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Pulmonary Embolism amongst Trauma and Orthopedic Patients: A retrospective study to determine their incidence and Outcome

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A B S T R A C T

Background: Venous thromboembolic (VTE) diseases include a wide spectrum of conditions, including pulmonary embolism (PE) and deep vein thrombosis (DVT). Despite the lack of definitive research results about the overall frequency of VTE in the population, a recent study suggested that its incidence is between 1-5 per1,000. Furthermore, in patients undergoing surgery, the risk of VTE might surpass 50% in the absence of thromboprophylaxis.

Objective: To determine the outcomes and incidence of pulmonary embolism among orthopedic and trauma patients.

Methodology: The current study was retrospective study carried out from January 2020 to December 2020 at the Department of Pulmonology and Orthopedic, Bacha Khan Medical Complex and MTI Mardan Medical Complex. The participants were selected after six months of hospitalization and exhibited clinical signs indicative of PE. Patients undergoing elective total knee or hip arthroplasty (THA) received mechanical VTE prevention and alternative anti-embolism measures. A multivariable logistic regression model was applied to simulate fatality after PE and the Wald test was used to evaluate statistical significance.

Results: In our study a total of 8980 patients were enrolled of which 5560 patients were for elective orthopedic procedures and 3420 were admitted due to trauma. Additionally, (Computed Tomography Pulmonary Angiogram) CT-PA was advised for 290 suspected to have PE. However, only 60 (0.66 %) patients tested positive for PE through CT-PA. 43 (71.66 %) of the patients underwent TP. It was more common (56.66 %) among both lungs, followed by 26.66 % in the right lung.

Conclusion: The effectiveness of the treatment plans used in the current research emphasizes how crucial it is to put based on evidence management methods into practice to reduce the mortality and morbidity linked to complications from ventilator-associated pneumonia.

Keywords: Pulmonary Embolism; VTE; CT-PA; DVT

Introduction

Venous thromboembolic (VTE) diseases include a wide spectrum of conditions, including pulmonary embolism (PE) and deep vein thrombosis (DVT). Despite the lack of definitive research results about the overall frequency of VTE in the population, a recent study suggested that its incidence is between 1-5 per1,000. Furthermore, in patients undergoing surgery, the risk of VTE might surpass 50% in the absence of thromboprophylaxis.[1] Globally, about half of every patient in the hospital is susceptible to VTE, with those who had surgery being more vulnerable than non-surgical clients.[2]
Pulmonary embolism (PE) is a life-threatening condition characterized by the blockage of one or more pulmonary arteries, typically due to a blood clot (thrombus) that has traveled from another part of the body, most commonly the deep veins of the legs or pelvis—a condition known as deep vein thrombosis (DVT). The consequences of PE can be severe, including respiratory failure, cardiovascular collapse, and death.
Studies have shown that the incidence of PE among trauma and orthopedic patients is higher than in the general population. For example, patients undergoing major orthopedic surgeries such as hip or knee replacement have a substantially increased risk of PE, with some estimates suggesting an incidence of up to 1-2% within the first few weeks postoperatively. In trauma patients, the incidence can vary depending on the severity and type of injury, with rates ranging from 1% to 10% in some studies. Individuals with trauma who survived the injury that caused it are more susceptible to thromboembolic conditions along with subsequent numerous organ failure, either of which significantly increase their likelihood of illness and fatality in the future.[3-5] DVT along with Pulmonary thromboendarterectomy (PTE) are two clinical presentations of VTE, a potentially fatal, but avoidable consequence following trauma. One of the main causes of fatalities and permanent disabilities worldwide is trauma, which is a potent trigger contributor to VTE.[6-8] Though the greatest risk manifests one week following trauma, individuals are susceptible to hypercoagulability in the initial days following trauma. Many cases of PTE are identified in the initial few days that follow following injury, as well as many cases are discovered as soon as 24 hours after injury. The hypercoagulable condition continued long after the individual was discharged.[9,10] According to a recent investigation, trauma patients who experience PTE during 72 hours represent 41.5% of all cases of PTE, and PTE patients have a considerably greater death rate than non-PTE individuals following 72 hours.[11] Moreover, a considerable fraction of treatment costs and patient deaths are attributable to VTE along with its associated outcomes. In the domains of trauma as well as orthopedics, the estimated prevalence of PE as well as DVT are 0.93 percent as well as 1.16%, respectively. Mortality rates that vary from 3.8 percent and 0.38% have been recorded.[12,13]
Although information regarding the frequency of PE among trauma as well as orthopedic patients has been collected, there remains a widespread perception that such consequences might go undiagnosed since its clinical manifestations are vague and often hidden.[14] The development of PE in trauma and orthopedic patients has significant clinical implications. PE is associated not only with increased morbidity and mortality but also with longer hospital stays, higher healthcare costs, and reduced quality of life. Thus, identifying risk factors and implementing effective prophylactic measures are essential components of patient care in this setting. The major objective of the current research was is to determine the PE frequency in orthopedic as well as trauma patients hospitalized at a tertiary care facility and to look into its relationships to concurrent illnesses, thromboprophylaxis, and injury patterns, including death rates.

Objective

To determine the outcomes and incidence of pulmonary embolism among orthopedic and trauma patients.

Methodology

This study was retrospective and was carried out from January 2020 to December 2020 at the Department of Pulmonology and Orthopedic, Bacha Khan Medical Complex and MTI Mardan Medical Complex, Mardan. Throughout this research period, all subjects who had to be hospitalized for either acute trauma, as well as planned orthopedic surgeries, had been selected. Individuals admitted to a hospital because of medical or other surgical causes irrelevant to our field of study were excluded. The participants in the research were patients who, after undergoing an acute trauma or orthopedic operation for around six months, exhibited clinical signs indicative of PE and underwent additional radiological testing in order to verify or eliminate any remaining clinical uncertainty. CT scanners with several detectors were used. The accurate identification of PE had been confirmed by the ventilation/perfusion (V/Q) test. Additional examination of electronic databases and health information was conducted in order to determine the individual's likelihood for developing a VTE infection. The following details were recorded: the individual's concurrent illnesses, length of stay in the hospital, the type of orthopedic procedures performed, application of thromboprophylaxis (TP), days of PE detection upon being admitted, and fatality. The severity of the PE episode was assessed using the combined Pulmonary

Table 1. Frequency, Mortality, and Time of Death after Pulmonary Embolism

Performed procedure	Number	Percentage	Deaths n (%)	Time of death after PE
Orthopedics procedures				
Total hip arthroplasty	3	5.0%	0	
Total knee arthroplasty	8	13.33%	0	
Knee arthroscopy	1	1.66%	0	
Spine	3	5.0%	1 (1.66%)	98 days
Metalwork removal	4	6.66%	2 (3.33%)	51 days
Femoral osteotomy	2	3.33%	0	
Total	21	35.0%	3 (5%)	74.5 Median
Trauma Cases				
Femoral neck fixation	7	11.66%	4	23 days
Hemiarthroplasty	3	5.0%	1	9 days
Other lower limb injury	20	33.33 %	3	19 days
Vertebral fracture	2	3.33 %	0	
Pelvis and acetabulum	1	1.66%	0	
Upper limb injury	6	10.0%	2	87 days
Total cases	39	65.0%	10	34.5 Median
Overall, PE cases	60			

Embolism Severity Measure.[15] Patients undergoing elective total knee or hip arthroplasty (THA, TKA) received care with mechanical VTE prevention (mechanical TP treatment) and alternative pneumatic instruments or stockings for anti-embolism from the moment of admittance. After surgery, while the risk of hemorrhage should be as low as possible, lower-molecular-range heparin (LMWH) and chem-based thromboprophylaxis (chemical-based TP) were given. Individuals undergoing TKA receive pharmacologic treatment for 14–18–20 days, though individuals undergoing THA receive it for 35 days.[16] Whenever the patient had a previous episode of having a positive PE and an elevated likelihood of hemorrhage and VTE being inserted.[17] Finally, applying a multivariable logistic regression model based on plausible variables of risk, and fatality after PE was simulated. Data were evaluated by applying the Wald test, which is used to determine statistical significance when a p-value of less than 0.05 is obtained.

Results

In the present study a total of 8980 participants were included of which 5560 patients were for elective orthopedic procedures and 3420 were admitted due to trauma. Additionally, (Computed Tomography Pulmonary Angiogram) CT-PA was advised for 290 suspected to have PE. However, only 60 (0.66%) patients tested positive for PE through CT-PA. The common orthopedic procedure includes total knee arthroplasty (13.33%), and total hip arthroplasty (5%). In addition, there were two expiries in elective orthopedic procedures with the

Table 2. Characteristics of Thromboprophylaxis among the participants

Treatment protocols	Number	Percentage %
Number of individuals	43	71.66%
Type of TP treatment		
Low molecular weight heparin	38	68.33%
Thromboprophylaxis	3	5.0%
Inferior vena cava filter	2	3.33%
Patients without Treatment protocol		
Number of participants	17	28.33%
Reasons		
Minor surgeries	7	11.66%
Refused from treatment	1	1.66%
Incomplete risk evaluation	9	15.0%

median time after PE being 74.5 days. Lower (33.33%) and upper limb (10%) injuries were the most common among trauma patients (Table 1).

Among the study cases, 43 (71.66%) of the patients underwent thromboprophylaxis (TP). Among these cases, 68.33% and 5% were treated with low molecular weight heparin and thromboprophylaxis. However, 17 (28.33%) of them have minor surgeries, and 15% have incomplete risk evaluations (Table 2).

Thromboembolic events were more common (56.66%) among both lungs, followed by 26.66% in the right lung. DVT was also found in 19 (31.66%) of the cases, furthermore, it was confirmed in 15.0% and 11.66% of them have proximal to the knee and above as well below the knee joint (Table 3).

Discussion

Despite continuous advancements in knowledge of medicine and treatment techniques, the incidence of VTE and its related effects has remained relatively stable over the last thirty years. Although medical research and options for therapy are constantly expanding, the prevalence of VTE along with its associated consequences has stayed relatively constant over the preceding thirty years.[18] In this research, we looked at the prevalence and prognosis of pulmonary embolism in orthopedic and trauma patients. In the present study a total of 8980 participants were included of which 5560 patients were for elective orthopedic procedures and 3420 were admitted due to trauma. Additionally, (Computed Tomography Pulmonary Angiogram) CT-PA was advised for 290 suspected to have PE. In the present study, the incidence of PE was smaller for planned procedures (0.1%). This was in opposition to the recently released study,[19] but it was additionally in line with Jean-Marie Janu's findings from the research.[20] Similarly, in the present study, the incidence of PE was 0.66%. Moreover, 0.23% were orthopedic and 0.43% were trauma patients who had developed PE of the overall participants. The common orthopedic procedure includes total knee arthroplasty (13.33%), and total hip arthroplasty (5%). In addition, there were two expiries in elective orthopedic procedures with the median time after PE being 74.5 days. Lower (33.33%) and upper limb (10%) injuries were the most common among trauma patients. Another study reported that, out of a total of 18,153 patients admitted to hospitals during the research duration, only 0.48% had positive CT-PA results. Of them, 26 underwent elective procedures and 62 suffered from acute trauma. Of them, thromboprophylaxis was administered to almost 75% of the patients. The 3 most frequently found associated risks were cardiovascular disease, high blood pressure, along being overweight. The death rate was 0.07% following PE. In the trauma group of people, the death incidence was 0.15 percent, while for planned orthopedic surgical operations, it was only 0.02 percent.[21] The reduction in

Table 3. Description of the thromboembolic event among the participants

Location of PE	Numbers	Percentage
Right lung	16	26.66%
Left lung	10	16.66%
Bilateral	34	56.66%
Concomitant DVT: extension		
Proximal to the knee	9	15.0%
Distal to the knee	3	5.0%
Above and below the knee	7	11.66%
Total	19	31.66%

fatalities was consistent with earlier data reported by Januel JM et al.[14] This reduced fatality rate may be the result of TP treatment plan prescription and less severe injuries. In the current study 43 (71.66%) of the patients underwent TP. 68.33% and 5% were treated with low molecular weight heparin and thromboprophylaxis. However, 17 (28.33%) of them have minor surgeries, and 15% have incomplete risk evaluations. Several investigators have attempted to establish a correlation between particular hazards and the start of PE. There is a strong correlation between the length of being hospitalized, previous experience of VTE, and the amount as well as the number of operations.[22] Cardiovascular illness was the second most common risk factor for PE.[23] While some members of the trial group continued to experience PE, 75% of patients received TP treatment. While we were unable to identify any additional specific risk factors for the development of VTE, we did observe approximately 62.4% of the individuals in our sample were older than 60, and 22.4 percent older than 80 years of age. Numerous studies have revealed age as a distinct risk factor.[24] The present investigation has several limitations. There was no control group, the data collection was retrospective in nature, and the sample size was small.

Conclusion

The present study concluded that incidence among the study participants aligned with the previous epidemiological statistics. The significant discovery of a decreased mortality rate, nevertheless, points to a possible improvement in clinical results as a result of improvements in treatment procedures and interventions. The effectiveness of the treatment plans used in the current research emphasizes how crucial it is to put based on evidence management methods into practice to reduce the mortality and morbidity linked to complications from ventilator-associated pneumonia. To significantly improve outcomes for those who are at risk of or already have VTE, ongoing efforts to improve risk assessment, optimize patient care, and modify treatment procedures are imperative. The current study's conclusions could be useful in clinical settings, and medical professionals could work to improve patient satisfaction and lessen the impact of VTE-related illnesses and fatalities worldwide.

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