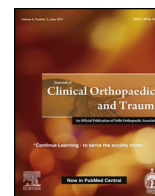




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Original article

Prevalence of deep vein thrombosis in patients with lower limb trauma

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ABSTRACT

Introduction: Venous thrombo-embolism (VTE), which consists of deep vein thrombosis (DVT) and pulmonary embolism, is a potentially fatal condition. According to Western literature, DVT of lower limb veins is one of the most common complications following surgeries for lower limb. Few studies have been published from India on the subject and little is known about the true prevalence of the DVT and hence there are no clear guidelines regarding the prophylaxis for DVT for Indian patients.

Materials and method: We carried out a prospective study to determine the prevalence of DVT in 125 patients with lower limb trauma. All the patients underwent Colour Doppler pre-operatively, 4th post-operative day, at 3rd month post operatively and at 6th month post operatively only in patients who remained DVT positive at 3rd month post operatively, to see for the recanalisation. No mechanical or chemical form of DVT prophylaxis was used in DVT negative patients either pre-operatively or post-operatively.

Results: In our series of 125 patients, 107 were males and 18 females (M:F = 5.9:1). Majority of our DVT positive patients were above 60 years of age. Out of 47 patients with periacetabular fractures, 8.51% developed DVT. Out of 8 patients with floating knee injury, 25% developed DVT.

Combination of risk factors rather than a single risk factor had played important role for development of DVT in our study. 6 patients were DVT positive (4.8%). Amongst them 3 (2.4%) had proximal DVT and 3 (2.4%) had distal DVT. There was single case of pulmonary embolism (PE).

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1. Introduction

Deep vein thrombosis (DVT) means a blood clot (thrombus) in the deep venous system of the leg. DVT is not dangerous in itself. The situation becomes life-threatening when a piece of the blood clot breaks off (embolus), travels downstream through the heart into the pulmonary circulation system, and becomes lodged in the lung which could be life threatening. Hence early diagnosis and treatment of a deep venous thrombosis (DVT) is essential to prevent this catastrophe (Fig. 1).

Parakh et al.¹ in their review article have stated that the Indian perspective on this topic is lacking due to the non-availability of published Indian data.

The reported lower incidence of DVT could also be because of the lack of awareness among the doctors and the patients, and availability of diagnostic facilities in this part of the world; thus many of the cases remain undiagnosed. Even the investigations

required to screen or diagnose such cases, like D-dimer test, Fibrinogen uptake studies, colour Doppler machines or expertise to carry out venography are nonexistent in the majority of the rural hospitals of our country.

Low incidence among Asians has been attributed to several factors like high fibrinolytic activity, complete lack of Activated Protein C resistance, a higher incidence of blood group 'O', low intake of fat, lower incidence of obesity and climatic differences.^{2,3}

Few studies which have reported very low incidence of DVT in India have been conducted in patients undergoing elective orthopaedic surgery and used colour duplex for diagnosis.⁴ In the absence of any study in this population under the high-risk condition of trauma, it is unwise to assume that Indians are genetically protected against VTE after trauma.

Some workers have shown that even established thrombi in Asian patients resolve spontaneously without any long-term consequences.^{5,6} Some recent studies report an increasing incidence of VTE in the Indian subcontinent.^{7,8} The increased incidence is attributed to increased life expectancy, changing lifestyle and better methods of diagnosis.⁸

The above facts clearly bring out the need to study the prevalence of DVT with lower limb trauma in Indian patients by an

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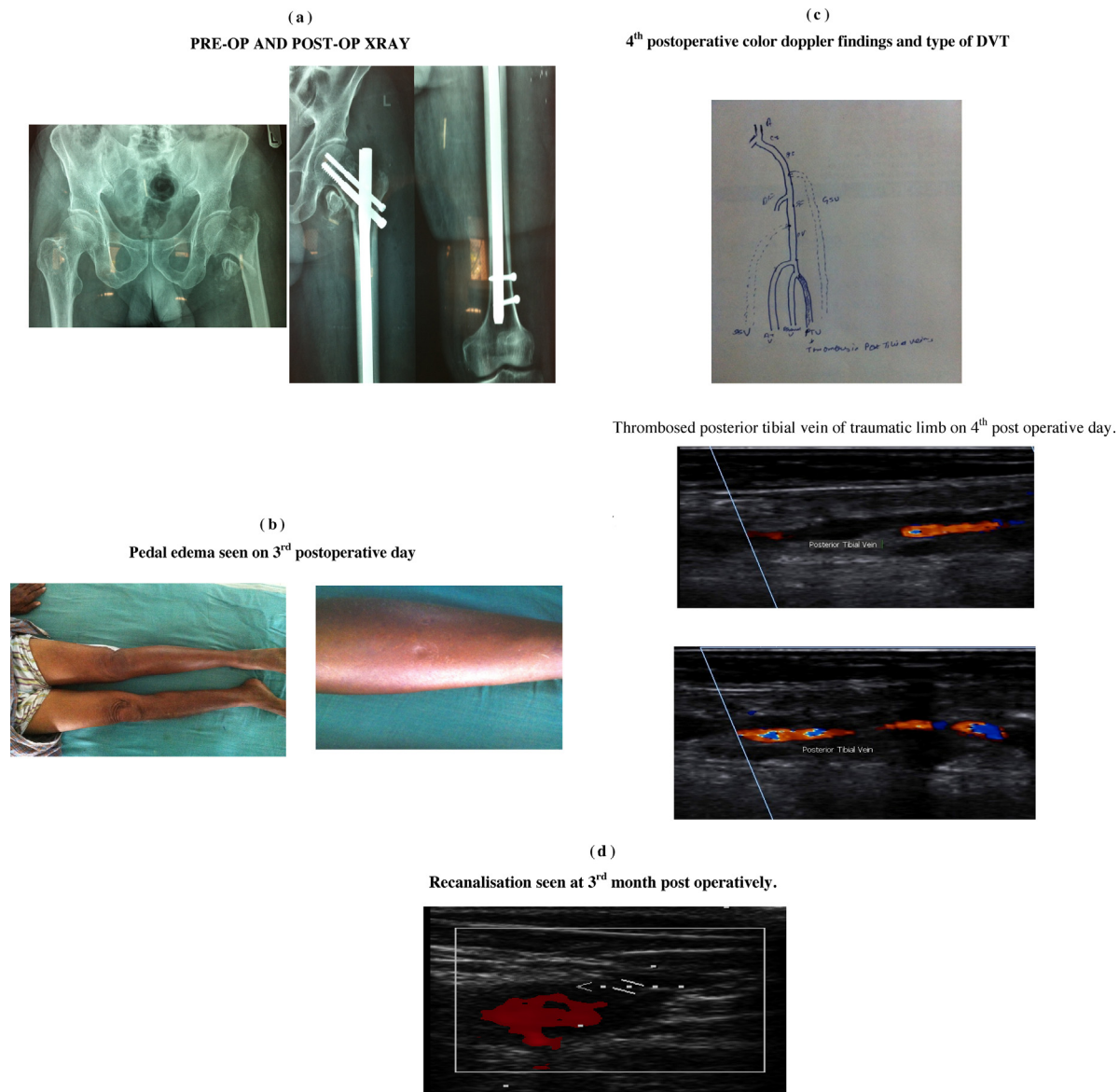


Fig. 1. 72 y/M h/o fall at home, presented to us after 14 days of trauma, no DVT on preoperative Colour Doppler, operated 18 days after trauma, closed proximal femoral nailing done, surgical time was 2 h. (a) Pre-op and post-op X-ray. (b) Pedal oedema seen on 3rd postoperative day. (c) 4th postoperative Colour Doppler findings and type of DVT. Thrombosed posterior tibial vein of traumatic limb on 4th post operative day. (d) Recanalisation seen at 3rd month post operatively.

authentic as well as a practical approach to plan a generalized management of DVT and avoid its catastrophe.

2. Materials and methods

This study has been carried out on patients having lower limb trauma admitted at our institute from September 2012 to June 2014.

All lower limb fractures except compound grade III fractures and isolated fractures of the foot were included in our study.

The patients were first seen in the casualty or outdoor department. By taking proper history in each patient we noted time of injury, mode of injury, date of admission, risk factors for development of DVT like diabetes mellitus, hypertension, varicose veins, past history of venous thrombo-embolism, chronic use of steroids, old age, smoking, alcohol, prolonged bed ridden condition.

After completing general examination, a detailed local examination of traumatic lower limb was carried out to note:

- Neurovascular status of the limb
- Swelling & tenderness over calf
- Compartment syndrome
- Blisters
- Closed or open fracture (grade I or II)
- Probable site of fracture (fracture neck/inter-trochanter/shaft femur/tibia)

Patients were immobilized either by traction or plaster support according to the fracture type till the surgical fitness was given.

Each patient was subjected to venous Colour Doppler of the affected lower limb.

No mechanical or chemoprophylaxis was started pre-operatively in DVT negative patients. In preoperative DVT positive patients chemoprophylaxis was started.

The patients were operated upon as soon as they were fit for the surgery. Patients had undergone various operative procedures like internal fixation, external fixation, hemi-replacement arthroplasty of hip whichever was appropriate for the fracture concerned. The

date of operative intervention, surgical time duration were noted in each patient.

No mechanical or chemical prophylaxis was administered in the postoperative period. They were evaluated daily for signs and symptoms of DVT like pedal oedema, calf-pain, calf tenderness (positive Homan's sign), and erythema during their course in hospital. Colour Doppler ultrasonography of traumatic lower limb was performed on 4th post operative day in every patient. The Doppler assessment included examination of bilateral common femoral, superficial femoral, popliteal, anterior tibial and posterior tibial veins. They were assessed for flow, visualized thrombus, compressibility and augmentation. A diagnosis of DVT was made where there was visualization of thrombosis, absence of flow, lack of compressibility or lack of augmentation. In DVT positive patients initially LMWH (0.6) subcutaneously O.D. was started. Activated partial thromboplastin time (APTT) was closely monitored and was maintained at 1.5–2.5 times control. Tab. Warfarin-5 mg per day was commenced simultaneously and international normalized ratio (INR) was monitored every two days. When therapeutic level of INR (between 2 and 3) was achieved, LMWH was discontinued. Warfarin was continued till the recanalisation occurred.

A repeat Doppler study was performed at 3 months post-operatively in every patient. The DVT positive patients who did not show recanalisation at 3 months post operatively were subjected to a repeat Colour Doppler study at 6 months post operatively.

3. Observations and results

In our study 55 (44%) patients fall under the young age group of 21–40 years followed by 36 (28.8%) patients under the age group of 41–60 as is usually seen in all trauma series. Most of the patients are male in our study (M:F = 5.9:1) as male predominance is seen in all trauma series.

Most of the patients i.e. 63.2% presented within 48 h, however 40% of all were seen within first 24 h. Out of 125 patients 66 patients (52.8%) were operated after 5 days of trauma in our hospital.

Most common type of fracture in our study was inter-trochanteric femur (34), followed by upper third tibia-fibula (25), lower third tibia-fibula (18) and shaft femur (17).

One patient in whom DVT was diagnosed preoperatively did not undergo any surgical intervention in our institute and went home against medical advice. Unfortunately patient died 14 days after trauma. Total number of DVT positive patients (pre-op + post-post op 4th day) were 6 (4.8%). Out of 6 patients with DVT, 1 patient developed DVT after trauma which was detected pre-operatively and 5 patients developed de-novo DVT which was diagnosed on 4th POD.

Out of 125 patients, 12 patients had clinical features of DVT post operatively and among them, only 5 (41.66%) were diagnosed DVT positive. Out of the total 6 DVT positive patients, one patient had no clinical features of DVT. The most frequent clinical feature in our DVT positive patients was oedema (5 patients), followed by calf tenderness (2 patients), calf pain (1 patient).

4. Discussion

VTE after major trauma is the most common cause of morbidity and mortality in patients who survive the first 24 h.^{9,10} The reported rates of DVT among western world are 75% in TKR, 60% in hip fracture surgery, 50–55% in elective hip surgery.¹¹ Though routine chemoprophylaxis is provided to all such patients in western nations its use in the Asian population is still not practiced because a proper study on these populations has not been performed to date.

The reported incidence of VTE in Indian patients (Asians) is approximately 63%.¹² However very few studies are there which include only post traumatic patients to determine incidence of VTE in Indian populations.^{13,14} Thus it is important to study the prevalence of DVT in patients having lower limb trauma in Indian population and determine the role of routine prophylaxis in all lower limb fractures.

Furthermore, the patho-physiology of VTE in trauma is different from elective surgery and most of the lower limb fractures (like peri-acetabular and fractures around knee) result from high velocity trauma, associated with injury to vascular structures around the hip and knee. Subsequent manipulation during surgery causes further insult to the vascular endothelium.⁹ A prolonged immobility after trauma or surgery further accelerates the event of thrombus formation.

A reliable diagnostic investigation is very necessary to diagnose DVT. The available tests for diagnosis of DVT are contrast venography, Colour Doppler ultrasonography, MR venography, D-dimer assays. When compared with contrast venography, MRV had a sensitivity of 100%, specificity of 96%, positive predictive value of 90%, and negative predictive value of 100%. For duplex scanning the sensitivity was 100%, specificity was 96%, positive predictive value was 94%, and negative predictive value was 100%. Moreover Colour Doppler is the most simple and safe non-invasive, inexpensive, widely available objective test that can be used as a screening method which can be easily repeated. That is why we selected Colour Doppler ultrasonography as a diagnostic tool for our study.

No patients have been given chemoprophylaxis pre-operatively in our study. However various drugs like LMWH, Heparin, Warfarin, Aspirin, Fondaparinux are available. But LMWH is the preferred drug over Heparin and its other preparation in acute condition because of convenience of its dosage and almost no monitoring is required. So we decided to use it for anticoagulant therapy for our DVT positive patients only in our study.

We have studied the incidence of VTE in 125 consecutive patients admitted in our hospital with lower limb trauma.

Out of 125 patients, 107 patients are males (85.60%) and 18 patients are female (14.40%) (Table 1) with the male:female ratio 5.9:1 (Table 2) as male predominance is seen in other trauma series.^{13,14}

As young population is more active and mobile, they are more prone to road traffic accidents. More often they use two wheelers and hence have more chances of lower limb trauma. Most of the patients of our series are from younger age group (21–60 years; 72.8%) with the mean age of 52 years (age range 14–90 years).

Table 1
Distribution of age of patients.

Age (years)	No. of patients	Percentage
10–20	9	7.20%
21–40	55	44.00%
41–60	36	28.80%
61–80	23	18.40%
>81	2	1.60%
Total	125	100.00%

Table 2
Distribution of sex of patients.

Sex	No. of patients	Percentage
Male	107	85.60%
Female	18	14.40%
Total	125	100.00%

Table 3

Injury – operation interval.

Injury operation interval (days)	No. of patients	Percentage
0–5	59	47.2
6–10	33	26.4
11–15	13	10.4
16–20	7	5.6
21–25	4	3.2
26–30	3	2
>30	6	4.8
Total	125	100

Table 4

Distribution of types of fractures.

Type of fracture	No. of such type of fractures
Acetabulum	3
Neck femur	11
Inter trochanter (IT)	34
Sub trochanter (ST)	7
Shaft femur	17
Supracondylar femur	4
Intercondylar Femur	2
U/3 Tibia-fibula	25
M/3 Tibia-fibula	13
L/3 Tibia-fibula	18
Medial and lateral malleoli	6
Total	140

Our demographic profile of patients is comparable to others studies.^{14,15}

Out of 125 patients 66 patients (52.8%) were operated after 5 days of trauma (Table 3) and out of 66 patients 4 patients (6.06%) developed DVT in our study. So we found significant association between delay in surgery and the development of DVT, a finding similar to Sharma et al.,¹³ Bagaria et al.,¹⁶ Montgomery et al.¹⁷ and Stannard et al.¹⁸ who reported significant association of VTE with prolonged period of immobilization, which fits with current understanding of VTE pathogenesis.

Now looking to the fracture distribution of our study, 47 (37.6%) patients were having peri-acetabular fractures followed by fractures around knee 20 (16%) and floating knee injury 8 (6.4%) (Table 4). In available literature, we could not find similar studies for Indian population. However, few studies are involving only specific types of fracture of lower limb. Sharma et al.¹³ reported 19.6% DVT rate in 112 hip fracture patients⁹; Bhan et al.¹⁹ had 0% DVT with mechanical prophylaxis in 15 lower limb fractures and 10 spinal injuries²¹; Sen et al.¹⁵ showed that 28.6% of patients had DVT in 56 pelvi-acetabular fracture patients. So reported incidence among Indian patients with lower limb trauma has ranged from 0% to 28.6% and commonest fracture associated with this is hip fracture.

Total number of DVT positive patients (pre-op + post-post op 4th day) are 6 (4.8%) with single case of PE (Table 5). Ratio of PE in our patients is 1:125 but in group of DVT positive patients that accounts to 1 out of 6 DVT positive patients (16.66%). These results are comparable to V Bagaria et al.¹⁸ [6.12% DVT rate (9 out of 147 patients) with single case of PE]; Jain et al.²⁰ [1.9% DVT rate without single case of PE]; Mavalankar et al.²¹ [7.2% DVT rate (9 out of 125 patients) without single case of PE].

Out of 6 patients with DVT, 1 patient developed DVT after trauma which was detected preoperatively and 5 patients (83.33%) developed DVT post operatively and was diagnosed on 4th post operative day (Table 5). This correlates with Sharma et al.¹³ in which 72.7% of DVT was detected on the 4th post operative day. Where as in few studies, first Colour Doppler study was usually

Table 5

Colour Doppler results.

Doppler	Pre-operatively	4th post Op day	At 3 months post operatively
No. of patients with DVT	1 (0.8%)	5 (4.04%)	1 (0.8%)
No. of patients without DVT	124 (99.2%)	119 (95.96%)	123 (99.2%)
Total	125 (100%)	124 (100%)	124 (100%)

done post operatively between 5 and 10 days.^{15,16} These facts clearly reveal that 1st Colour Doppler study postoperatively should be performed as patient becomes pain free that is usually on 4th POD or at the time of clinical signs and symptoms appearance.

Clinical features of DVT were seen in 12 out of 125 patients. Among these 12 patients, only 5 patients (41.67%) were diagnosed DVT positive where as 7 (58.33%) patients did not have DVT. Most common DVT clinical feature was pedal oedema which was present in 5 (83.33%) patients. These findings are correlating with Sharma et al.¹³

In our study 5 (83.88%) out of 6 DVT positive patients had clinical features of DVT. While in most other studies, clinical features were present in only 50% DVT positive patients.^{22,23} This suggests that presence or absence of clinical features does not have correlation with the diagnosis of VTE.

DVT can occur up to six weeks after hospital discharge²⁴ and some studies suggest that most DVT occur after discharge from hospital.^{25,26} We evaluated all our patients for minimum up to 6 months [average follow up is 8.5 months (6–11 months)].

In our series, all 3 distal DVT patients showed recanalisation within 3 months post operatively without single episode of PE. Among them 1 patient showed recanalisation even without anticoagulant therapy. Mavalankar et al.²¹ in his study did not administer anticoagulants to the patients with distal DVT, even though resolution of thrombosis occurred in all of them.

Out of 3 proximal DVT patients, one had episode of PE and died because of that. One patient took longer time (6 months) for recanalisation where as one showed recanalisation at 3 months postoperatively.

By looking at these 6 positive patients significant correlation between age, type of fracture, prolonged immobilization, surgical duration and development of DVT was found.

Though age is uncertain as a risk factor, we found an increasing evidence of thrombosis with greater age. In our study, out of 6 DVT patients, 4 (66.7%) patients were ≥60 years of age. This reconfirms the results of studies carried out by Sharma et al.¹³ (81% DVT positive patients were >60 years of age group), Mavalankar et al.²¹ (all DVT positive patients were >60 years of age group).

Out of 6 DVT positive patients, 4 had periacetabular fractures and 2 had floating knee fractures. Out of 47 patients with periacetabular fractures, 4 (8.51%) had developed DVT. Out of 8 patients with floating knee injury, 2 (25%) had developed DVT. These findings are correlated with Sharma et al.¹³ (19.6% developed DVT from 112 hip fracture patients), Bagaria et al.¹⁶ (6.8% developed DVT from 102 proximal femoral fracture patients), Sen et al.¹² (28.6% developed DVT from 56 pelvi-acetabular fracture patients). These facts show clearly that the proximity of fractures to hip and knee increase risk of DVT.

Our study showed that surgery lasting for more than two hours was associated with significant risk of development of VTE as out of 6 DVT positive patients 4 patients (66.67%) had >2 h operative period. Our findings are correlated with the study carried out by Sen et al.¹⁴ and Bagaria et al.¹⁶

We also saw that a combination of risk factors rather than a single risk factor has importance for development of DVT.

Patients who developed DVT in our study had combination of 3 or more risk factors except one young patient with floating knee injury. This fact was also observed by Sharma et al.¹³ and Bagaria et al.¹⁶

5. Conclusion

We believe that though there is enough evidence in the Western literature to advocate routine thrombo-prophylaxis for patients undergoing total joint replacement and surgery for fractures of lower limb, there is not yet enough evidence to justify the same for Indian patients undergoing major lower limb surgery.

From our study, it appears that DVT and PE in Indian patients with lower limb trauma is a fairly low-incidence problem. The sample size of 125 patients in our study seems to be fair, as the sample size required for the estimation of incidence rate (of value 0.07) is 123 with an error of 0.045.

Though it is perhaps not appropriate to make any definite recommendation about chemoprophylaxis only on the basis of our research, we advocate that the orthopaedic surgeons should use pharmacological prophylaxis only for the high-risk patients (having combination of risk factors like advanced age >60 years, co-morbid conditions, peri-acetabular or floating knee injury, immobilization more than 5 days, surgery lasting more than 2 h) in whom the potential benefits clearly appear to outweigh the risks. However, a close clinical monitoring with a high level of suspicion for DVT and pulmonary embolism must be exercised.

A multi centric study involving a larger number of patients with lower limb trauma in future is required to confirm findings of this research which would help resolve the dilemma in India whether or not to subject the lower limb trauma patients to chemoprophylaxis for DVT and PE.

Conflicts of interest

The authors have none to declare.

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