acquire in advancing age are some of the contributing causative factors (Silverstein et al., 1998).

- A study conducted by *Kline and Runyon, (2005)* aimed that patient presenting with possible PE may become a nightmare for the treating physician. It may culminate in significant morbidity and mortality, yet is difficult to diagnose. The wide range of non-specific signs and symptoms may result in the diagnosis being missed. As many as 400,000 cases may be missed annually in the United States (Runyon, Sanapareddy, Gellar and Kline, 2005).

- A study conducted by *Leblanc & Paul, (2010); Roach et al., (2010)* Challenges related to the performance of CTPA include the risk of complications from iodinated contrast due to allergic reactions, as well as the high thoracic radiation dose. This is a major concern especially in pregnant patients, and patients with impaired creatinine clearance (Leblanc & Paul, 2010; Roach *et al.,* 2010a). Although significant adverse events occur in less than 1% of patients, this incidence may increase up to 50% if the patient has severe chronic renal disease (Leblanc & Paul, 2010). Neonates that have been exposed in utero to iodinated contrast may develop depressed thyroid function (Leblanc & Paul, 2010). It is thus recommended to monitor thyroid functions in these patients (Roach et al., 2010).

Chapter Three

Chapter Three

Materials and Methods

3.1 Materials

3.1.1 Study Design

Descriptive study was conducted.

3.1.2 Study Area

The study was conducted in Khartoum state, included hospitals

1. Royal care (siemens).
2. Almoalem hospital (Toshiba).

3.1.3 Study Duration

From September to October 2021.

3.1.4 Study Population

Fifty Sudanese patients underwent for CTPA.

3.1.5 Inclusion and exclusion criteria

This study was aggregated from medical report of patients having pulmonary embolism, No excluded patients.

3.2 Methods

3.2.1 CTPA imaging procedure

Patient Preparation

1. Patient's laboratory result of the renal function tests most be in the normal.
2. All patients were asked to continue adequate simple fluid intake up to 3 hours prior to examination to ensure adequate hydration.
3. Patients were taught how to hold breath during examination when requested.

3.2.2 Technique

Patients positioned supine on the CT table in the “foot first” position with an 18-20 gauge cannula placed into a superficial vein within the antecubital fossa, a two scouts were acquired, anteroposterior and lateral, the examination was planned on these scouts from the level of mid of the neck till the upper abdomen and the patients were requested to hold their breath during the first 20 seconds of the acquisition.

The technical parameters will be sassed (kV, mAs tube rotation/s), the acquisition timing for optimum opacity is achieved by using automatic bolus tracking in region of interest placed on an artery the ROI is placed on the pulmonary artery just below the tracheal carina , the trigger level is set at 80 Hounsfield units.

This study will evaluate the variation of contrast media used volume of low osmolar non-ionic contrast medium. Before dynamic CT was performed, high resolution CT (HRCT) images were obtained. One –mm- thick imaged were taken at 10-mm spacing from lung apexes to lung bases, with the patient breathing out fully for each image. Then 100 ml of iodinated contrast medium (Omnipaque 300 mg/ml) was intravenously injected with a power injector at rate 5 ml/sec. The scanning was then performed from the lung apexes to the middle pole of the kidneys. Smart preparation technique scanning delay was automatically determined with bolus tracking in the pulmonary trunk , and only after the contrast medium injection and subsequent waiting for density of in the pulmonary trunk to be over 80 HU was the starting scan used. The region of interest (ROI) was placed in the in the pulmonary trunk. The scanning parameters were a collimation of 1.25 mm, a table speed of 34.375 mm/sec and a pitch of 1.375. Axial slices were reconstructed with a slice width of mm and a slice interval of 5.0 mm. Then, the 0.625 mm reconstructed raw data of the dynamic CT images were sent to the CT workstation (Advantage Window 4.4).

3.2.3 Data collection and Analysis

The data of patients were obtained by a data collect sheet from medical report used to collect a various information and these variables were age, gender, Medical History (DM, HTN or both), affected of pulmonary embolism (Right, Left, or Bilateral), affected vessels by the emboli is the central or peripheral (segmental or subsegmental)and the type of embolism. The obtained data were then analyzed using SPSS software program.

3.2.4 Ethical considerations

1. It will be sought from SUMASRI Institutional Review Board (SIRB).
2. No identification or individual study was published.

Chapter Four

Chapter Four

Results

Table (4.1): Show the Frequency distribution of age groups:

Age	Frequency	Percent
30-40	8	16%
41-50	7	14%
51-60	14	28%
61-70	15	30%
71-80	3	6%
81-90	3	6%
Total	50	100%

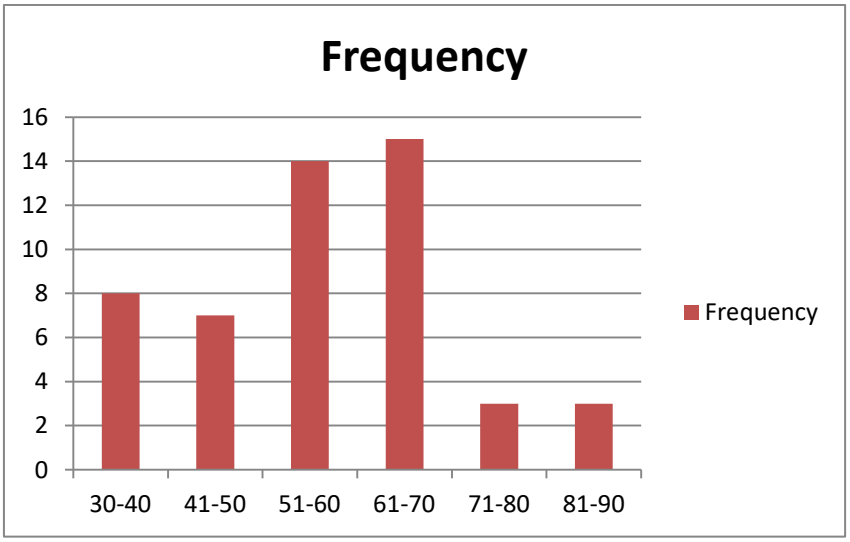

Figure (4.1): Show the Frequency distribution of age groups.

Table (4.2): Show the Descriptive statistic of the age group:

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
Age Group	50	30	85	57.72	13.459

Table (4.3): Show the Frequency distribution of gender:

Gender	Frequency	Percent
male	18	36%
female	32	64%
Total	50	100%

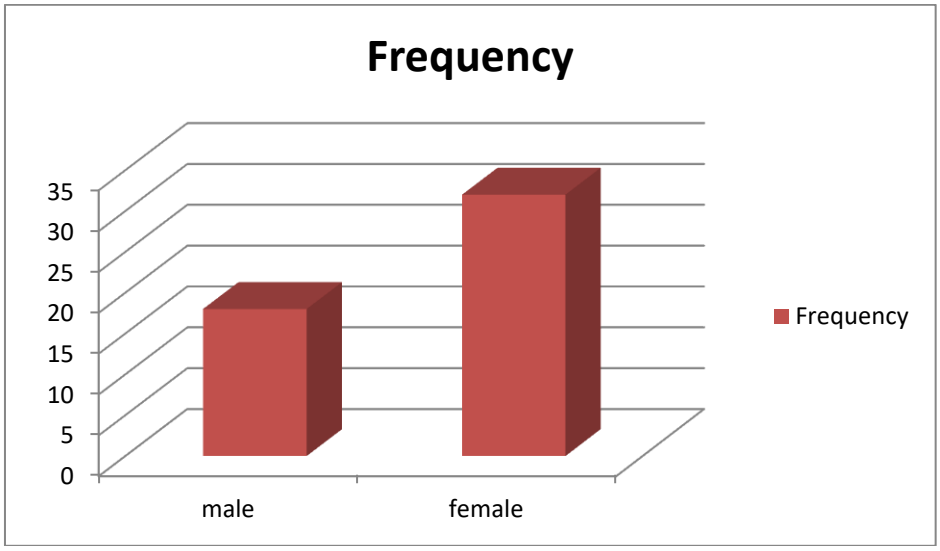

Figure (4.2): Show the Frequency distribution of gender.

Table (4.4): Show the Frequency distribution of characteristic of PE:

Characterization of PE	Frequency	Percent
central	21	42%
peripheral	29	58%
Total	50	100%

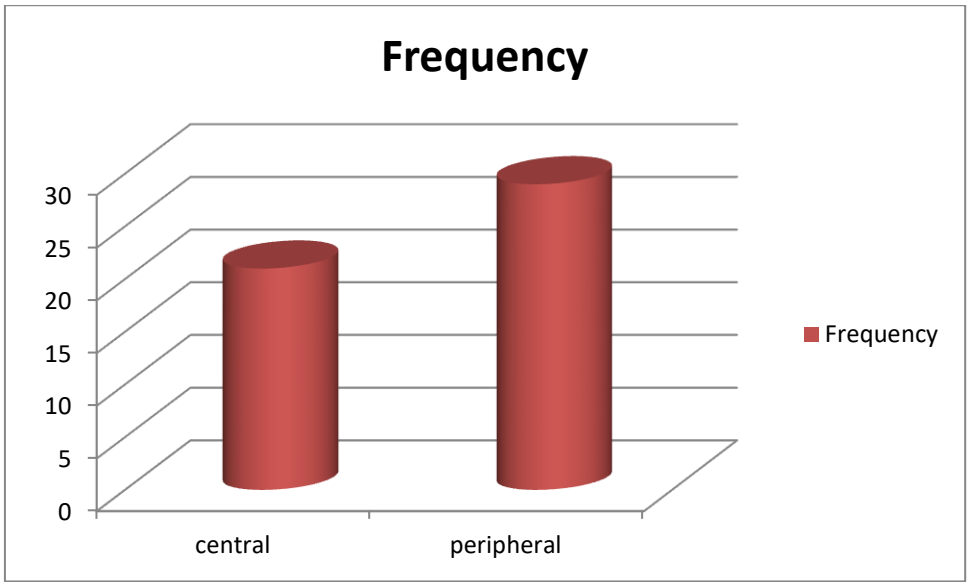

Figure (4.3): Show the Frequency distribution of characteristic of PE.

Table (4.5): Show the Frequency distribution of the medical history:

Medical history	Frequency	Percent
None	23	46%
DM	5	10%
HTN	16	32%
Both	6	12%
Total	50	100%

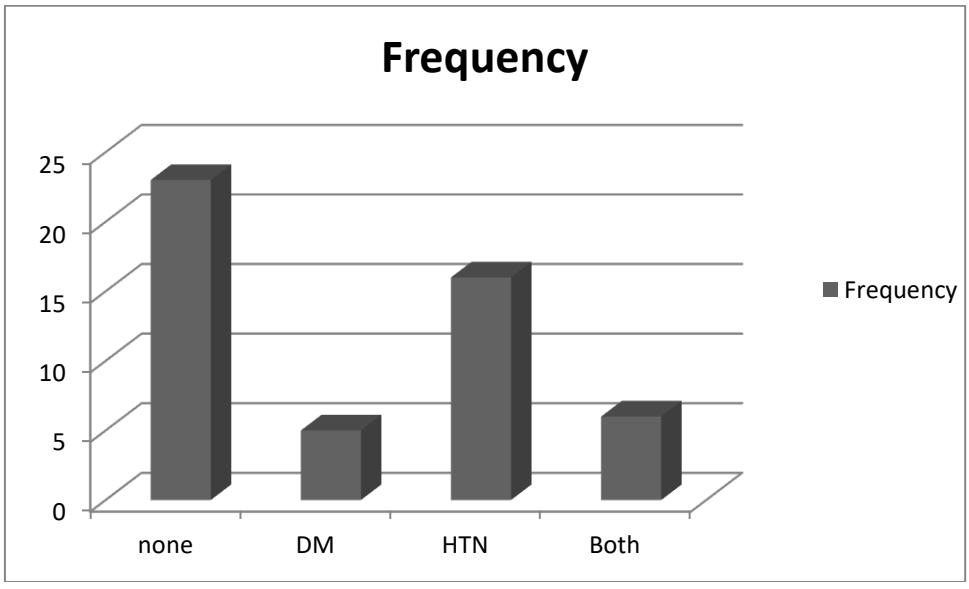

Figure (4.4): Show the Frequency distribution of the medical history.

Table (4.6): Show the site of Pulmonary Embolism:

Site of PE	Frequency	Percent
right	13	26%
left	8	16%
bilateral	29	58%
Total	50	100%

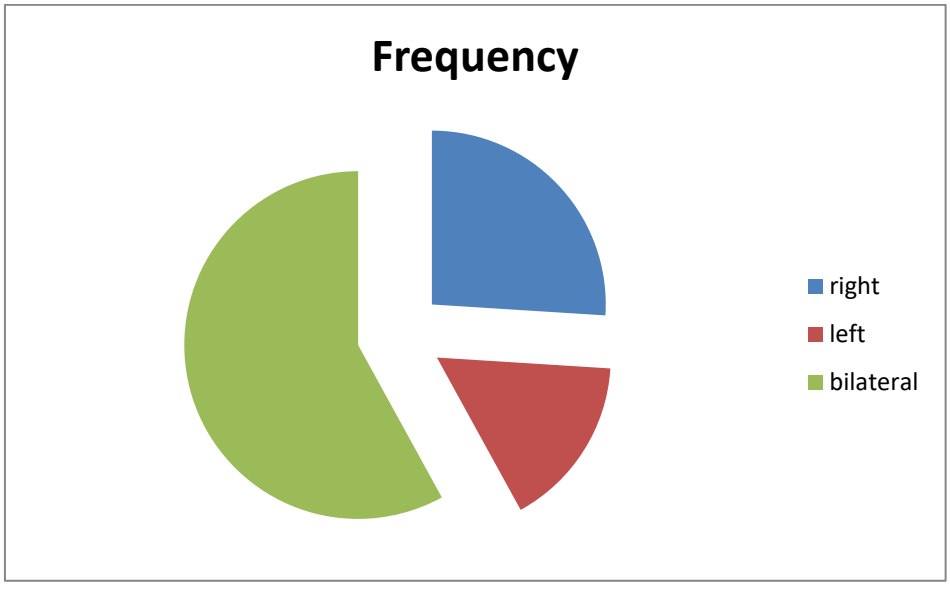

Figure (4.5): Show the site effect of Pulmonary Embolism.

Table (4.7): Show the Frequency distribution of the type of pulmonary embolism:

Type of PE	Frequency	Percent
Saddle PE	2	4%
Lobar PE	14	28%
Distal PE	29	58%
Massive PE	5	10%
Total	50	100%

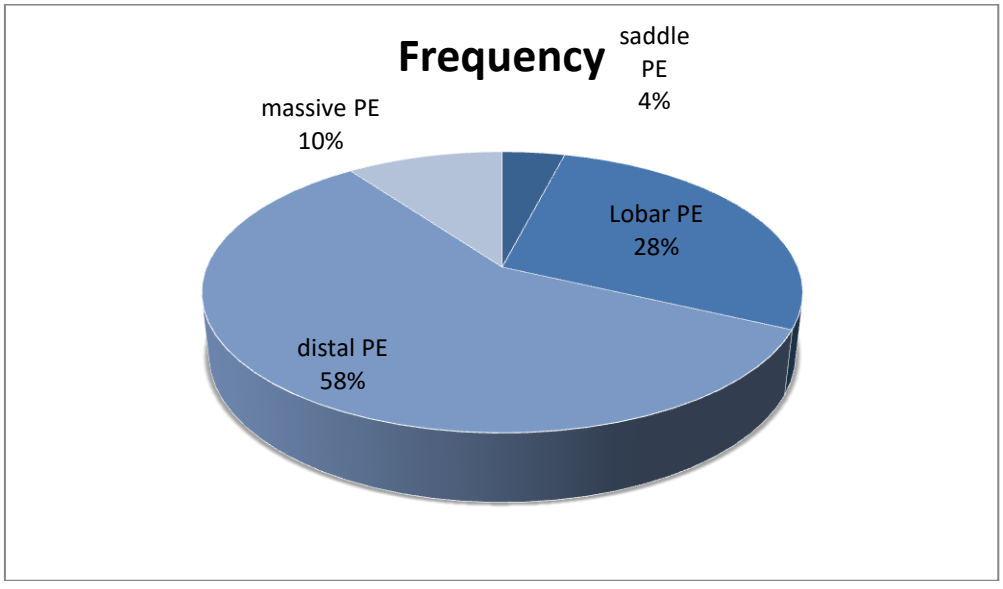

Figure (4.6): Show the Frequency distribution of the type of pulmonary embolism.

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Table (4.8): Show the gender * site of PE Cross tabulation:

Gender	Site of PE			Total
	Right	Left	Bilateral	
Male	1	4	13	18
Female	12	4	16	32
Total	13	8	29	50

Table (4.9): Show the Relation between the gender and the site of PE:

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.183[a]	2	.045
Likelihood Ratio	7.309	2	.026
Linear-by-Linear Association	4.491	1	.034
N of Valid Cases	50		

Table (4.10): Show the medical history * the gender cross tabulation:

		Medical History				Total
		none	DM	HTN	Both	
Gender	male	11	1	3	3	18
	female	12	4	13	3	32
Total		23	5	16	6	50

Chapter Five

Chapter Five

Discussion, Conclusion and Recommendations

5.1 Discussion

The diagnosis of PE is a major challenge to the emergency care physician. In the United States, it is the third most common cause of death, with an incidence estimated at 600,000 patients per year (Worsley et al., 1993).

This study was conducted in almoalem hospital and Royal care hospital. The sample was distributed by the frequency and their percentage. The study constitutes of 50 patients having pulmonary embolism. The sample was classified according to the gender 18 males(36%) and 32 females(64%) and this was presented in table (4.3) and figure(4.2). with percentage of female more than male, the similar result that mentioned female more affected than male by Robert Ebadi, et. al. (2010) and present the percentage of female (57%) and male is(43%).

The sample according to the age group was presented in table (4.1) and figure (4.1) that the age group from 61-70 have a higher percentage of patients having PE (30%), and a group age from 51-60 having (28%), and the age group from 71-80 and 81-90 having similar lower percentage (6%). according to the samples the maximum age is 85 and minimum age is 30 table (4.2).

The affected artery was presented in table (4.6) and figure (4.5), and the study showed that the arteries is more affected bilaterally 29 patients with percentage (58%), right and left (26%), (16%) pulmonary artery respectively. Study is also showed the affected vessels by emboli peripherally (58%) more than central emboli (42%) these were presented in table (4.4) and figure (4.3).

The sample according to the medical history (DM, HTN or both) was presented in table (4.5) and figure (4.4) shows that the hypertensive patients have 23% and diabetic patients having 10%, and 12% have both DM and HTN.

The type of PE (saddle PE-massive PE- distal PE- lobar PE) was presented in table (4.7) and figure (4.6) and the study showed that the distal emboli is more common (58%), and the lobar emboli having 28% and massive emboli having 10%, the saddle emboli is more rare which have 4%.

Table (4.8) show cross tabulation of site of PE (right, left or bilateral) findings and the Gender (male or female) findings, and a table (4.9) show the relation between them and Chi-Square were found There is relations between site of PE (right, left or bilateral) and the Gender (male or female Cross tabulation because the significant value less than 0.05, were statistical significant was 0.045.

5.2 Conclusion

The study concluded that the women are more likely to develop PE than men, and the embolus in this study is located bilaterally (Right and Left) of the pulmonary artery more than right or left pulmonary artery itself, and a peripheral embolus is more common than the central.

The age group at highest risk of pulmonary embolism is between 61-70 years old, and The hypertensive patients are more likely to develop pulmonary embolism than the diabetic patients

The common type of pulmonary embolism is distal PE, and the saddle embolism is the rarest type.

According to the results of the study, there is a relationship between the gender of the patients and the site of embolism, the women have higher rates of pulmonary embolism in the right pulmonary artery and bilaterally, and the men effected more bilaterally and in the left pulmonary artery .

5.3 Recommendations

1. For further study it's recommended to increase sample size to get more confirmed result.
2. Pulmonary CTA is a good stander modality in detection of pulmonary embolism but still need another investigation to support the diagnosis.

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Appendices

Appendix (A)

Data collecting sheet

General Patients Data:-

ID	Age	Gender	(C /P)	(R/L/Bi)	(HTN/DM/both)	Type of PE

Appendix (B)

CT IMAGES

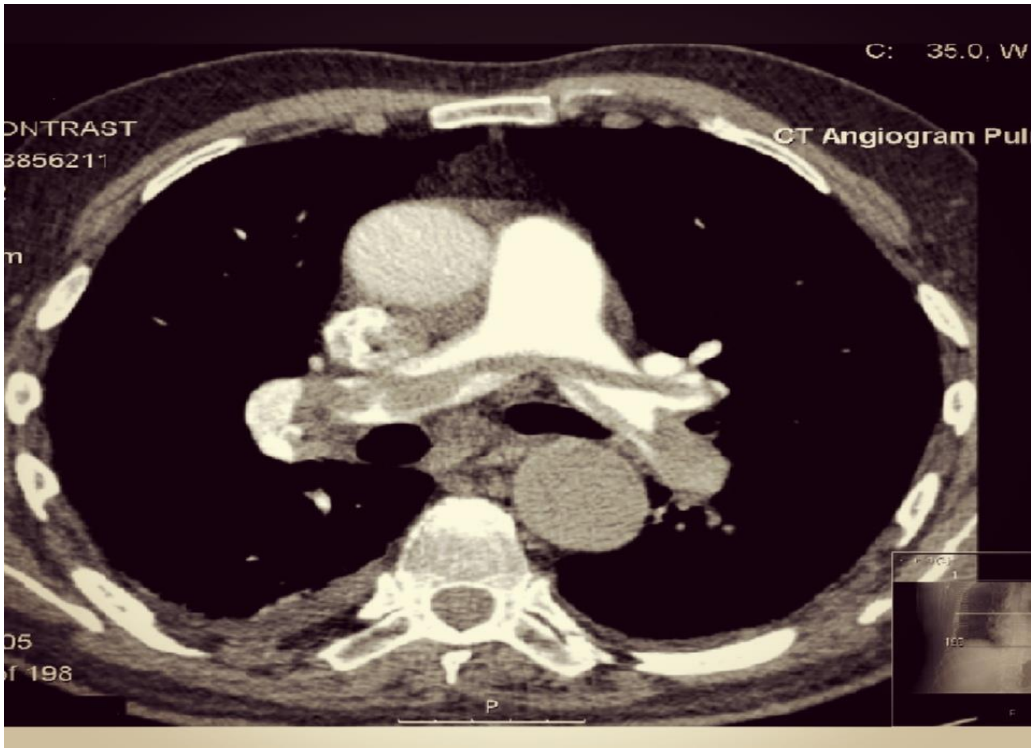

Image (1) : patient have chest pain and severe dyspnea 60 years male, this image showing large intra-luminal filling defect (saddle PE). Axial CT scan.

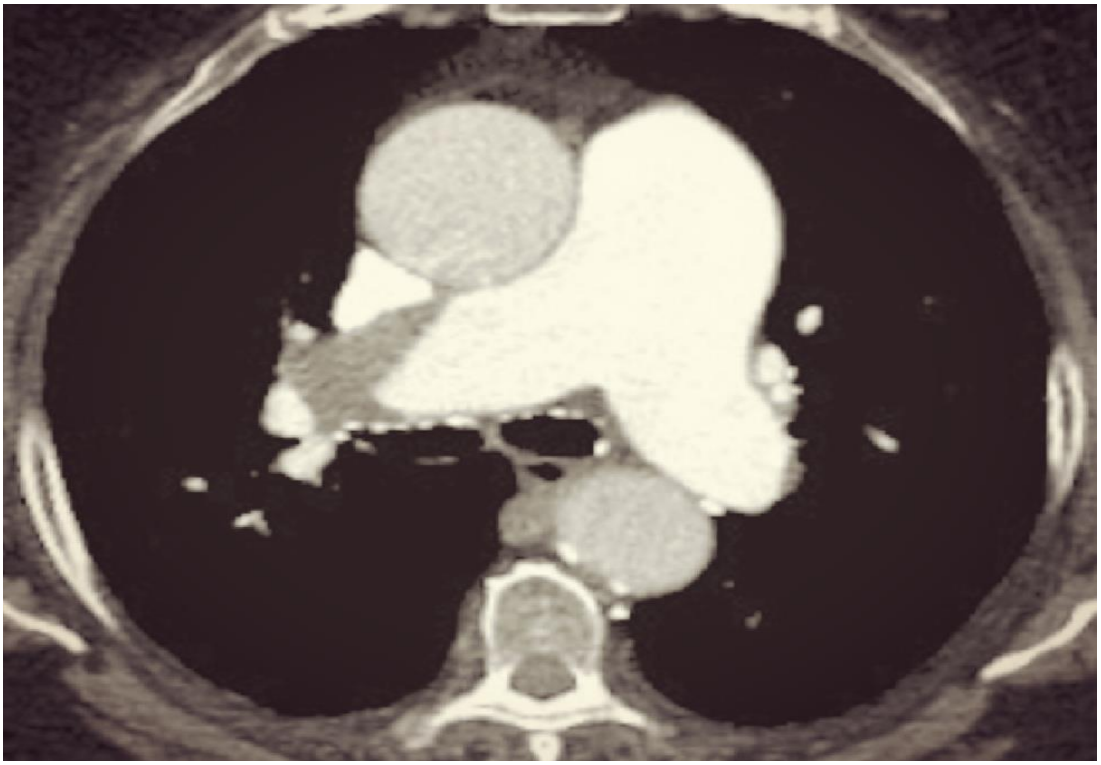

Image (2) : patient with PE an 86 year –old female patient with a history of breast cancer. Axial CT scan showing a filling defect with obtuse margin in the right pulmonary artery