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Comparison of Pulmonary Thromboembolism Before and After the Autopsy in Patients With Trauma

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Abstract

Background and Objectives: It is well established that pulmonary thromboembolism is frequent in patients with trauma. In this study we compared pulmonary thromboembolism before and after the autopsy in patients with trauma.

Methods: In this cross-sectional study, the patients being referred to 3 of teaching hospitals of Tehran from March 2015 to March 2016 because of trauma and died in hospital due to the diagnosis of pulmonary embolism (PE) were recruited. Then the patients were autopsied and the cause of death was evaluated and the frequency of PE was compared before and after the autopsy.

Findings: A total of 168 patients with PE (108 males 64.3% and 60 females 35.7%) mean age 48.5 years were evaluated. After the autopsy, PE was diagnosed in 50% of the patients. The correlation between age and autopsy was significant ($r=0.47$, $P=0.006$), however, the correlation of autopsy with sex, underlying disease, and the hospitalization duration was not significant.

Conclusions: According to our results, among patients with trauma, half of the premortem diagnosis of PE is not confirmed by autopsy. In addition, age significantly correlate to the PE.

Keywords: Pulmonary thromboembolism, Autopsy, Trauma

Background and Objectives

After myocardial infarction and stroke, pulmonary embolism (PE) is the third most common acute cardiovascular disease.[1,2] The most of the previous studies indicated the strong correlation between trauma and thromboembolism, however, the incidence of thromboembolism after trauma differs widely from lower than 10% to more than 50%, due to the kind of trauma and the technique applying for detection of thromboembolism.[3-6] PE is classified under the venous thromboembolism (VTE) spectrum. A study by Markovic-Denic et al in 2012 indicated that VTE occurred in 1-5 in 1000 in the normal population and 50% of patients after a surgical procedure without prophylaxis of thromboembolism are involved in VTE.[7] PE is the cause of 5%-10% of death in hospitalized patients.[8,9]

Although the PE is preventable, however, the studies indicated that PE is the most important cause of mortality in patients during 24 hours after trauma and the incidence of death is about 12.5%.[10] This may be due to the fact that the PE in some cases is silent disease and its symptoms and signs are not specific for the PE, so, the PE may be missed and undiagnosed.[11] The most important risk factors for PE are surgical intervention and the duration of hospitalization, moreover, cardiovascular diseases and obesity are other highly reported risk factor for PE.[12-14] Reviewing these studies, we postulated that the clinical symptoms of PE including isolated dyspnea, pleuritic pain, and/or hemoptysis, and circulatory collapse[15,16] are not sufficient to the diagnosis of the PE, therefore, PE may be underdiagnosed. In this regard, we conducted this cross-sectional study to evaluate the accuracy of antemortem PE diagnosis in traumatic patients being referred to 3 of teaching hospitals of Tehran by reviewing the autopsy of these patients.

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Methods

In this study the patients being referred to 3 of teaching hospitals of Tehran from March 2015 to March 2016 because of trauma and died in hospital because of PE were recruited. Then the patients were autopsied and the cause of death was identified after the autopsy. The chart review was used to correlate autopsy records with clinical records. Pathology database was used to identify all patients autopsied at 3 of teaching hospitals of Tehran during the study period whose primary cause of death was confirmed at autopsy to be PE. Clinical records of all patients between admission and death were used to determine whether the diagnoses were recognized. The PE diagnosis was respected as recognized if the clinical records revealed that the diagnosis was clearly suspected on clinical grounds before the death of patients. Then 168 patients with a diagnosis of PE as the primary cause of death, confirmed by clinical evaluation and using computed tomography pulmonary angiogram [CT-PA] were enrolled. Then these patients were autopsied and 2 pathologic criteria were used to diagnosis of the PE as follows: (1) gross evidence of an occlusive thrombus in the pulmonary artery bifurcation and (2) histologic evidence that this lesion was both organizing and associated with the wall of the vessel. The clinical data and data collecting after autopsy were compared regarding the frequency of PE in the clinic and after the autopsy. All data provided for this cross-sectional study was de-identified, moreover, this study fulfilled all of the requirements for research as outlined by the Iran University of medical sciences ethic committee.

Statistical Analyses

The data were analyzed using the Statistical Package for Social Studies (SPSS) version 22 (SPSS Inc, Chicago, IL). Categorical data are presented as numbers (%), and continuous data as mean ± standard deviation (SD). We used the chi-square test to compare categorical variables and linear regression to evaluate the correlation between PE and other variables. $P<0.05$ was considered significant.

Results

A total of 168 patients with mean age 48.5 years including 108 males (64.3%) and 60 females (35.7%) were evaluated. PE was detected in all patients before autopsy, however after the autopsy, PE was diagnosed in 50% of the patients, followed by acute myocardial infarction (AMI) and myocardial infarction (MI) (Table 1). We assessed the correlation between autopsy results and other variables using regression test. The correlation between age and

Table 1. The Patients' Characteristics

Variables	
Age (28-78 y), mean ± SD	48.52±13.53
Sex, No. (%)	
Male	108 (64.3)
Female	60 (35.7)
Hospitalization (5-35 days), Mean±SD	15.30±6.60
Underlying disease, No. (%)	
No	84 (50)
Diabetes	16 (9.5)
HTN	28 (16.7)
CAD	8 (4.8)
CHF	8 (4.8)
Hyperthyroidism	4(2.4)
Asthma	4(2.4)
Mixed	16(9.5)
Total	168(100)
Autopsy, No. (%)	
PTE	84(50)
AMI	24(14.3)
MI	20(12)
MOF	16(9.5)
Sepsis	8(4.8)
Pneumonia	8(4.8)
SD	8(4.8)
Total	168(100)

autopsy was significant ($r=0.47$, $P=0.006$), however, the correlation of autopsy with sex, underlying disease and the hospitalization duration was not significant (Table 2).

Discussion

Patients with trauma are at risk for PE, deep venous thrombosis, and death in some cases, therefore, PE has been of interest to authors and continues improvement occurred in diagnosis and treatment of PE during recent decades. However, the incidence and its complications persisted relatively constant in recent years.[17] The estimation of PE in the clinic is challenging, therefore, in this cross-sectional study we evaluated the autopsy of 168 patients (mean age 48.5 years) with the diagnosis of antemortem PE in the clinic. The results of current practice indicated that of 168 patients with the diagnosis of antemortem PE, we only detected the PE in 84 patients (50%) in the autopsy. This finding was in contrast to

Table 2. The Correlation Between Autopsy Results and Sex, Age, Underlying Diseases and Hospitalization

Autopsy	r	P
Sex	0.02	0.87
Age	0.47	0.006
Underlying Disease	0.14	0.39
Hospitalization	0.01	0.95

previous studies that indicated the incidence of antemortem PE due to its silent development is underestimated.[18] Moreover, these studies emphasized that the development of PE is asymptomatic and its detection is difficult.[19,20] Furthermore, the authors signified that the technique of detection of PE is impractical, so asymptomatic PE is missed. In line with this hypothesis a study on 90 patients with moderate to severe trauma signified that 24% of the PE evaluated by surveillance contrast-enhanced helical CT scanning was asymptomatic.[21] To diagnosis of PE, the CT-PA is the gold standard, its accuracy is comparable to the angiography and it is the noninvasive procedure.[19] The sensitivity of CT-PA for the diagnosis of PE in the previous study differed from 45-100 and its specificity was from 78%-100%.[22-24] To increase the power of diagnosis of the PE some studies have suggested that the evaluation of some risk factors are useful. These studies revealed that age is an independent risk factor for VTE, may be because of lower limb pathology in older patients.[25-28] Another study in line with this finding indicated that immobility and hospitalization are the most important factors correlates with PE.[28] In current practice we revealed the strong association between age and PE, however, the correlation of autopsy with hospitalization duration, underlying disease, and PE was not significant in our experience. Further studies reported a significant correlation between surgery interventions, previous history of VTE and hospitalization with PE, these trials suggested these are important risk factors and the evaluation of them can predict the development of PE.[12,13,28] In tune with these reports, further studies have reported cardiovascular disease as a risk factor of PE,[7,29] but in our survey, we did not detect any correlation between cardiovascular disease and other underlying diseases with PE. Furthermore, the incidence of PE in our survey did not show a significant difference between male and female; however, a study by Yang et al reported that the PE is more frequent in male than female.[30]

In summary, recent investigations reported significant improvement in the clinical diagnosis of PE,[31,32] further examinations also, have shown that the rate of mortality because of PE has reduced.[33-36]

This was a single-center study with a relatively small sample size that limits the ability to generalize the result of our report. Further multicentric investigations with larger sample size are required to validate findings reported here.

Conclusions

Our study showed that 50% of antemortem diagnosis of PE are not confirmed by autopsy among patients with trauma. Moreover, age is significantly correlated to the PE.

Abbreviations

(PE): pulmonary embolism; (VTE): venous thromboembolism; (AMI): acute myocardial infarction; (MI): myocardial infarction.

Competing Interests

The authors declare no competing interest.

Authors' Contributions

The authors made equal contributions to the present study.

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