ASSOCIATION OF CLINICAL CRITERIA AND COMPUTED TOMOGRAPHY PULMONARY ANGIOGRAM FINDINGS IN PATIENTS SUSPECTED TO HAVE PULMONARY EMBOLISM

BY

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CERTIFICATION AND DECLARATION OF COPYRIGHT

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The following supervisors certify that the following proposal is an original work of the named candidate to be conducted under their direct supervision. The proposal is titled 'Association of clinical criteria and Computed Tomographic Pulmonary Angiography findings in patients suspected to have pulmonary embolism' as partial fulfillment of the requirements for the degree of masters of medicine in diagnostic radiology.

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ABBREVIATIONS AND ACRONYMS

ALARA…………………….As Low As Reasonably Achievable

ACR………………………American College of Radiologists

ANOVA…………………..Analysis of Variance

CAD………………………Coronary Artery Disease

CTPA……………………Computed tomography pulmonary angiography

DRC……………………….Democratic Republic of Congo

DVT………………….…….Deep venous thrombosis

ESR………………………..European Society of Radiologists

HIV……………………….. Human Immunodeficiency Virus

HRT………………………..Hormone Replacement Therapy

KNH……………………….Kenyatta National Hospital

NH…………………………Nairobi hospital

NHIF……………….……..National Hospital Insurance Fund

PAD……………………….Peripheral arterial disease

PE………………………….Pulmonary Embolism

RESPECT-ED…………….Rates of pulmonary emboli and subsegmental pulmonary emboli

with modern computed tomograms in Emergency Departments

RCR………………………Royal College of Radiologists

SSPE……………………Subsegmental pulmonary embolism

USA………………………United States of America

VTE……………………….Venous Thrombo- Embolism

ABSTRACT

Background

Pulmonary Embolism (PE) is a frequently encountered emergency condition. It brings forth challenges during diagnosis because other conditions can mimic pulmonary embolism. Various diagnostic tools are used for diagnosis including clinical criteria combined with laboratory investigations or diagnostic imaging examinations.

Computed Tomography Pulmonary Angiography (CTPA) is a recommended test to confirm diagnosis. Previous studies done in various centers show that the yield of PE from CTPAs done have been unexpectedly low. This means that many patients who undergo these tests end up with a negative outcome, a grave concern considering CTPA exposes the patients to ionizing radiation, extra medical costs and risks of contrast use among other concerns. .

Study Objective

This study targets to find out the local yield of CTPAs done for pulmonary embolism and correlate the findings of the CTPA with the clinical presentation of the patients using Wells criteria which is a clinical recommended diagnostic tool. Essentially, the study will help to ascertain whether the patients who are sent for CTPA currently actually require the test and if the clinical scoring criteria helps to identify the patients likely to benefit from the test. The study would also seek to find out the overall yield of CTPAs done to negate or confirm the assumption that excessive and unnecessary CTPAs are being done currently.

Methodology

A prospective analytical study was done at Kenyatta national hospital, radiology department from December 2019 to April 2020. Patients referred to the radiological department

for a CTPA study to rule out pulmonary embolism fulfilled the inclusion criteria. These were enrolled into the study. Once enrolled, the demographic information of the patient was taken, then the Wells score was recorded (with the information gathered from patient clerking, primary doctor or the patients hospital file). The CTPA findings were read and findings recorded in the patient's data collection sheet. All the reported CTPAs were verified by a consultant radiologist before being accepted as part of the study data. Standardized reporting protocol was used in all the cases. Data was analyzed using SPSS version 23, Microsoft Access and Excel it was then represented on tables and graphs. Analysis involved was done to compare the Wells score findings and CTPA for each patient. Significance was defined as $p<0.05$.

Outcome:

A total of 103 participants were recruited into the study. Their ages ranged between 17 years and 95 years. The median age was 44.0 years and the mean age 46.2 years. The male: female ratio was 1:2.4. Most of the participants were in the 36 - 45 years age group in both sexes. The patients were derived from emergency department and in patient. The CTPA yield was found to be 34%. The male: female ratio of patients with positive PE on CTPA was 1:1.4. A myriad of additional and alternative diagnosis explaining the symptomatology were found in 86.4 % of the participants. There was no statistically significant difference between the clinical criteria and CTPA findings.

Conclusion and Significance of the study:

There was a positive correlation of the clinical stratification method used with the radiological findings meaning that the Well's score can be used with combination with other clinical methods to rule out patients unlikely to benefit from a CTPA. The CTPA yield for PE was 34%, within the

recommended level as outline by Royal College of Radiologists and comparable to similar studies in Africa.

The knowledge gained will be useful in the development of clinical imaging guidelines for imaging in suspected PE.

CHAPTER 1

 INTRODUCTION

Pulmonary Embolism refers to embolic occlusion of the pulmonary arterial system. It poses a diagnostic challenge to clinicians because of its ambiguous and non-specific clinical presentation. PE, being an emergency condition, requires one to have high index of suspicion to allow for quick and accurate diagnosis. Prompt diagnosis is necessary because a patient with PE can easily end up as a mortality if not assessed in the right and timely way. On the downside the clinicians can easily end up over-investigating patients with any symptom suggesting PE. This has been shown in several studies, the CTPA as a diagnostic tool for PE has been overused [1,2](Smith et al., 2016; Wiener, Schwartz & Woloshin, 2011). Hence, a large percentage of patients sent for CTPA did not require it as evidenced by the lower than recommended yield rate of all CTPAs done.

CTPA is a benchmark diagnostic test for PE. On the downside, it is costly, invasive, and not easily available in many medical centers, especially in a developing country (Wells et al., 1998)[3]. Cost of medical care in this region is a concern and there is a need to reduce the cost of care by prudent choices. To achieve this, medical practitioners need to refer patients for only those tests that will benefit them and by using guidelines that will reduce the chances of sending patients for unsuitable tests.

The optimal approach to investigating suspected pulmonary embolism should combine clinical judgment, lab investigations and relevant imaging. Clinical judgment may lack standardization; hence the use of clinical prediction rules is key. Well's criteria for instance has been validated and is based on readily available information. The criteria are used to conclude diagnosis as low, moderate, or high clinical probability of PE and a two-category scheme (PE

likely or unlikely) (Wells, 2013; Heit et al 2000)[4]. The Wells criteria used by most clinicians for the diagnosis of PE are suitable for the black population in this part of the world. Wells Criteria is an objective way to establish patients who have high or intermediate probability of having PE and therefore cut down on the number of the patients sent for unnecessary CTPAs.

The purpose of this study is to ascertain the yield of the CTPAs investigating for PE done at a referral hospital in Nairobi and to check if the clinical criterion being used helps to correctly pick out patients likely to have PE. This would eventually contribute to the development of local diagnostic imaging guidelines for PE. The established association between these criterion and CTPA findings will also be a form of audit on whether the use of clinical scoring is used before the decision is made to do a CTPA.

LITERATURE REVIEW

Epidemiology of PE

Pulmonary embolism (PE) is a condition affecting the pulmonary arterial vasculature presenting with total or partial obstruction by blood clots that are usually dislodged from the large veins of the lower extremities. It is a serious cause of mortality in both surgical and non-surgical patients. Due to its ambiguous clinical presentation, the disease is diagnostically challenging to clinicians. While in some cases the presence of PE may be an incidental finding, in others, it may remain asymptomatic, or its first clinical presentation may be sudden death (Cohen et al, 2007; Heit et al 2000)[56]. PE has been noted as a major cause of mortality in Europe with over 317,000 deaths recorded in the European Union countries in 2004 (Cohen et al,2007), and in the United States with over 100,000 deaths directly or indirectly related to the PE annually. It is the 3rd leading cause of cardiovascular associated mortality in the United States of America (Tarbox & Swaroop, 2013)[7].

Undiagnosed PE has been a major basis of fatality in the cases presented above. Take for instance, the case of Europe, 59% of the death resulted from PE that was not diagnosed during life and 34% of the cases presented sudden death (Cohen et al., 2007). These findings are not far from those of studies across Africa, which have shown high rates of PE mortality among the African population. In a systematic review of 21 studies focusing on venous thromboembolism (VTE) epidemiology in Africa, Danwang et al. found a mortality rate of PE between 40% and 69.5% proving that PE is not uncommon in Africa (Danwang et al 2017)[8]. Ogeng'o et al. found a mortality rate of 28.1% in a retrospective study carried out in a Kenyan tertiary referral hospital-Kenyatta National Hospital (KNH). The study was done for cases attended to between 2005 and 2009 (Ogeng'o et al, 2011)[9].

Natural history of PE

As PE is the most extreme presentation of thrombi embolization, majority of the existing data on the disease are accrued from studies on VTE in its entirety. PE typically results from deep venous thrombosis (DVT) of lower extremities and is the most frequent cardiovascular disease (Cohen et al, 2007). Though very preventable, PE can lead to chronic disease, disability, or even death (Klok et al, 2010; Condliffe et al, 2009)[10] [11]. Patients experiencing DVT in the proximal leg veins are at a higher risk of developing PE than those with DVT of the isolated calf. Hence, distal clots are reported to have a considerably lower embolic potential (Sule et al, 2009)[12].

DVT may also originate in the iliac or common femoral veins and may extend in a cephalic direction. In this case, it is referred to as Iliofemoral DVT and may extend to the inferior vena cava and ultimately to the pulmonary arterial system. Iliofemoral DVT occurs in patients who are anatomically predisposed to venous stasis. For instance the May-Thurner syndrome is an adequate description of such a scenario where the left iliac vein is compressed between a vertebral body and the right iliac artery (Foley, Waldo & Armstrong, 2015)[13]. This causes a higher risk of DVT in the left extremity. On the other hand, the extrinsic compression of iliac veins can occur with various mechanisms such as trauma or pelvic malignancy, and on either leg.
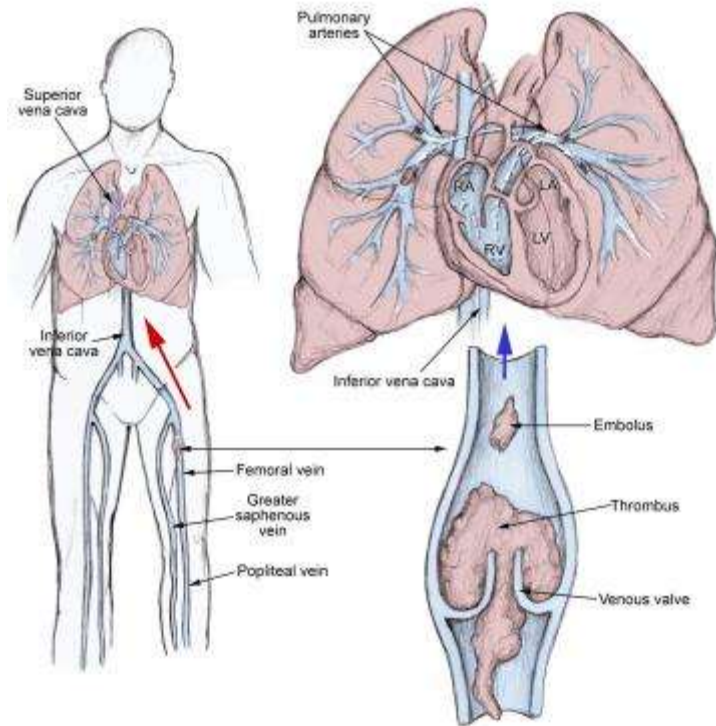
Figure 1: The venous thrombi mainly originate in venous valve pockets and at other sites of apparent venous stasis. The thromboemboli travel through the venous system right side of the heart and to the pulmonary artery where it progressively narrows the vessel to total occlusion causing a VQ mismatch. The vascular bed beyond this point is deprived of profusion. Image retrieved from https://emedicine.medscape.com/article/300901-overview

Patients with iliofemoral DVT may also have Virchow's triad of thrombogenesis (Golan, Tashjian & Armstrong 2011)[14]. This consists of increased chances of coagulation, hemodynamic changes (stasis or turbulence), and endothelial injury or dysfunction. Such instances include long surgical operations, prolonged immobility during travel, varicose veins, endothelium trauma, pregnancy, and obesity among others.

Clinical presentation of PE

Signs and symptoms of PE are non-specific and largely depend on the size of the embolism and co-morbidity, hence, may escape prompt diagnosis. PE may be one of the most misdiagnosed conditions in many hospitals; patients with PE can also test negative during diagnosis. In many cases, PE is asymptomatic and is revealed incidentally during the diagnosis

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of another disease, and worse still, during an autopsy. Only about 40% of the patients with VTE present with classic PE symptoms. PE symptoms include dyspnea (new or worsening) pain in the chest, or low blood pressure with no other cause (McRae, 2011)[15]. In most cases, during the diagnosis of PE, dyspnea is usually the first suspect symptom of PE, in addition to pre-syncope or syncope, chest pain, and haemoptysis (Stein & Henry, 1997; Morrone & Morrone, 2018)[16] [17]. Though intermittent, shock and arterial hypotension are significant in the diagnosis as indicators of central PE or haemodynamic abnormality.

Dyspnea in central PE may be acute and severe, while in Subsegmental Pulmonary Embolism (SSPE) it presents as mild and transient (Konstantinides et al, 2014)[18]. Among patients with pre-existing heart failure and pulmonary disease may only present with worsening dyspnoea. On the other hand, dyspnea may be absent even in patients with circulatory collapse (Stein et al, 2007)[19]. Dyspnea, Syncope and hypotension usually indicate massive PE while chest pain, cough and hemoptysis indicate a smaller and peripheral emboli present in patients with pulmonary infarction. Chest pain in PE is caused by pleural irritation resulting from distal emboli triggering pulmonary infarction. Central PE may clinically be confused with angina especially due to right ventricular ischaemia, or aortic dissection.

Clinicians' awareness of risk factors is crucial for more effective and efficient discernment of PE. The likelihood of a patient being positively diagnosed with PE is more when they have more predisposing factors (Anderson Jr. & Spencer, 2003)[20]. On the other hand, it is reported that no risk factors can be detected in more than a quarter of patients with PE (Stein et al, 2007).

Risk factors

The diagnosis of PE has to be intentional for the disease to be detected. All tests for PE are specific to its symptoms and the physician has to discern the likelihood of the patient presenting PE to order for testing. This makes the PE very easy to miss, if its clinical presentation is vague. The awareness of the predisposing factors to PE is, therefore, crucial for one to increase their index of suspicion.

Genetic factors that provoke PE include history of thrombi in the family, personal history of recurrent blood clots, and personal history of inexplicable miscarriages (Crous-Bou, Harrington & Kabrhel, 2016)[21]. Acquired risk factors include smoking, cancer, pregnancy, and hormonal contraception especially estrogen based and Hormonal Replacement Therapy (HRT), obesity and immobility due to illness or after surgery among others. Diseases that predispose patients to PE include atherosclerosis, diabetes, metabolic syndrome, atrial fibrillation, obesity, heart failure, vasculitis, DVT, peripheral artery disease (PAD). Other risk factors include use of medication such as Human Immunodefiency Virus (HIV) treatments and estrogen based contraceptives, pregnancy, increase homocysteine levels, smoking, dehydration, etc.

Diabetes mellitus. Acute or chronic hyperglycemia triggers the coagulation cascade and the result is hypo fibrin development that causes PE (Demir et al., 2017)[22]. In addition, impaired glucose tolerance and stress hormones cause high blood sugar levels and present a risk factor for PE. Hence, the presence of diabetes mellitus increases the risk of developing PE.

Pregnancy and HRT are among risk factors listed in the National Health Commission venous thromboembolism prophylaxis and treatment guide. Anatomical and physiological changes that occur during pregnancy increase PE risk and should be considered during diagnosis include hyper coagulopathy, development of thrombus, venous stasis, pressure on inferior vena

cava and pelvic veins, and reduced venous blood flow. In addition, a case of prolonged pregnancy or any condition that would interfere with blood circulation would predispose the patient to PE, particularly in the third trimester or the sixth week of pregnancy. Coughing during pregnancy also increases the prevalence of PE. Demir et al., 2017 state that HRT treatment may cause an increase in blood components due to proliferative properties of estrogen, fluctuations in triglyceride-cholesterol metabolism as well as a number of diseases resulting from prolonged estrogen usage.

Orthopedic procedures. History of Orthopedic surgery in patients increase the risk for of VTE. Procedures such as hip and knee replacements cause the highest risk especially if they are not put under anticipatory prophylaxis. This is due to endothelial damage and immobility. DVT in patients without prophylaxis is 40–84% after knee surgery (Kim et al, 2010)[23].

Cancer poses a high PE risk especially of the lung. Hematological malignancies, lung cancer, gastrointestinal cancer, pancreatic cancer, and brain cancer usually carry the highest risk (Demir et al, 2017).

Gender can be a risk factor when combined with other factors. For instance, women over 30 years of age on oral contraceptives, and are smokers are at a high risk of PE. Other risk factors are age, diabetes, obesity, hypertension, smoking, migraine headaches, and thrombogenic mutations. Smoking causes vein destruction, resulting in thromboembolic development (Demir et al, 2017). Smoking and hypertension are risk factor in both men and women.

VTE risk in women increases with age. Women over 40 with cardiovascular risk factors, who use estrogen-containing contraceptives, are at a higher risk of venous and arterial thromboembolic events (Demir et al, 2017). The prevalence of VTE in premenopausal women ranges from 5 to 10 per 10 000 woman-years. In women of reproductive age, the risk of PE

among those who use estrogen-based contraceptives is twice that of non-users (Reid et al,

2009)[24]. Pregnancy and puerperium are higher risk factors than contraceptives.
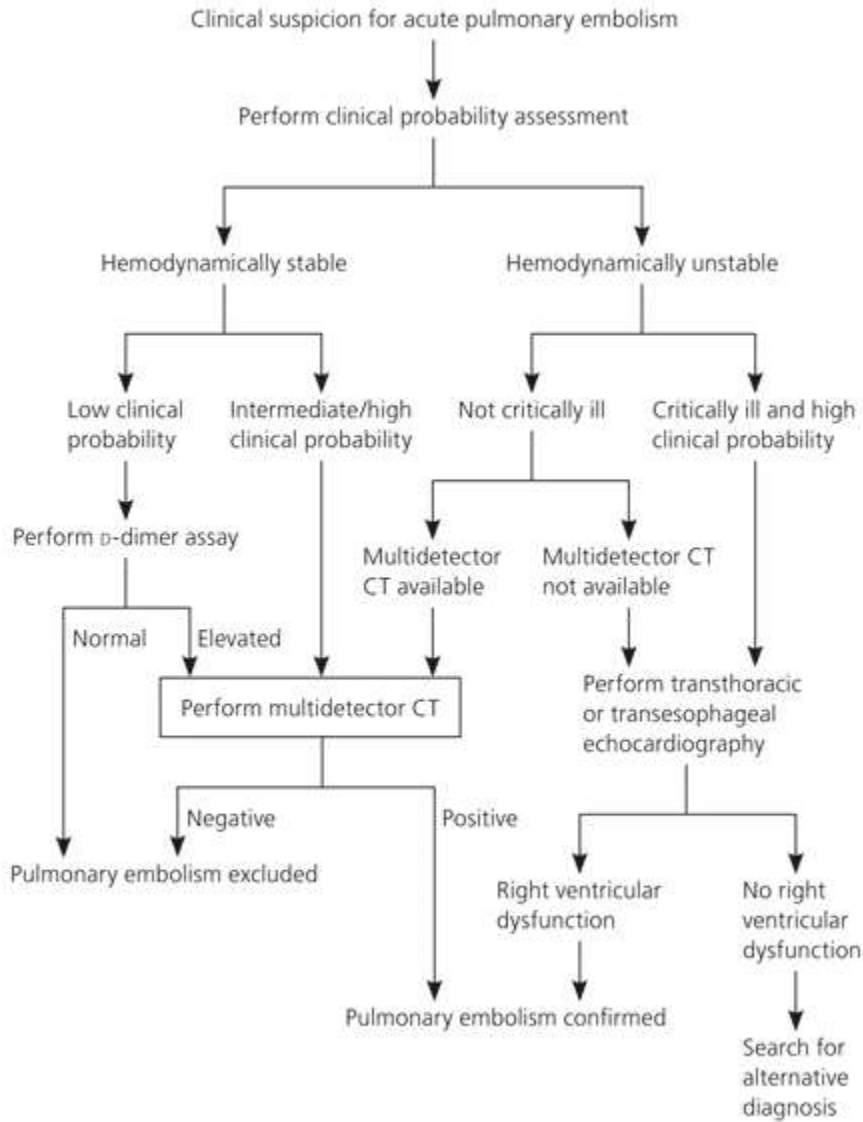
Diagnosis of PE

Figure 2 DIAGNOSTIC ALGORITHM FOR PE. (Adapted from American Association of Family Physicians).

Diagnosis of pulmonary embolism is outlined in the above algorithm. It shows the

decision whether to do a CTPA or not, heavily depends on the clinical presentation.

From the above algorithm, use of CTPA is indicated as a confirmatory test for all patients with high or intermediate probability and in the low probability where D dimer is positive. A CTPA currently costs 10,000 Kenyan Shillings (100 USD). This is way beyond the reach of many who present in the public hospitals especially considering that this is cost for a single test in patient that will require many other tests and that the test is required as an emergency. Hence why the clinician should be careful to request this test for only patients that require it

Wells criteria is a scoring criteria used to decide on the highly suspicious patients depending on their clinical presentation of certain aspects of their medical history. The following table outlines the wells criteria.

Characteristics	Score
Previous pulmonary embolism or deep vein thrombosis	1.5
Heart rate > 100 beats/minute	1.5
Recent surgery or immobilization	1.5
Clinical signs of deep vein thrombosis	3
Alternative diagnosis less likely than pulmonary embolism	3
Hemoptysis	1
Cancer	1
Interpretation: Low probability: 0-1 points Intermediate probability: 2-6 points High probability: 7 or more	

D-dimer testing

The plasma D-dimer enzyme-linked immunosorbent assay rises in the presence of PE due to plasmin's breakdown of fibrin (Riley et al., 2016)[25]. D-dimer is a fibrin degradation product purposed to rule out thrombo-embolic disease in instances of low clinical probability.

Related studies

Qiao Ji did a retrospective study in China involving 551 patients diagnosed with PE in Hospital between 2012 and 2016 (Qiao Ji et al, 2017)[26].They evaluated typical symptoms of PE in patients and their related predictors. They went ahead to correlate differentiated typical groups of patients with similar characteristics with their principal presentations of PE symptoms. They concluded that different symptoms were associated with different clustered clinical indicators and demographics among PE patients.

This in my opinion would immensely help in narrowing down patients with a high likelihood of having PE and cut down on unnecessary CTPA studies. This information was also represented in a local retrospective study done by Ogeng'o. It studied 128 patients treated of PE from 2005 to 2009 (Ogeng'o et al. 2011). The currently proposed study seeks to update this information for the local cases.

Rates of pulmonary emboli and subsegmental pulmonary emboli with modern computed tomograms in Emergency Departments (RESPECT-ED study, 2017)[27] was a large study involving 7077 patients in 15 centers across Australasia region. It involved finding the rates of Pulmonary Emboli and sub segmental PE with modern CTPA in Emergency Department.

It studied the yield of CTPA and correlated it with the factors that affect the yield. Significant yield was considered to be 15.4%, a previous determined rate by the Royal college of

Radiologists which was derived from analysis of previous studies on use of CTPA for diagnosis of PE in various centers (Kim, Hills and Beckert, 2013)[28]. 1028 CTPA studies out the total 7077 done were positive for PE, giving a yield of 14.6%. There is one previous study done in Kenya by Wainaina A in 2013 study - Patterns of findings in MDCTPA for suspected pulmonary embolism in Nairobi that reported the yield of CTPA to be 27.3 % (Wainaina et al, 2013)[29]. The proposed study sought to compare these with the current trends. She faced some limitations in her study then. The requesting doctors offered scanty information on the clinical presentation of the patients. So she was inadequately equipped to offer a comparison of the clinical scores to the CTPA findings. She also recommended that CTPAs should be carried out on patients with high probability of PE to avoid unnecessary CTPAs. The current study has sought to address the limitations that were encountered in the Wainaina study.

Schissler published a study done in USA that concluded that there was an increase in number of CTPAs being done with no corresponding increase of clinically significant PE diagnosis (Schissler et al, 2015)[30]. This meant a larger portion of the population was being exposed to the examination unnecessarily. There is an emerging chance of the same issues raised being faced in the local environment because of the increasing access to CTPA services in Kenya. It is necessary to confirm or rule out the probability of increasing chances of CTPA overuse in PE workup.

In 2012, Tambe et al published a study done in Cameroon to assess the incidence of PE in patients underwent CTPA for diagnosis of PE. The study had 37 patients and 12 (32.4%) of them were positive for PE (Tambe et al, 2012)[31].

Costa et al published a study in 2014 that sought to establish the yield of CTPA to exclude acute PE. This was done in the background of evidence suggesting overuse of CTPA to

exclude PE. The yield was 15.0%. In the discussion they also reinforced the importance of strong clinical assessment of suspected patients in PE diagnosis (Costa et al, 2014)[32]. The same should be encouraged in the Kenyan scenario. The study is an audit of clinical tools prior to committing a patient for CTPA.

Ong et al sought to investigate and established that implementation of Well's criteria as a clinical prediction tool for PE diagnosis reduced the number of CTPAs requested by 26.6% (Ong et al, 2013)[33]. Similarly, this study provides very useful information necessary for PE diagnostic clinical guidelines development.

CHAPTER 2

RATIONALE AND JUSTIFICATION

This research study is mainly a descriptive study seeking to show the findings on CTPA for patients who are suspected to have PE in relation to the clinical presentation in a tertiary hospital in Nairobi, Kenya. The study aims to identify areas of need as well as narrow down the phenomena for future studies. A review of related studies based on primary data will provide an overview of the issues that have already been addressed as well as the emerging data. After assessing the use of criteria for the diagnosis of PE in the selected population, the study will help to disambiguate its reliability for patients in this region and provide a basis for future research and use of the criteria by practitioners in the region. These results may form a part of clinical imaging guidelines in patients presenting with acute chest symptoms.

The need of this study is justified by the rising cost of healthcare in the region. The prevalence of Non-Communicable Diseases is intensifying in the country, which is said to be exerting pressure on the cost of healthcare, resulting to higher premiums paid for health insurance (Ramlakhan, Andronikou, &Ashmitha, 2017)[34]. Patients encounter a substantial economic burden that can be disastrous to their budgets. Screening interventions should therefore be prioritized to curb this problem. Furthermore, majority of the population, which depends on services from public hospitals are unable to access CTPA and have to be redirected to referral hospitals. Hence, there is a need to transfer the diagnosis of PE to more economical methods and only refer for CTPA when the risk level is high. The available CT scan facilities now available in county hospitals should be used prudently, ensuring the resource is available and well-preserved for critical cases.

This study also takes into account the attainment of the ALARA Principle for radiological protection management that prompts physicians and radiologists to be cognizant of the radiation exposure during radiological tests. Therefore one should limit the dose using the optimization principle that conditions all exposures to be kept As Low As Reasonably Achievable (ALARA) with socioeconomic factors being taken into account. Considering the ALARA, CTPA scans should only be conducted when there is a high index of suspicion. This should be facilitated by the availability of an effective diagnostic criterion for PE. It will overall reduce the cost of care and radiation exposure.

This study is also working towards helping attain the vision and objectives of AFROSAFE, an African movement of radiation workers who have a common vision targeting radiation safety. Afrosafe targets to make radiation based imaging and other interventional procedures in Africa appropriate and safe.

Patients suspected to have PE are diagnosed using CTPA in major hospitals in the country. CTPA is the preferred for diagnostic imaging in patients who have presenting signs and symptoms of PE. This scan provides high-resolution images that are accurate and less invasive when compared to pulmonary angiography, which was the 'gold standard' procedure earlier. However, the cost of medical care is still a challenge and many patients are not able to access CTPA, especially those who seek medical services from public hospitals.

There are several studies done regarding PE in Kenya. But no study has sought to directly correlate clinical presentation and radiological findings. This will therefore form a baseline for further scientific studies, seek to add to the scientific knowledge available, and generally help improve on the state of health care in Kenya.

RESEARCH QUESTION

How does the clinical criteria of PE diagnosis compare to the radiological –CTPA findings

OBJECTIVES OF THE STUDY

BROAD OBJECTIVE

The main objective of this prospective analytic study is to determine the correlation of clinical presentation of pulmonary embolism and radiological findings on CTPA in patients suspected to have PE in a tertiary referral hospital.

SPECIFIC OBJECTIVES

The specific objectives of the study include:

1) To establish the yield of all CTPA tests done to rule out PE

2) To establish demographic patterns observed in PE

3) To compare the clinical scores and patterns of clinical presentation of patients who present for CTPA

    The secondary objective is:

1) Find alternative radiological diagnosis that may present on CTPA images negative for PE

CHAPTER 3

STUDY DESIGN AND RESEARCH METHODOLOGY

STUDY DESIGN:

This is a mainly prospective analytic study seeking to find out the yield of CTPA done to rule out PE and to co-relate the CTPA outcome with prevailing clinical presentation.

STUDY AREA:

The study was carried out at Kenyatta National Hospital, a public tertiary hospital that serves as the main referral hospital in the apex of the Kenyan public referral system. Its radiology department is well equipped to carry out CT scans. It has a 128 slice Siemens CT scanner and can be used to produce CTPA images of good diagnostic quality. The department serves a casualty department, various outpatient clinics and a1800 bed capacity divided into specialty wards. It has been carrying out an average of 10 CTPAs monthly. The department radiologists review all CTPAs before they are released to the primary doctor.

STUDY POPULATION

Subjects and data for the study were collected from the requests received at the radiology departments in the study center for CTPA to rule out pulmonary embolism

SAMPLING METHOD AND RECRUITMENT PROCEDURE

Consecutive and purposive sampling method was used to select the study participants who met the criteria. Consecutive sampling requires investigator to pick subjects for the study as they present in the study site at the convenience of the researcher as long as the sample size is attained. Purposive sampling is also known as selective sampling, it is purposive because the subjects chosen have to follow laid out inclusion criteria.

The patients to be recruited for the study were identified from the radiology department when they presented with a request for CTPA. Consent was sought from them by the principle investigator or her assistants before their inclusion in the study. Those who were not be able to give their own consent, it was sought from their next of kin.

Inclusion criteria

1. Patients who presented at the study centers for CTPA study within the study period.

2. Patients from whom, the clinical diagnostic criteria used was available

Exclusion criteria

1. Patients who decline consent

2. Those from whom we could get the clinical diagnostic criteria used.

    .

STUDY SAMPLE SIZE:

  The sample size is 78.

SAMPLE SIZE DETERMINATION

Sample size estimation

Yamane Formula was used to compute the sample size for the study for the average 86 positive CTPA done every year at KNH which came to with a desired confidence level of 95%.

$$n = \frac{N}{1 + N(e)^2}$$

 (Yamane, 1967)

Where:

n = sample size being sorted

N =population size 86. That is the annual average patients seen with PE   according to the KNH records (Appendix 1)

e = level of precision that is a confidence level 95% (expressed as precision of 0.05)

$$n = \frac{86}{1 + 86(0.05)^2}$$

$$n = 71$$

Since the study allows for 10% loss of information, the sample size was adjusted upward by 7 participants (i.e. 10% of 71).

Therefore, 78 subjects were recruited in the study.

Study procedure

Following approval from the hospital administration as well as the University of Nairobi Research Board in collaboration with the KNH Research and Ethics committee the researcher commenced the study.

Upon assessment of the inclusion criteria into the study, the CTPA images were assessed and findings of all individual studies recorded.

The patients' demographic characteristics including age, sex, occupation, and co-morbidities were collected using a predesigned data collection tool.

The clinical criteria to be assessed was according to Well's criteria. This information would be collected from the requesting doctor with the permission of the patient or the next of kin where it applies.

The data collected was analyzed to finally answer the research question.

ETHICAL CONSIDERATIONS

The following ethical

1) Only patients who give consent for their inclusion in the study were be included

2) The identities of all patients were not included in the research instruments as well as the findings data sheets/reports. Only participant numbers were used to allow for referral purposes. Questionnaires did not collect patient names and only hospital identification numbers to allow easy association of the clinical data with the radiological data.

3) The researcher only commenced with the study after receiving approval from the ethical committee of the concerned institutions

4) The results of the study were delivered to the participating facilities to assist in creating a database for future studies and reference to facilitate improvement in patient care.

5) After the study is finalized, the researcher will destroy all information which can be used to identify participants.

6) The study participants were recruited voluntarily.

7) The results will be shared with relevant policy making bodies to improve on appropriate utilization of CTPA in patients with acute chest syndrome.

CHAPTER 4

DATA MANAGEMENT

DATA COLLECTION

When the patient presented with their request for CTPA at the radiology department, the CTPA was carried out immediately because of the emergency nature of the examination. Informed consent was then taken from the patient or the next of kin thereafter. The CTPA was conducted with a Siemens 128 slice multidetector CT scanner. 60 -100ml of contrast was administered to the patients at a speed of 5ml/ sec. The contrast dose was determined by the weight of each patient.

Scans with poorly opacified main or lobar pulmonary arteries were considered inadequate. The CTPA were reported and the findings together with the demographic data of the patient will be entered in the data collection tool (Appendix 2) after verification by the radiologist on duty. PE was concluded if there is a filling defect within the main pulmonary arteries of the lobar arteries.

The clinical data required for Well's scoring was collected either from the patients' medical records or by clerking the patient and entered into the designed forms. For this study, data was collected during the allocated period between from December 2019 to April 2020. The survey method was used as the primary strategy for these data collection. This was combined with clinical findings which will be sought from the requesting doctor or the patients' records where available.

All the information was presented in the data collection tool

– Appendix 2(one for each patient.)

DATA PROCESSING

These findings together with the demographic information for each patient were processed with the help of a biostatician.

DATA ANALYSIS

The data collection tool was used to collect basic demographic information (gender, age, and occupation), WELL's score and CTPA findings for each patient separately.

The CT scans were assessed by principal investigator in conjunction with the radiologist on duty. The findings of the CTPA were summarized as 'No PE, Sub Segmental PE and Proximal PE'.

The data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 23.0 followings descriptive and inferential statistical technique. Univariate analysis was applied to obtain the means, frequencies, percentages and standard deviations for continuous variables. Multivariate logistic regression models was used to find relations between the clinical scores (Well's Score) and CTPA outcomes.

Chi square Fishers exact test was used to determine if the Well's score has a significant association to the CTPA findings.

Inferential statistics was applied to perform an ANOVA test that was conducted to compare the variables and determine the significance of values. All significant levels will be set at 0.05.

STUDY RESULTS

The main objective of the study was to determine the correlation of clinical presentation of pulmonary embolism and radiological findings on CTPA in patients suspected to have PE in a tertiary referral hospital

A total of 143 consecutive patients presented at the radiology department with requests for CTPA during the study period. Out of these 103 patients (73.4% of the total) satisfied our inclusion criteria (Fig. 4). The reason for exclusion of the other 40 patients included denial of consent, inability to get complete clinical information, CTPA request for different indication like for diagnosis of congenital malformation, for surgical planning or for follow up of patient previously diagnosed for PE.
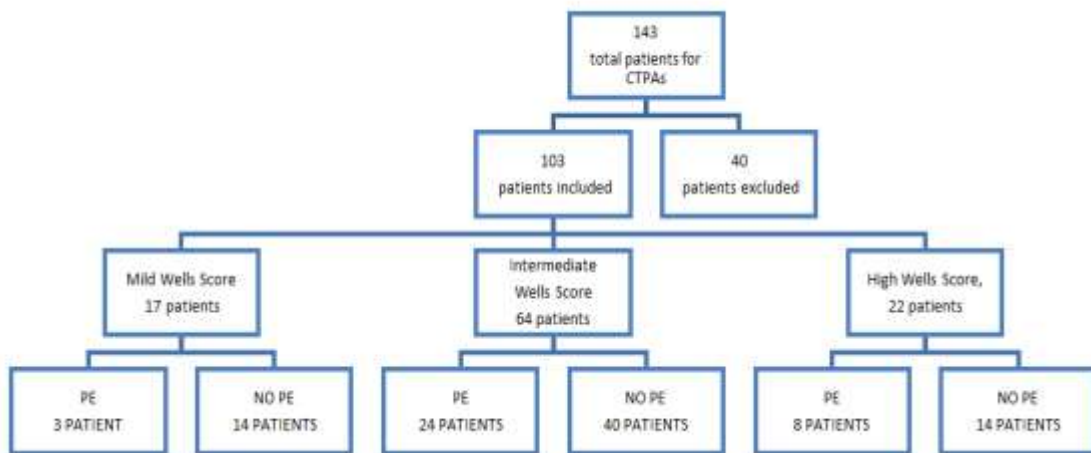

Figure 4: Flow chart showing Wells scoring and CTPA outcome of the study participants

Among the 103 patients, there were 30 male and 73 female. As per table 2, it is noted that the bulk of the patients who presented with potential signs and symptoms of PE were in the 36 to 45 years age group.

The mean age of the patients was 46.2 years (SD=17.1), while the median age was 44.0 years (IQR=23.0), the youngest was 17.0 years, while the oldest 95.0 years

The mean age of the male patients and female patients was 50.3 (SD=18.1) years and 44.8 (SD=16.6) years respectively. The median age for male patients with positive PE was 49.5 (IQR=25.0) years and that of female was 43 (IQR=20) years. The youngest of the male patients was 19.0 years, while the oldest 83.0 years, while that of the female was 17 years youngest with

the oldest of 95 years. The table below shows the distribution of the patients recruited into the study by age and sex.

Age (years)	Male	Female	Total
17-25	3(10.0)	6(8.2)	9(8.7
26-35	3(10.0)	18(24.7)	21(20.4)
36-45	8(26.7)	23(31.5)	31(30.1)
46-55	6(20.0)	10(13.7)	16(15.5)
56-65	3(10.0)	5(6.8)	8(7.8)
66-75	3(10.0)	7(9.6)	10(9.7)
76-85	4(13.3)	3(4.1)	7(6.8)
Above 85	0(0.0)	1(1.4)	1(1.0)
Total	30(29.2)	73(70.8)	103(100)

Table 2.1 showing the patient distribution by age and sex. The percentage constitution of each category is shown in brackets

The CTPA yield (overall prevalence of PE) was 34% (35/103).

The mean age for those with positive PE cases was 46.7 (SD=15.7) years, while the median age was 45.0 (IQR=21) years. The youngest was 19 years, and the oldest was 83 years.

Age group	Positive PE	No PE
17-25	1(11.1)	8(88.9)
26-35	8(38.1)	13(61.9
36-45	14(45.2)	17(54.8)
46-55	4(25.0)	12(75.0)
56-65	3(37.5)	5(62.5)
66-75	2(20.0)	8(80.0)
76-85	3(42.9)	4(57.1)
86+	0(0.0)	1(100)
Total	35(34)	68(66)

Table 2. 2 Age distribution observed in PE

Of the patients who had positive PE on CTPA, 14 (40%) were male and 21(60%) were female.

The Wells Score categorized the patients as follows:

Table 2. 3 Wells scoring of recruited patients

Wells Score	Frequency	percentage
Low	17	16.5
Intermediate	64	62.1
Total	103	100

Among the patients scored as low on Wells score the prevalence of PE was 17.6% (3/17), the intermediate scores had a PE prevalence of 37.5% (24/64) while the high Wells score group's prevalence was 36.3% (8/22). These results have been presented in the table below.

Table 2. 4 CTPA findings as per the clinical stratification groups. (Comparison of the clinical scores and patterns of clinical presentation of patients who present for CTPA)

Wells' score	No PE	Positive PE	P value
Low	14 (82.4%)	3 (17.6% of Low score)	0.317
Intermediate	40 (62.5%)	24 (37.5%of intermediate)	
High	14(63.6%)	8 (36.3% of High)	
Total	68 (66%)	35 (34%)	

Among the 103 patients, 70.9% (73) were female and 29.1% (30) were male. The total yield of 34 patients had 14 male and 20 female most falling in the 36-45 years age group in both male and female patients.

In male, the predominant underlying predisposing factors were malignancy and immobilization due to history lower limb injury. In the female, the main underlying predisposing factors were history of recent delivery and malignancy. These and others were also the presented co-morbidities. Most frequent comorbidities included Malignancy (25.7%); DVT (25.7%); infections including HIV and pulmonary tuberculosis (8.8%); cardiovascular conditions including hypertension and heart failure (11.4%); post-surgery (11.4 %) and pueperium (5.7 %) and diabetes mellitus (2.9%).

On the other hand there were alternative radiological findings in the negative CTPAs and additional findings found in the positive CTPAs done as represented in the following table.

Table 2. 5 Shows a summary of CTPA findings- also outlining alternative and additional findings in the CTPA which had negative and positive PE respectively

CTPA findings	Positive PE additional findings	Negative CTPA alternative findings	Total
Pleural effusion	2	25	27
Atelectasis	4	12	16
Lung metastasis	5	9	14
Cardiomegaly	3	8	11
Lung consolidation	3	11	14
Pulmonary Arterial Hypertension	4	4	8
Bronchus compression by enlarged nodes	1	4	5
Pericardial effusion	1	7	8
Miscellaneous	3	11	44
No findings	0	0	14

Regarding the table above, it is noted that 13.6% (14/103) of the CTPAs done were normal, that is 41.2 % of the negative CTPAs were normal. In the positive CTPAs for PE additional findings included lung metastasis, atelectasis and pulmonary arterial hypertension among others as noted above in the summary table 2.5.

The negative CTPAs on the other hand had alternative findings that may have been responsible for the presenting symptoms. This included Pleural effusion, pericardial effusion, atelectasis, lung metastasis and others as shown in the table 2.5.

Table 2.4 above shows there was no statistical differences between the clinical scores and the patterns of clinical presentation

The modified Wells Score was used to calculate the sensitivity and specificity of the clinical stratification. When tested against the CTPA findings, the Modified Wells score had 68.6 % sensitivity, a specificity of 48.5 %, Positive predictive value (PPV) of 40.7 % and negative predictive value (NPV) of 75%.

The clinical presentation of the patients confirmed to have PE had the following distribution:

Table 2. 6 Frequency of presentation of the Wells score criteria in the sample population with positive PE

CLINICAL PRESENTATION	Number presented
Clinical signs and symptoms of DVT	11
PE as number 1 diagnosis or equally likely	20
Heart rate>100bpm	25
Immobilization at least 3 days or surgery in the last 4 weeks	16
Previously objectively diagnosed PE OR DVT	6
Current malignancy or treatment within the last 6 months or palliative care	9
Hemoptysis	11

On assessment of the different characteristics that are used in the clinical scoring, from the table above, it is clear that the most common presentation of the patients who were suspected

to have PE was tachycardia 71.4% (25/35). On the other hand only 25.7 %(9/35) had history of previous DVT or PE.

Table 2 .7 Factors of Wells score against the CTPA outcome.

| Clinical Factors	PE (N=35)	No PE (N=68)	OR (95% CI)	p-value	AOR (95% CI)	p-value
Current DVT	11 (31.4)	18 (26.5)	1.3 (0.5-3.1)	.597	1.3 (0.5-3.6)	.554
PE most likely diagnosis	19 (54.3)	25 (36.8)	2.0 (0.9-4.7)	.091	3.3 (1.3-8.8)	.015
HR>100	25 (71.4)	59 (86.8)	0.4 (0.1-1.1)	.063	0.2 (0.1-0.6)	.004
Immobilation Surgery in last one month	16 (45.7)	29 (42.6)	1.1 (0.5-2.6)	.766	1.1 (0.4-2.7)	.857
Previous DVT/PE	6 (17.1)	10 (14.7)	1.2 (0.4-3.6)	.747	1.7 (0.5-5.8)	.387
Hemoptysis	9 (25.7)	10 (14.7)	2.0 (0.7-5.5)	.177	3.0 (0.9-9.5)	.063
Cancer in the last 6 month	11 (31.4)	13 (19.1)	1.9 (0.8-4.9)	.165	3.7 (1.2-11.7)	.028

Abbreviations: CI, confidence interval; DVT, deep venous thrombosis; min, minutes; no-PE, no pulmonary embolism; OR, odds ratio; OR adjusted, adjustment for each item of wells score; PE, pulmonary embolism; wks., weeks; %, percentage; N, number

Those diagnosed with PE were more likely to present with the following components of the Wells score: 'haemoptysis', 'PE as the most likely diagnosis' and 'history of cancer in the last 6 months' which all have an odds ratio of 2.0, 2.0 and 1.9 respectively and even higher adjusted odds ratio. The p values (adjusted) are also showing significant values for 'PE as the only diagnosis' and 'history of cancer in the last six months'. This means this two are most weighted values in the wells criteria in the sample population studied. (Table 2.7).

For the patients who had negative CTPAs for PE (68), alternative diagnosis (as assessed clinically) to explain their symptoms included:- lung metastasis 14.7%(10/68), pulmonary

hypertension 7.4% (5/68) , Lung infections 6% (4/68), congestive cardiac failure 4%(3/68),

sepsis 4% (3/68), Asthmatic attack 4%(3/68), COPD 4%(3/68) and other miscellaneous ones . A

large percentage, 27.9 %(19/68) had no direct attributable explanatory cause.

Figure 5: Distribution of alternative clinical diagnosis in patients who had negative PE on CTPA

Legend:
- Miscellaneous 28%
- no attributable cause 27.9%
- lung metastasis 14.7%
- pulmonary hypertension 7.4%
- lung infections 6%
- congestive cardiac failure 4%
- sepsis 4%
- asthmatic attack 4%
- COPD 4%
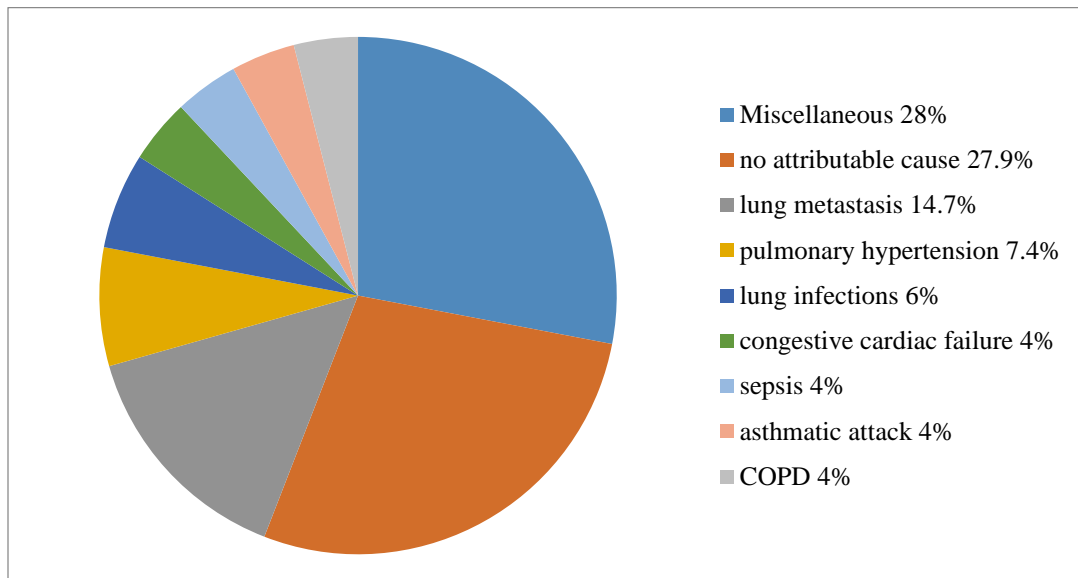
ILLUSTRATIONS OF SAMPLE CASES:

Case 1:

Figure 6: Patient with bilateral pulmonary metastasis, pleural thickening, mild pleural effusion, light carotid thrombus with left sided segmental pulmonary embolism.
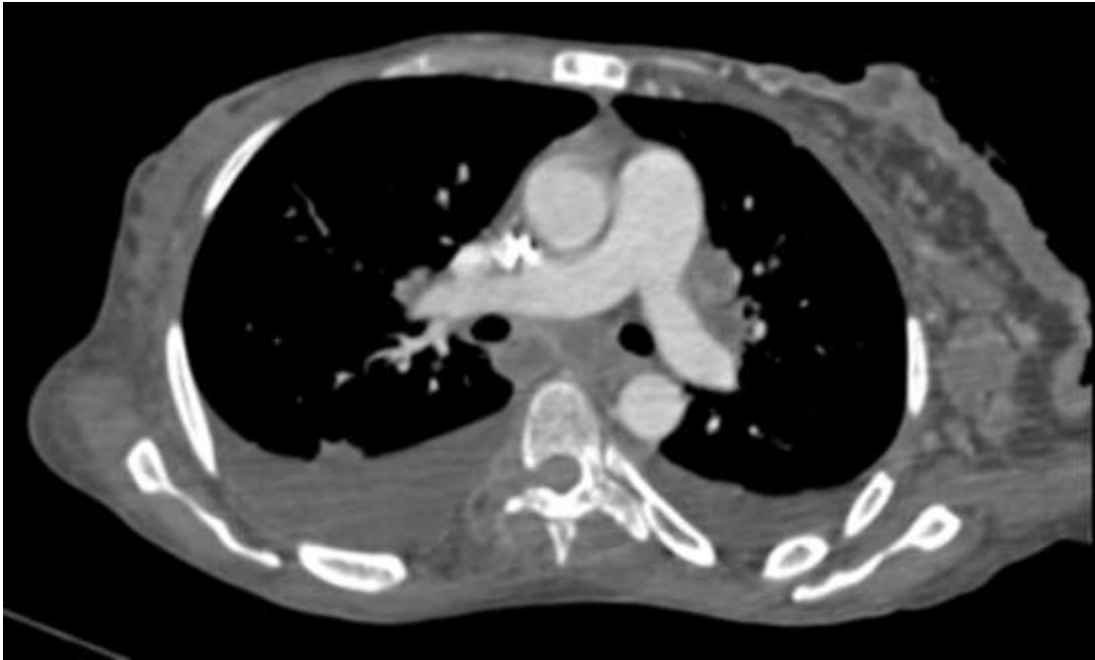
Case 2:

Figure 7: Patient with left breast cancer, hilar and mediastinal lymph nodes with loss of normal morphology and bilateral pleural effusion. No PE
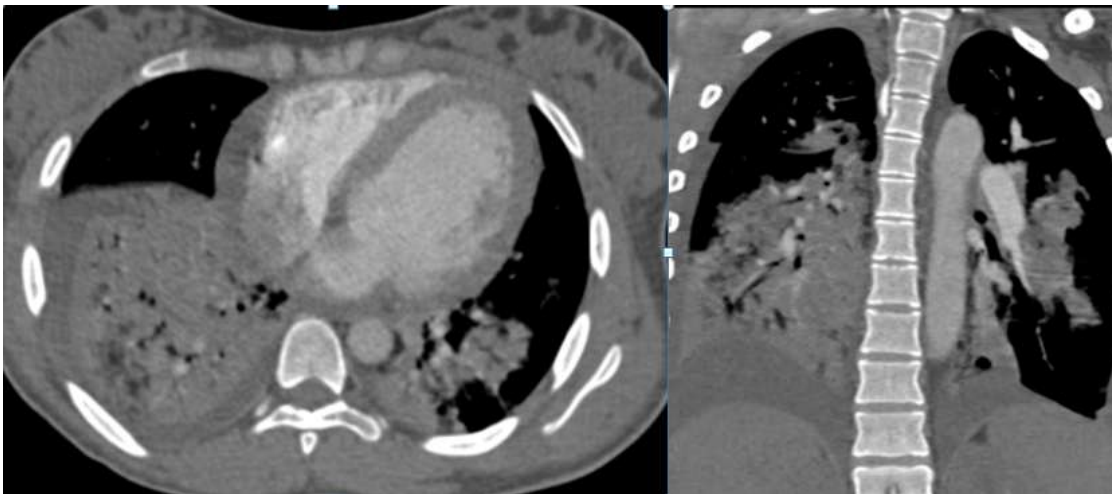
Case 3:

Figure 8: CTPA images showing bilateral basal lung atelectasis with bilateral pleural effusion

Case 4:

Figure 8: Bilateral posterior lower lobes parenchymal opacification in a patient with history of injury, concluded to be lung contusion
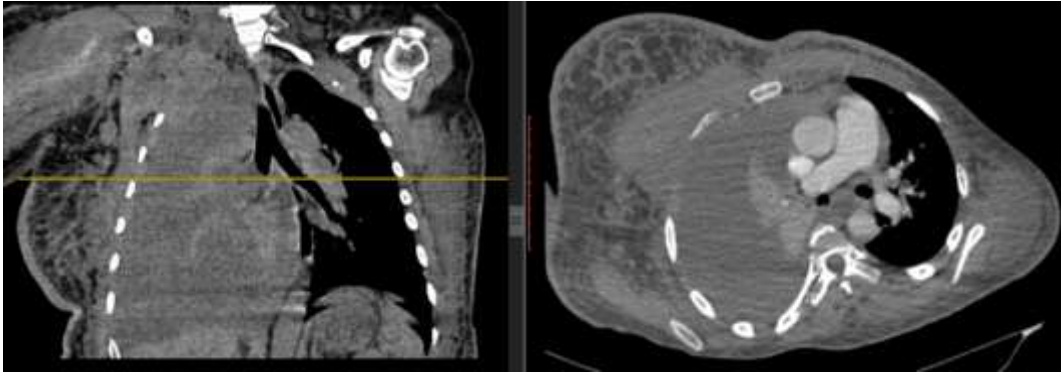
Case 5:

Figure 9: Patient with Cancer of the Breast showing right sided malignant pleural effusion with ipsilateral atelectasis with mediastinal and hilar lymphadenopathy

Case 6:

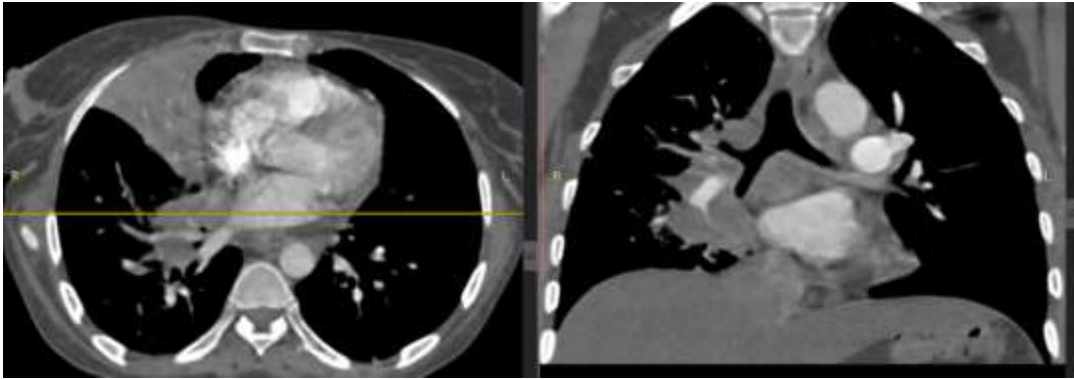*Figure 10: Patient with negative PE with cardiomegaly*

Case 7:

Figure 11: Patient found to have left sided hilar lymphadenopathy with segmental atelectasis
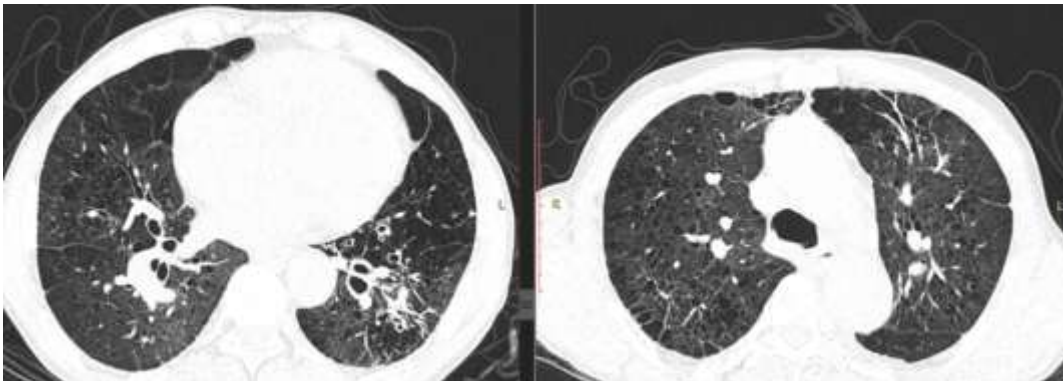
Case 8:

Figure 12: Patient with findings of previously interstitial lung disease: bilateral ground glass opacification interspersed reticular & septal thickening, pulmonary emphysema with formation of bullae & traction bronchiectasis

DISCUSSION

Age and sex distribution

In this study, we find that PE was most predominant in the 36-45 years age group. This can be mostly attributed to the prevalence of the other predisposing factors like malignancy and use of hormonal contraception. The male: female ratio is 1:1.4. This is not far off from the ratio of 1: 1.13 reported by Ogeng'o.   The female preponderance may be because of the above mentioned predisposing factors and also because women have a better health seeking behavior than men (a complete audit that includes both morbidity and mortality numbers (including those diagnosed during autopsy) may be better for this assessment. In comparison to an Argentinian study done by Barco et al[35] and published in 2018, the overall male to female ratio was 1:1. Though when ages were stratified the largest group was also similar for patients with identified risk factors which were malignancy and use of hormonal contraception. The highest incidence occurred in the 40- 49 year age group. But they also noted in their groups that there was a higher incidence of pulmonary embolism in patients with unidentifiable risk factors in patients above 50 years. In my study the data collected was not adequate to compare these findings.

Comorbidities

Malignancy was one of the most frequent comorbid factors. This may be associated with the increasing prevalence of cancer in the country. In the Ogeng'o study, DVT was the most common co-morbidity. DVT was the other most frequent comorbidity at the same level with malignancy (25%).This was still the case in the same Ogeng'o study. The association of infective factors leading to PTE has increasingly reduced when compared to the same in this study (where it comprised of 23.4 % combined and now it is down to 8.8% combined). The other comorbid factors were diabetes mellitus, pueperium, fractures and stroke. This suggests that now the non-

communicable diseases in Kenya predispose a larger percentage of the patients with PE than communicable diseases. More studies may need to be done to find out screening parameters that may need to be included in the follow up of cancer patients so as to determine who needs to be put on prophylaxis of thrombi formation.

Alternative diagnosis in negative CTPA examinations.

71.1% of the patients who had no PE on their CTPAs done, had other positive chest findings that could as well explain their symptoms. Lung metastasis was the most common alternative finding at 14.7% (with the most being from breast cancer) followed by pulmonary hypertension and lung infections.

Association of clinical criteria and Well's score

This study was geared towards determining whether the Wells score can be used to rule out potentially PE negative patients initially suspected of PE so as to avoid them from undergoing unnecessary CTPA tests.

Table 2.4 above shows there was no statistical differences between the clinical scores and the patterns of clinical presentation therefore indicating that the Wells score is an appropriate and accurate way to rule out patients without PE.

Of the patients who scored low and intermediate risk of having PE, 17.6% (3/17), and 37.5% (24/64) still ended up having a PE confirmed by CTPA respectively. Since the utilization of D dimers levels was not considered in this study, there is an assumption that the negative predictive value of this clinical stratification would have greatly improved the primary doctors decision on who may still have required a CTPA despite having it been ruled out by Wells score.

With a negative predictive value of 75%, without utilization of the D dimer levels, it confirms that the lower the Wells score the less likely a patient has PE.

The numbers involved especially for the patients with positive PE was in the low probability and high probability groups were low and therefore reducing the clinical utility of the Wells score in this group. A more robust study would be ideal for this reason. In this study, only three factors of the Wells score (PE as the most likely diagnosis, Tachycardia of >100bpm, and history of malignancy in the last 6 months) had a significant p value and therefore were the more weighted factors in the diagnosis of PE.

Study Volume and CTPA Yield

In the study sample, the results showed that the CTPA yield is 34 % which is higher than most of other studies done and within the recommended yield by Royal College of Radiologists. This is almost similar to the study done by Wainaina in 2013 that had a CTPA yield of 27.3 %. .The study found that out of the 110 patients, 31 (27.3%) patients had positive PEs, while this study found that out of the 103 patients, 35 (34%) had positive PEs, this being an increase of 6.7%. While this may be the case, the two proportions are not statistically significantly different (p=0.3604). The Wainaina study (which was a multicenter study) was able to recruit only 37 patients over the period of 7 months from KNH. Currently in this study 103 patients were recruited over a period of 4 months out of 147 CTPAs request. If we make a loose assumption that the rate of exclusion was similar, then we can come to a conclusion that the CTPA volume in Kenyatta National Hospital (KNH) has increased over the years.

 Of positive interest is those diagnosed with PE were more likely to present with the following components of the Wells score: 'haemoptysis', 'PE as the most likely diagnosis' and

'history of cancer in the last 6 months' which all have an odds ratio of 2.0, 2.0 and 1.9 respectively and even higher adjusted odds ratio. The p values (adjusted) are also showing significant values for 'PE as the only diagnosis' and 'history of cancer in the last six months'. This means this two are most weighted values in the wells criteria in the sample population studied. (Table 2.7). Though this may have happened, the Yield remains acceptable. This pattern of findings could help further cut down on potentially negative CTPAs. Although no correlation was done to associate the role of D dimer tests and deep venous Doppler ultrasounds in the decision making on CTPA requests, this has been found to be beneficial to this quest in other studies.

It is important to note that out of all the patients, only one had intentionally documented Well score in their clinical notes. For the others the information was gathered from the clerking notes and filled up by clerking the patient to fill gaps whenever necessary. The most missed out criteria in the notes was hemoptysis which luckily was verifiable from the patient. This indicates that the clinicians more likely rely on subjective means to arrive at a high index of suspicion for PE than in objectively using a laid down algorithm/ guideline.

For the patients who had negative CTPAs for PE (68), alternative diagnosis (as assessed clinically) to explain their symptoms included:- lung metastasis 14.7%(10/68), pulmonary hypertension 7.4% (5/68) , Lung infections 6% (4/68), congestive cardiac failure 4%(3/68), sepsis 4% (3/68), Asthmatic attack 4%(3/68), COPD 4%(3/68) and other miscellaneous ones . A large percentage, 27.9 %(19/68) had no direct attributable explanatory cause.

The yield in this study showed 34% which was within the suggested acceptable CTPA yield for PE by the Royal College of Radiologists (15.4 %-37.4%). The Table below shows yields found in various previous studies published within the last 5 years.

Table 3. 1 The table below shows yields found in various other studies published in the last 5 years.

Study	Number of patients	Yield %
Ramlakhan et al (2017) South Africa	164	26
Bojana et al (2015) South Africa	127	32
Tannous et al (2016) Detroit USA	208	5.7
Davy et al (2017) Ireland	293	7.4

36 37 38

According to a retrospective study done at Hutt hospital by Kennedy et al[39] in which patients sample size was studied, the CTPA Yield was found to be 15% just below the RCR recommendation (15.4% -37.4%).   The bulk of negative CTPAs fell in the groups with low Wells Score and intermediate Wells score. Furthermore the authors noted that only 12 % of the patients had a Wells score or Geneva score performed and documented. A significant number of patient falling in the low and intermediate groups did not have a correlating D Dimer test done to further cut down on patients with possibly a negative CTPA outcome. Though this study did not further find out the role of D dimer tests in pre CTPA patient stratification, I agree with them that clinical scores and D dimer testing can help avoid unnecessary CTPA scans while safely investigating for PE. This can be a good follow up study in our set up to see if appropriate use of D dimer tests will help further reduce the rate of negative CTPAs. This will help improve patient care by reducing waiting time for patients, cutting down on the burden on radiological services, improving the cost of health care and reducing radiation and potential contrast media side effects to patients.

CONCLUSION

In conclusion the study demonstrated that the wells score is a criteria that can be used to find out the clinical probability of one having PE. Though its outcomes can be further improved by other adjunct tests like D dimers and lower limb Doppler among others

LIMITATIONS:

1. The study limited itself to the utility of Wells score in decision making on PE management algorithm to decide on whether a patient requires a CTPA or not. A further study to combine utility of D dimer and bilateral pedal Doppler may give a better assessment. This may go ahead to improve the clinical criteria.

2. Being an observational study, bias could not be totally ruled out.

3. These results represented were from a single center which is also a teaching hospital and therefore cannot be assumed to be a representation of other centers in the Nairobi and Kenya

4. The sampling was done for patients who were already suspected to have PE and therefore it may not have been very reliable in determination the prevalence of PE in the general population.

5. The sample type was from the African population therefore the findings cannot be generalized for other ethnic groups present in Kenya. The sample size was small which also restricts generalizability of the results to a larger target group.

6. The correlational aspect of this study limits the generalizability to associations and it's impossible to make many conclusions.

7. Having almost no set PE management protocols in the hospital it may be challenging to know of any extra compelling clinical information that prompted clinicians to still request for a CTPA in patients who had a low clinical score.

RECOMMENDATIONS:

1.   A further study is recommended to further determine the impact of conducting other associated tests to rule out PE such as D dimer, ECG and Echocardiogram so as to reduce patients who need CTPA.

2.   Having a small sample size which may not truly represent a population of over 47 million. A more robust study involving multiple centers would be useful to see the trends in the rest of the country, especially now that there are CT scanners in all the 47 counties in Kenya

3.   Currently the clinicians use subjective methods to decide on who needs to be investigated for PE, I recommend that the radiology department should cooperate with the clinicians in coming up with a PE management guideline for the local patients which will be able to improve the index of suspicion of clinicians as they encounter patients who potentially have PE. This will prevent possibilities of significant percentage of missed diagnosis as is the present case.

STUDY TIMELINE

	MARCH -JUNE 2019	JUNE-JULY 2019	AUG TO SEPT 2019	SEPT 2019 TO JAN 2020	JAN TO FEB 2020	FEB 2019 TO APRIL 2020
Proposal write up	X					
Corrections after supervisors' input		X				
First submission to KNH-UON ERC		X				
2ND Submission and corrections			X			
Final submission and expected approval			X			
Data collection and data entry				X	X	X
Data analysis					X	X
Report writing and desertation submission						X

STUDY CLOSURE AND DISSEMINATION PLAN

Having completed the study:

1. The findings have been presented before a panel in the University of Nairobi Radiology department

2. A completed manuscript has been submitted to a medical journal for publishing.

3. It will also be availed to the department of Diagnostic Imaging and Radiation Medicine as part of the conditions to be met for the successful completion of the Masters of Medicine in Diagnostic Imaging and Radiation Medicine.

RESEARCH BUDGET

ITEM	UNIT COST	NUMBER	TOTAL COST Ksh
Research Assistants /Data Collection Clerks	5000	3	15000
Biostatician Fees			20000
Printing Research Proposal	5	(6 x30)	9000
Printing consent and Data collection Forms	5	100	500
pens	20	20	400
Airtime for calls and data	10000		10000
Transport	500 per week	16	8000
Printing Final report	5	(10x60)	3000
Miscellaneous			5000
Contingencies (10 % of total budget)			7090
TOTAL			**77990**

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APPENDICES

APPENDIX 1: PREVALENCE OF PE CASES IN KNH

Source: KNH Health Information Department (18/06/2019)

YEAR	ALIVE	DEAD	TOTAL
2014	44	27	71
2015	53	16	69
2016	82	34	116
2017	52	21	73
2018	67	31	98
2019 (Upto 18/06/2019)	46	14	60

APPENDIX 2 DATA COLLECTION SHEET

CT SCAN NUMBER: **HOSPITAL NUMBER:**
 AGE: **SEX:**
OCCUPATION:
CO-MORBIDITIES:

CLINICAL SIGNS OF DVT	
NO ALTERNATIVE DIAGNOSIS FOR PE	
HR>100BPM	
IMMOBILSATION FOR 3 OR MORE DAYS/ SURGERY IN THE LAST 4 WEEKS	
PREVIOUS DVT OR PE	
HEMOPTYSIS	
CURRENT MALIGNANCY OR TREAMENT IN THE LAST 6 MONTHSOR IN PALLIATIVE CARE	
TOTAL SCORE	
CTPA FINDING (PROXIMAL PE / SSPE /NO PE)	

APPENDIX 3: CONSENT FORM FOR PARTICIPATION IN THE STUDY

This consent has three parts:

Participant information sheet; sharing information about the research
Consent form for signing
Statement by the researcher.

PARTICIPANT INFORMATION SHEET

Investigator's statement.

My name is Dr.Oline Loice Amunga, a postgraduate student at the University of Nairobi department of diagnostic imaging and radiation medicine .I am conducting a study to compare your physical complains and CTPA (CT Scan) results to show whether you have Pulmonary Embolism (blood clots in the lung blood vessels). I am requesting you to take part in the study. The purpose of this consent form is to help you decide whether you want to be included in the study or not. Please read through the form carefully. You are free to ask any questions about the study. The investigator will be available to answer any questions during the study. The investigator or her assistants will be available to answer any questions during the study or thereafter.

Benefits

What we learn from this study will help us understand this condition better and therefore in future be in a better position to diagnose it more efficiently

Duration of study 6 months.

Compensation

You will not receive any compensation for participating in the study. You are free to choose whether or not to participate in the study. You will suffer neither penalties nor loss of any benefits for declining to participate in the study.

Confidentiality

If you agree to participate in the study, information from your examination will be kept strictly confidential and will only be used for the purpose of this study. Information obtained will be kept under lock and key and soft copy information will be password protected. No specific information of any participant will be revealed to any person without their permission in writing. Your names will not appear on any of the records used for this study.

PARTICIPANT CONSENT FORM AND PARTICIPANTS STATEMENT

I hereby confirm that the doctor has explained to me about the above study and I understand fully. I have been given opportunity to ask questions regarding the study which have been adequately answered. I understand that my participation is voluntary and that I have not been forced to take part. I understand that I can decline without giving any reason and medical care and legal rights will not be affected. I understand that I will not receive any compensation either financial or otherwise and will not receive any preferential treatment, gift, or reward for participating in the above study. I understand that my personal information will be kept confidential but any relevant medical information will be accessible to the researcher and the supervisors where relevant to the study. I give them permission to have access these information.

I hereby consent to take part in the above study.

Respondent's signature: _____

Date: _____

STATEMENT BY RESEARCHER/RESEARCH ASSISTANT

I hereby confirm that I have accurately read out the contents of the information sheet to the participant. To the best of my ability, I have made sure the participant understands the following; Participation in this study is on voluntary basis and no compensation will be given. Refusal to participate or withdraw from the study at any point will not in any way compromise the quality of care accorded to the patient. All the information that shall be given will be treated with confidentiality.

Name: _____

Signature: _____

Date: _____

CONTACTS

RESEARCHER

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University of Nairobi, P.O box 15167-00100 NAIROBI.
Telephone number: 0773745132
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If you have any questions on your rights as a research participant you can contact Kenyatta National Hospital Ethics and Research Committee whose task is to ensure research participants are protected from harm.

KENYATTA NATIONAL HOSPITAL/UNIVERSITY OF NAIROBI ETHICS AND RESEARCH REVIEW COMMITTEE KNH/UON/ERC

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APPENDIX 4: KIBALI CHA KUSHIRIKI KATIKA UTAFITI

KAULI YA MTAFITI

Jina langu ni Dr. Oline Loice Amunga, mwanafunzi wa uzamili katika Chuo Kikuu cha Nairobi idara ya radiologia na dawa mionzi. (Idara ya 'Xray'). Ninafanya utafiti amabo unalinganisha dalili za ugonjwa wako na matokeo ya CTPA (CT Scan) uliyotumwa na daktari wako ufanye.

.Ningependa kukuomba ushiriki katika utafiti huu. Madhumuni ya fomu hii ya idhini ni kukusaidia kuamua kama unataka kushiriki katika utafiti huu au la. Tafadhali soma fomu hii kwa makini. Unao uhuru wa kuuliza maswali yoyote kuhusu utafiti.Mtafiti au wasaidizi wake wataweza kujibu maswali yoyote ambayo unayo wakati wa utafiti au baada ya hapo.

FAIDA
Utafiti huu utasaidia madkatari kuelewa kwa kina juu ya ugonjwa huu wa embolism ya mapafu. Kwa hivyo wataweza kuelewa njia bora zaidi ya kuuchunguza ugonjwa huu.

FIDIA
Hakuna malipo yoyote utakayopewa kwa kushiriki katika utafiti huu.

HAKI YA KUKATAA AU KUJIONDOA KATIKA UTAFITI
Uko na uhuru wa kuchagua kushiriki au kutoshiriki katika utafiti. Hautateseka au kunyimwa huduma unayohitaji kwa sababu ya kuchagua kutoshiriki katika utafiti huu.

SIRI YA UTAFITI
Taarifa zote na matokeo ya utafiti huu zitalindwa vilivyo na kuwekwa katika hali ya siri. Hakuna taarifa maalum ya mshiriki yeyote zitafafanuliwa kwa mtu yeyote bila ya idhini yako kwa maandishi.Majina yako hayataonekana kwenye kumbukumbu za utafiti huu.

MADHARA
Hakuna madhara yanayotarajiwa kutokana na wewe kuchagua kushiriki katika utafitit huu.

FOMU YA KUIDHINISHA KUSHIRIKI KATIKA UTAFITI
Mimi natoa dhibitisho kwamba daktari amenieleza vikamilifu kuhusu utafiti ambao kichwa chake kimetajwa hapo juu.Ninakiri kuwa pia nimepewa fursa ya kuuliza maswali kuhusu utafiti huu na nimeridhika na majibu niliyopewa na daktari/mtafiti msaidizi. Ninaelewa kwamba kushiriki katika utafiti huu ni kwa hiari yangu mwenyewe na sijalazimishwa. Natambua kwamba sitapokea fidia yoyote iwe fedha au vinginevyo, wala sitapokea matibabu yoyote ya upendeleo, takrima au tuzo kwa ajili yakushiriki kwangu katika utafiti huu. Naelewa kuwa taarifa zangu za kibinafsi zitakuwa siri. Ingawa hivyo taarifa kuhusu matokeo ya uchunguzi zitakazokusanywa wakatiwa utafiti huu zitaangaliwa na kuchambuliwa na mtafiti mkuu pamoja na wasimamizi wake pindi itakavyohitajika.

Ninatoa idhini yangu kushiriki katika utafiti huu.

Sahihi ya mshiriki: _____

Tarehe: _____

DHIBITISHO LA MTAFITI/MTAFITI MSAIDIZI

Ninadhibitisha ya kuwa nimemwelezea mshiriki mambo yafuatayo kuhusu utafiti huu; Kwamba kushiriki ni kwa hiari yake. Hakuna fidia yoyote itakayopeanwa kwa kushiriki katika utafiti. Mshiriki anaweza kubadili uamuzi wa kuendelea kushiriki katika utafiti huu bila ya kuadhiri huduma ya matibabu yake. Haki za mshiriki zitalindwa na habari zitakazotolewa na mshiriki zitawekwa siri wakati wote na zitatumika kwa ajili ya utafiti huu pekee yake

Jina: _____

Sahihi: _____

Tarehe: _____

Kwa maelezo zaidi unaweza kuwasiliana na mtafiti mkuu kupitia anwani ifuatayo:

Dr. Oline Loice Amunga

Idara ya Radiologia na Dawa Mionzi

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Au

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