

Pulmonary Embolism as a Cause of Death in Medico-legal Death in North of Jordan in the Period of 2017-2021

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Abstract

Background: Pulmonary embolism (PE) is a potentially fatal illness where blood clots block the arteries in the lungs. These clots typically come from the deep veins in the lower limbs. It is a significant contributor to illness and death on a global scale.

Objective: This study aims to analyze the forensic deaths resulting from PE in the northern region of Jordan, namely those received at the Forensic Medicine Teaching Centre in Irbid, Jordan, between the years 2017 and 2021.

Methods: A retrospective study was conducted to collect data from files of cases diagnosed with PE as a prime cause of death. The study sample included 80 cases of PE. A working Excel spreadsheet was created to collect data for all cases. Data analysis was made using the SPSS software version 21. Descriptive statistics were used to describe and represent data in tables.

Result: During a span of 5 years, a total of 80 instances of death caused by PE were examined. Our study revealed that 55% of the cases were females, and the bulk of fatalities (67.6%) took place during the cold months of winter and fall. Regarding the age group, it was discovered that 46.3% of individuals fell within the age range of 25 to 45 years. 45% of the cases were not obese, and 81.3% of the cases had no history of prior surgery. Out of the total number of cases, 66.3% had not been immobilized. Additionally, 88.6% of the female cases were not pregnant, and 82.5% of cases did not have any prior trauma. Most individuals had large thromboembolism 56.3% and 70% of patients exhibited emboli in both pulmonary arteries. Out of all the patients, 76.3% exhibited lung congestion, whereas only 15% reported discharge.

Conclusion: Multiple reasons cause PE deaths in northern Jordan. Female death rates rise somewhat, mostly among 25-45-year-olds. Recent surgery, trauma, and immobility dramatically affect PE death rates. Obese people had a lower PE mortality rate than non-obese people. Winter and fall have a somewhat greater PE rate than summer and spring.

Keywords: Pulmonary embolism, forensic medicine, trauma, mortality.

Introduction

Thromboembolic events are responsible for almost 25% of all deaths worldwide, making them a major cause of global mortality (Wendelboe and Raskob, 2016; Zuin et al., 2024). The growing occurrence of thromboembolic circumstances in poor countries is defined by comparatively limited levels of knowledge (Okoye et al., 2021). Antero et al. (2022) highlighted the importance of giving priority to thromboembolic

events, specifically focusing on the relevance of PE. PE is identified as the third most common cause of cardiovascular mortality (Dalen, 2002; Tafur Caprini, 2024). Furthermore, the increasing prevalence of PE causing mortality in younger age groups is quite alarming (Calé et al., 2024). Barco et al (2021) underline the importance of starting early identification and preventive efforts as soon as possible.

Additional factors can impact the likelihood of mortality linked to PE. Shimi et al. (2014) found that gender is a notable risk factor. This finding was confirmed by a recent study (Huang et al., 2023). Lucena et al. (2008) reported that around 59% of the victims were male. Nevertheless, a study carried out by Stein et al. (2011) revealed that the prevalence of PE was greater in women, suggesting that this gender discrepancy was not permanent. Obesity is a contributing factor that can greatly elevate the fatality rate associated with PE. Lucena et al (2008) reported that 75% of fatal PE cases exhibited obesity. Moreover, Yakar et al (2016) observed that 52% of autopsy results showed a body mass index (BMI) over 25. Surprisingly, certain research suggests that fat might offer a degree of safeguarding (Bradbury et al., 2018). Stein et al (2011) established a correlation between osteosis and a reduced mortality rate, with the strongest impact shown in persons aged 80 and above. Shimi et al. (2011) have found that immobility plays a crucial role in determining the fatality rates of PE, which affects around 65% of cases. Although other factors contribute to the risk of death from PE, immobility is linked to various risk factors that make individuals more vulnerable to PE, such as recent traumatic events or surgical procedures (Siddiqui et al., 2022).

Study objectives

This study aimed to investigate and document forensic deaths from PE reported in Northern Jordan and received at the Forensic Medicine Teaching Centre in Irbid from 2017 to 2021.

Subjects and methods: This section outlines the fundamental procedures employed in carrying out the current investigation. The document encompassed the subsequent aspects:

Study design and setting: A retrospective study was conducted to collect data from files of cases. The study was carried out in the Forensic Medicine Teaching Centre affiliated with the Jordan University of Science and Technology for 5 year period of (2017-2021).

Study sample: A total of 2766 files were chosen for evaluation. A total of 80 examples were deemed suitable for inclusion.

Study process: Following the obtaining of ethical approval from the Institutional Review Board (IRB) at Jordan University of Science and Technology, the research team evaluated medical records to choose cases to be represented. Then, a functional Excel spreadsheet for cases was created. Study variables

included demographic and general variables such as age, gender, season of occurrence of cases, obesity, recent surgery, recent immobilization, pregnancy (for female variables only), recent trauma, size of pulmonary embolus, site of pulmonary embolus, lung congestion, presence of discharge (blood/froth/vomit/yellowish discharge) from the nose or mouth. The analysis of data was made using the SPSS version 21 software, and the findings were presented in tables.

Results

Out of 2766 cases that were examined in the Centre of Forensic Medicine / North of Jordan in the years 2017-2021, the cause of death was determined to be PE in 80 cases (2.9%).

As demonstrated in Table (1), PE existed in females (55%), whereas it was among 45% of males.

Table 1: The frequency and distribution of PE cases by gender

Variable	Frequency (N)	Percentage (%)
Gender:		
- Female	44	55%
- Male	36	45%

According to the data presented in Table (2), the age group with the highest occurrence of PE was the 25-45-year age group, accounting for 46.3% of all cases. There are a total of 19 cases in the age group between 45 and 65 years, which accounts for 23.8% of the overall number of cases.

Table 2: The frequency and distribution of PE cases by age groups

Age group	Frequency (N)	Percentage (%)
<25	13	16.3%
25-45	37	46.3%
>45-65	19	23.8%
>65	9	11.3%
Missing	4	5%
Total	78	100%

Seasonal variations in PE cases are detailed in Table (3). In Winter, a total of 25 (31.3%) reported cases of PE occurred. In Autumn, a total of 29 (36.3%) of cases occurred representing the highest total of any season. In the Summer season, a total of 16 (20%) of cases occurred. In the Spring season, the lowest number of cases occurred. 10 (12.5%) occurred.

Table 3: The frequency and distribution of PE cases by season

Season	Frequency (N)	Percentage (%)
Winter	25	31.3%
Autumn	29	36.3%
Summer	16	20%
Spring	10	12.5%
Total	80	100%

Table 4 provides a comprehensive list of the illnesses linked to PE. Obesity was observed in 20 (25%) instances. The precise characteristics are uncertain. On the other hand, there were a total of 60 (75%) instances without observed obesity. Regarding the exposure to recent surgery, 4 women were subjected to cesarean section. recent surgery was reported by 11 (13.8%) of participants. Out of the total number of instances, 53 (66.3%) do not involve immobilization. Pregnant women were present in 5 (11.4%) cases.

A total of 66 (82.5%) cases did not have recent trauma, whereas in 17.5% of cases recent trauma was observed. Large pulmonary emboli were observed in 56.3% of cases. The categorization of all 19 (23.8%) of the total, into large and small_emboli was observed. Small emboli were observed in 14 (17.5%) of instances. Two instances, representing 2.5% of the total, could not be identified.

Regarding the site of pulmonary emboli, the data showed that in 56 (70%) instances, both pulmonary arteries were involved, the main trunk was involved in 10% of cases, and peripheral arteries were involved in 17.5 of cases. Two instances, representing 2.5% of the total, could not be identified.

Seventeen instances (21.3%) did not show any signs of lung congestion, while a total of 61 (76.3%) of cases exhibited lung congestion. Two instances, representing 2.5% of the total, could not be identified. The presence of discharge was observed in 12 (15%) of cases.

Table 4: Clinical conditions associated with PE cases

Condition	Frequency (N)	Percentage (%)
Obesity:		
- No	60	75%
- Yes	20	25%
Exposure to recent surgery:		
- Cesarean	4	5%
- No	65	81.3%
- Yes	11	13.8%
Recent immobilization:		
- No	53	66.3%
- Yes	27	33.8%
Pregnancy among females:		
- No	39	88.6%
- Yes	5	11.4%
Having recent trauma:		
- No	66	82.5%
- Yes	11	17.5%
Size of pulmonary embolus:		
- Large	45	56.3%
- Large and small	19	23.8%
- Small	14	17.5%
- Undetermined	2	2.5%
Site of pulmonary embolus:		
- Both pulmonary arteries	56	70%
- Main pulmonary trunk	8	10%
- Peripheral arteries	14	17.5%
- Undetermined	2	2.5%
Lung congestion:		
- No	17	21.3%
- Yes	61	76.3%
- Undetermined	2	2.5%
Presence of discharge:		
- Yes	12	15%
- No	68	85%

Discussion

Within the spectrum of thromboembolic events, PE assumes paramount significance, standing as the

third leading cause of cardiovascular mortality, as elucidated by Antero et al (2022). Of particular concern is the observation that mortality associated with PE is manifesting at progressively younger ages.

This underscores the critical imperative for the timely implementation of early detection and prevention strategies, as emphasized by Barco et al (2021).

In our study, we took into account several variables that could've been considered as risk factors for PE mortality including age, gender, season in which the cases occurred, obesity, recent surgery, recent immobilization, pregnancy or not in the female variables only, recent trauma, pulmonary embolus was large or small, site of the pulmonary embolus, lung congestion, if there was any discharge (blood/froth/vomit / yellowish-discharge) from the nose or the mouth. In our study, a notable trend emerged concerning the age distribution of cases, with a significant majority, approximately 62.6%, falling within the age category of under 45 years. This observation is consistent with findings from a study conducted by Zuin et al (2024). In the United States, which documented a rising mortality rate attributed to PE among individuals aged 25 to 45 years during the period spanning 1999 to 2019 (Zuin et al., 2023). However, contrasting results were reported in a study conducted in Glasgow by a group of researchers, where an examination of 582 cases revealed that the majority, comprising 72%, occurred among individuals aged 60 years and older (Starling et al., 2000).

Gender exerted a limited influence on mortality associated with PE in our study, where a slight predominance of female cases (55%) was observed. This trend parallels findings reported by Stein et al. (2011) who documented a higher prevalence of PE among women. In contrast, Shimi et al (2014) emphasized gender as not only a significant risk factor but also indicated a predominance of male victims, with a ratio of 1.84.

The heightened prevalence of immobility during colder weather, acknowledged as a potential risk factor for PE, coupled with the impact of cold temperatures on vasoconstriction, as observed by Montes (2003) in his analysis of seasonal variations in PE morbidity and mortality may account for the trends identified in our study, where a substantial majority (67.6%) of cases were recorded during the colder seasons of autumn and winter. Nevertheless, diverging findings are presented by Stein et al. (2011), who argue in their investigation that seasonal fluctuations do not significantly impact PE mortality.

As illustrated by Lucena et al. (2009), obesity was documented in 75% of fatal PE (PE) cases. Additionally, Yakar et al (2016) observed a prevalence of a body mass index (BMI) exceeding 25 in 52% of autopsies. However, surprisingly, certain

studies have posited the possibility of obesity serving as a protective factor. According to Stein et al (2011), obesity was associated with a reduction in mortality rates, with the most notable effect observed among individuals aged 80 years and older. This trend was reflected in our study, where the majority of cases were non-obese.

Both recent surgical procedures and periods of immobilization are recognized as significant risk factors for the development of PE. However, our study findings indicate that only 18.8% of cases had undergone surgery, and 33.8% had experienced recent immobilization. These findings are consistent with those of a study conducted in Sevilla, as reported by Lucena et al (2009), which found that only 28% of cases had experienced recent immobilization, and 22% had undergone prior surgical interventions.

It is noteworthy that in most cases, specifically 82.5%, there were no prior traumatic events reported before their death. This contrasts with a study conducted in Turkey by Yakar et al (2016), where nearly 45% of the 51 cases examined had experienced multiple traumas before their death.

In the context of female medical cases, pregnancy is acknowledged as a significant predisposing factor for the onset of PE. However, our study reveals that out of the total cohort of 44 cases examined, only five were identified as pregnant. The study of Urriago-Osorio et al (2023) reported different findings in which pregnancy is a significant predisposing factor for PE.

In the context of PE about their site and magnitude, our study findings indicate that a significant proportion, 56.3%, comprised large thromboembolic. Furthermore, our analysis revealed that in approximately 70% of the 80 cases investigated, such embolic events were observed concurrently in both pulmonary arteries. Findings like these make it even more important to find and treat PE quickly, especially when it affects both lungs and causes serious problems. In addition, it stresses the need for more research to fully understand the underlying processes and risk factors that affect the occurrence of these embolic episodes (Janssens, 2024). Finally, it was noted that 76.3% of cases exhibited lung congestion, while 85% displayed an absence of discharge. This observation suggests a potential correlation between these cases of PE and concurrent comorbidities, such as left heart failure, which could've played a role in the worsening of their case. This result shows how complicated the link is between PE and other health problems that are happening at the same time, especially heart issues like left heart failure (Dini et al., 2023). It is important to emphasize that it is

important to take into account other illnesses a person may have when identifying and treating a PE since these illnesses can make the illness worse or last longer (Arrigo and Huber, 2021).

Conclusion

As the study demonstrates, PE emerges as a significant contributor to mortality in northern Jordan, influenced by various variables. Mortality rates show a slight elevation among females compared to males, with most cases occurring in individuals aged between 25 - 45 years old. Factors such as the presence of recent surgical history, trauma, or immobilization significantly impact PE mortality rates. Additionally, the location and size of the embolus play a crucial role, with over two-thirds of cases involving either a large embolus or emboli in both pulmonary arteries.

Contrarily, surprisingly, the mortality rate of PE appears lower in obese individuals compared to non-obese counterparts, possibly due to the challenge in suspecting PE in non-obese patients. Pregnancy does not seem to affect the mortality rate of PE, as the majority of affected female cases were not pregnant. Seasonality does not exhibit a significant effect on mortality rates, although slightly higher occurrences were noted in winter and autumn compared to summer and spring.

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