Comparison of Computed Tomography Pulmonary Angiograms at the University Hospital of the West Indies, Jamaica with Reported Cases in Literature
W West, D Brady-West

ABSTRACT

Objective: This study was undertaken to determine the positive rate for Computed Tomography Pulmonary Angiograms (CTPAs) at the University Hospital of the West Indies (UHWI), to compare the positive rate at the UHWI to that reported in the literature and to compare the rates of positive CTPAs between the sexes.

Method: Data were obtained from the databases of the Radiology Department of the UHWI. All CTPAs performed to confirm a clinical diagnosis of pulmonary embolism and the results issued during the period January 1st 2013 and December 31st 2013 inclusive were reviewed. Only initial examinations of adequate diagnostic quality were included in the study.

Results: 313 CTPAs were performed for initial diagnosis of pulmonary embolism. 16 examinations were excluded for inadequate diagnostic quality. 297 examinations on 223 females and 74 males were included in the study. The means for age were 49.7 years and 55.1 years respectively; the difference in the means was significant (p < .05). 94 examinations (31.6%) on 22 males (7.4%, mean age 58.4 years) and 72 females (24.2%, mean age 57.5 years) were positive for pulmonary embolism. The difference in the means was not significant (p = 0.8). On chi-squared test there was no significant difference in the percentage of positive CTPAs between males and females (p = 0.7).

Conclusions: The percentage of positive CTPAs at the UHWI is high. There was no significant difference between the sexes in the percentage of positive CTPAs or the mean age at which pulmonary emboli were detected.

Keywords: Age, CTPA, pulmonary embolus, sex

From: ¹Department of Surgery, Radiology, Anaesthesia and Intensive Care, and ²Department of Pathology, University of the West Indies, Mona, Kingston, Jamaica.

Correspondence: Dr W West, Department of Surgery, Radiology, Anaesthesia and Intensive Care, University of the West Indies, Mona, Jamaica. E-mail: wayne_west@hotmail.com
INTRODUCTION

Venous thrombo-embolism and its sequel pulmonary embolism are a common cause of morbidity and mortality. The incidence of the conditions varies worldwide. French researchers Bénard et al conducted a systematic review of international medical databases and reported the annual incidence of deep vein thrombosis to be approximately 120 per 100,000 in France and 60-100 per 100,000 worldwide. They found the annual incidence of pulmonary embolism, to be between 60 to 111 per 100, 000 in France and between 23 and 107 per 100,000 internationally. (1) Cushman et al estimated that 187,000 cases of first-time venous thrombo-embolism were diagnosed yearly in the United States among those aged 45 years or older. Their study population sample comprised 21,680 participants of the Atherosclerosis Risk in Communities study and the Cardiovascular Health Study.

Subjects were aged >/=45 years, resided in six communities, and were followed for 7.6 years. (2) The conditions are also reported to show significant variation with sex and ethnicity. Keenan et al reviewed articles published between 2005 and 2007 on the effects of race/ethnicity and sex on the risk of venous thrombo-embolism. They reported that “most studies found that women have a 40-400% lower risk of recurrent venous thrombo-embolism than men. (3) Bleker et al reported similar findings: that “men have a two-fold higher risk of developing a first VTE compared with women, which is in line with earlier observations that men have a two-fold higher risk of recurrent VTE”. They also noted that “The incidence of venous thromboembolism (VTE) is two-fold higher in women than in men during reproductive age, which is likely explained by the use of hormonal contraceptives and by pregnancy in this phase of life”. (4)

Studies of the effect of ethnicity/race on risk of venous thrombo-embolism and pulmonary emboli provide strong evidence that in the USA African-American patients are
the highest risk group for first-time venous thrombo-embolism” (3). These findings were supported by research published by Tang et al in 2011 reviewing venous thrombo-embolism and pulmonary embolism in the New York City area. They reported that “fatal out-of-hospital PE was 3 times more frequent in blacks (3.7 per 100 000 people per year) than in whites (1.15) and in Hispanics (0.9)”. Also “Compared with non-blacks, blacks experience 40% more VTE and 3 times more frequent fatal PE and die at a 10-year younger age in the case of fatal PE” (5).

The symptoms and signs of the venous thrombo-embolism and pulmonary embolism are non-specific so imaging is required for confirming the clinical diagnosis. Computed Tomography Pulmonary Angiography (CTPA) is a commonly used investigation for initial diagnosis of the pulmonary embolism as it is readily available and compared to conventional pulmonary angiography CTPA is non-invasive and relatively safe (6). CTPA has a greater diagnostic yield than nuclear medicine (7). CTPA is, however, expensive and associated with risk from the use of radiation and intravenous contrast. Reagle et al in a retrospective review of 1,514 patients who underwent CTPAs, found 125 (8.2%) positive for VTE/PE. Among the 925 patients of their population with adequate data to calculate the rate of contrast-induced nephropathy (CIN), 25.8% had an increase of at least 25% in serum creatinine following the CTPA (8). Mitchell et al reported a 7% positive yield for CTPA but 14% of patients developed contrast induced nephropathy (CIN) in their prospective study of 174 patients (9). Other researchers reported different rates of positive studies. Costa et al had a 15% rate of positive studies. They also reported wide variation in the positive rates between individual physicians For individual emergency physicians, the mean CTPA positivity rate was 15.4 % but varied considerably. (10)

The attendant costs and the risks associated with radiation exposure and use of intravenous contrast media have led to the development of number of algorithms for
managing the investigation of pulmonary embolism in order to make more efficient use of CTPA. There is however no universal agreement on the algorithmic approach. For example the D-dimer measurement is useful in identifying patients who are unlikely to have PE but a recent multinational, prospective management outcome study in 19 centers in Belgium, France, the Netherlands, and Switzerland found that “using the age-adjusted cutoff instead of the 500 µg/L cutoff increased the proportion of patients in whom PE could be excluded on the basis of D-dimer” (11)

The ALARA principle for radiation exposure requires that radiation exposure be as little as possible and, further, health care professionals are under obligation to exercise fiscal responsibility in their use of investigations. These two considerations make it necessary to evaluate the returns on the use of CTPAs.

This study was undertaken to determine the percentage CTPAs, performed at the University Hospital of the West Indies (UHWI) which were positive for a clinical diagnosis of pulmonary embolism. The hospital serves a predominantly black population in Jamaica. We also sought to compare the positive rate at the UHWI to that reported in the literature and to compare the rates of positive CTPAs between the sexes.

**METHOD**

This is a retrospective review. Exemption from ethical review was obtained from the Ethics Committee of the Faculty of Medical Sciences. Data were obtained from the reports and scanning databases of the Radiology Department of the UHWI. All CTPAs performed to confirm a clinical diagnosis of pulmonary embolism and the results issued during the period January 1st 2013 and December 31st 2013 inclusive were reviewed. Only initial examinations of diagnostic quality were included in the study. Follow-up examinations and
initial examinations which were not of diagnostic quality were excluded. All examinations were performed using a standard technique on a 64 MDCT Scanner (Brilliance iCT, Philips Healthcare, Cleveland, OH, USA). All final results were issued by a consultant radiologist.

**RESULTS**

313 examinations were performed for initial diagnosis of pulmonary embolism. 16 examinations were excluded because they were inadequate for diagnosis. 297 examinations on 223 females and 74 males were included in the study. The means for age for females and males were 49.7 years and 55.1 years respectively; the difference in the means was significant \(p < .05\). 94 examinations (31.6%) on 22 males (7.4%, mean age 58.4 years) and 72 females (24.2%, mean age 57.5 years) were positive for pulmonary embolism. Figure 1 (PE by decades). The difference in the means was not significant \(p = 0.8\). The mean age for patients with positive examinations was 57.8 years and for those with negative examinations 47.9 years. The difference in the means was significance \(p < 0.001\). On chi-squared test there was no significant difference in the percentage of positive CTPAs between males and females \(p = 0.7\).

![Figure 1. Positive CTPAs by decades](image-url)
DISCUSSION

Positive yield for CTPAs have been reported at between 6. – 31%. (12). With 31.6% of examinations giving positive results the yield of CTPAs at the UHWI is among the highest in the literature. The high positive yield of CTPAs is welcomed but raises further research questions. The finding may be due, at least in part, to the efficient diagnostic skills of referring physicians but the reported high risks for venous thrombo-embolic disease among blacks may also be a contributing factor (13).

It is therefore possible that despite the high yield of positive CTPAs if there is in the population a high incidence and prevalence of venous thrombo-embolism some patients with pulmonary embolism may not be being diagnosed. The findings suggest that local clinicians should probably be encouraged to have a higher index of suspicion for pulmonary embolism. We did not review which, if any, algorithms our referring physicians used in coming to the decision to refer for CTPA but such a review would be useful to determine if further gains in efficiency are possible. It would also be useful to define imaging strategies for our population based on prospective studies which reviewed the clinical findings and laboratory tests results in our local setting. This would not only increase efficiency but may result in fewer patients who may benefit from imaging being denied same.

A potential source of error in the study is that the resident - consultant combination reporting the study were in effect a single final reader in each case. We do not think that this detracts from the merit of the study however as resident - consultant combinations are final readers in actual clinical practice.

Patients with positive studies were significantly older than those with negative studies. This pattern is consistent with that seen in other countries and is indicative of the increased prevalence of predisposing conditions for venous thrombo-embolism such
as malignancy and obesity in the older population. Increasing age is also of itself a recognized risk factor for venous thromboembolism. (14) The absence of significant difference in the positive rates of returns for males and females appears to differ from that reported in the literature. However although overall females are reported to have significantly lower rates of venous thrombo-embolism than males and this may be an inherent predisposition Heit et al reported in their review of 625 patients in Minnesota that “Factors associated with institutionalization independently account for more than 50% of all cases of venous thromboembolism in the community”….. “Other recognized risk factors such as malignancy, trauma, congestive heart failure, immobilization account for about 25% of all cases of venous thromboembolism, while the remaining 25% of cases are idiopathic”. (15)

It is possible therefore that although males may have an inherently greater risk of PE, save for women in the child bearing age whose risks are increased by pregnancy and the pill, factors such as those associated with institutionalization and other known risk factors may be playing a more important role in our population.

Further the finding may be due to the fact that there was no significance difference between the sexes in the mean age at which pulmonary embolus was detected. The mean age, at 57.8 years, would be when the vast majority of women are post-menopausal when the increased risk present in the case of younger females is removed. In summary we reviewed the rate of positive CTPAs at the University Hospital of the West Indies. Our rate for positive studies is among the highest in the published literature. Patients with positive studies were significantly older than those without. There was no significant difference in the mean age for positive studies and the rate of positive studies between the sexes. Our high positive yield for CTPAs may indicate a high
prevalence of venous thrombo-embolism in our population similar to that found in other black populations. We recommend starting a registry for venous thrombo-embolism
REFERENCES


