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BRIEF REPORT

Characteristics of Mortalities related to Pulmonary Embolism following Multiple Trauma; a Brief Report

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Abstract: **Introduction:** Pulmonary embolism (PE) is introduced as the third major cause of death after trauma in those who survive more than 24 hours. This study aimed to describe the characteristics of mortalities due to trauma related PE in cases referred to the forensic medicine department. **Methods:** The present cross sectional study was conducted on medical profiles of cadavers that were registered as trauma related mortality in the dissection department of the Forensic Medicine Organization, Tehran, Iran, during 2011 to 2016. **Results:** The cause of death for 92 of the 10800 (0.85%) evaluated cadavers was diagnosed as trauma related PE. The mean age of these patients was 58.37 ± 19.39 years (66.3% male). Only 14 (15.2%) hospitalized patients had received anticoagulant agents. The most frequent trauma related PE mortality cases were male (p = 0.003) and aged > 55 years (p = 0.005), with trauma to death time of < 3 weeks (p = 0.004), lower limb injury (p = 0.003), car crash trauma mechanism (p = 0.003), and no anticoagulant prescribed (p = 0.001). **Conclusion:** According to the results of the present study, the prevalence of trauma related PE mortality was 0.85%. It seems that, having a clear anticoagulation therapy protocol in trauma centers could be helpful in decreasing the prevalence of traumatic thromboembolism and its' related mortality.

Keywords: Venous Thromboembolism; multiple trauma; Pulmonary Embolism; mortality; forensic medicine

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1. Introduction

Trauma patients are predisposed to venous thromboembolism (VTE) and pulmonary embolism (PE). Increase in the activity of blood coagulation factors, local vascular injuries in the damaged tissues, and hospitalization are some of the predisposing factors of thrombosis in these patients. So, some traumas may not be fatal in nature but may cause death due to PE (1). PE is introduced as the third major cause of death after trauma in patients who survive more than 24 hours after injury (2). The reported incidence of VTE after trauma anges from 7% to 58% depending on the demographics of the patients, the nature of the injuries, the method of detection (i.e. surveillance imaging versus clinical detection), and the type of VTE prophylaxis (if any) used in the study population (1-5). VTE is asymptomatic, and more than 70% of PE cases go undetected until a postmortem examination is performed after sudden death. Sudden death is often the first sign of PE (6). Since the mortality rate of post-traumatic PE approaches 50% in some series, most trauma centers have developed protocols for VTE prophylaxis, although there are no large studies to document the efficacy of any method of prophylaxis in this heterogeneous population. In a study by Mostafazadeh et al. on 200 cadavers suspected of having PE, its prevalence was estimated as 13.5% (7). This study aimed to describe the characteristics of trauma related VTE mortality cases referred to the forensic medicine department.

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2. Methods

2.1. Study design and setting

The present cross sectional study was conducted on medical profiles of cadavers who were registered as trauma related mortality in the dissection department of the Forensic Medicine Organization, Tehran, Iran, from 2011 to 2016. The study was approved by the ethics committee of Shahid Beheshti University of Medical Sciences; all data were treated as confidential.

2.2. Participants

Cases whose cause of death was diagnosed as trauma related PE at least 48 hours post trauma were enrolled. PE was confirmed based on autopsy and pathology findings or by computed tomography (CT) angiography conducted in the hospital. Trauma related PE was define as PE that had started at least forty eight hours after the trauma up to 90 days after the trauma in a healthy patient without any underlying risk factor for thromboembolism.

2.3. Data gathering

Data were gathered from medical profiles and autopsy reports by a trained forensic medicine resident. Using a researcher-made data collection form demographic data (age, sex), trauma to death time, site of injury, trauma mechanism, and anticoagulant therapy were gathered for all of trauma related PE mortality cases.

2.4. Statistical analysis

Data were descriptively analyzed using SPSS version 18 software. Qualitative data are reported as frequencies and percentages, and quantitative data as mean ± standard deviation. Chi square test was used for analysis and $P < 0.05$ was considered as the level of significance.

3. Results:

10,800 cadavers of patients who had died from trauma were evaluated. The cause of death was diagnosed as trauma related PE for 92 (0.85%) cadavers. The mean age of these patients was 58.37 ± 19.39 (23-89) years (66.3% male).

Table 1 shows the baseline characteristics of studied cadavers. PE was confirmed based on autopsy findings in 82 (89.1%) cases and via CT angiography in 10 (10.9%) cases. 60 (65.2%) cases had died during hospitalization, and 32 (34.8%) after discharge from hospital and in outpatients setting. None of the discharged patients were prescribed anticoagulant and only 14 (15.2%) hospitalized patients had received anticoagulant agents. The most frequent trauma related PE mortality cases were male (p = 0.003) and aged > 55 years (p = 0.005), with trauma to death time of < 3 weeks (p = 0.004), lower limb injury (p = 0.003), car crash trauma mechanism (p = 0.003), and no anticoagulant prescribed (p = 0.001).

Table 1: Relationship between baseline characteristics of patients and trauma related thromboembolism mortality

Variables	Number (%)	P
Sex		
Male	61 (66.3)	0.003
Female	31 (33.7)	
Age (year)		
23 - 35	6 (6.5)	
35 - 55	23 (25)	0.004
> 55	63 (68.5)	
Trauma mechanism		
Car crash	64 (69.6)	
Falling	18 (19.6)	0.003
Assault	5 (5.4)	
Unknown	5 (5.4)	
Body site of injury		
Lower limb	45(48.9)	
Head	36 (39.1)	0.003
Spinal cord	10 (10.9)	
Upper limb	1 (1.1)	
Trauma to death time (day)		
2 – 7	13 (14.1)	
7 – 14	25 (27.2)	0.004
14 – 21	17 (18.5)	
> 21	37 (40.2)	
Anticoagulant therapy		
Yes	14 (15.2)	0.001
No	78 (84.8)	

4. Discussion

According to the results of the present study, the prevalence of trauma related PE mortality was 0.85%. In a study by Ho et al. in 2009 in Perth, West Australia, the prevalence of thromboembolism in similar cases was reported as 1.6% (8). In another study by Echeverria et al., in Sao Jose Hospital in Rio Pareto, Brazil, from July 2004 to June 2005, the total prevalence of thromboembolism was 2.75% (9). To explain the difference among the reported rates, former studies just focused on inpatients that died from thromboembolism after trauma, whereas the present study also included patients who died in their homes and were assessed in the dissection department of the forensic organization. The mean age of the patients in the present study was 58.4 years, and most of the cases were aged >50 years. In line with our results, in the study by Mostafazadeh et al. most of the investigated cases were also aged >50 years (7). Some other studies also reported age of >40 years as a risk factor of thromboembolism (2, 4). In addition, a study by Alikhan et al. on cadavers that had undergone biopsy between 1991 and 2000 in King's College Hospital, London, UK, showed that the mean age of the

patients who died from PE was 72 years and that 80% of them were aged >60 years (10). The aforementioned results indicated that as age increases, the mortality from thromboembolism after trauma also increases.

In a study by Ho et al. that was published in the British Journal of Anaesthesia, a significant association was reported between fatal embolism and old age, accompanying disease, and high body mass index, although no significant association was observed with the place of trauma (8). However, a significant association was observed between lower limb and head injuries, with death from embolism after trauma in the present study. In a study conducted by Lu in China from 2003 to 2004 on traumatized patients with lower limb fractures, the prevalence of VTE was reported to be 12.4% and femoral shaft fracture was the most common fracture among the studied cases (11). It is noteworthy that patients with head trauma were also at high risk of thromboembolism (12). According to the results of the present study, the maximum time interval between the incidence of trauma and death was less than 3 weeks; however, in a study by Yarak et al. in Istanbul, Turkey, from January 2010 to December 2014, the prevalence of death from PTE was 74% within the second week post trauma (13). Echeveria et al., in a study from 2004 to 2005, also reported car crash followed by falling from height as the main causes of death among cases who were referred to the forensic medicine organization; the findings were in agreement with those of the present study (9). Since approximately 35% of fatal embolism cases occur in outpatients immobilized because of splinting or casting, the application of a pharmaceutical/non-pharmaceutical method at the time of discharge is recommended to prevent thromboembolism in such patients. Hence, mechanical or medical prophylaxis, such as Clexane, is recommended to prevent thromboembolism in outpatients.

5. Conclusion

According to the results of the present study, the prevalence of trauma related PE mortality was 0.85%. It seems that, having a clear anticoagulation therapy protocol in trauma centers could be helpful in decreasing the prevalence of traumatic thromboembolism and its related mortality.

6. Appendix

6.1. Acknowledgements

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6.2. Author contribution

All authors met the four criteria for authorship contribution based on the recommendations of the international committee of medical journal editors.

6.3. Funding

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6.4. Conflict of interest

None.

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