Section: Forensic Medicine

Original Research Article

MEDICO-LEGAL EVALUATION OF DEEP VEIN THROMBOSIS IN LOWER LIMB FRACTURE CASES: AN AUTOPSY-BASED OBSERVATIONAL STUDY AT S.M.S. MEDICAL COLLEGE JAIPUR, RAJASTHAN DURING THE YEAR 2023-24

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ABSTRACT

Background: Deep Vein Thrombosis (DVT) is a serious but often missed condition, especially in patients with lower limb fractures. It occurs when blood clots form in deep veins, commonly in the legs, and can lead to Pulmonary Embolism (PE), a potentially fatal complication. Many cases of DVT remain undiagnosed during treatment and are only discovered during postmortem examination. **Aim:** To assess the prevalence and medico-legal significance of DVT in lower limb fracture cases based on autopsy findings at S.M.S. Medical College, Jaipur.

Materials and Methods: This was a retrospective, autopsy-based observational study conducted from October 2023 to September 2024 at the Department of Forensic Medicine & Toxicology, S.M.S. Medical College, Jaipur. A total of 70 adult autopsy cases with confirmed femur, tibia, or fibula fractures were included. Data were collected from police inquests, hospital records, and postmortem reports. Dissection of lower limb deep veins was performed to identify thrombi. Clinical details like age, gender, trauma type, surgery, anticoagulation use, and cause of death were recorded and analyzed.

Results: In the present study of 70 autopsy cases with lower limb fractures, 17 cases (24.3%) had Deep Vein Thrombosis (DVT) or Pulmonary Embolism (PE) identified as the primary cause of death, while in 10 cases (14.3%), DVT or PE played a contributory role in the fatal outcome. A missed diagnosis of DVT or PE was observed in 28 cases (40%), and 31 cases (44.3%) had not received any anticoagulant therapy despite being at risk. Furthermore, 20 deaths (28.6%) were considered potentially preventable with timely intervention, and in 4 cases (5.7%), there were complaints or allegations of medical negligence. The majority of the deceased were males, predominantly within the 46–60 years age group. Road traffic accidents were the most common cause of trauma, accounting for 54.3% of the cases, and surgical management was undertaken in 64.3% of the individuals.

Conclusion: DVT remains an underdiagnosed but significant cause of death in trauma patients with leg fractures. Many of these deaths could be prevented with proper screening and early treatment. Forensic autopsy helps identify missed DVT cases and plays a vital role in medico-legal investigations. Greater awareness and preventive care can improve outcomes and reduce legal issues.

Keywords: DVT, PE, leg fractures, autopsy, trauma deaths, negligence, surgery, RTA, thrombosis.

INTRODUCTION

Deep Vein Thrombosis (DVT) is a significant clinical and medico-legal concern, especially in cases involving orthopedic trauma. It refers to the formation of thrombi within the deep venous system, most commonly affecting the lower limbs—specifically the tibial, peroneal, popliteal, femoral, and iliac veins.[1] DVT may remain asymptomatic until a fatal pulmonary embolism (PE) occurs, making it one of the most underdiagnosed yet preventable causes of sudden death. Venous thromboembolism (VTE), which includes both DVT and PE, is globally recognized as the third most common cause of cardiovascular mortality, following myocardial infarction and stroke.[2]

The global annual incidence of VTE ranges from 0.8 to 2.7 per 1,000 people, with a sharp rise in the elderly population, particularly those over 70 years.[3] In trauma patients, especially with lower limb fractures, DVT risk increases due to immobility, vessel wall injury, and hypercoagulability collectively described as Virchow's triad4. Studies report that in the absence of thrombo-prophylaxis, the incidence of DVT in lower limb fractures can range from 18% to 40–70%.[5,6]

Many DVT cases go undiagnosed due to overlapping symptoms with trauma-related pain or inflammation. In several autopsy studies, PE has been reported as the actual cause of death in patients without prior DVT diagnosis.[7] Forensic autopsy is crucial in such cases, as it allows differentiation between ante-mortem thrombi—which are adherent to the vessel wall and show lamination—from post-mortem clots, which are non-adherent and gelatinous.[8]

In India, VTE prophylaxis remains underused due to the incorrect belief that Asians have a lower risk of thromboembolism. However, recent studies have contradicted this, showing comparable rates of DVT and PE to Western populations, with post-mortem findings revealing undiagnosed embolic events in 9–34% of hospital deaths.[9,10]

This study is designed to fill a critical gap in Indian forensic literature. By evaluating autopsy cases of lower limb fracture-related deaths at S.M.S. Medical College, Jaipur, the study aims to determine the prevalence and anatomical distribution of DVT and explore missed diagnoses, the role of thrombo-prophylaxis, and the medico-legal implications in trauma care.

Aim: To evaluate the prevalence and medico-legal significance of deep vein thrombosis in lower limb fracture cases through autopsy findings at S.M.S. Medical College, Jaipur, during 2023–24.

MATERIALS AND METHODS

Study Place: This autopsy-based observational study was conducted in the Mortuary of Department of Forensic Medicine & Toxicology, S.M.S. Medical College and Attached Hospitals, Jaipur.

Sample collection: From October 2023 to September 2024.

Sample Size: A total of 70 cases were selected using purposive sampling[11].

Inclusion Criteria

- Adults aged 18 years and above
- Obtaining consent from the relatives
- Confirmed fractures of the femur, tibia, or fibula were included

Exclusion Criteria

- Decomposed, burnt, or mutilated bodies and cases with incomplete records
- Deceased was already on blood-thinning medications prior to fracture of leg Bones.

Data were collected from police inquest reports, hospital records, and post-mortem documents. Information regarding age, gender, type and cause of trauma, site of fracture, surgery, duration of hospital stay, and use of anticoagulants was recorded. After the routine autopsy, detailed dissection of deep veins in the lower limbs was done to detect thrombi. The site, size, consistency, and adherence of the thrombus were noted to differentiate between ante-mortem and post-mortem clots. All findings were recorded in a structured format to evaluate the presence of DVT and its medico-legal relevance.

RESULTS

Table 1: Age and Sex Distribution of Cases (N = 70)

Age Group (years)	Male	Female	Total (n, %)
18y–30y	08	03	11 (15.7%)
31y–45y	14	04	18 (25.7%)
46y–60y	15	07	22 (31.4%)
>60y	12	07	19 (27.1%)
Total	49 (70%)	21 (30%)	70 (100.0%)

The majority of the cases were male, accounting for 70.0% (49 cases), while females made up 30.0% (21 cases). The age group with the highest number of cases was 46–60 years, comprising 31.4% (22 cases) of the total sample, followed by the >60 years group with 27.1% (19 cases). The 31–45 years group included 25.7% (18 cases) of the participants, and the 18–30 years group had the lowest representation at 15.7% (11 cases). In all age groups, males outnumbered females, with the greatest male predominance observed in the 31–45 and 46–60 year groups.

Table 2: Mode of Trauma Leading to Leg Bone Fracture N=70

Mode of Trauma	Number of Cases	Percentage (%)
Road Traffic Accident	38	54.3
Fall from Height	14	20.0
Assault	08	11.4
Crush Injury	06	08.6
Others (e.g., fall at home)	04	05.7
Total	70	100

The most common cause of injury was road traffic accidents (RTAs), accounting for 54.3% (38 cases) of the cases. This was followed by falls from height, which were responsible for 20.0% (14 cases) of the injuries. Assaults contributed to 11.4% (08 cases) of the cases, while crush injuries were reported in 08.6% (06 cases). The remaining 05.7% (04 cases) of cases were due to other causes, such as falls at home.

Table 4: Distribution of Cases Based on Surgical Intervention (N=70)

Surgery Performed	Number of Cases	Percentage (%)
Yes	45	64.3
No	25	35.7
Total	70	100

This table outlines the proportion of patients who underwent surgical management for their fractures. Out of the 70 cases, 45 cases (64.3%) received surgical intervention, while the remaining 25 cases (35.7%) were managed conservatively without surgery.

Table 5: Cases Where DVT or PE Was Cause of Death (N=70)

Cause of Death Attributed To	Number of Cases	Percentage (%)
Primary DVT/PE	17	24.3
Contributory Role of DVT/PE	10	14.3
Unrelated to DVT/PE	43	61.4
Total	70	100

In this study, the distribution of causes of death among the 70 cases, with specific reference to the role of deep venous thrombosis (DVT) and pulmonary embolism (PE). In 17 cases (24.3%), DVT or PE was identified as the primary cause of death, indicating a direct fatal outcome due to thromboembolic events. An additional 10 cases (14.3%) showed DVT or PE as having a contributory role, meaning that while not the sole cause, it significantly influenced the clinical course leading to death. The majority of deaths, 43 cases (61.4%), were deemed unrelated to DVT or PE, suggesting other predominant causes.

Table 6: Medico-Legal Concerns Identified in DVT-Associated Deaths (N=70)

Category	Number of Cases	Percentage (%)
Missed Diagnosis	28	40.0
Delayed or No Surgery	08	11.4
No Anticoagulation Despite Risk	31	44.3
Death Potentially Preventable	20	28.6
Complaint/Allegation of Negligence	04	05.7

In this study, a missed diagnosis of DVT or PE was documented in 40.0% of cases (28 cases), indicating a substantial gap in timely detection. In 31 cases (44.3%), no anticoagulation was administered despite the presence of known risk factors, highlighting a significant lapse in preventive care. Delayed or absence of surgical intervention was reported in 11.4% of patients (8 cases), potentially contributing to worsened outcomes. While, in 28.6% of the cases (20 cases), the death was deemed potentially preventable, suggesting that timely diagnosis and management may have altered the clinical course. Complaints or allegations of medical negligence were recorded in 05.7% of cases (4 cases), reflecting the legal implications of suboptimal care.

DISCUSSION

This study reviewed 70 autopsy cases of lower limb fractures to understand the role of Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE) in trauma-related deaths and their medico-legal importance. In 24.3% of cases, DVT or PE was the main cause of death, and in 14.3%, it contributed to death. These findings are similar to those of Velmahos GC et al. (2003),[5] who found that patients with severe leg injuries had a high risk of developing DVT. Westrich GH et al. (1998)6 also reported DVT in 19% of leg fracture cases, which supports our results. Most DVT-related deaths in our study occurred in people aged 46–60 years and older. This trend is consistent with the study by Heit

JA (2015),[2] who noted that the risk of venous thromboembolism increases with age. White RH (2003)3 also mentioned that people above 60 years have a much higher risk of developing DVT. Road traffic accidents (RTAs) were the most common cause of leg fractures in our study (54.3%). This matches the findings of Zhu Y et al. (2021),[11] who showed that fractures from high-impact accidents like RTAs are often linked with a higher chance of DVT. Our data also support Anderson FA and Spencer FA (2003)1, who described the three main causes of DVT: slow blood flow (stasis), injury to blood vessels, and increased clotting—known as Virchow's triad. One of the concerning findings was that 44.3% of patients did not receive any treatment to prevent DVT (thromboprophylaxis), despite having risk factors. Geerts WH et al. (2004),[4] strongly recommended using blood thinners or other preventive methods after trauma or surgery. Similarly, Agarwala S et al. (2003),[9] pointed out that in Indian hospitals, DVT prevention is often ignored, especially after orthopedic surgeries. We also found that in 40% of cases, DVT or PE was not diagnosed during the patient's treatment, and in 28.6% of cases, the death might have been preventable. Dong H et al. (2010),[10] found similar results in autopsy studies from Asia, where PE was often missed before death. Joffe HV et al. (2004),[7] noted that DVT can go unnoticed because it often has mild or no symptoms. In our study, 4 out of 70 cases (5.7%) had complaints of medical negligence related to missed DVT diagnosis or lack of treatment. According to Saukko P and Knight B (2004),[8] forensic autopsies are important in such cases to determine whether a blood clot formed before death (ante-mortem) or after death (postmortem), which can affect legal decisions.

CONCLUSION

This study shows that Deep Vein Thrombosis (DVT) is a common but often missed cause of death in people with leg bone fractures. Many patients did not receive proper treatment to prevent blood clots, even when they were at risk. DVT or pulmonary embolism was not suspected in many cases until after death. Most of these deaths could have been prevented with early diagnosis and care. The study also highlights the important role of autopsy in finding the true cause of death and checking for possible medical negligence. Better awareness and care can save lives in such cases.

Recommendation of Study

All patients with leg fractures should be checked for blood clots (DVT), especially if they are old or unable to move. Doctors should start blood-thinning treatment early in such cases to prevent clots. Medical staff should be trained to spot warning signs like leg swelling or pain. Hospitals should keep proper records and follow safety rules. Autopsies should be used to learn from missed cases. These steps can help save lives and avoid legal problems due to missed treatment.

Limitation of Study

This study was done at a single hospital, so the results may not apply to other places. It included only those cases where full records and consent were available, so some relevant cases may have been missed. Decomposed or badly damaged bodies were excluded, which could have affected the findings. Also, clinical data like use of medicines or exact time of death might not always be accurate. These limitations should be kept in mind while applying the results to a larger population.

Conflict of Interest: Nil

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Ethical Clearance: Ethical clearance taken from institutional Ethical committee.

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