

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 genders.

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: Three hundred and thirteenth CTPAs were performed for initial diagnosis of pulmonary embolism. Sixteen examinations were excluded for inadequate diagnostic quality. Two hundred and ninety-seven 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 ($p < 0.05$). Ninety-four 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 genders in the percentage of positive CTPAs or the mean age at which pulmonary emboli were detected.

Keywords: Age, CTPA, gender, pulmonary embolus

Comparación de las Angiografías Pulmonares por Tomografía Computarizada en el Hospital Universitario de West Indies, Jamaica, con los Casos Reportados en la Literatura

W West, D Brady-West

ABSTRACT

Objetivo: Este estudio se llevó a cabo con el propósito de determinar la tasa positiva de las angiografías pulmonares por tomografía computarizada (APTC) en el Hospital Universitario de West Indies (UHWI), comparar la tasa positiva en el UHWI con la que se reporta en la literatura, y comparar las tasas de APTC positivas entre géneros.

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

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

Método: Se obtuvieron datos de las bases del Departamento de Radiología de UHWI. Se examinaron todas las APTC realizadas para confirmar un diagnóstico clínico de embolia pulmonar y los resultados emitidos durante el período del 1ero de enero de 2013 y 31 de diciembre de 2013 inclusive. En el estudio se incluyeron únicamente exámenes iniciales de calidad diagnóstica adecuada.

Resultados: Treientos trece APTC fueron realizadas para el diagnóstico inicial de embolia pulmonar. Se excluyeron 16 exámenes por poseer una calidad diagnóstica inadecuada. Doscientos noventa y siete exámenes de 223 hembras y 74 varones fueron incluidos en el estudio. Los promedios de edad fueron 49.7 años y 55.1 años respectivamente. La diferencia de los promedios fue significativa ($p < 0.05$). Noventa y cuatro exámenes (31.6%) de 22 varones (7.4%, edad promedio 58.4 años) y 72 hembras (24.2%, edad promedio 57.5 años) fueron positivos a la embolia pulmonar. La diferencia de los promedios no fue significativa ($p = 0.8$). En la prueba de Chi-cuadrado no hubo diferencias significativas en el porcentaje de APTC positivas entre varones y hembras ($p = 0.7$).

Conclusiones: El porcentaje de APTC positivas en el UHWI es alto. No hubo diferencias significativas de género en el porcentaje de APTC positivas o la edad promedio a la que se detectaron los émbolos pulmonares.

Palabras clave: Edad, tomografía computarizada, angiografías pulmonares, género, émbolo pulmonar

West Indian Med J 2019; 68 (2): 161

INTRODUCTION

Venous thrombo-embolism (VTE) and its sequel pulmonary embolism are common causes 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 VTE were diagnosed yearly in the United States of America (USA) among those aged 45 years or older. Their study 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 gender and ethnicity. Keenan *et al* reviewed articles published between 2005 and 2007 on the effects of race/ethnicity and gender on the risk of VTE.

They reported that “most studies found that women have a 40–400% lower-risk of recurrent VTE than men” (3). Bleker *et al* reported similar findings:

the “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 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 VTE and pulmonary emboli provide strong evidence that in the USA African-American patients are the highest risk group for first-time VTE” (3). These findings were supported by research published by Tang *et al* in 2011 reviewing VTE and pulmonary embolism in the New York City area. They reported that “fatal out-of-hospital PE was three 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 three 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 VTE 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). Computed tomography pulmonary angiography has a greater diagnostic yield than nuclear medicine (7). Computed tomography pulmonary angiography is, however, expensive and associated with risk from the use of radiation and intravenous contrast. Reagle *et al* in a retrospective review of 1514 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, healthcare 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 genders.

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 University Hospital of the West Indies (UHWI). All computed tomography pulmonary angiography (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

Three hundred and thirteen examinations were performed for initial diagnosis of pulmonary embolism. Sixteen examinations were excluded because they were inadequate for diagnosis. Two hundred and ninety-seven 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 ($p < 0.05$). Ninety-four 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 significant $p < 0.001$. On Chi-squared test there was no significant difference in the percentage of positive CTPAs between males and females ($p = 0.7$).

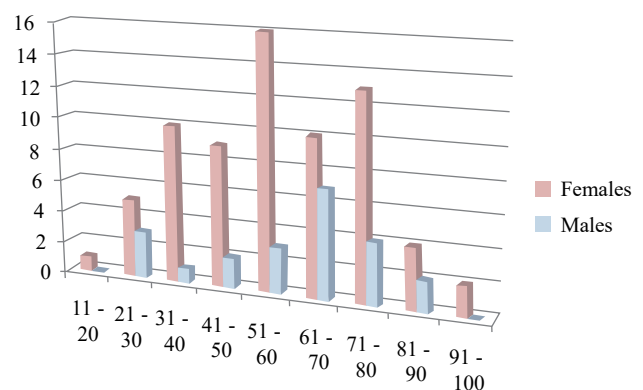


Figure 1. Positive CTPAs by decades

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 (VTE) 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 VTE some patients with pulmonary embolism may not be being diagnosed. The findings suggests 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 VTE such as malignancy and obesity in the older population. Increasing age is also of itself a recognized risk factor for VTE (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 VTE 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 VTE in the community”... “other recog-

“nized risk factors such as malignancy, trauma, congestive heart failure, immobilization account for about 25% of all cases of VTE, while the remaining 25% of cases are idiopathic” (15).

It is possible therefore, that although males may have an inherently greater risk of PE, women in the child bearing age whose risks are increased by pregnancy and the pill, factors such as those associated with institutionalization and other know 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 significant difference between the genders 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 genders. Our high positive yield for CTPAs may indicate a high prevalence of VTE in our population similar to that found in other black populations. We recommend starting a registry for VTE.

REFERENCES

1. Bénard E , Lafuma A , Ravaud P. Epidemiology of venous thromboembolic disease. *Presse Med* 2005; 26; **34**: 415–9.
2. Cushman MI, Tsai AW, White RH, Heckbert SR, Rosamond WD, Enright P et al. Deep vein thrombosis and pulmonary embolism in two cohorts: the longitudinal investigation of thromboembolism etiology. *Am J Med* 2004; **117**: 19–25.
3. Keenan CR, White RH. The effects of race/ethnicity and sex on the risk of venous thromboembolism. *Curr Opin Pulm Med*. 2007; **13**: 377–83.
4. Bleker SM, Coppens M, Middeldorp S. Sex, thrombosis and inherited thrombophilia. *Blood Rev* 2014; **28**: 123–33. doi: 10.1016/j.blre.2014.03.005. Epub 2014 Apr 1.
5. Tang Y, Sampson B, Pack S, Shah K, Um SY, Wang D et al. Ethnic differences in out-of-hospital fatal pulmonary embolism. *Circulation* 2011; **123**: 2219–25.
6. Au VWK, Veitch E, Gustafson S, Kermeen F, Sage MR. Radiological investigation of pulmonary embolism: an audit in a teaching hospital. *Hong Kong J Radiol* 2005; **8**: 141–5.
7. Chin P, Hurrell M, McGregor D, Beckert L. The role of CT pulmonary angiography in patients with suspected pulmonary embolism.
8. Reagle Z, Tringali S, Gill N, Peterson MW. Diagnostic yield and renal complications after computed tomography pulmonary angiograms performed in a community-based academic hospital. *Acad Emerg Med* 2012; **19**: 618–25. doi: 10.1111/j.1553-2712.2012.01374.x.
9. Mitchell AM, Jones AE, Tumlin JA, Kline JA. Prospective study of the incidence of contrast-induced nephropathy among patients evaluated for pulmonary embolism by contrast-enhanced computed tomography. *Emerg Radiol* 2014; **21**: 133–41. doi: 10.1007/s10140-013-1169-x. Epub 2013 Nov

10. Costa AF, Basseri H, Sheikh A, Stiell I, Dennie C. The yield of CT pulmonary angiograms to exclude acute pulmonary embolism. *Emerg Radiol* 2014; **21**: 133–41. doi: 10.1007/s10140-013-1169-x. Epub 2013 Nov 2.
11. Righini M, Van Es J, Den Exter PL, Roy PM, Verschuren F, Ghuyssen A et al. Age-adjusted D-dimer cutoff levels to rule out pulmonary embolism: the ADJUST-PE study. *JAMA* 2014; **311**: 1117–24. doi:10.1001/jama.2014.2135.
12. Walen S, Leijstra MA, Uil SM, Boomsma MF, van den Berg JW. Diagnostic yield of CT thorax angiography in patients suspected of pulmonary embolism: independent predictors and protocol adherence. *Insights Imaging* 2014 Apr 3. (Epub ahead of print).
13. Roberts LN, Patel RK, Arya R. Venous thromboembolism and ethnicity. *Br J Haematol* 2009; **146**: 369–83.
14. Geerts WH, Bergqvist D, Pineo GF, Heit JA, Samama CM, Lassen MR et al. Prevention of venous thromboembolism: american college of chest physicians evidence-based clinical practice guidelines (8th Edition), *Chest*. 2008; **133 (6_suppl)**: 381S–453S. doi:10.1378/chest.08-0656
15. Heit JA, O'Fallon WM, Petterson TM, Lohse CM, Silverstein MD, Mohr DN et al. Relative impact of risk factors for deep vein thrombosis and pulmonary embolism: a population-based study. *Arch Intern Med* 2002; **162**: 1245–8.

© West Indian Medical Journal 2019.

This is an article published in open access under a Creative Commons Attribution International licence (CC BY). For more information, please visit https://creativecommons.org/licenses/by/4.0/deed.en_US.

