



**St. Paul Hospital Millennium Medical College
Graduate Study Program**

**Prevalence of pulmonary thromboembolism And associated Factors In
clinically suspected Adult patients in SPHMMC From September 2021 to
September 2023 Using chest CT angiography , Addis Abeba, Ethiopia**

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September, 2023

Addis Ababa, Ethiopia



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Using chest CT angiography , Addis Abeba, Ethiopia**

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September, 2023

Addis Ababa, Ethiopia

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List of Abbreviation/ acronyms

CDC=Center for disease control and prevention

CFV=Common Femoral Vein

CTA= computed tomography angiography

DVT =Deep Venous Thrombosis

HIV/AIDS=Human Immunodeficiency Virus

HUCSH=Hawassa University Comprehensive Specialized Hospital

ICU=Intensive Care Unit

JUMC=Jimma university medical college

MRN =Medical Record Number

PTE/PE=Pulmonary Thromboembolism

PTE= pulmonary thromboembolism

SPHMMC=Saint Paulo's Millennium Medical College

SPSS= Statistical package for the social sciences TASH=Tikur Anbesa Specialized Hospital

US = Ultrasound

VTE=venous thromboembolism

VUS= Vascular Ultrasound

ABSTRACT

Background: Pulmonary thromboembolism is a condition that occurs when a blood clot that forms in a vein, loose and travels through the bloodstream to the lungs. It is a significant cause of morbidity and mortality of patients. To my knowledge and experience, there are only a few studies are done on the prevalence of pulmonary embolism and associated factors particularly in our country, Ethiopia and detailed study of it, aids in early patient management and prevention of it.

Objective: The primary aim of this study is to determine the prevalence of pulmonary thromboembolism and associated factors among clinically suspected patients by chest computed tomography angiography at St. Paulo's millennium medical college, Ethiopia.

Methods: Facility-based cross-sectional study was conducted at St. Paulo's millennium medical college, from September 2021 to September 2023. About 191 patients were taken by random sampling method. **Sampling:** The data was collected from patient card registry using questioner and from radiologic information system. Then, the data was exported and analyzed by using SPSS 25. Descriptive statistics were done to determine the prevalence of PTE among clinically suspected adults and binary logistic regression analysis was performed to identify possible factors. Hosmer-Lemeshow goodness of fit test was used to check the model. Finally, independent predictor variables of PTE were identified based on adjusted OR (AOR) with 95% CI and a p value of 0.05. **Results:** The prevalence of PTE among clinically suspected adults were 22%. The odds of PTE in patients with an underlying malignancy was 1.69 times (AOR=1.69, CI [1.22,11.58]) than those without an underlying active malignancy, the odds of PTE in female patients was 0.2 times (AOR=0.268, CI [0.097,0.739]) than males and the odds of PTE in immobilized patients was 4.6 times (AOR=4.602, CI [1.77,11.91]).

Conclusion and recommendation: This study found a significant correlation between PTE and female sex, immobility, and an active underlying malignancy and higher prevalence of PTE in our setup. Therefore, it would be best for health care

professionals and concerned organizations to address the above risk factors for prevention of the disease. **Keywords:** - Prevalence, SPHMMC, associated factors, Pulmonary thromboembolism (PTE)

1. INTRODUCTION

1.1. Background of the study

Pulmonary thromboembolism is a condition that occurs when a blood clot that forms in a vein, loose and travels through the bloodstream to the lungs. It is the most serious potentially life threatening complication of deep vein thrombosis. In addition, PE associated with DVT is the leading cause of hospital related preventable death.(1)

PE is not a single entity. Approximately 90% of all pulmonary thromboembolism originate from deep veins of lower extremities. Together, deep venous thrombosis (DVT) and pulmonary embolism constitute venous thromboembolism. Different literature states that when untreated, PE is fatal in 30% of patients.

The diagnosis of PTE is made by clinical and imaging studies. The definitive diagnosis of it is usually made by chest CTA.

Age, obesity, surgery, general anesthesia, trauma, immobility, malignancy, neurologic disease, central venous catheter, and prior superficial vein thrombosis, as well as varicose veins, congenital or acquired thrombophilia, have all been proposed as risk factors which leads to the development of PTE.

The early diagnosis and addressing of the risk factors of PTE is mandatory to prevent unnecessary deaths from PE, as the treatment of deep venous thrombosis and pulmonary embolism is a daily concern in the intensive care unit (ICU). (2)

So knowing the exact prevalence of PTE and common predisposing risk factors is important to early address the common risk factors and also diagnosing it as early as possible to initiate appropriate management.

1.2 Statement of the problem

Pulmonary thromboembolism is among the three leading causes of cardiovascular disease worldwide. In developed countries, pulmonary thromboembolism is already a serious public health problem and ranks among the main causes of mortality. Mortality from this disease is also increasing in developing countries.(3)

PTE is a major healthcare problem worldwide. In the US, DVT and PE together affect an estimated 350,000–600,000 people each year, leading to estimated 100,000–300,000 deaths.(4). In the EU over 500,000 deaths were associated with an estimated 1.1 million venous thromboembolic events.(5)

Despite the increasing recognition of venous thromboembolism as a major cause of morbidity and mortality, there is a lack of comprehensive data on its prevalence and associated factors in the Ethiopian population. Understanding the burden of this condition and its associated risk factors is crucial for developing effective prevention and management strategies.

Previous studies done in Ethiopia on recurrence and risk factors, use a small sample size and they didn't put the exact prevalence of the diseases particularly in northern parts of the country.(6,7) As well studies done in two large hospitals (TASH and HUCSH) use retrospective studies.(8)

An understanding of the associated factors for venous thrombosis is necessary to maximize the prevention of this disease in high-risk individuals and groups of patients. Despite its high burden, there have been not enough previous studies summarizing the epidemiology and prevalence of PTE in African populations particularly in Ethiopia.(9,10)

Therefore, knowing the prevalence and associated factors of PTE is necessary for our community or population to prevent and early diagnose the diseases.

1.3 Significance of the study

This study will provide the prevalence and associated factors of pulmonary thromboembolism (PTE) for an adult population of SPHMMC and its surrounding areas, and thereby serve as a guideline for the management follow-up of patients.

This will also establish the correlation between PTE/VTE and variable factors, which reminds the physicians, radiologists, and radiology technologists, to consider these associated factors for further follow-up and prevention of the diseases.

It will take the knowledge of radiology trainees and radiologists to a high level in the assessment of CTA features of PTE of clinically suspected patients .

The findings will be compared to what is obtained elsewhere, bearing in mind the peculiarity of our environment.

Data obtained from the research will be used to improve on the quality of patient care. Moreover ,the results of the study will enables the administrative council or policy makers, health bureau to identify the prevalence and causes of PTE at SPHMMC and make the use of the findings to strengthen the existing intervention strategies.

Lastly, the final findings of this study will serve as reference researchers.

2. LITERATURE REVIEW

2.1 Literature review on magnitude of pulmonary thromboembolism

Venous thromboembolism (VTE) is the third most common cause of death worldwide. The incidence of VTE varies according to different countries, ranging from 1–2 per 1000 person-years in Western Countries, while it is lower in Eastern Countries (<1 per 1000 person-years).(11)Using National Hospital Discharge Survey discharge diagnosis codes from 2007 to 2009, an estimated 548,000 VTE hospitalizations occurred each year among USA residents aged 18 years, of which 349,000 were DVT and 278,000 were PE.(12)

A study in Johannesburg, South Africa (2018) showed venous thromboembolism was Identified in 74 patients; 56(75.7%) with isolated DVT and 13 (17.6%) with isolated PE. There were five (6.8%) patients who had a concurrent DVT with PE. (13) A study in Saudi Arabia(2021) Alshahrani et.al the most common VTE sites were the left lower limb (38.5%) followed by the right lower limb (20.5%) then bilateral lower limbs (12.2%).(14)

A Study Cameroon(2015) on the pattern of venous thromboembolic diseases in from 1445 patients admitted for medical illnesses, a total of 79 venous thromboembolic diseases were detected (55 deep vein thrombosis, 14 pulmonary embolisms, 9 post phlebitis syndromes, and 1 cerulean Alba doles). The leading risk factors were prolonged immobilization (100%), age > 40 years (78.9%), obesity (43%), long-distance travel (30.4%) and HIV-AIDS (21.50%). Thirty-one (40.5%) had ≤ 2 cumulative risk factors, and 8 (10.1%) more than 4. (15)

A study in Jima was conducted among adult patients diagnosed with DVT, who was admitted to inpatients wards of JUMC and SPHMMC (2020) showed that the anatomic site of DVT, the majority of patients (124/ 96.1%) had the thrombosis of the lower extremities extending from the common iliac vein to the popliteal veins. About 115 (89.1%) of participants were found to have unilateral and only 14 (10.1%) patients have combined involvement of bilateral DVT, whereas approximately two-third of participants

had left lower extremity involvement. On the Doppler ultrasonography examination, the majority of 103 (79.8%) of DVT cases were proximal and only 21 (16.3%) cases were located distal area for the lower extremity. (16)

2.2 Burden of pulmonary thromboembolism

Thromboembolic conditions were estimated to account for 1 in 4 deaths worldwide in 2010 and are the leading cause of mortality.(17)According to the CDC (2018), an estimated 100,000 Americans die each year from VTE. According to one US research, 10-30% of people will die within one month of being diagnosed, and sudden death is the first symptom in approximately 25% of people who have a PE, costing the US health care system more than \$10 billion each year.(18) Using National Hospital Discharge Survey discharge diagnosis codes from 2007 to 2009, an estimated 548,000 VTE hospitalizations occurred each year among USA residents aged 18 years, of which 349,000 were DVT and 278,000 were PE. (12)

The burden and prevalence of VTE in Africa is high following surgery, in pregnancy and post-partum. The prevalence of deep vein thrombosis (DVT) varied between 2.4% and 9.6% in postoperative patients, and between 380 and 448 per 100 000 births per year in pregnant and postpartum women. The prevalence of pulmonary embolism (PE) in medical patients varied between 0.14% and 61.5%, with a mortality rate of PE between 40% and 69.5%. The case-fatality rate after surgery was 60%.(19)

Two studies in Africa showed the prevalence of VTE varied from 4%-11.5%. The first one in Zambia shows Prevalence of DVT of the lower limbs was 11.1 % (33/296). The prevalence of proximal lower limb DVT was 9.1%. Eighty-two percent (27/33) of all patients with DVT had proximal lower limb DVT. Asymptomatic lower limb DVT was noted in 85 % (28/33) of all patients with DVT. (20) The second one in Cameroon Cross Sectional Study VTE was seen in 4.4 cases per 1000 admissions in the internal medicine unit and ICU. About twelve cases of VTE are seen yearly at the DGH, with in-hospital mortality of 10%.(21)

According to an Ethiopian retrospective cross-sectional study conducted at TASH, 5.5 percent of patients develop VTE during their hospital stay for more than 15 days. (22) VTE associated with a recent hospitalization for medical illness imposes a significant economic burden on society across all hospital and ambulatory care services provided.

2.3. Diagnosis of pulmonary thromboembolism

- Pulmonary embolism (PE) is difficult to diagnose. The clinical signs and symptoms of the disorder are nonspecific, and the results of laboratory tests are undependable. Accordingly, imaging studies have played a major role in evaluation of patients with suspected PE.(23)
- With the introduction of helical CT in the early 1990s, direct visualization of PE became possible. Advances in CT technology have made CT pulmonary angiography (CTA) the most frequently used diagnostic method for PE in recent years.(24)
- CTA enables direct visualization of PE. Acute PE can be seen as a complete, a central partial, or an eccentric partial filling defect. A central partial filling defect presents as “polo mint sign” or “railway track sign” when perpendicular or parallel to the long axis of the vessel, respectively. With complete filling defects, vessels may be enlarged compared with those of the same generation. Indirect signs of acute PE include wedge-shaped peripheral opacities, representing pulmonary infarcts. Atelectasis and pleural effusion are nonspecific findings of acute PE.(imaging of pulmonary thromboembolism)(24)

3. OBJECTIVES

3.1General Objective

- To determine the prevalence of pulmonary thromboembolism and associated factors among clinically suspected patients by chest CTA from September 1, 2021 to September, 2023 at the SPHMMC, Addis Ababa, Ethiopia.

3.2 Specific Objective

- To determine the prevalence of pulmonary thromboembolism using chest Computed tomography angiography (CTA) during the study period.
- To identify factors associated with pulmonary thromboembolism during the study period.

4. METHODS AND MATERIALS

4.1 Study area and study period

The study was conducted at St. Paul's Hospital Millennium Medical College. St. Paul's Hospital Millennium Medical College is one of the tertiary referral hospitals directly under the Federal Ministry of Health. The hospital gives service to about 300,000 people annually with a catchment population of more than 5 million. It has a total bed capacity of 360 and on average 650 patients visit the hospital as outpatient and emergency daily. The hospital college provides both academic and non-academic services in various clinical disciplines. Close to 20% of the 300,000 annual outpatient visits to the hospital were made in the department of diagnostic and interventional radiology. Ultrasound examination accounts for one third of the imaging units.

The study was conducted from July to September, 2023.

4.2 Study design

The study design is a facility-based cross-sectional study design.

4.3 Source Population

All adult patients who visit SPHMMC during the study period.

4.4 Study Population

Sampled patients who come to the radiology department of SPHMMC for a CTA with clinical suspicion of PTE during the study period.

4.5 Inclusion and exclusion criteria

4.5.1 Inclusion criteria

All adult patients who have a clinical diagnosis of PTE at SPHMMC who came for chest CTA during the study period.

4.5.2 Exclusion criteria

Patients who had no chest CTA with clinical suspicion of PTE.

4.6 Study Variables

4.6.1 Independent variables: - Age, Sex, pregnancy or postpartum state, major surgery, trauma, prior VTE, malignancy, immobility, Heart failure

4.6.2 Dependent Variable: PTE

4.7 Sample size determination

The sample size was determined using the single population proportion formula. The three common factors to be taken into consideration for determining sample size are the level of significance (α), the margin of error (d), and the estimated baseline level, of the indicator to be measured (p). Then, the initial sample size (n_0) is given by

$$n_0 = \frac{z_{\alpha/2}^2 \times p(1-p)}{d^2}$$

Due to the absence of prevalence of PTE in our area, the sample size was calculated based on a prevalence of 50% at a 95% confidence level and margin of error of 5 %.

Given- confidence interval = 95% $Z = 1.96$, $P = 0.5$, $W = 0.05$

Study is about n

Study is about $n_0 = \frac{1.96^2 \times 0.5(1-0.5)}{0.05^2} \approx 384$ since the study population was 840

patients a finite population correction formula was used and the sample size was 263 and By considering a 10 % non-response rate , a sample size of 289 patients was taken.

4.8 Sampling technique

Random sampling was employed systematically. Within one year from September 1, 2022 to september1, 2023, 840 clinically suspected PTE were seen in st paul hospital. Based on their medical record number, they were reregistered from 1 to 842 with the new prepared notebook. All patients admitted with a clinical diagnosis of suspected PTE were taken as the study population of 840. The sample population was 289, with a k-value of 2 and the first sample was selected by lottery method, then every other sample was taken from the notebook until 289.

4.8.1 Data Collection tool

A structured questionnaire was developed based on study objectives and available literature.

4.8.1 Data collectors

The data was collected by 3 trained 3rd-year radiology residents using questioner. The one-day training was given to them on how to collect data.

Senior (as seen with chest fellow radiologist and general radiologist-to avoid diagnosis bias) approved chest CTA reports was collected by principal investigator.

4.9 Data collection procedure

The clinical history and associated factors was taken from the EMR (electronic medical registry). Images of the patients with clinical suspicion of PTE were assessed from PACS system .

4.10 Data management and analysis

Data entry and analysis was performed using SPSS version 25. Descriptive statistics such as frequency, percent, median and interquartile range were used to describe the study population in relation to relevant variables.

First, bivariable logistic regression was used to assess the association of one independent variable with the dependent variable.

The Hosmer-Lemeshow goodness-of-fit was used to test for the model fitness.

And then after multivariable logistic regression analysis was done, variables with a P-value < 0.05 at 95% CI were declared as statistically significant. Finally, the study was presented by statements and tables.

4.11 Data quality

To ensure the completeness, accuracy and consistency of data collection, a session was held on each day of the data collection period. During these sessions thorough checking was done before using the filled questionnaires.

Data editing was conducted on a daily basis by the principal investigator to check for accuracy, consistency and completeness of the questionnaires.

4.12 Ethical Consideration

Before data collection, an official written letter was obtained, from the SPHMMC Institutional Review Board, and submitted to the responsible hospital administration

office.

The participants were informed about the objectives of the study and verbal consent will be made with the full right not to participate in the study.

During the data collection procedure, patient privacy and confidentiality was kept to the maximum by collecting data anonymously.

4.13 Dissemination of the Result

After accomplishing the study, the results will be presented to the Department of Radiology and disseminated by hard or soft copy to the stack holders (SPHMMC, other referral and district hospitals, and private clinics) and policymakers.

Subsequently, attempts will be made to present it at scientific conferences and publish it in scientific journals.

5. Result

5.1 descriptive analysis

In this study a sample size of 191 was planned but because of missing data of 6 patients, a total of 185 adult patients were participated. The mean age of the participants was 41.91 with ± 11.409 SD. The minimum age was 21 years, and the maximum was 65 years.

Out of this 142 (76.8%) were female and 43 (23.2%) were male.

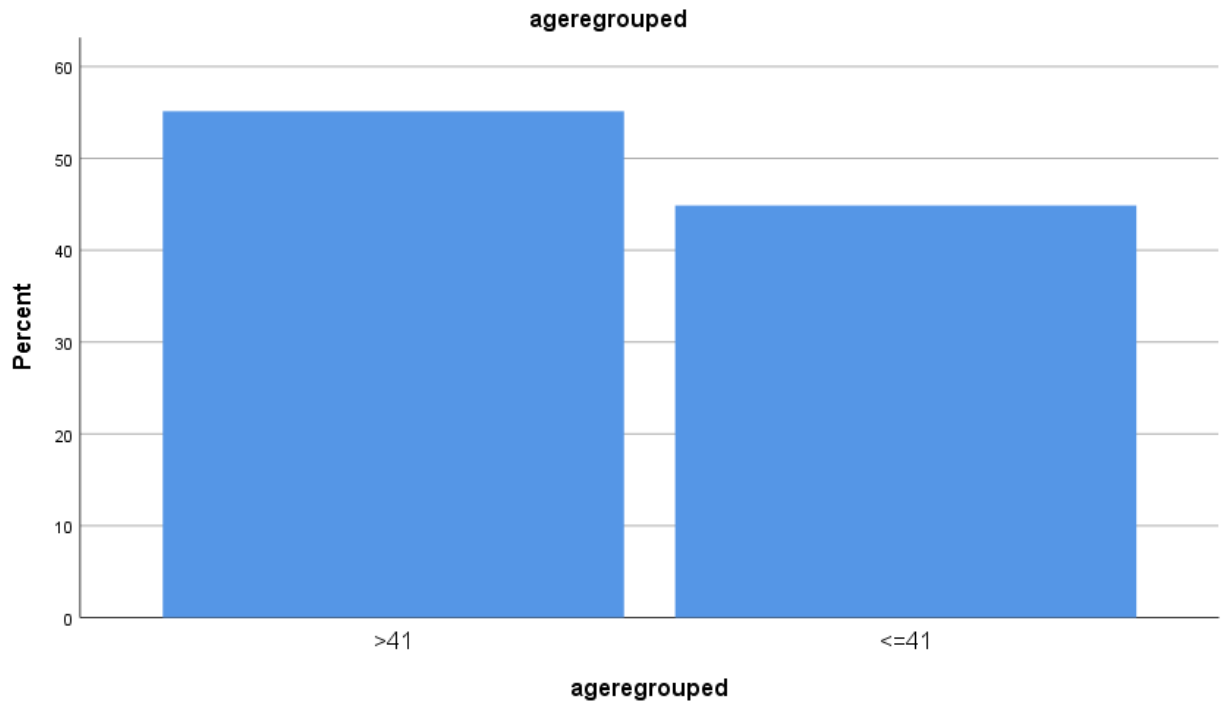


Fig 1. Socio demographic characteristics (age groups) of the study participants

Table 2: Socio-demographic features of patients who had CTA for a clinical diagnosis of PTE at SPHMMC from September 2021 to September 2023

Variables	Categories	Frequencies	Percentages
Sex	Male	43	23.2
	Female	142	76.8
Age	≤41 Years	83	44.9

>41Years Old	102	55.1
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5.2 Prevalence of PTE among the respondents.

Out of the 185 patients who were sent for Chest CTA with clinical suspicion of PTE 42 (22.3%) patients have PTE and 142 (75%) participants have no evidence of PTE on CTA.

From the patients who have an acute lower limb DVT 62% were female and 38% were male.

	Frequency	Percent
No	143	77.2
Yes	42	22.3
Total	185	100.0

Table 2, prevalence of PTE of the study participants

Out of the 185 -study population, 33 (17.8%) patients have an underlying active malignancy, and 13 (7%) of the patients had a previous history of PTE, 14 patients (7%) were pregnant/immediate post-partum, 19 patients (10%) had a recent major surgery, 10 patients (5%) had a recent major trauma, 55 patients (29%) had an immobilizing condition and 19 patients (10%) had heart failure.

5.2 Regression analysis

A total of nine variables were tested on the bivariable binary logistic regression analysis, which includes age, gender, an underlying active malignancy, previous history of PTE, pregnancy/post-partal state, major surgery, heart failure ,major trauma, and an immobilizing condition. From these five variables were identified as candidates for the multivariable analysis. These variables were gender, an underlying active malignancy, previous history of PTE, major surgery, and an immobilizing condition.

The result of the multivariable analysis identified three statistically significant factors with P-Value < 0.05 at 95% CI which are an underlying active malignancy, female sex and immobilization.

Patients with an underlying active malignancy were 4.834 times more likely to develop DVT compared to their counterparts who has no underlying malignancy (AOR=4.834, CI (1.978, 11.817)). Patients with an underlying malignancy was 1.69 times more likely to develop PTE compared to their counterparts who has no underlying malignancy (AOR=1.69, CI [1.22, 11.58]). Female patients was 0.2 times more likely to develop PTE compared to males (AOR=0.268, CI [0.097, 0.739]). Immobilized patients was 4.602 times more likely to develop PTE compared to their counterparts who are not (AOR=4.602, CI [1.77, 11.91]).

Variables	Categories	PTE		P-Value	COR	AOR	95% CI
		Yes	No				
Age	≥41 Years Old	28	74	0.342	1.86	1.57	0.61, 4.03
	<41 Years Old	14	69			1	
Sex	Female	28	114	0.011	0.509	0.268	0.097, 0.739*
	Male	14	29			1	
Malignancy	Yes	10	23	0.008	1.630	1.69	1.22, 11.58*
	No	32	120			1	
Major surgery	Yes	9	10	0.053	3.627	3.98	0.98, 8.56
	No	33	133			1	
Immobilization	Yes	23	32	0.002	4.199	4.602	1.77, 11.91*
	NO	19	111			1	
Heart failure	Yes	9	10	0.073	3.627	2.62	0.72, 2.67
	No	33	133			1	
pVTE	Yes	5	8	0.152	2.280	2.89	0.82, 5.64
	No	37	135			1	

*Statistically significant association **statistically highly significant association

Table 3: Bivariable logistic regression analysis showing factors associated with PTE in clinically suspected patients.

6. Discussion

The aim of this study was to assess the prevalence of PTE in clinically suspected adults having chest CTA and to assess determinants of PTE.

The key finding was the prevalence of PTE in clinically suspected adults having chest CTA are 22.3 % in the study populations. This result was higher in our study compared to the prevalence of PTE in a study done in Italy on prevalence of PTE among hospitalized patients with clinical suspicion of PTE having chest CTA which was 17.3 %.(25). The discrepancy in the prevalence can be due the epidemiologic differences of the study participants.

To my knowledge there is no study on prevalence of PTE on clinically suspected patients using chest CTA in Ethiopia and Africa. Most of the studies are on already diagnosed VTE patients to assess the risk factors.

Risk factors including age, gender pregnancy/post partal status, underlying active malignancy, recent major trauma, recent major surgery, immobilizing conditions were assessed, but sex, immobilization and underlying active malignancy were the significant risk factor for PTE from my multivariable analysis.

The significant association between PTE and malignancy in my study with an AOR of 1.69, is comparable with the Sirius study showing history of cancer or cancer progression as an intrinsic DVT risk factor (OR 2.33; $p=0.001$). (26) And the MEDENOX study showing a statistically significant higher risk of VTE (OR 1.62) among medical patients with cancer. (27)

The significant association of immobilization and PTE in my study with an AOR of 4. is higher compared to a study done on magnitude of risk factors of PTE (OR 1.9) .(28) and also in a study done in Cameroon where 100 % of patients with prolonged immobilization had VTE (29) .

Most patients in this study were young, but no significant differences in PTE rates were seen based on age stratification, which is in contrast to western studies which show PTE to be the disease middle age and elderly with PTE incidences increasing as age increase. (10)The apparent high number of young patients enrolled in this study could mask the usual relationship of PTE and increasing age.

Other predisposing factors such as recent major trauma, recent major surgery, heart failure conditions, pregnancy and post partal status that have been identified as significant in other studies were not statically significantly associated with PTE in my study, but many of these factors were rare, limiting my power and thus ability to draw definitive conclusions. The different epidemiological profile can play a role.

7. Limitation of the study

Pediatrics patients are not included in the study.

This cross-sectional study design with repeated sampling only enabled us to establish point prevalence of PTE on clinically suspected patients but not the incidence of new events over time, which could be a focus for future research.

The analysis of many important subgroups was limited by the small numbers of patients in these groups, limiting our power to draw conclusions about many traditional risk factors.

8. Conclusion

This study shows that the prevalent of PTE in clinically suspected patients using chest CTA is 22.3%. And immobilization, active underlying malignancy were the significant associated factor for the development of PTE in clinically suspected patients in my study.

9. Recommendation

For radiologists:

Better to do and recommend chest CTA for clinically suspected patients with high index of suspicion more importantly in immobilized patients and those having underlying active malignancy.

For other health care professionals:

Better to provide awareness on clinical signs of venous thrombosis and on the purpose of ambulation for medically admitted patients with immobilization and also putting them on prophylactic medication and also in patients with active malignancy.

For researchers:

The future researchers better to include large survey samples.

For patients with an underlying active malignancy:

Better to develop habit of early health seeking behavior as they are at increased rate of developing VTE.

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11. Annexes

Questionnaire and Data Capturing Sheet

[illegible]

Assurance of Investigator

I the undersigned resident agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide a timely progress report to my advisors and seek the necessary advice and approval from my advisors during the research. I will also communicate timely to my advisors and all stakeholders involved in the study.

Name of the Resident: Dr. Abreham Kinfu (Radiology Resident)

Signature: _____

Date: _____

Approval of Advisors

Name of Advisor: Dr. Mekonnen (MD, Consultant Radiologist)

Signature: _____

Date: _____

Name of Advisor: Mr. Abreham (MPH)

Signature: _____

Date: _____