

**INCIDENTAL PULMONARY EMBOLISMS IN CT ANGIOGRAMS IN PATIENTS
IMAGED AS PER STROKE CODE PROTOCOL: INCIDENCE AND DETECTION RATE**Abdul Rehman AlMutairi*¹, Syed Zubair Ayoub², Mohammed AlAhmadi³, Yasir AlJadhi⁴ and Sofia Muzafer⁵

Place of Study and Affiliation- King Fahad Medical City, Riyadh, Saudi Arabia.

*Corresponding Author: Abdul Rehman AlMutairi

Place of Study and Affiliation- King Fahad Medical City, Riyadh, Saudi Arabia.

Article Received on 15/10/2020

Article Revised on 05/11/2020

Article Accepted on 25/11/2020

ABSTRACT

PE is a preventable cause of death among hospitalized patients. The mortality related to PE can be as high as 24% but early treatment is highly effective. A standard CTA stroke protocol examines the neurovasculature from the aortic arch to the vertex of the head, providing additional information on the angiography of the upper lobes of the lung including the hilum. Our study is a hospital based retrospective study, about 327 CT scans were studied done over a period of 3 months with properly followed CT stroke code protocol as per the department policy. Out of the studied 327 cases, 322 (98.5%) were negative and 5 (1.5%) cases were positive. Out of the 5 positive cases 3 (0.9%) were detected by the first reporting neuroradiologist and 2 (0.6%) were missed on initial reporting. These 2 cases were retrospectively detected by the team which consisted of two neuroradiologist, a fellow and a 3rd year resident.

KEYWORDS AND ABBREVIATION: Computed tomography (CT), PE (Pulmonary embolism), Stroke code, AIS (Acute Ischemic Stroke).

INTRODUCTION

Incidence of PE is estimated to be approximately 60 to 70 per 100,000, of the general population.^[1] Pulmonary embolism is major health problem that can be the source of significant morbidity and mortality. PE is a preventable cause of death among hospitalized patients.^[2] The mortality related to PE can be as high as 24%,^[3] but early treatment is highly effective. Deaths occurring in first week after a large stroke are primarily due to direct effect of brain injury, while deaths occurring subsequently are due to preventable medical conditions like PE.^[4] Modern preventive therapy for VTE on a stroke unit can substantively reduce the occurrence of this common stroke-related morbidity. As per the research by Jitphapa (2013) PE occurred in nearly 1% of acute ischemic stroke patients.^[5] It may be related to an underlying pro-thrombotic state. Patients with PE are at increased risk of paradoxical embolism due to increased cardiac pressure.

A standard CTA stroke protocol examines the neurovasculature from the aortic arch to the vertex of the head, providing additional information on the angiography of the upper lobes of the lung including the hilum. Imaged pulmonary vasculature in CT scans done as per stroke protocol is quickly glimpsed or even sometimes overlooked by the reading radiologists in the setting of stroke code activation mainly due to the

limited time available for prompt decision making thus an incidental pulmonary embolism can be missed.

Hypotheses/Research Question

To identify the incidence of pulmonary embolisms and its detection rate in CT scans done as per stroke code protocol

Literature Review

- Jitphapa (2005) unsuspected pulmonary embolism was present in 20 (3.4%) of 581 patients who have done CT scans of the chest for other reasons than PE.^[6]
- PE was identified in 10 out of 440 patients, an incidence of 2.23%, was described by Farrell C (2009)^[7]
- Karius (2018) suspected PE was found in 0.3% incidence of PE in patients imaged for cardiac assessment utilizing ECG-gated coronary CT angiography.
- Winston (1996) has found Incidental pulmonary emboli were detected in approximately 1% of patients who underwent contrast-enhanced CT of the chest.^[8]

Methods & Data Collection

It is tertiary care hospital based retrospective study where about 327 CT scans were studied done over a period of about 3 months with properly followed CT

stroke code protocol as per the department policy. All the scans were already reported by neuroradiologists, then retrospective review of the cases was carried out by a team of two neuroradiologist, a fellow and a 3rd year radiology resident, with particular focus on visualized pulmonary vasculature.

Incidental findings will be classified into two groups; positive for pulmonary embolism or negative for pulmonary embolism and then further categorized into missed or detected following retrospective review of the report.

Inclusion and Exclusion criteria

The data was collected through retrospective descriptive observation from the RIS and PACS systems of 327

patients, the data collected were based on the inclusion criteria which is (any case done as per stroke code protocol in KFMC CT departments from the period 1st of January 2009 to 25th of march 2019. There are no exclusion criteria. The data was analyzed by the SPSS.

Limitations

The population of interest is limited to the patients whom presented with AIS to our institution (KFMC) and may not widely represent the scale of patients with AIS in general population. The size of the sample is small, and it may not give an accurate estimation.

Data Presentation/Findings

Table 1: Showing collected data and analysis.

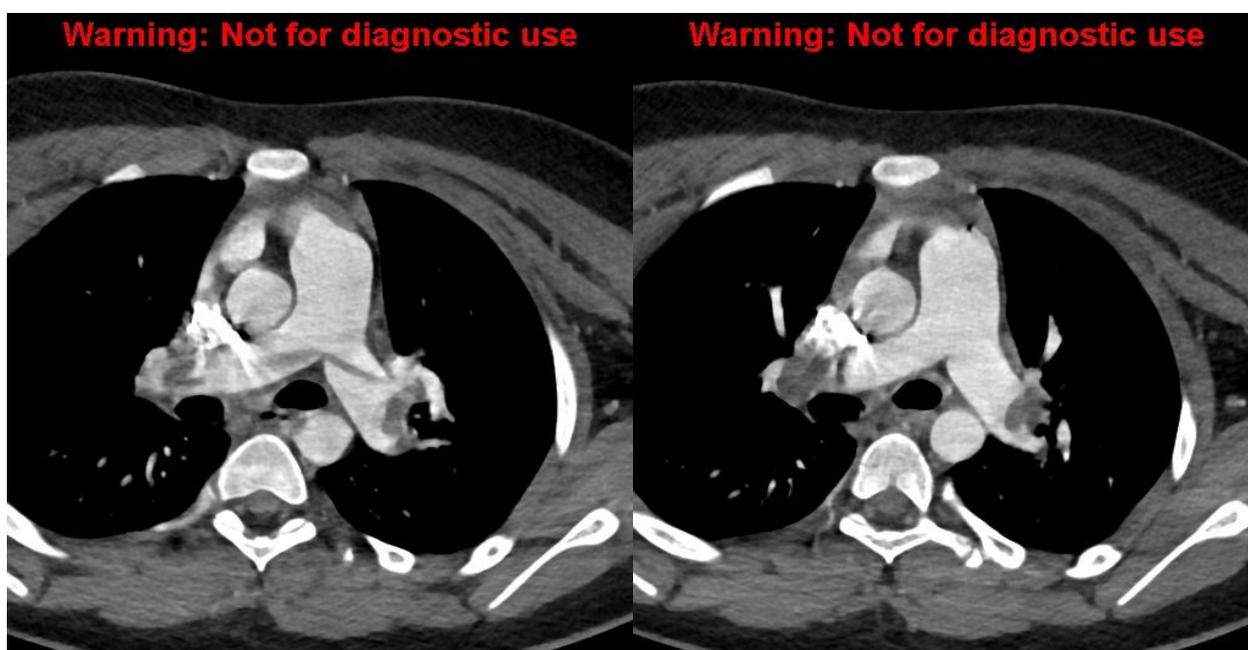
Pulmonary Embolism	(our observation) N (%)	(neuroradiologist) N (%)		
		Not detected	Detected	Negative
Negative	322(98.5)	0(0)	0(0)	324(99.1)
Major	2(0.6)	0(0)	2(0.6%)	0(0)
Segmental	2(0.6)	1(0.3)	1(0.3)	0(0)
Sub-segmental	1(0.3)	1(0.3)	0(0)	0(0)
Total detected	5(1.5)	2(0.6)	3(0.9)	327(100)

Table explanation- Total 327 cases were studied, out of which 322 (98.5%) were negative and 5 (1.5%) cases were positive. Out of the 5 positive cases 3 (0.9 %) were detected by the first reporting neuroradiologist and 2

(0.6%) were missed by him which were minor pulmonary embolism. These 2 cases were retrospectively detected by the team which consisted of two neuroradiologist, a fellow and a 3rd year resident.

Table 2: Statistical analysis.

Within our observation	Not detected N (%)	Detected N (%)	Kappa	P-value
Our observation	0(0%)	5(100%)	0.7	0.0001
Neuroradiologist	2(40%)	3(60%)		



Two CT images showing major bilateral pulmonary embolism.

Incidence rate of PE in AIS patients is 1.5%. Considering the negative cases as undetected cases, the reporting Neuroradiologist didn't detect 0.6% of positive cases. Although the agreement factor Kappa was 0.7 reflecting substantial agreement (Cohen Kappa) and there was a significant difference between the two observers ($P=0.0001$) regarding agreement level. However in such a major and potentially life-threatening condition any agreement level less than almost perfect agreement should not be accepted.

CONCLUSION

Pulmonary embolism is a preventable life threatening condition, hence it is mandatory to focus on pulmonary vasculature in any post contrast exam specially taken in arterial phase, which includes a part of the chest. As per our study there is a 0.6 % chance of missing PE by a qualified neuroradiologist. This is more pronounced when there is high load of cases and quick reports are needed.

REFERENCES

1. Jan Bělohávek, MD PhD, Vladimír Dytrych, MD, and Aleš Linhart, MD PhD. Pulmonary embolism, part I: Epidemiology, risk factors and risk stratification, pathophysiology, clinical presentation, diagnosis and nonthrombotic pulmonary embolism.
2. Naess IA, Christiansen SC, Romundstad P, Cannegieter SC, Rosendaal FR, Hammerstrøm J. Incidence and mortality of venous thrombosis: a population-based study. *J Thromb Haemost*, 2007; 5: 692-9.
3. Carson JL, Kelley MA, Duff A, et al. The clinical course of pulmonary embolism. *N Engl J Med*, 1992; 326: 1240-5.
4. Skaf E, Stein P, Beemath A, Sanchez J, Olson R. Fatal pulmonary embolism and stroke. *Am J Cardiol*, 2006; 97(12): 1776-7.
5. Prasanna Venkatesan Eswaradass (a1), Sadanand Dey (a1), Dilip Singh (a1) and Michael D. Hill "Pulmonary Embolism in Ischemic Stroke", May 2018; 343-345. *Canadian Journal of Neurological Sciences*.
6. Jitphapa Pongmoragot, Alejandro A. Rabinstein, Yongchai Nilanont and Gustavo Saposnik "Pulmonary Embolism in Ischemic Stroke: Clinical Presentation, Risk Factors, and Outcome" *October Journal of the American Heart Association [Online]*, 2013.
7. C. Farrell, M. Jones, F. Girvin, G. Ritchie, J.T. Murchison*. Unsuspected pulmonary embolism identified using multidetector computed tomography in hospital outpatients.
8. C B Winston, R J Wechsler, A M Salazar, A B Kurtz, P W Spirn "Incidental pulmonary emboli detected at helical CT: effect on patient care".