



## Approach to management & prevalence of Deep venous thrombosis in periarticular knee fractures

Dr. Indira Sarin<sup>1</sup>, Dr. Siddharth Lamba <sup>\*2</sup>, Dr. Jatin Raj Sareen<sup>3</sup>

<sup>1</sup>Assistant Professor (Obstetrics & Gynaecology) National Institute of Medical Sciences, Jaipur (Rajasthan)

<sup>2</sup>Associate Professor (Orthopaedics) Balvir Singh Tomar Institute of Medical Sciences & Research, Jaipur (Rajasthan)

<sup>3</sup>Assistant Professor (Orthopaedics) Maharishi Markandeshwar College of Medical Sciences & Research, Sadopur, Ambala (Haryana)



### Correspondence:

**Dr Siddharth Lamba\***

Associate Professor (Orthopaedics)  
Balvir Singh Tomar Institute of Medical  
Sciences & Research, Jaipur (Rajasthan)

**Received: June 11, 2025**

**Revised: June 19, 2025**

**Accepted: July 01, 2025**

**Published: July 11, 2025**

### Abstract

The present study is intended to evaluate prevalence of DVT in patients presenting with acute injuries around knee. The study was conducted in the department of Orthopedics, NIMS Hospital, Jaipur from January 23 to December 24. A detailed history, clinical & radiological examination along with investigations was carried out in all 65 patients. The study aimed to look at whether conservative treatment increases the risk of DVT when compared with operative treatment. 65 cases were included in study. 7 cases of VTE were seen with highest prevalence in patients with fracture around knee. The overall prevalence of VTE was found to be 10.7%. 2 cases of pulmonary embolism were seen during the period of study. Overall incidence of Pulmonary embolism was 3% which is high as per International norms (1%).

**Keywords:** DVT, VTE



This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).

### INTRODUCTION

Deep venous thrombosis is characterized by presence of thrombus within deep veins of the extremity.<sup>1,2</sup> If not recognized timely, deep venous thrombi can embolize to pulmonary arterial circulation subsequently lodging in a lung which can be life threatening within few hours of onset. Hence early diagnosis is only preventive & therapeutic measure needed for its management. Complex periarticular knee fractures due to high energy trauma lead to endothelial injury and subsequent manipulation fulfill Virchow's triad namely venous stasis, endothelial damage and hypercoagulability important in thrombus formation<sup>3,4</sup>.

Previous studies done in view of Indian perspective on this topic is lacking due to the non-availability of published Indian data.<sup>5</sup> The disease is very elusive in terms of its recognition. DVT is the most common serious complication seen postoperatively early after total hip and knee arthroplasty.<sup>6,7</sup> As a consequence pulmonary embolism which is a life threatening catastrophe may occur. Lower limb fractures and surgeries, amongst them, total hip & knee arthroplasty,

have a high risk of developing DVT as a potential complication<sup>8,9</sup>. Age above 50 years, long period of immobilization, previous H/o stroke, previous history of venous Thromboembolism, pregnancy and puerperium are other risk factors for DVT. <sup>6,10</sup>

In Asian population incidence of DVT is reported upto 63%.<sup>11</sup> Limited studies are there which include only post traumatic patients to determine incidence of DVT in Indian populations.<sup>12,13</sup>

Clinical signs such as pain, edema, local tenderness, skin changes (including redness, pigmentation, cyanosis), and positive Homan's sign are suggestive of DVT. The disease is very elusive both in terms of its recognition and management, the clinical diagnosis being inaccurate in up to 50% of cases<sup>5</sup>.

Colour Doppler Ultrasonography is the most noninvasive, safe, inexpensive accurate & widely available diagnostic modality as compared to MRI

Venography and hence it was selected as diagnostic tool for our study.

## MATERIALS AND METHODS

The study was conducted in the department of Orthopedics, NIMS Hospital, Jaipur from January 2023 to December 2024

The study was a non-analytical cohort study.

### Inclusion criteria

1. All patients getting admitted for surgeries for trauma around the knee at NIMS Hospital.
2. All patients admitted for periarticular knee trauma & managed conservatively.
3. Minimum age criteria was 18 years and above.

### Exclusion criteria

1. Patients with history of bleeding tendencies.
2. All known cases of hypercoaguable states.
3. Patient not willing to be part of study.
4. Patient already diagnosed as having DVT.
5. Non trauma surgeries such as knee arthroplasty & Arthroscopy.

A detailed clinical history, clinical and radiological examination was carried out in all 65 patients.

## HISTORY

A detailed history of trauma/mode of injury

Past History: any previous history of DVT, or any other risk factors such as smoking, contraceptive pills, H/O cardiac disease/ stroke, long immobilization, bleeding disorders was excluded.

## RESULTS

**Table 1: Age interval in the study group**

| Age Interval | N  | %    |
|--------------|----|------|
| < 20         | 1  | 1%   |
| 20 – 30      | 11 | 17%  |
| 30 – 40      | 9  | 14%  |
| 40 – 50      | 5  | 8%   |
| 50 – 60      | 17 | 26%  |
| 60 – 70      | 14 | 22%  |
| ≥ 70         | 8  | 12%  |
| TOTAL        | 65 | 100% |

Majority of subjects in the study groups belong to the 50-70(48%) year age group and considerable amount of subjects in the 20-40 (31%) years age group.

**Table 2: Co-morbid illness in our study group**

| Comorbid illness | n  | %   |
|------------------|----|-----|
| Diabetes         | 11 | 17% |
| Hypertension     | 19 | 24% |
| Smoking          | 3  | 4%  |

### Local Examination

Calf swelling, Neurovascular status of limb, any wound, erythema/blisters.

Homan sign i.e. pain on passive calf stratching were assessed

### Investigations done:

Venous Doppler B/L lower limb was carried out in all patients fitting inclusion criteria.

Preoperative assessment for DVT was done in patients by Doppler ultrasonography. The assessment included examination of the bilateral common femoral, popliteal, anterior tibial and posterior tibial vein for their flow/velocity, diameter, presence of thrombosis & compressibility.

A diagnosis of DVT was made in case of visualization of thrombus, absence of flow, lack of compressibility or lack of augmentation. However colour doppler ultrasasonography of deep venous thrombosis relies on loss of vein compressibility as a primary criteria for diagnosis of DVT.

A repeat Doppler study was performed at 3 months in every patient diagnosed with DVT to look for evidence of recanalisation. In patients diagnosed with DVT, LMWH 0.6 mg OD was administered along with warfarin 5mg per day with regular monitoring of APTT& PT/INR.

Out of 65 patients with fractures around knee, 11 patients had associated Diabetes Mellitus, 19 patients had Hypertension and 3 patients had H/o chronic smoking

**Table 3: Prevalence of Venous Thromboembolism (VTE) in our study group**

| Group  | n  | %     |
|--------|----|-------|
| Normal | 58 | 89.3% |
| VTE    | 7  | 10.7% |
| TOTAL  | 65 | 100%  |

DVT was diagnosed in 7 out of 65 patients i.e. 10.7% of patients.

**Table 4 – Comparison of DVT in surgical v/s conservative management**

| No. of DVT cases | 7/65 | %   |
|------------------|------|-----|
| Conservative Mx  | 5/7  | 71% |
| Post surgery DVT | 2/7  | 29% |

Out of 7 cases diagnosed with DVT 5 were being managed conservatively and 2 were diagnosed in postoperative period.

**Table 5: Number of DVT cases at initial & 2 weeks**

| Total diagnosed cases                   | 7/65 | %   |
|-----------------------------------------|------|-----|
| Diagnosed at 1 <sup>st</sup> ultrasound | 5/65 | 71% |
| Diagnosed at 2 weeks                    | 2/65 | 29% |

5 cases were positive after the first Doppler ultrasound. They might have developed DVT within initial 24 hrs as the first Doppler was done with 48 hrs. Additional 2 cases were positive on the 2<sup>nd</sup> Doppler at 2 weeks interval.

**Table 5: Comparison of clinical & subclinical DVT**

|                 |     |     |
|-----------------|-----|-----|
| Clinical DVT    | 4/7 | 57% |
| Subclinical DVT | 3/7 | 43% |

In patients diagnosed with DVT, clinical signs of DVT was present in 4 cases i.e. 57%. Most reliable sign is Calf pain which directly correlates with DVT.

**Table 6: Comparison between proximal and distal DVT among patients with DVT**

| DVT ↓    | Normal |   | VTE |      |
|----------|--------|---|-----|------|
|          | n      | % | n   | %    |
| Proximal | -      | - | 3   | 43%  |
| Distal   | -      | - | 4   | 57%  |
| TOTAL    | -      | - | 7   | 100% |

Among the patients with DVT, 3 cases had proximal DVT and rest of 4 cases had distal DVT. Proximal DVT is defined as DVT involving popliteal vein and above while Distal DVT involves calf veins.

This correlation suggests high incidence of distal DVT as compared to proximal DVT

**Table 8: Distribution of fractures included in study**

| Type of fracture     | N     | %   |
|----------------------|-------|-----|
| Distal femur         | 28/65 | 43% |
| Proximal Tibia       | 34/65 | 52% |
| Floating knee injury | 3/65  | 5%  |

Distal femur fractures (43%) included were distal shaft 1/3, supracondylar & intercondylar femur fractures while proximal tibia fractures (52%) included were condylar fractures and proximal shaft fractures upto 1/3 tibia.

Floating knee injuries were 5%.

**Table 7: Age vs management of fracture**

| Age Interval | Management of Fracture |      |           |       |
|--------------|------------------------|------|-----------|-------|
|              | Conservative           |      | Operative |       |
|              | n                      | %    | n         | %     |
| < 20         | 1                      | 5%   | 0         | 0.00% |
| 20 – 30      | 5                      | 25%  | 6         | 13%   |
| 30 – 40      | 3                      | 15%  | 6         | 13%   |
| 40 – 50      | 1                      | 5%   | 4         | 9%    |
| 50 – 60      | 4                      | 20%  | 13        | 29%   |
| 60 – 70      | 2                      | 10%  | 12        | 27%   |
| >= 70        | 4                      | 20%  | 4         | 9%    |
| TOTAL        | 20                     | 100% | 45        | 100%  |

Conservative managed cases were 20 (31%) & operated cases were 45(69%).

**Table 9: Distribution of Fractures and DVT cases**

| Type of fracture        | N (DVT patients) | %   |
|-------------------------|------------------|-----|
| Proximal tibia fracture | 5/7              | 72% |
| Distal femur fracture   | 1/7              | 14% |
| Floating knee injury    | 1/7              | 14% |

Proximal Tibia fractures had maximum no. of DVT cases (72%).

## DISCUSSION

DVT after lower limb trauma results from injury to vascular endothelium, any subsequent manipulation and prolonged immobility further lead to events accelerating thrombus formation.

65 patients were included in the study with periarticular knee fractures and floating knee injury as per inclusion criteria. All patients underwent Doppler ultrasound within 24-48 hrs of admission and repeat Doppler was done 2 weeks after the first Doppler.

5 cases were positive after the first Doppler ultrasound. These cases were followed up as it was not clear at what stage they developed DVT. Two of these had no clinical symptoms prior to admission in hospital. They might have developed DVT within initial 24 hrs as the first Doppler was done with 48 hrs. Additional 2 cases were positive on the 2nd Doppler at 2 weeks interval. While the 1st Doppler may have picked up pre-existing DVT, repeat picks up all those which have developed during the course of the treatment.

Among the patients with DVT, 3 cases i.e. 43% of diagnosed cases had proximal DVT and rest 4 cases i.e. 57% cases had distal DVT. This might also suggest that there are high chances of progression of thrombus to proximal veins during the course.

Doppler evidence of DVT were found in 7 (10.7%) patients, The incidence of DVT in our study was lower in comparison of Li et al<sup>14</sup> & Zhang et al.<sup>15</sup>

Of these 7 patients 4 (57%) had clinical signs of DVT while only 3 (43%) were subclinical. This is in correlation with other studies.<sup>12</sup>

Most persistent feature was edema in all patients having clinical features. 9 patients had clinical features but no evidence of DVT on Doppler.

In our study, amongst the 7 patients who developed DVT, 5 cases were being treated conservatively (71%) and 2 cases were being treated operatively (29%). While amongst the normal patients, maximum patients were treated operatively. This data is statistically significant (p value <0.05). This suggests conservatively managed cases had a higher incidence of DVT as compared to operative cases probably as postsurgical cases are mobilized by Non weight bearing ambulation almost the next day. Since the most number cases of DVT were present in the above 50 yr. age groups, maximum number of conservative cases were also in the same age group as compared to other groups where operative intervention is used most commonly.

2 patients developed DVT in post operative period. One patient had tourniquet applied in intraoperative period while in other tourniquet was not applied since the number of cases is low, we can't establish any significant correlation between tourniquet application and incidence of DVT in post operative patients.

Out of diagnosed 7 patients with DVT 5 (71%) patients were above 50 years age group, only 2 (29%) patients

belong in 20-40 year age group. This suggests that the incidence of DVT increases with age as suggested by some other studies (Sharma et al<sup>12</sup>, Kapoor et al<sup>16</sup>)

Road traffic accidents was most common mode of injury (68%). Patients coming after Road traffic accidents had high energy trauma.

In our study we included a variety of fractures around the knee joint. Out of those variety, proximal Tibia fractures were more common (52%) while distal femoral fractures were (43%). Approx. 5% of cases were of floating knee injury.

We have found higher incidence of DVT in proximal tibial fractures (72%). The risk of DVT appears to increase with the proximity of the fracture to the knee, tibial plateau fractures have higher risk.<sup>15</sup> One of the possible reasons could be as most of the trauma around the knee resulted from high energy and hence greater soft tissue damage leading to a higher incidence of DVT.

In our study out of 65 patients, majority of them belong to the 50-70 year age group (48%) and considerable amount of subjects in the 20-40 years age group (31%) probably because it is the most common age group suffering from Road traffic accidents. Out of 65 subjects, 35 were male and 30 were female. But a significant statistical correlation could not be made out for association between gender and incidence of DVT.

1 patient expired in our study. This was a post traumatic # proximal tibia with established DVT and died because of pulmonary embolism.

Patients with established DVT were kept on LMWH 0.6 mg once a day along with warfarin 5 mg along once a day along with PT/INR & APTT monitoring at time of discharge of DVT and they were kept on follow up for 3-6 months

Patients who developed DVT were followed upto 3 month until there was no sign of DVT on Doppler. Except one patient who expired in our study, rest all of the patients recovered. Edema lasted for 3 months.

Chemoprophylaxis was not given to any patients in our study, only patients diagnosed with DVT received LMWH as empirical treatment.

## CONCLUSION

This study was done to study the prevalence of DVT in patients presenting to this hospital with periarticular fractures around knee. The study also showed that conservatively treated cases shows statistically significant more risk for DVT than operated cases.

The prevalence of DVT & pulmonary embolism in this study highlights the importance of high index of

suspicion for both DVT and Pulmonary embolism and need for both mechanical and chemoprophylaxis in these cases.

In our study, 43% cases of diagnosed DVT were clinically asymptomatic as compared to 57% of clinically symptomatic cases.

Among the operative cases, use of tourniquet with DVT was assessed. But since the number of patients were too less, no adequate correlation can be made out.

Limitations of study were non inclusion of all lower limb fractures & small sample size.

## REFERENCES

1. Heit JA, Silverstein MD, Mohr DN, Petterson TM, O'Fallon WM, Melton LJ 3rd. Risk factors for deep vein thrombosis and pulmonary embolism: a population-based case-control study. *Arch Intern Med* 2000; 160: 809- 15. 34.
2. Agarwala S, A Bhagwat, J Modhe, FD Dastur, S Patil. Incidence of deep vein thrombosis in Indian patients. A prospective study in 104 patients. *Indian Journal of Orthopaedics*.2005 ;65:159-162.
3. Wang P, Yan X, Fei C et al (2022) Clinically important venous thromboembolism in tibial plateau fractures: incidence and risk factors. *Sci Rep* 12:20206.
4. Li J, Zhu Y et al (2020) Incidence and locations of deep venous thrombosis of the lower extremity following surgeries of tibial plateau fractures: a prospective cohort study. *J Orthop Surg Res* 15:605.
5. Parakh R., Kakkar V.V., Kakkar A.K. Venous Thromboembolism (VTE) Core Study Group. Management of venous thromboembolism. *J Assoc Physicians India*. 2007;55:49–70.
6. European consensus statement on the prevention of venous Thromboembolism. London, Med-Orion, 1992.
7. Ko PS, Chan WF, Siu TH, Khoo J, Wu WC, Lam JJ. Deep venous thrombosis after total hip or knee arthroplasty in a “low-risk” Chinese population. *J Arthroplasty* 2003; 18: 174.
8. Jain V., Dhaon B.K., Jaiswal A. Deep vein thrombosis after total hip and knee arthroplasty in Indian patients. *Postgrad Med J*. 2004;80:729–731. doi: 10.1136/pgmj.2003.018127.
9. Caprini JA, Arcelus J, Sehgal LR, et al. The use of low- molecular- weight heparins for the prevention of postoperative venous thromboembolism in general surgery. A survey of practice in the United States. *Int ngiol*. 2002; 21: 78-85.
10. Leizorovicz A, Turpie AG, Cohen AT, Wong L, Yoo MC, Dans A; SMART Study Group. Epidemiology of venous thromboembolism in Asian patients undergoing major orthopedic surgery without thromboprophylaxis. The SMART study. *J Thromb Haemost* 2005; 3: 28-34.

11. Dhillon K.S., Askander A., Doraisamy S. Postoperative deep-vein thrombosis in Asian patients is not a rarity. *J Bone Joint Surg (Br)* 1996;78-B:427–430.
12. Sharma H., Maini L., Agrawal N., Upadhyay A., Vishwanath J., Dhaon B.K. Incidence of deep vein thrombosis in patients with fractures around hip joint: a prospective study. *Indian J Orthop.* 2002;36(3).
13. Sen R.K., Kumar A. Risk of postoperative venous thromboembolism in Indian patients sustaining pelvi-acetabular injury. *Int Orthop.* 2011;35(July (7)):1057–1063.
14. Dong Y, Zhang T, Zhong S, Ren Y, Zheng Z. Analysis on risk factors for deep vein thrombosis in patients with traumatic fractures. *Chin J Orthop.* 2015;35:1077–83.
15. Zhang J, Zhao K, Li J, Meng H, Zhu Y, Zhang Y. Age over 65 years and high levels of C-reactive protein are associated with the risk of preoperative deep vein thrombosis following closed distal femur fractures: a prospective cohort study. *J Orthop Surg Res.* 2020;15:559.
16. Kapoor C.S., Mehta A.K., Patel K, Golwala P. Prevalence of deep vein thrombosis in patients with lower limb trauma. *J Clin Orthop Trauma* 2016 Jul 25;7(Suppl 2):220–224