



## Frequency of Deep Venous Thrombosis on Venous Doppler Ultrasound in Patients Presenting with Hip Fractures

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### ABSTRACT

**Objectives:** The purpose of this research is to determine the prevalence of deep vein thrombosis DVT in hip fracture patients as well as the risk factors for DVT as diagnosed by venous Doppler ultrasound. **Materials and Methods:** A cross-sectional survey was carried out in the department of Orthopaedics at Fauji Foundation Hospital, Rawalpindi in the duration from 25th October, 2024 to 7th April, 2025. Recruitment includes 111 patients aged 50 and older with hip fractures using consecutive sampling techniques. Participants' demographic data and DVT diagnosis were noted, and Doppler USG was used to find DVT. Data were analyzed using the software Statistical Package for Social Science version 26.0. **Results:** In this study, DVT incidence was 24% for all DVT, 18% for proximal DVT, and 9% for distal DVT. In the present study, DVT was noted to be related to age, ASA status, and type of fracture. The highest frequency was registered for patients aged 65 years and over with ASA III and femoral neck fractures. **Conclusion:** DVT is known to affect hip-fracture patients globally, more so the elderly and those with other medical conditions. Where possible, the early detection and prevention of conditions and diseases that exacerbate the patient's symptoms are crucial to ensuring good results.

### INTRODUCTION

Mortality increases for patients with hip fractures and especially for those who developed DVT. The condition is prevalent among the elderly undergoing trauma and surgery, and it involves the formation of clots in the deep veins in the lower limbs (1). This can lead to pulmonary embolism which is lethal, therefore screening for DVT, and prevention is paramount in hip fracture patients (2). For example, venous doppler ultrasound earlier has been established extremely valuable to define dvt status of patients with hip fracture presenting with high sensitivity and specificity to detect thrombus formation (3).

Some studies conducted in the last few years to define the risk of DVT in hip-fractured patients has described an overall incidence ranging between 20 and 50% (4). A particular increased risk of developing DVT is associated with elderly patients especially the one who presents at the hospital much later than they should (1). Bengoa et al (2020) say that most patients with hip fractures take a long duration before presenting to the hospital, and this defines their risk of DVT (1). This explains why people should go for tests early and get the right treatment started so that the diseases will not progress.

This current research has focused on the problem area of preventive evaluation of DVT, as seen in preoperative and postoperative assessment. For instance, non-invasive duplex Doppler ultrasound done preoperatively and postoperatively is believed to be a reliable diagnostic modality for DVT in patients who sustain pelvic or hip bone fractures (2). Sitting additional support to the early diagnose of DVT, conducting a Doppler ultrasound examination is helpful. Clinically, it enables hazardous patients to receive pharmacological thromboprophylaxis (2), according to Cerbasi et al. (2022). However, other researchers have noted that some predictors such as age, gender and exactly which comorbidity, including hyperglycaemia, does influence DVT in hip fracture patients (12). For example, Yao and al. noted that preoperative DVT was associated with raised blood glucose levels at admission in patients with femoral neck cracks(12).

Femoral neck and intertrochanteric fractures are found to be associated with the risk of DVT since it is associated with the risk of immobility and trauma (3). Previous clinical risk factors such as age, trauma, and severity also predicted new DVT among intertrochanteric

fracture patients through a direct relationship, according to Fan, He, and Zhang (2021) (3). Moreover, Zhang et al. (2020) identified a specific strategy applying Doppler ultrasound may assist in diagnosing DVT in the early stage, which is essential for preventing pulmonary embolism (5).

Namely postoperative DVT remains a critical and highly common concern relative to hip fracture surgery. Such protective measures, as the use of anticoagulants and mechanical compression devices, might considerably reduce the rate of postoperative DVT which has been proved (6). However, as indicated earlier, there is a gap in how these preventive measures can be strengthened to cover high risk occasions such as patients with complications including but not limited to comorbidity (7). The study also also highlights the importance of patient triage with respect to their risk factors during the beginning of treatment to ensure that proper intervention is instituted at the earliest opportunity.

In regards with the diagnosis of DVT in hip fracture patients, venous Doppler ultrasound is moderately useful. Doppler ultrasound is less invasive, fast, and inexpensive method for diagnosing DVT in the lower limbs (8). In the emergency and trauma zones, Canty et al. (2020) found that the use of point-of-care ultrasound is significant as it provides results on the spot, which is important in solving the physicians' decision-making process (8). The technique is useful in a setting whereby other diagnosis procedures such as venography or CT scans may not be suitable for use or accessible to all people.

Similarly Doppler ultrasound was once used as the gold standard for diagnosis of DVT, other modality such as MRI and CT have also been used for diagnosis of VTE in the trauma patients (9). However, these methods are relatively costly and may not even address the perceived population of people as familiar with them as the conventional ones especially in the developing world. Therefore, Doppler ultrasound is the only mode that can be used to screen hip fracture patient for DVT (9).

Apart from Doppler ultrasound, various scoring systems and nomograms have been established in an attempt to identify hip fracture patients at higher risk of DVT. For instance, Yang et al. (2023) worked on the prediction model of DVT in patients with pelvic and acetabular fractures, and injury severity and laboratory data were among the parameters (9). These models can benefit clinical management decisions relating to thromboprophylaxis and other preventive measures.

Pharmacologic and mechanical prevention measures have long been prescribed for the elderly with hip fractures. Thromboprophylaxis for high-risk DVT is predominantly achieved through the administration of LMWHs despite the increasing utilization of 'new generation' agents (10). Furthermore, mechanically driven procedures such as converting with SCDs or GCS is known to enhance the venous blood flow circulation so as to reduce the chances of clot formation (6). However, none of these strategies have been able to elevate the routine use of thromboprophylaxis to high levels therefore the subsequent protocols need further studies in an attempt to

get the best rates for the aforementioned patients(11).

This risk is made worse by obesity, prolonged sitting and other causes of hypercoagulability in hip fracture patients (7). For instance, a research study has showed that hospitalized patients especially the aged or those with other complications, those with diseases such as diabetes, high blood pressure and cardiovascular diseases, have a higher possibility of developing DVT than other patients (14). Similarly, reviewing the interference of preoperative factors and other associated disorders such as serum phosphorus levels and high glycemic level on DVT in hip fracture patients has been discussed in a few studies (6, 7). These factors underscore the difficulty of the prevention of DVT in such a population since different factors should be considered each time.

Lastly, DVT is still a worrying risk factor, especially in candidates for hip surgery with the elderly and those with other chronic illnesses. The early use of venous Doppler ultrasound in hip fracture patients is an effective mode of identifying DVT. However, the prevention and treatment of DVT involve a combination of pharmacological and mechanical procedures together with knowledge of patient risk factors for DVT. Further developments of diagnostic tools and therapeutic strategies will go on in future efforts to reduce the unfavorable impacts of hip fracture and to prevent DVT occurrence and its consequences (15).

### Objective

The purpose of this study is to determine the incidence of DVT among hip-fractured patients through the use of venous Doppler ultrasound, review factors that make the patients prone to DVT, and determine how early detection and preventive measures can help in managing the high-risk hip-fractured patients.

## MATERIALS AND METHODS

### Study Design

This cross-sectional descriptive study uses venous Doppler ultrasound to determine the prevalence of deep venous thrombosis (DVT) among hip-fractured patients. The sample size was estimated using the WHO sample size calculator with a level of confidence of 95% and a marginal error of 3.5%. From several associated cases analyzed from various previous related research, the anticipated incidence rate of DVT in patients with hip fractures is 3.66%. The calculated sample size is 111 cases (12).

### Study Setting

This research will occur in the Department of Orthopaedics at Fouji Foundation Hospital in Rawalpindi, Pakistan.

### Duration of the Study

The study was from 25<sup>th</sup> October, 2024 to 7<sup>th</sup> April, 2025.

### Inclusion Criteria

The patients that will be targeted in the study will be the two-gendered patients who are 50 years of age and above with hip fracture diagnosis. Patients must meet the ASA status of I, II, or III to undergo surgery and anesthesia.

### Exclusion Criteria

Patients with hip fractures with treatment initiated more than 3 weeks after the injury, open soft tissue fractures, or fractures from high energy or pathological causes will be excluded from the study.

### Methods

Overall, 111 patients with hip fractures will attend the outpatient ward of the Orthopaedic Department at Fauji Foundation Hospital, Rawalpindi, who will be included in this study. The participants will also provide written informed consent for the study. The patient's venous Doppler ultrasound will be done on each of them by a single specialized radiologist in a color ultrasonic mode. DVT will be assessed based on the operational definition, and the type of DVT will be classified based on the operations guidelines. The demographic information and DVT confirmation will be documented in the proforma to be completed by the researcher. Sources of bias will be dealt with using proper exclusion criteria in wound sample analysis to compare the two groups of mice. According to the standard operational procedures set in the department, all patients will be treated as follows.

The collected data will be entered and analyzed using Statistical Package for Social Science (SPSS) version 26.0. Age and time since fracture will be described by mean  $\pm$  STD, while frequencies and percentages will describe other ordinal and nominal data. Gender, side of injury, ASA status, type of fracture, DVT, and types of DVT will be characterized by their frequency and percentage. In an attempt to control for effect modifiers, the frequency of DVT shall first be grouped by age, gender, time since fracture, ASA status, side of injury, and type of fracture. After post-stratification, a chi-square test will be carried out at  $p \leq 0.05$  significance level.

### RESULTS

There were 111 hip-fractured patients in the study population. Some of the demographic variables, like age, gender, and the ASA status of the participants, are shown in Table 1 below. The patients' mean age was  $65.4 \pm 10.2$  years, and 62 percent were female. ASA status distribution indicated that most patients were ASA II (52%), while 33% were ASA III, and 15% were ASA I.

**Table 1**

#### Demographic Characteristics of Patients

Parameter	Frequency (%)
Age (Mean $\pm$ SD)	65.4 $\pm$ 10.2
<b>Gender</b>	
Female	62%
Male	38%
<b>ASA Status</b>	
ASA I	15%
ASA II	52%
ASA III	33%

Regarding the kinds of fractures, 60% of the patients had femoral neck fractures, and 40% had an intertrochanteric fracture. Table 2 encapsulates the distribution of various fracture patterns and the side on which the patients were injured. This study also revealed that the right side of the affected spine was more dominant (55%) than the left side (45%).

**Table 2**

#### Fracture Type and Injury Side

Fracture Type	Frequency (%)
Femoral Neck	60%
Intertrochanteric	40%
<b>Injury Side</b>	<b>Frequency (%)</b>
Right	55%
Left	45%

The incidence of DVT in hip fracture patients was 24%, with 27 patients having DVT on examination. In detail, 18 patients had proximal DVT, and nine patients had distal DVT, as indicated in the table below in Figs 3 and 4. DVT was found to be more common in elderly patients of 65 years or above (32%) than the younger ones, those below 65 years (15%). However, DVT was more frequent in patients with ASA III status 35% and in those with femoral neck 28% than intertrochanteric fractures 19%.

**Table 3**

#### Frequency and Type of DVT

DVT Diagnosis	Frequency (%)
No DVT	76%
DVT	24%
<b>Type of DVT</b>	<b>Frequency (%)</b>
Proximal DVT	18%
Distal DVT	9%

The study revealed a statistically significant relationship between newly developed DVT and age, ASA status, and the type of fracture. After post-stratification, the chi-square test further showed a variation in DVT frequency across ages ( $p = 0.03$ ), ASA grouping ( $p = 0.01$ ), and fracture types ( $p = 0.04$ ). Similarly, no statistically significant relationship between gender, the side of the body involved in the injury, and DVT development was identified.

### DISCUSSION

DVT is well known to occur in elderly hip fractures and patients with numerous other diseases and disabilities. The study was designed to identify the prevalence of DVT in patients with hip fractures and identify the factors that influence its occurrence. The calculated prevalence of DVT in hip fracture patients was 24%, which corresponds with the data previously reported in the literature. Age, ASA status, and the type of fracture were established as predictors for DVT, which underlines the importance of regular and timely DVT detection and prevention strategies.

The overall incidence of DVT for our study was 24 %, with Proximal DVT being high at 18 % and Distal DVT being slightly lower at 9%. This is in concordance with other studies that have also described a wide variability in the incidence of DVT in hip fracture patients, with reported incidence ranging from 20-50% (1), (2). Due to these gaps, prevalence might vary, and this is because different population groups may have different prevalence rates for the same disease. However, as indicated in the present study, DVT is highly prevalent, so it should be incorporated into the hip fracture patients' management.

Age was a predictor of DVT in our study, as patients aged 65 years old and above had a higher incidence of DVT, 32%, as compared to younger patients, 15%. This finding is by the previous studies, which state that the DVT risk is

higher in elderly patients because of the presence of risk factors such as immobility, blunted venous tone, or comorbidities (3), (4). Older people are especially at high risk for the development of VTEs because of physiological alterations related to aging that affect coagulation, endothelium, and platelets. Furthermore, consequent immobility because of hip fractures and due to surgical procedures also put the patients at high risk of DVT (5).

Some other factors that showed a correlation with DVT in our study were ASA status; patients with ASA III (severe systemic disease) had the highest incidence of DVT at 35%. This is in contrast to earlier studies that have affirmed that comorbid conditions such as cardiovascular diseases, diabetes, and obesity contribute to DVT risk factors (6), (7). ASA classification reflects the general health state of a patient and can be used to prognose postoperative complications. Our findings also demonstrated an increased risk in patients receiving surgery for DVT with a higher ASA score, as it is understood that the patient's comorbid conditions, as well as the relative health risk of surgical procedures, contribute to this increased risk.

The fracture site was identified to have a moderate relation with the development of DVT. Authors of included studies demonstrated that 28% of patients with femoral neck fractures developed DVT, while only 19% of patients with intertrochanteric fractures developed the same. This observation is in concordance with previous research that has established that fracture types that require highly invasive procedures, including hip replacement or internal fixation, particularly femoral neck fractures, are more likely to cause thromboembolic events (8), (9). Some of the essential causes of DVT that involve patients with fractures include the severity of the fracture, the requirement for surgical intervention, and the long periods of inactivity after surgeries. Furthermore, femoral neck fractures are reported in older patients with other related risk factors that increase the susceptibility to DVT (10).

On the other hand, there was no evidence of a difference between the injury side (right or left) and DVT in the present trend. This is in concordance with the other research, which has not observed a significant relationship between the side of the injury and DVT (11). Therefore, factors such as the patient's general well-being, the fracture's severity, and whether the patient had surgery are more deterministic of DVT than the side of the fracture. A notable feature of our study is the ability to use venous Doppler ultrasound as the criterion for diagnosis of DVT. Doppler ultrasound is the most recommended diagnostic modality for DVT because of its high sensitivity and specificity; hence, it remains relevant in clinical practice, especially in cases involving trauma and surgery (12). Among the diagnostic tools we used in our study, Doppler ultrasound was invaluable in the timely diagnosis of DVT to avert excesses of formation of blood clots, which can result in pulmonary embolism. Research findings have established that observation and compression Doppler ultrasonic examinations for DVT in heightened population groups could considerably decrease the occurrence of thromboembolic episodes (13). Increased chances of

identifying DVT give the patients a chance to undergo treatment such as anticoagulation that helps in avoiding the development of extended effects (14).

Several preventive measures regarding the formation of DVT in the hip fracture patient population have been cited in the available literature. In high-risk sufferers, medical prevention with LMWH or DOACs is usually recommended for the prevention of DVT (15). Nonpharmacologic measures include IPCs or GCS mechanical methods of DVT prophylaxis, as these also increase venous return and decrease blood stasis (16). In this study, none of the patients was excluded from any management direction of the department of the treating hospital, including indication and appropriate measures for thromboprophylaxis and mechanical intercessions in high-risk patients. Nevertheless, guidelines cannot always be followed in clinical practice, and efforts should be made to provide the highest standards of prophylactic management for all patients at high risk.

As the statistics have shown, even when productive preventive measures were implemented, the rates of DVT in patients with hip fractures remained high. Factors such as late hospital attendance, more immobility periods, and brief or wrong anticoagulation therapy are blamed for producing high DVT rates in this population. According to Bengoa et al. (2020), if surgical intervention is not performed in the early hours after the identified hip fracture, thromboembolic complications are likely to occur in elderly patients (1). Furthermore, the research we reviewed established that any delay or lack of thromboprophylaxis raises the risk of developing DVT (17).

Lastly, DVT is still a significant threat for patients with hip fractures, especially the elderly, as well as those whose ASA score is high. This study is relevant to stress early identification of patients at risk for developing DVT and other preventive measures to lower the risk or the condition's paralyzing ramifications. Universal screening with Doppler ultrasound and adequate pharmacological and mechanical prophylaxis can also enhance patient outcomes in the management of DVT within this high-risk group.

## CONCLUSION

Therefore, the present analysis aims to underscore the fact that approximately 24% of patients with hip fractures experience DVT based on the current trial. Age, ASA status, and the type of fracture had been considered independent predictors of DVT. Specifically, older patients, raised ASA scores, and femoral neck injury were found to be the independent risk factors. The authors demonstrated that venous Doppler ultrasound for early use was an effective diagnostic tool for DVT in this population. Nevertheless, despite the use of preventive measures, including pharmacological and mechanical ones, DVT remains a problem. These observations stress the utility of the early detection of risk factors, the creation of individual prevention plans, as well as the need to perform the intervention to minimize the development of DVT and its complications, namely pulmonary embolism.

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