https://doi.org/10.29309/TPMJ/2025.32.01.8089

The Professional Medical Journal
www.theprofesional.com
2025, Volume, 32 Issue, 01

ORIGINAL ARTICLE

Real world experience of acute pulmonary embolism presented to a dedicated tertiary cardiac care center.

Mohammad Waleed[1], Abidullah[2], Shama Ayaz[3], Shah Zeb[4], Rafiullah Jan[5], Ali Raza[6]

Article Citation: Waleed M, Abidullah, Ayaz S, Zeb S, Jan R, Raza A. Real world experience of acute pulmonary embolism presented to a dedicated tertiary cardiac care center. Professional Med J 2025; 32(01):11-17. https://doi.org/10.29309/TPMJ/2025.32.01.8089

ABSTRACT… Objective: To highlight incidence, management and outcomes of disease in patient presenting to a tertiary cardiac center with acute pulmonary embolism. **Study Design:** Observational Cross-sectional study. **Setting:** Peshawar Institute of Cardiology, Peshawar. **Period:** 1st Sept, 2022 to 31st August 2023. **Methods:** All patients who underwent in-hospital Computed tomography pulmonary angiogram (CTPA), at out center. We collected data of all patient who were with CTPA proven pulmonary embolism via non-probability convenient sampling method. We accessed our local radiology and clinical databases for data collection. The collected data was integrated in SPSS version 23 for statistical analysis. **Results:** A total of 33 patients with CTPA proven pulmonary embolism were included out of which majority of patients were intermediate risk i.e., 20(71.4%). Management strategy used mainly was anticoagulation 27(81.8%). Regarding outcomes, 3(9.1%) expired while 30(90.9%) patients were discharged home successfully. **Conclusion:** Pulmonary embolism is not as uncommon as previously thought. A proper workup for its diagnosis and risk factors identification specially in young patients will not only improve management strategies but also quantify future risk of recurrence. Management of intermediate risk patient poses problems; this class of patients need strict monitoring for any clinical deterioration. Among these patients' careful selection for thrombolysis to avoid deterioration has to be balanced with high risk of bleeding. In some high bleeding risk group catheter-based therapy may be an option.

Key words: Anticoagulation, Cardiopulmonary Arrest, Hemodynamics, Pulmonary Embolism, Thrombolytics.

INTRODUCTION

Pulmonary embolism along with deep venous thrombosis, the venous thromboembolism (VTE), is considered as third most common cause of acute cardiovascular syndrome after MI and stroke.[1] The exact incidence of the disease is not known. Although reported infrequent, it may be largely prevalent in old aged, hospitalized, bed bound patients with multiple comorbidities and their cause of death. Additionally, up to 40-50% of deep venous thrombosis patients may develop pulmonary embolism which goes unrecognized.[2] In one study pulmonary embolism was observed in 14.6% of autopsy reports of all hospitalized patient while it contributed to or caused death in 0.2% of all hospitalized patients regardless of their diagnosis[3], unveiling the importance of workup for diagnosing and then treating all suspected patients with PE. In brief, it's the low level of suspicion and inaccuracies in clinical and even autopsy diagnosis, that pulmonary embolism is reported as uncommon. The annual incidence of PE and DVT is approximately 0.5-1.0 per 1000 people.[1] The mortality of treated patients for PE is 8%, however figures as high as 30% are reported for those who do not receive treatment out of these 10% of patient have sudden death.[2]

Clinical presentation of PE ranges from completely asymptomatic patients, where it is diagnosed accidently, to hemodynamic instability. Symptoms with which patient present are dyspnea, chest pain even presyncope and syncope. Along with clinical sign and symptoms, knowledge of patient risk factors also adds to clinical probability of disease. Common risk factors for pulmonary embolism are postoperative states, major abdominal/pelvic surgery, hip/knee

1. MBBS, MRCP (UK), Assistant Professor & Associate Dean Research, Peshawar Institute of Cardiology, KPK, Pakistan.
2. MBBS, MRCP (UK), Associate Professor & Head Cardiology, Consultant Cardiologist, Department of Cardiology, Peshawar Institute of Cardiology, KPK, Pakistan
3. MBBS, FCPS, Trainee Registrar Cardiology, Peshawar Institute of Cardiology, KPK, Pakistan.
4. MBBS, FCPS, Associate Professor Cardiology, Peshawar Institute of Cardiology, KPK, Pakistan.
5. MBBS, FCPS, Assistant Professor Cardiology, Peshawar Institute of Cardiology, KPK, Pakistan.
6. MBBS, MRCP, CCST (UK), Assistant Professor Cardiology, Peshawar Institute of Cardiology, KPK, Pakistan.

Correspondence Address:
Dr. Ali Raza
Department of Cardiology
Peshawar Institute of Cardiology, KPK,
Pakistan.
aliraza987@hotmail.com

Article received on: 04/01/2024
Accepted for publication: 06/08/2024

joint replacement, postoperative intensive care, pregnancy, and purpureum, lower limb fractures, malignancies, limited mobility and genetics (thrombophilia). Chest x-ray is mostly abnormal but with nonspecific changes. ECG changes of RV strain and tachycardia my point towards severity of disease. Echo may also aid in diagnosing PE by revealing features of RV, depending on size and site of thrombus.[2] Determining probability of disease via Geneva or wells criteria is important to decide which patients will go for CTPA.[1]

By integrating clinical evaluation, imaging, laboratory markers and scoring systems (PESI and sPESI), pulmonary embolism is categorized into low, intermediate and high-risk groups. Low risk pulmonary embolism, is managed with anticoagulation only. A sub-category of low-risk PE which involves subsegmental branches (SSPE) on computed tomography of pulmonary artery (CTPA) may be just observed for clinical deterioration.[4] High risk PE, PE with hemodynamic instability, needs additional therapy with thrombolytics, catheter-based therapy or surgical embolectomy depending upon contraindication to thrombolytics and availability of interventional and surgical expertise and risk of complications with these treatment modalities like bleeding and intracranial hemorrhage.[5] Management strategy for intermediate risk pulmonary embolism, which constitute a major bulk, is not clear. An individualized approach based on risk of clinical deterioration and adverse effects of advanced therapies is used.[1,3,6]

OBJECTIVE

1. To determine the frequency of pulmonary embolism presenting to a tertiary care dedicated cardiac center
2. Review the applied management strategies and their outcomes.
3. To highlight the importance of comprehensive assessment and need for modern treatment modalities in selected high-risk category patients.

METHODS

It was an observational cross-sectional study. We collected data of all patient who were admitted with CTPA proven pulmonary embolism via non-probability convenient sampling method. We accessed our local radiology database (RadiAnt DICOM) for all those patients who underwent in-hospital CTPA, from 1st Sept, 2022 to 31st August 2023 after approval from institutional Review Board Committee (IRC/23/51). The search yielded total number of 79 adults who underwent CTPAs (Figure-1). Among them 67 patients had CTPA done for suspicion of PE while 11 patients had it done for other purposes, 1 patient was <18 years of age and 1 patient had no data in HMIS except for CTPA report, so they were excluded. Only the CTPA reports for suspicion of PE were reviewed and final 33(49%) patients with positive CTPA findings of acute PE were included in our analysis.

For demographic, clinical and echocardiographic data collection hospital management information system (HMIS) and electronic medical record (EMR) was accessed for each patient. Patients with ECG changes of T-wave inversion in leads V1–V4, III and Avf, Incomplete or complete right bundle branch block, cardiac axis tilt >90°, S-wave in lead I and Q wave in lead III, P pulmonale in leads II and III, ST-segment elevation in leads V1–V2 or tachycardia were considered as positive for PE changes. For transthoracic echocardiography (TTE), increase in RV/LV dimension ratio, dilation of non-hypertrophic RV, hypokinesia or akinesia of the RV free wall, paradoxical ventricular septal motion, 'D-shape' of the interventricular septum, RV dilation, or pulmonary artery dilation were considered positive.[2] Using the information available we categorized our patients into 3 groups. Patients were grouped into low, intermediate and high risk based on hemodynamics, sPESI score, troponin, and TTE changes. Low risk patients were those who were stable hemodynamically with sPESI of <1 and normal troponin and no TTE changes. Intermediate patients were those who were vitally stable with sPESI score ≥1 and either/both raised troponins and TTE changes. High risk group was one with hemodynamic instability i.e. systolic BP <100mmhg, with signs

of end organ hypoperfusion.[1] Management strategy used and outcomes of all these patients were reviewed. The collected data was integrated in SPSS version 23 for statistical analysis. We calculated mean with standard deviations for quantitative data like age and duration of hospital stay in days, while frequencies and percentages were calculated for qualitative data like gender, clinical presentation, risk factors, ECG and echo changes, troponins, hemodynamic stability, severity, management strategy and outcomes of patient. Valid percentages were calculated for variables with missing values like ECG changes, troponins, and severity of PE. Finally, contingency tables were used to analyze outcomes with respect to level of thrombus on CTPA, severity of pulmonary embolism, hemodynamics of patient on presentation, and management strategy used.

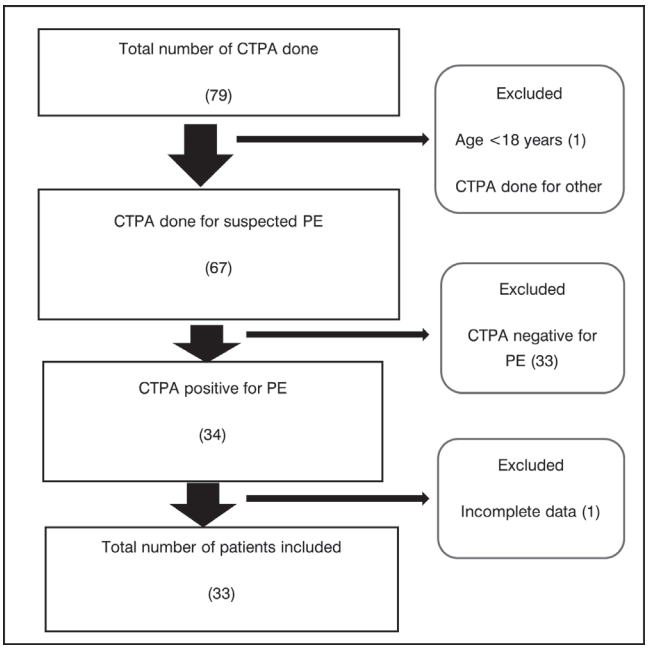

Figure-1. Flowchart for data collection

RESULTS

Out of the total 67 patients presenting with suspicion of acute pulmonary embolism who underwent CTPA, only 33 patients (49.2%) with CTPA positive diagnosis of pulmonary embolism over 1-year span were included in the study. Mean age observed was 52.79 (SD14.5) years. Patient demographic details has been summarized in Table-I. 54.5% were male and 45.5% were female with mean stay at hospital was 5.7(SD 3.8) days. Major presenting symptom in patients was SOB 23(69.7%). Out of 33, 16(55.2%) patients had ECG changes consistent with PE, while 23(69.7%) of patient had at least 1 feature of disease on transthoracic echo (TTE). In our study it was observed that more than 2/3rd of patients 24(72.7%) the risk factors were not identified and none of patient had undergone thrombophilia screening, proper workup for risk factors was lacking and majority of identified risk factors were only history based with no laboratory workups. Troponins were raised in 7 (25.9%) patients.

We also analyzed the CTPA results and categorized the patients on the basis of locality of the thrombus in the pulmonary arterial circulation. Around 60% of the patients had the thrombus in proximal segments; either in the main pulmonary artery (MPA), right pulmonary artery (RPA) or left pulmonary artery (LPA) (Table-I). These are patient at highest risk for clinical deterioration while main treatment strategy used overall and even in these patients was only anticoagulation (81.8%). Only 1(3.0%) patient admitted was hemodynamically unstable. Major bulk of patients 20(71.4%) were falling in category of intermediate risk group. Anticoagulation strategy was used in 27(81.8%) of patient while thrombolytics administered to 6(18.2%) of patients, none of patient received catheter-based therapy or surgical resection.

Regarding in-hospital mortality, 30 (90.9%) patients were discharged alive while 3 (9.1%) of patient died in hospital. (Figure-2)

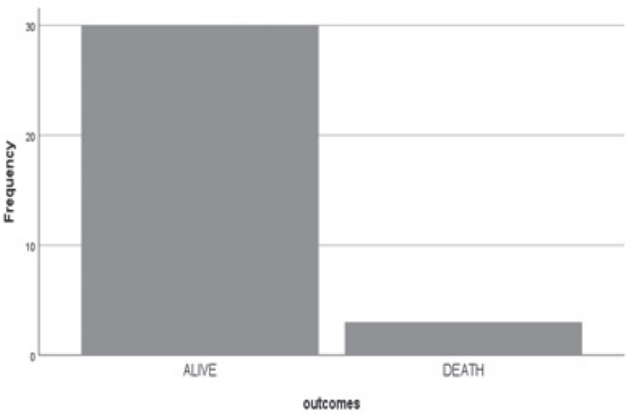

Figure-2. Outcomes of patients presenting with pulmonary embolism

Age	
<39 years	6(18.2%)
40-49 years	7(21.2%)
50-59 years	9(27.3%)
60 years and above 11(33.3%)	11(33.3%)
Gender	
Female	15(45.5%)
Male	18(54.5%)
Hospital stay (in days)	5.70(SD 3.8)
Clinical presentation	
SOB	23(69.7%)
Chest pain	5(15.2%)
Chest pain+ SOB	4(12.1%)
Presyncope	1(3.0%)
Risk factors	
Trauma, surgery, limb fracture	2(6.1%)
Cancer	1(3.0%)
Heart failure	2(6.1%)
Bed rest	2(6.1%)
Obesity	2(6.1%)
Couldn't identify	24(72.7%)
ECG changes	
No	13(44.8%)
Yes	16(55.2%)
Missing	4
sPESI	
<1	3(9.1%)
≥1	30(90.9%)
ECHO changes	
Yes	23(69.7%)
No	10(30.3%)
Troponins	
Normal	20(74.1%)
Raised	7(25.9%)
Missing	6
CTPA Findings	
Main pulmonary artery with saddle thrombus	10(30.3%)
Right or left pulmonary artery	10(30.3%)
Lobar	7(21.2%)
Segmental and sub-segmental	6(18.2%)
Hemodynamic stability	
Yes	32(97.0%)
No	1(3.0%)
Severity	
Low	3(10.7%)
Intermediate	20(71.4%)
High	5(17.9%)
Missing	5
Management	
Anticoagulation	27(81.8%)
Thrombolytics	6(18.2%)
Outcomes	
Discharged alive	30(90.9%)
Death	3(9.1%)

Table-I. Characteristics of patients admitted with pulmonary embolism

Figure-3. Pulmonary embolism

		Level of thrombosis on CTPA				Total
		Main Pulmonary Artery With Saddle Thrombus	Right or Left Pulmonary Artery	Lobar	Segmental and Subsegmental	
Out comes	Alive	9	9	6	6	30
	Death	1	1	1	0	3
Total		10	10	7	6	33

Table-II. Outcomes VS level of thrombosis on CTPA crosstabulation

		Anticoagulation	Thrombolytics	Total
Outcomes	Alive	25	5	30
	Death	2	1	3
Total		27	6	33

Table-III. Outcomes VS in hospital management Crosstabulation

DISCUSSION

Acute pulmonary embolism can be a life-threatening disease and is not an infrequent presentation to any hospital emergency department. It is the low level of suspicion and incomplete investigational workup that delays the timely and appropriate diagnosis. If diagnosed and treated promptly[24], it can lead to saving lives. Also, as opposed to previous believes, it is no more an old age disease and as shown in our cohort, significant percentage of patients (66.7%) with this condition were of relatively younger age group, with age less than 60 years.[7]

One of the crucial aspects in patient with acute pulmonary embolism, is to make every effort to determine the underlying predisposing risk factors. Determining the underlying temporary

and/or permanent risk factor, will not only dictate the duration of treatment with oral anticoagulation (OAC), but also helps in addressing and guiding the appropriate treatment for the risk factors. In case of permanent and non-modifiable risk factors, patients will be advised for long term anti-coagulation. Among those patients who were diagnosed with the disease majority of patients (69.7%), had no comprehensive and complete workup done for determining risk factors for the disease. Even among those whose risk factors were identified all of them were history-based e.g., those with diagnosed cancer, history of surgery or being bed-ridden, or obesity on examination were all identified on arrival history. No laboratory tests were done for those in whom risk factors were not present on history because these tests were not available in our setup and patients couldn't do them from outside hospital due to financial constraints. European Society of Cardiology (ESC) has summarized the VTE predisposing factors and categorized into strong, moderate and weak risk factors on the basis of odds ratios.[13,22] Every effort must be made to look for these predisposing factors, and, even if despite detailed history and examination no risk factors are identified than the patient should be screened for autoimmune disease and thrombophilia.[19]

Another important finding was presence of thrombus in proximal segments on CTPA i.e., main or right or left pulmonary artery 20(60.6%) (Table-I) (Figure-3). These are patient at highest risk for clinical deterioration while main treatment strategy used overall and even in these patients was only anticoagulation (81.8%).[23] In our data 2 of died patients had proximal thrombus where 1 patient received thrombolytics and other was only on anticoagulation (Table-III). Both the patient when presented to hospital were hemodynamically stable. These results show that although not included in criteria of risk stratifications in ESC guidelines, level of thrombus may have impact on clinical deterioration, as it progresses from non-obstructive to completely obstructive thrombus thus destabilizing patient with more proximally located thrombi, focusing on the importance of strict monitoring of these high-risk patients and planning regarding treatment strategies on basis of CTPA findings. For these high-risk patients considering thrombolytics without waiting for hemodynamic deterioration may be an option in our part of world, but taking into consideration high bleeding risk with streptokinase efforts should be made to introduce newer modalities like catheter base focal thrombolytics administration of these proximal thrombi. It will not only clear pulmonary artery of thrombi effectively but also save the patients from grave side effects, like ICH, of streptokinase.[19] A multicenter Registry of catheter-directed mechanical aspiration thrombectomy (CDMT) in 110 high risk and intermediate-high risk PE patients using 8F Indigo (Penumbra, Alameda, CA, USA) system, have shown that CDMT improve hemodynamics with acceptable safety profile.[10,25] In a meta-analysis comparing catheter directed thrombolysis (CDT) versus systemic anticoagulation alone in sub massive PE[20,21,22], CDT was associated with significantly lower in-hospital, 30-day, and 90-day mortality and a tendency toward lower 1-year mortality with similar bleeding rates as compared with systemic anticoagulation.[11-18]

Our study has several limitations. It is a retrospective, single center, small sample size study. Being a life-threatening problem, we author strongly believe that despite small sample size, this study highlights the actual presentation of disease to the emergency department, need of thorough assessment, appropriate treatment of acute pulmonary embolism and reinforce the need of new CDMT in selected high risk PE patients. The other limitation is the inclusion criteria. We only included those patients who had the CTPA for suspected PE. There have been few other patients presented to our hospital emergency department with unstable acute PE, who presented in pre-arrest or cardiac arrest situation and were not stable enough to make it to the CT department for CTPA. After doing bedside echocardiography and making a clinical and echocardiographic diagnosis of very high-risk PE, immediate systemic thrombolytic therapy was administered in those few cases. None of those cases survived and hence has not had CTPA and not included in our study. These high risk hemodynamically unstable patients might

have benefited from CDMT.

CONCLUSION

Pulmonary embolism is not an uncommon disease. A proper workup for its diagnosis and risk factors identification specially in young patients will not only improve management strategies but also quantify future risk of recurrence. The current management protocols used in our side of the world has a lot to improve in terms of strict monitoring, proper workup of admitted patient for risk factors identification, individualizing treatment options for each patient based on CTPA findings, clinical stability, and risks associated with medications like bleeding and ICH with streptokinase. Besides that, it is high time to work on introduction of newer modalities in the country like catheter-based therapies to improve RV functions with lower bleeding risk and thus overall outcomes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Konstantinides SV, Meyer G, Becattini C, Bueno H, Geersing GJ, Harjola VP, Huisman MV, Humbert M, Jennings CS, Jiménez D, Kucher N. **2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS) The Task Force for the diagnosis and management of acute pulmonary embolism of the European Society of Cardiology (ESC).** European Heart Journal. 2020 Jan 21; 41(4):543-603.

2. Bělohlávek J, Dytrych V, Linhart A. **Pulmonary embolism, part I: Epidemiology, risk factors and risk stratification, pathophysiology, clinical presentation, diagnosis and nonthrombotic pulmonary embolism.** Experimental & Clinical Cardiology. 2013; 18(2):129.

3. Stein PD, Henry JW. **Prevalence of acute pulmonary embolism among patients in a general hospital and at autopsy.** Chest. 1995 Oct 1; 108(4):978-81.

4. Goy J, Lee J, Levine O, Chaudhry S, Crowther M. **Sub segmental pulmonary embolism in three academic teaching hospitals: a review of management and outcomes.** Journal of Thrombosis and Haemostasis. 2015 Feb 1; 13(2):214-8.

5. Kürkciyan I, Meron G, Sterz F, Janata K, Domanovits H, Holzer M, et al. **Pulmonary embolism as cause of cardiac arrest. Presentation and outcome.** Arch Intern Med. 2019; 160:1529-35.

6. Weinstein T, Deshwal H, Brosnahan SB. **Advanced management of intermediate-high risk pulmonary embolism.** Critical Care. 2021 Dec; 25(1):1-8.

7. Wu H, Cao H, Song Z, Xu X, Tang M, Yang S, Liu Y, Qin L. **Rivaroxaban treatment for young patients with pulmonary embolism.** Experimental and Therapeutic Medicine. 2020 Aug 1; 20(2):694-704.

8. Irmak İ, Sertçelik Ü, Öncel A, Er B, İnam G, Durhan G, et al. **Correlation of thrombosed vessel location and clot burden score with severity of disease and risk stratification in patients with acute pulmonary embolism.** Anatolian Journal of Cardiology. 2020 Oct; 24(4):247.

9. Furfaro D, Stephens RS, Streiff MB, Brower R. **Catheter-directed thrombolysis for intermediate-risk pulmonary embolism.** Annals of the American Thoracic Society. 2018 Feb; 15(2):134-44.

10. Sławek-Szmyt S, Stępniewski J, Kurzyna M, Kuliczkowski W, Jankiewicz S, Kopeć G, et al. **Catheter-directed mechanical aspiration thrombectomy in a real-world pulmonary embolism population-a multicenter registry.** European Heart Journal: Acute Cardiovascular Care. 2023 Jun 15; zuad066.

11. Ismayl M, Balakrishna AM, Aboeata A, Gupta T, Young MN, Altin SE, et al. **Meta-analysis comparing catheter-directed thrombolysis versus systemic anticoagulation alone for submassive pulmonary embolism.** The American Journal of Cardiology. 2022 Sep 1; 178:154-62.

12. Lenzhofer R, Wimmer F, Haydl H, Kardeis J, Gruber G, Ganzinger U, et al. **Prospective study of determining the value of D-dimer in diagnosing pulmonary embolism.** Wien Klin Wochenschr. 2019; 105:492-96.

13. Jimenez D, Lobo JL, Monreal M, Moores L, Oribe M, Barron M, et al. **Prognostic significance of multidetector computed tomography in normotensive patients with pulmonary embolism: Rationale, methodology and reproducibility for the PROTECT study.** J Thromb Thrombolysis. 2022; 34:187-92.

14. Moores L, Aujesky D, Jimenez D, Diaz G, GoMez V, Marti D, et al. **Pulmonary embolism severity index and troponin testing for the selection of low-risk patients with acute symptomatic pulmonary embolism.** J Thromb Haemost. 2020; 8:517-22.

15. Vanni S, Nazerian P, Pepe G, Baioni M, Risso M, Grifoni G, et al. **Comparison of two prognostic models for acute pulmonary embolism: Clinical vs. right ventricular dysfunction-guided approach.** J Thromb Haemost. 2021; 9:1916-23.

16. Jimenez D, Lobo JL, Monreal M, Moores L, Oribe M, Barron M, et al. **Prognostic significance of multidetector computed tomography in normotensive patients with pulmonary embolism: Rationale, methodology and reproducibility for the PROTECT study.** J Thromb Thrombolysis. 2022; 34:187-92.

17. Donze J, Le Gal G, Fine MJ, Roy PM, Sanchez O, Verschuren F, et al. **Prospective validation of the pulmonary embolism severity index. A clinical prognostic model for pulmonary embolism.** Thromb Haemost. 2019; 100:943-48.

18. Kearon C: **Excluding pulmonary embolism with th helical (spiral) computed tomography: Evidence is catching up with enthusiasm.** CMAJ. 2003; 168:1430-31.

19. Musset D, Parent F, Meyer G, Maître S, Girard P, Leroyer C, et al. **Diagnostic strategy for patients with suspected pulmonary embolism: A prospective multicenter outcome study.** Lancet. 2002; 360:1914-1920.ce is catching up with enthusiasm. CMAJ 2023; 168: 1430-1431.

20. Kucher N, Printzen G, Goldhaber SZ: **Prognostic role of brain natriuretic peptide in acute pulmonary embolism.** Circulation. 2023; 107:2545-56.

21. Bone RC: **The low-probability lung scan: A potentially lethal reading.** Arch Intern Med. 2023; 153:2621-22.

22. Kucher N, Printzen G, Doernhoefer T, Windecker S, Meier B, Hess OM, et al. **Low pro-brain natriuretic peptide levels predict benign clinical outcome in acute pulmonary embolism.** Circulation. 2022; 107:1576-78.

23. Konstantinides S, Geibel A, Olschewski M, Kasper W, Hruska N, Jackle S, et al. **Importance of cardiac troponins I and T in risk stratification of patients with acute pulmonary embolism.** Circulation. 2022; 106:1263-68.

24. Tsapogas M: **Contemporary aspects in vein thrombosis.** Hellenic surgery. 1987; 59:411-18.

25. Ogino H, Ando M, Matsuda H, Minatoya K, Sasaki H, Nakanishi N, et al: **Japanese single-center experience of surgery for chronic thromboembolic pulmonary hypertension.** Ann Thorac Surg. 2006; 82:630-36.

AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Mohammad Waleed	Conceptulize and reviewing.	
2	Abidullah	Data collection.	
3	Shama Ayaz	Write article & draft of manuscript.	
4	Shah Zeb	Data collection.	
5	Rafiullah Jan	Data collection.	
6	Ali Raza	Critical and revision.	