A retrospective study on pattern of pulmonary embolism in chestdepartment-Assiut University

Maha M. El-Kholy[a], Samiaa H. Sadek[a], Reham M. Elmorshedy[a], Adel M. El-labody[b]

[a]Department of Chest, Faculty of Medicine, Assiut University Hospital, Assiut, [b]Chest Hospital, ICU Department, Sohag, Egypt

Correspondence to Adel M. El-labody, MSc, Gomhorria St, Tagdeef Dief Allah Tower, In Front of Tagdeef Club, Floor 9, Flat 31, Sohag, Egypt.
Postal Code:82511;
Tel: 00201017400534;
e-mail: Adel.labody@yahoo.com

Background
Pulmonary embolism (PE) is a severe and fatal disease, and its incidence varies widely between countries.

Aim
To determine the frequency of PE in the Chest Department of Assiut University Hospital, to determine the risk factors and effective treatment, and to study the outcome of the disease in this locality.

Patients and methods
In this retrospective study, 222 patients suspected to have PE were screened for PE and underwent computed tomography-pulmonary angiogram to confirm or exclude a clinical suspicion of PE. All of the following were collected from patient data sheets: history, clinical examination data, ECG abnormalities, chest radiograph, Doppler ultrasound, echocardiography, chest ultrasound, laboratory reports, treatment lines, and the outcome in the form of mortality, ICU admission, length of hospital stay, and discharge to home.

Results
Of the included PE cases, all of them received heparin followed by warfarin, except for 10 patients who received rivaroxaban without any toxicity. Warfarin dose needed to reach therapeutic international normalized ratio (between 2 and 3) was 3–9 mg in –85% of the patients. A total of 71 patients needed admission to ICUs, and of them, 24 patients died, but there were no recorded deaths in the ward. Housewives represented 43.7%. The most common symptoms were dyspnea (84%) and chest pain (62%). Tachypnea was the most frequent sign (72%), and hypotension was observed in 13.5%. PE was common in patients with diabetes mellitus, patients with chronic obstructive pulmonary disease (COPD), patients with deep-vein thrombosis, and those who use oral contraceptive pills (18.5, 17.5, 17.1, and 14.4%, respectively). Regarding echocardiography findings, 16.4% of our patients were cardiomyopathic, 74.4% had mild to moderate pulmonary hypertension, with severe pulmonary hypertension detected in only 7% of patients. Computed tomography-pulmonary angiogram revealed main pulmonary artery embolism in 49.09% of the patients, and in 60 (27%) patients, it was bilateral.

Conclusion
PE is frequent in Upper Egypt. Diabetes and COPD are the most important risk factors of PE. Death owing to PE is markedly associated with OHS and COPD morbidity.

Keywords:
assiut, pattern, venothromboembolism

Introduction

Pulmonary embolism (PE) was clinically described in the early 1800s, when von Virchow first described the connection between venous thrombosis and PE [1,2].

PE spans a broad spectrum of illnesses, ranging from asymptomatic, incidentally discovered subsegmental thrombus detected on chest computed tomography (CT) scan [3] to pressure-dependent PE complicated by cardiogenic shock and multisystem organ failure [4,5]. Between these two extremes are patients with symptomatic low-risk or intermediate-risk disease [6,7].

PE can be a severe disease and is difficult to diagnose, given its nonspecific signs and symptoms. Because of this, testing patients with suspected acute PE has increased dramatically.

However, the overuse of some tests, particularly CT and plasma D-dimer measurement, may not improve care while potentially leading to patient harm and unnecessary expense [8].

Acute PE can lead to significant morbidity and mortality [9,10].

It is essential to detect risk factors and demographic features of PE at the population level. Different studies have demonstrated different risk factors. This study was carried out to describe incidence, demographic data, and risk factors of PE in Assiut University Hospital to determine its incidence, risk stratification, and outcome.

Patients and methods

Patients
Data were recruited retrospectively by reviewing records of 260 patients admitted to the Chest Department of Assiut University Hospital with primary diagnosis of PE between January 2011 and December 2015, with IRB number: 17101547. A total of 38 patients were excluded because of missing data. An informed consent was obtained from all patients before their inclusion in this study.

Inclusion and exclusion criteria
All patients who were admitted to the Chest Department of Assiut University Hospital in the medical emergency room and respiratory ICU between January 2011 and December 2015 with primary diagnosis of PE were eligible to participate in this study.

This study protocol was approved by the local ethics committee in Assiut faculty of medicine. Privacy and confidentiality of all the information were assured.

Methods
This study was formed by identifying all patients with clinical features of PE who underwent computed tomography-pulmonary angiogram (CTPA) to confirm or exclude a clinical suspicion of PE.

All of the following were collected from patients' sheets.

History
Full history, including age; sex; occupation; risk factors such as history of trauma, operations, flight, immobility, and oral contraceptive pills; main complaints; previous history of similar conditions; history of deep-vein thrombosis (DVT); and therapeutic history.

Moreover, history of comorbid medical conditions such as congestive heart failure, chronic obstructive pulmonary disease (COPD), cerebrovascular disease, and connective tissue disease was also taken.

Clinical examination data
Patients underwent assessment of vital signs, general examination, and chest examination.

ECG abnormalities, for example, tachycardia, atrial fibrillation, inverted T wave, P pulmonale sign, S1Q3T3 sign, and others, were recorded.

Imaging reports
Chest radiography reports and any abnormal findings were recorded.

CT pulmonary angiography was done to detect site and level of PE.

Doppler ultrasound was done on the deep venous system.

Regarding echocardiography (Chemla et al., 2004) reports, we classified severity of pulmonary hypertension by estimating systolic pulmonary artery pressure using echocardiography and application of the following formula: $MPAP = 0.61\ SPAP + 2$ mmHg [11].

Chest ultrasound was used as a bedside tool to detect any abnormal findings related to PE.

Laboratory investigations were done for the following:
(1) ABG at admission and discharge included pH, $PaCO_2$, and PaO_2.
(2) Collagen profile (done in limited numbers of patients) included the following:
   (a) Rheumatoid factor.
   (b) Antinuclear antibody.
   (c) Lupus anticoagulant.
   (d) Anti-DNA.
(3) International normalized ratio (INR) at admission and discharge was recorded.

Treatment lines were reported including unfractionated heparin, LMWH, warfarin, and NOACs.

Outcomes were in the form of the following:
(1) Mortality.
(2) ICU admission.
(3) Length of hospital stay.
(4) Discharge to home.

Statistical analysis
The data was collected , analyzed and tabulated .The results were expressed as mean ± standard deviation or frequencies. Statistical analysis was performed using Statistical Package for the Social Sciences version 22 (SPSS Inc., Chicago, II., USA) software. P value is considered significant if it equals or below 0.05.

Results

In this retrospective observational study period, 14 878 patients were admitted to the Chest Department between 2011 and 2015. A total of 260 (1.75%) patients were diagnosed clinically as having PE, which is confirmed by CTPA in 222 (1.5%) patients. Patients with confirmed CTPA were included in the present study; all of them received heparin followed by warfarin, except for 10 patients who received rivaroxaban without any toxicity. Warfarin dose needed to reach therapeutic INR (between 2 and 3) was 3–9 mg in ~85% of the patients. A total of 71 patients needed ICU stay, and of them, 24 died, with no recorded death in the ward; the total death rate was 10.8% (Fig. 1). Regarding demographic data of our patients (Table 1), 51.4, and 48.6% were males and females, respectively, with a mean age of 49.81 ± 11.00 years. Nonsmokers were 48.2%. Housewives represented 43.7% of the patients. The most common symptoms of PE were dyspnea (84%) and chest pain (62%), whereas syncope was reported in only 9% of the patients. On the contrary, tachypnea was the most frequent sign (72%), hypotension was observed in 13.5%, and fever was detected in only 7.5% of the patients (Table 2). PE was common in patients with multiple comorbidities (27%), but other common risk factors included diabetes mellitus, COPD, DVT, and use of oral contraceptive pills (18.5, 17.5, 17.1, and 14.4%, respectively) (Table 3). Table 4 demonstrates that the most frequent ECG finding was sinus tachycardia. The specific ECG finding S1Q3T3 was observed in only 17.7% of the patients. Overall, 35.6% of patients had normal chest radiograph finding. Chest ultrasound was done in only 62 patients, and it was positive in ~87% of patients (Table 5). Regarding
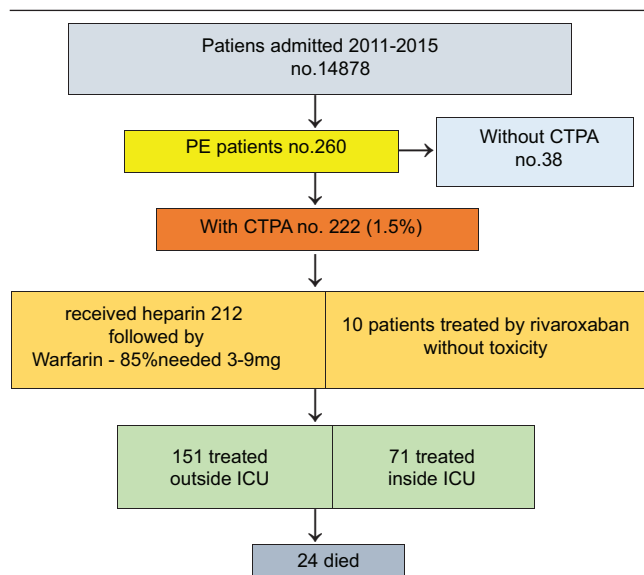
echocardiography findings, 16.4% of our patients were cardiomyopathic, 74.4% had mild to moderate pulmonary hypertension, with severe pulmonary hypertension detected in only 7% of patients (Table 6). CTPA revealed main pulmonary artery embolism in 49.09% of the patients, and in 60 patients, it was bilateral (27%) (Table 7). A total of 51 (54.8%) patients with main pulmonary artery embolism were had classified as high probability of PE depending on the Revised Geneva Score (Table 8).

Figure 1

Frequency and outcome of patients with confirmed PE by CTPA included in the present study. CTPA, computed tomography-pulmonary angiogram; PE, pulmonary embolism.

Table 1 Demographic data of patients with pulmonary embolism

	n=222 [n (%)]			
Sex				
Male	114 (51.4)			
Female	108 (48.6)			
	(%)	Male	Female	P
Age (years)				
<50	104 (46.9)	42	62	0.002*
≥50	118 (53.1)	72	46	
Mean±SD (range)	49.81±11.00 (17.0-73.0)			
	n=222 [n (%)]			
Special habits:				
No smoking	107 (48.2)			
Current smoker	37 (16.7)			
Former smoker	49 (22.1)			
Passive smoker	29 (13)			
			n=222 [n (%)]	
Occupation				
Farmer			29 (13.1)	
Housewife			97 (43.7)	
Driver			21 (9.4)	
Manual workers			22 (9.9)	
Employees with jobs requiring sitting for long periods			53 (23.9)	

*Significant.

Table 2 The clinical presentation of patients with pulmonary embolism

Symptoms	n=222 [n (%)]	Signs	n=222 [n (%)]
Dyspnea	187 (84)	Tachypnoea (RR >20/min)	160 (72)
Chest pain	137 (62)	Tachycardia (HR >100/min)	60 (27)
Cough	50 (22.5)	Signs of DVT	28 (12.5)
Hemoptysis	40 (18)	Fever	17 (7.5)
Syncope	20 (9)	Cyanosis	10 (4.5)
Wheezes	42 (19)	Hypotension	30 (13.5)
Orthopnea	40 (18)	Signs of pleural effusion	
Calf/thigh pain	44 (20)		33 (14.9)

DVT, deep-vein thrombosis; HR, heart rate; RR, respiratory rate.

Table 3 Risk factors and comorbidities in patients with confirmed pulmonary embolism

Risk factors	n=222 [n (%)]
Multiple comorbidities	59 (27)
Diabetes	41 (18.5)
Chronic obstructive pulmonary disease	39 (17.5)
Deep venous thrombosis	38 (17.1)
Oral contraceptive pills	32 (14.4)
Others	13 (5.8)

Discussion

Venous thromboembolism has a significant load all over the world, with associated high risk of death [12].

The frequency of PE cases in our hospital was 1.5%. Overall, 85% of patients with PE achieved therapeutic INR with an average dose of warfarin between 3 and 9 mg. This was in agreement with Rackauskiene *et al.* [13], who observed that the average dose of warfarin to achieve therapeutic level of INR in patients younger than 65 years was 6 ± 3 mg.

Table 4 ECG and radiograph findings

ECG	%	Chest radiograph findings	%
Normal sinus	23.7	Normal	35.6
Sinus tachycardia	63.4	Wedge shaped opacity	22.5
Atrial fibrillation	1.8	Pleural effusion	14.9
Inverted T wave	8.5	Consolidation	10.4
S1Q3T3	17.7	Elevated hemi diaphragm	9.9
P pulmonale	8.5	Cardiomegaly	8.5
PRWP	4.9	Prominent pulmonary artery	4.5

Table 5 Chest ultrasound

	n=222 [n (%)]
Chest sonar	
Done	62 (27.9)
Not done	160 (72.1)
	n=62) [n (%)]
Chest sonar findings	
Normal	8 (13)
Consolidation	24 (38.7)
Pleural-based hypoechoic lesion	12 (19.4)
Pleural effusion	33 (53.2)

Table 6 Echocardiography reports

	n=222 [n (%)]
Echocardiography	
Found	94 (31.1)
Echocardiography findings: n=94	n (%)
Missed	128 (68.9)
Normal	11 (11.7)
Dilated right side	40 (42.6)
Tricuspid regurgitation	24 (25.5)
Mild tricuspid regurgitation=3	24 (12.5)
Moderate tricuspid regurgitation=9	24 (37.5)
Severe tricuspid regurgitation=12	24 (50)
Left atrium dilatation	9 (9.5)
Diastolic dysfunction	9 (9.5)
Ejection fraction	n=73 (%)
Ejection fraction ≥50%	61 (83.6)
Ejection fraction <50%	12 (16.4)
Pulmonary artery systolic pressure	n=70) (%)
No pulmonary hypertension	
SPAP ≤38 mmHg	13 (18.6)
Mild pulmonary hypertension	
SPAP=about 39-55 mmHg	26 (37.2)
Severe pulmonary hypertension	
SPAP >55 mmHg	31 (44.2)

There were no recorded cases of death in the ward. All cases of death were recorded in ICU, with a total death rate among patients with PE of 10.8%. This observation is logical as all critical patients and patients with massive PE were admitted to ICU. Comparable death rates were observed in many studies, where 30-day case fatality rate was 10% and was 15% in 3 months [14,15].

In the present study, 51.4% were males and 48.6% were females, with a mean age of 49.81 ± 11.00 years. This is in agreement with Barrios *et al.* [16], who conducted a retrospective cohort study of 2096 patients diagnosed with acute PE and revealed that 48% of patients were males and 52% were females, but the study disagrees with our results related to the mean age of patients, which was higher in their study (68.7 ± 16.6 years). This could be explained by economic and lifestyle factor differences between the two countries where both studies were conducted.

Another Egyptian study by El-Komy *et al.* [17] confirms our opinion about decreased mean age of PE occurrence in Egypt. They found that the mean age was 51.7 ± 12.34 years and also revealed 79.2% were males and 20.8% were females.

The most common symptom of PE in this study was dyspnea (84%) and the least one (9%) was syncope. Many studies support these results [18,19], and tachypnea was the most common clinical sign in these studies and also in this study.

Moreover, these studies [18,19] documented a comparable prevalence of fever in patients with PE (7%) to ours (7.5%).

Overall, 27% of patients with PE had multiple comorbidities, which reflects different mechanisms of developing PE. Moreover, diabetes, COPD, DVT, and history of oral contraceptive pills were common risk factors. Many studies are in agreement with these results [20–22].

This study revealed that sinus tachycardia was the most common ECG finding of the patients. The study by Petruzzelli *et al.* [23] is in agreement with this result.

The specific ECG finding S1Q3T3 was observed in only 17.7% of the patients of this study. This is in agreement with Ullman *et al.* [24], who documented that S1Q3T3 pattern was seen in ~15–25% of patients with PE, whereas Vanni *et al.* [25] found S1Q3T3 in 56 (15%) of 386 patients with PE.

Despite chest ultrasound was done in only 62 patients, it was positive in 87% of them, and this result is comparable to the observations of Squizzato *et al.* [26],

Table 7 Level and extent of pulmonary embolism obstruction

Affected side findings	Right side alone	Left side alone	Bilateral	Total of affected patients by variable lesions. (*n*=222)	% *n*=222	*P*
Main pulmonary artery embolism	41	8	60	109	49.09	0.000*
Lobar and segmental level PE	18	15	28	61	27.47	0.139

*Significant. PE, pulmonary embolism.

Table 8 Relationship between probability of pulmonary embolism depending on the Revised Geneva score, results of computed tomography-pulmonary angiogram, and echocardiography

Clinical probability CTPA and cardiography	Low probability *n*=55/222 [*n* (%)]	Intermediate probability *n*=74/222 [*n* (%)]	High probability *n*=93/222 [*n* (%)]	*P*
Main pulmonary artery embolism (*n*=109)	32 (58.2)	26 (35.1)	51 (54.8)	0.012*
Lobar and segmental-level pulmonary embolism (*n*=61)	16 (29.09)	13 (17.57)	32 (34.4)	0.051
Subsegmental-level pulmonary embolism (*n*=97)	18 (32.7)	30 (40.54)	49 (52.69)	0.049
No pulmonary hypertension SPAP ≤38 mmHg (no. 13)	6 (46.2)	4 (30.8)	3 (23)	0.054
Mild pulmonary hypertension SPAP=about 39-55 mmHg (*n*=26)	4 (15.3)	7 (27)	15 (57.7)	0.205
Severe pulmonary hypertension SPAP >55 mmHg (*n*=31)	5 (16.1)	6 (19.4)	20 (64.5)	0.022*

*Significant. CTPA, computed tomography-pulmonary angiogram.

who found positive results in 82% of patients with confirmed PE.

Our study revealed jugular vein thrombosis in only 3.4% of patients, and this agrees with the study by Ho [27], who observed that lower extremity and pelvic venous thromboembolism is more frequent than upper extremity.

Conclusion

PE is frequent in Upper Egypt. Diabetes and COPD are the most important risk factors of PE. Death owing to PE is markedly associated with OHS and COPD morbidity.

Limitations

We observed a significant defect in database of the department, with many items not reported, which affected markedly the results of the research, so we recommend revising and rearrangement of our database to allow obtaining valuable research data.

Moreover, we do not have data about long-term follow-up of patients with PE after discharge from hospital, so we recommend doing future research in this field.

Recommendations

(1) Establishment of multidisciplinary teams for diagnosing and treating patients with PE is needed.
(2) More health education about PE disease in needed, especially for those who are at high risk of developing PE.
(3) Clinical probability scores need more re-evaluation according to multicenter study.

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