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LETTERS TO THE EDITOR

Clinical characteristics and risk factors of pulmonary embolism: data from a Saudi tertiary-care center

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Pulmonary embolism (PE) is a common condition in hospital emergency departments, and its incidence increases exponentially with age [1]. As PE remains largely underdiagnosed and inappropriately treated, outcomes are suboptimal. This is partly because clinical symptoms and signs can be non-specific [2]. However, a recent study indicated that most PE patients have at least one of the four following symptoms: sudden-onset dyspnea, chest pain, syncope, and hemoptysis [3]. Diagnosis is usually based on these clinical findings, laboratory tests, and imaging data. However, it has also been suggested that clinical probability should ideally first be assessed by means of a validated prediction model [3]. Early diagnosis, risk stratification and timely treatment are critical for improving the clinical outcome of PE patients. Thus, optimization of risk stratification to enable the treatment of patients before they develop hemodynamic instability, the most significant prognostic factor, is the focus of current PE management strategies. Here, we aimed to describe the clinical features and risk factors of PE patients presenting to a Saudi tertiary-care center. We retrospectively analyzed the medical records of all patients referred to the Radiology Department of the King Khalid University Hospital for a suspected PE between January 2008 and January 2012. PE diagnosis was based on clinical manifestations, laboratory findings (e.g. D-dimer levels), and radiologic data (e.g. spiral computed tomography, ventilation–perfusion scan, and computed tomography angiography).

General characteristics of the study population

Among 341 suspected PE patients referred to the hospital, 273 were found to be non-PE patients, and PE was diagnosed in 68 patients. Of the suspected cases, 126 (126/341) were outpatients (37.0%), and 18 of these (18/126) were verified as having PE. Thus, 26.5% of those diagnosed with PE were outpatients (73.5% were inpatients), and 39.6% of non-PE patients were outpatients ($P = 0.032$). Also, 25 patients diagnosed with PE were men and 43 were women (36.7% vs. 63.3%, respectively; $P = 0.404$), revealing an overall female/male ratio of 2 : 1 for diagnosed PE patients. However, it must be noted that 60.8% of non-PE patients were women.

The mean age of participants was 45.1 ± 17.9 years, and this did not differ between diagnosed and suspected cases (44.3 ± 17.0 vs. 45.1 ± 18.1; $P = 0.724$). The proportions of PE in adolescents (≤20 years of age), adults (21–60 years of age) and elderly people (> 60 years of age) were 4.6%, 78.5%, and 16.9%, respectively. It is striking that our patients were much younger than PE patients from other reported studies. Although it has been reported that those aged ≥ 75 years are at increased clinical risk of PE [4], only three diagnosed PE patients were aged > 75 years in our study. The low mean age could be attributable to the population structure in Saudi Arabia, as only 3% of the population is > 65 years of age, whereas in Western countries > 13% of the population is > 65 years of age. In fact, in line with our observations, another study from Saudi Arabia, which focused on deep vein thrombosis, found a mean age of ~ 45 years [5].

Clinical features

We observed that the most frequent symptoms in patients referred to the Radiology Department for PE were shortness of breath (69.8%), chest pain (43.1%), cough (22.0%), tachycardia (15.8%), leg swelling (15.5%), and hemoptysis (7.0%) (Table 1), which is in accordance with data from other studies [4,6]. However, our results revealed that the rates of chest pain (58.8% vs. 39.2%; $P = 0.004$), leg swelling (25.0% vs. 13.2%; $P = 0.024$) and dyspnea (89.7% vs. 64.8%; $P < 0.001$) were significantly different between patients with and without PE. The remaining symptoms, including cough (30.9% vs. 19.8%; $P = 0.071$), hemoptysis (11.8% vs. 5.9%; $P = 0.110$), and

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Table 1 Risk factors and comorbidities of suspected and diagnosed pulmonary embolism (PE) patients

	Non-PE patients (n = 273), no. (%)	PE patients (n = 68), no. (%)	P-value
Antiphospholipid syndrome	3 (1.1)	6 (8.8)	0.003*
FVII deficiency	3 (1.1)	1 (1.5)	0.592
FXII deficiency	2 (0.7)	0 (0.0)	0.640
FV Leiden disorder	0 (0.0)	2 (2.9)	0.040
Hyperhomocysteinemia	1 (0.4)	3 (4.4	0.026*
Lupus	6 (2.2)	10 (14.7)	< 0.0001*
Protein S/C deficiency	7 (2.6)	13 (19.1)	< 0.0001*
Obesity	26 (9.5)	12 (17.7)	0.051
Advanced age	7 (2.6)	1 (1.5)	0.502
Transient immobility	27 (9.9)	12 (17.6)	0.088
Mechanical valve replacement	1 (0.4)	0 (0.0)	0.800
Road traffic accident	12 (4.3)	3 (4.4)	0.649
Surgery	56 (20.5)	18 (26.5)	0.325
Pregnancy	5 (1.8)	3 (4.5)	0.196
Postpartum	14 (5.1)	5 (7.4)	0.553
Oral contraceptives	0 (0.0)	3 (4.4)	0.008*
Sickle cell disease	7 (2.6)	2 (2.9)	0.566
Thalassemia	1 (0.4)	0 (0.0)	0.800
Diabetes	74 (27.1)	15 (22.1)	0.443
Chronic liver disease	8 (2.9)	6 (8.8)	0.040*
Heart failure	47 (17.2)	10 (14.7)	0.718
Nephrotic syndrome	16 (5.9)	2 (2.9)	0.544

*Student's t-test was performed, and a P-value of < 0.05 was considered to be statistically significant.

tachycardia (22.1% vs. 14.3%; $P = 0.137$), also showed a tendency to be more common in patients diagnosed with PE than in non-PE patients, but the differences were not statistically significant.

Risk factors and comorbidities

The most common risk factors detected in the study population were diabetes (26.1%), recent surgery (21.7%), heart failure (16.7%), transient immobility (11.4%), and obesity (11.1%), but they were not significantly associated with the onset of PE. Instead, antiphospholipid syndrome (8.8% vs. 1.1%; $P = 0.003$), factor V Leiden (2.9% vs. 0.0%; $P = 0.040$), systemic lupus erythematosus (14.7% vs. 2.2%; $P < 0.001$), hyperhomocysteinemia (4.4% vs. 0.4%; $P = 0.026$), protein S or protein C deficiency (19.1% vs. 2.6%; $P < 0.001$), oral contraceptive use (4.4% vs. 0.0%; $P = 0.008$) and chronic liver disease (8.8% vs. 2.9%; $P = 0.040$) were significantly associated with a positive diagnosis of PE. The high rate of protein C/protein S deficiency is noteworthy, and could be attributable to the high rates of consanguinity in the Saudi population, which might enhance the rates of autosomal recessive disorders. Several other factors showed a tendency to be more frequent in diagnosed PE patients, including obesity, transient immobility, pregnancy, recent parturition, and recent surgery. Conversely, cancer and/or malignancy were not associated with PE in our study, although they have been reported as common comorbidities in some studies [4]. This might be attributable to the limited size of our study population, which constitutes one of our limitations.

Laboratory test results were similar between the two groups. However, D-dimer (15.7 ± 79.7 mg L^{-1} vs. 2.3 ± 2.9 mg L^{-1}; $P = 0.439$) and platelet count ($[291.4 \pm 120.5] \times 10^6$ mL^{-1} vs. $[323.5 \pm 149.8] \times 10^6$ mL^{-1}, $P = 0.065$) tended to be higher in PE patients. In the study group, D-dimer levels were significantly higher than normal ranges, probably because they can be non-specifically elevated in the setting of other acute disorders. However, D-dimer levels were not statistically different between suspected and diagnosed PE patients.

Together, our results are very promising. Indeed, we did not compare PE patients with a group of healthy subjects, but with suspected cases of PE that were refuted after more thorough investigation. Thus, considering that all patients in our study were referred to the Radiology Department for suspected PE, we expected to find similar results in terms of clinical features and risk factors between the two groups, which was not the case. Therefore, our data indicate that the identified variables could be good indicators with which to differentiate a suspected from a confirmed PE in clinical practice. The assessment of a pretest clinical probability in clinical management is feasible in these patients, and could help to avoid unnecessary exposure of patients to radiation. In fact, many studies have focused on developing scoring systems to improve the predictive value for suspected PE as compared with variables measured individually [7]. In conclusion, although the clinical manifestations of PE are non-specific, this study indicates that preclinical probability testing could be very useful in identifying those patients with increased probability of having a PE, who could then benefit from early diagnosis and treatment. A limitation of this study was that it involved the retrospective assessment of a limited sample of patients recruited in a single center. Therefore, larger, prospective and multicenter studies are warranted to confirm these results and better determine the clinical characteristics and risk factors of PE in Saudi Arabian patients.

Disclosure of conflict of interests

The authors state that they have no conflict of interest.

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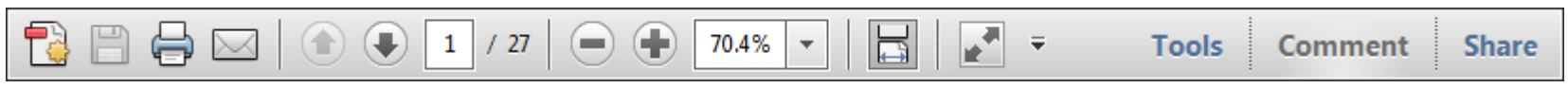

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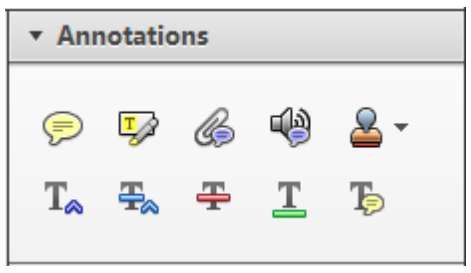

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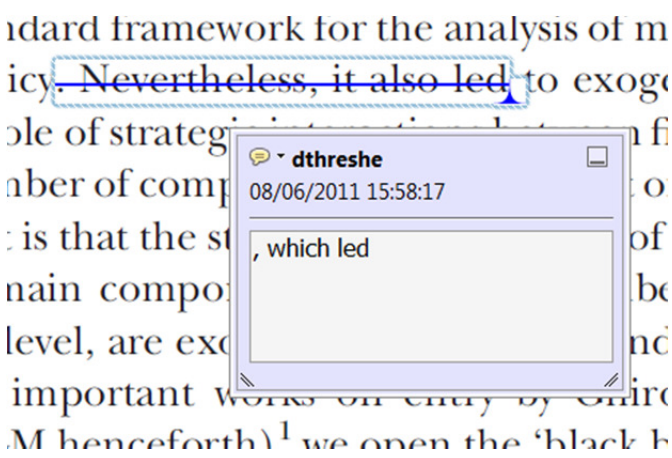

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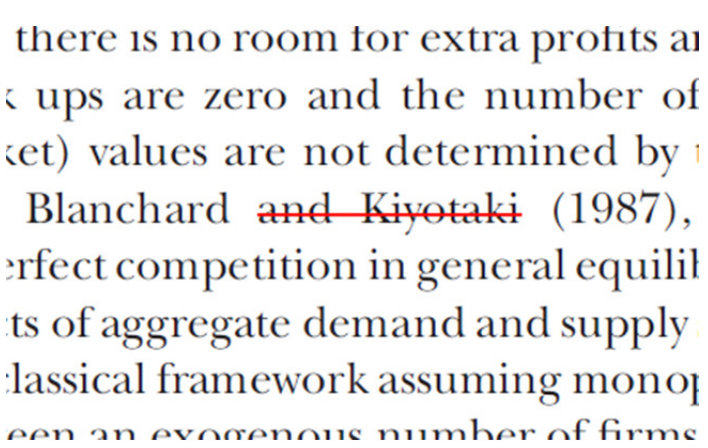

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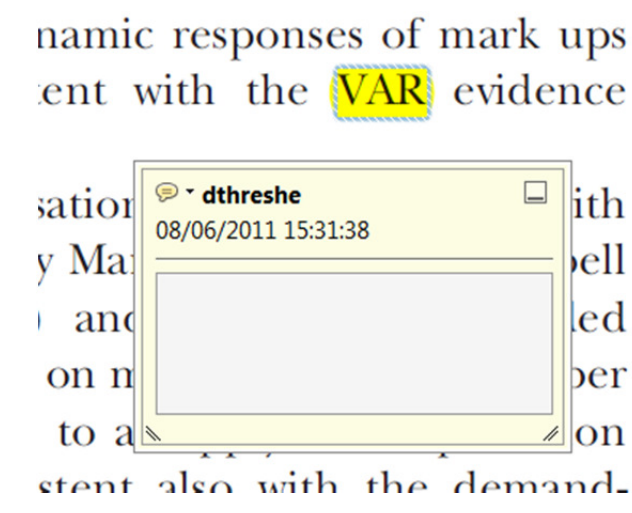

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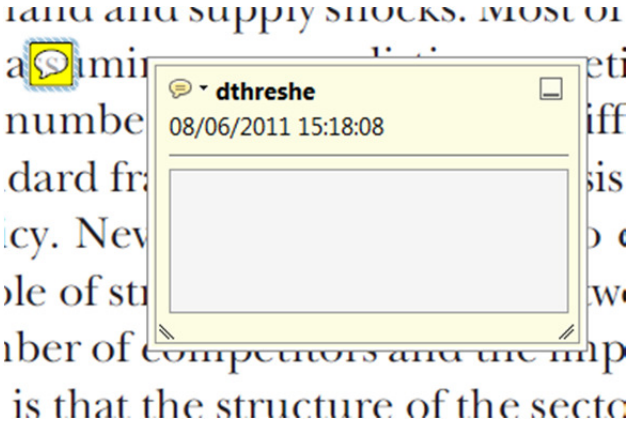

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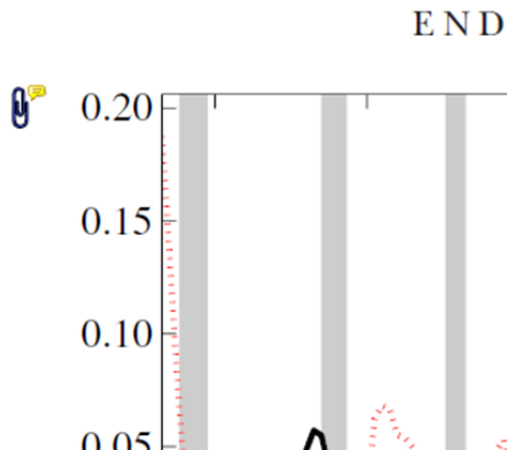

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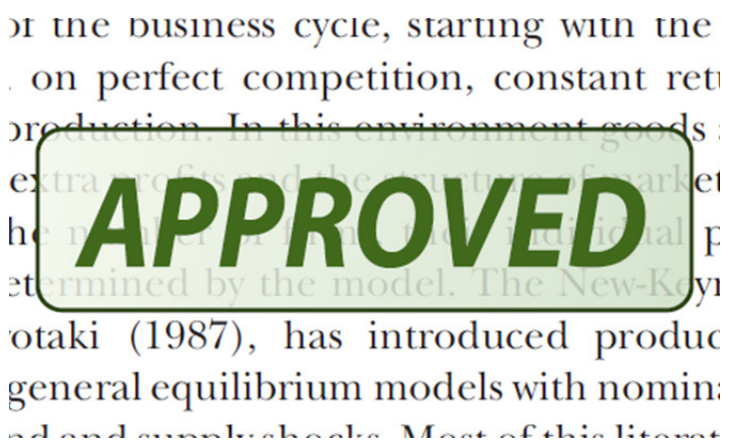

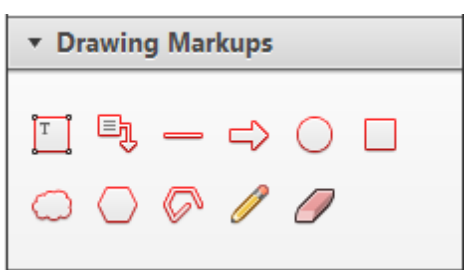

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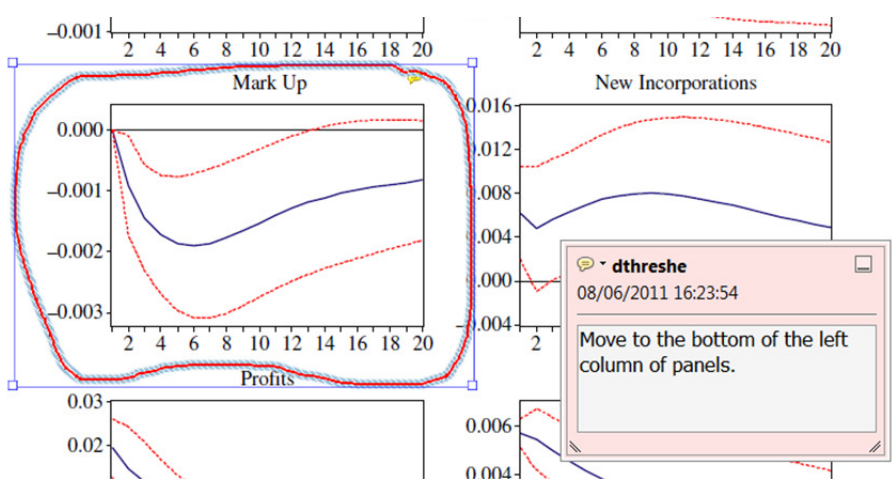

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