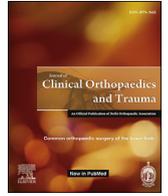




Contents lists available at ScienceDirect

## Journal of Clinical Orthopaedics and Trauma

journal homepage: [www.elsevier.com/locate/jcot](http://www.elsevier.com/locate/jcot)

# Acute venous thromboembolism in Indian patients of isolated proximal femur fractures



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## ARTICLE INFO

### Article history:

Received 13 September 2018

Received in revised form

8 January 2019

Accepted 23 February 2019

Available online 27 February 2019

### Keywords:

DVT

PE

Pulmonary Embolism

Deep vein thrombosis

Proximal femur fractures

Thromboprophylaxis

Venous thromboembolism

VTE

## ABSTRACT

**Introduction:** Venous Thromboembolism (VTE) has a variable incidence in trauma patients and fatal embolism can be the very first manifestation. Proximal femur fractures result from high velocity trauma in younger age groups and could require prolonged immobilisation, which is associated with increased risk of VTE. Therefore we sought to determine the occurrence of VTE in patients with proximal femur fractures.

**Objectives:** The present study was initiated to assess the occurrence of deep vein thrombosis (DVT) or pulmonary embolism in isolated proximal femur fractures and identify the requirement of routine thromboprophylaxis in such patients.

**Methods:** It was a prospective study conducted over a period of one and a half years. All patients, presenting with isolated proximal femur fractures were included. Patients having any other known risk factors for DVT were excluded, so that the proximal femur fracture remained their only acquired risk for DVT. All the patients were evaluated clinically and with help of diagnostic modalities like Color Doppler with compression ultrasound, D-dimer assays and CT venogram, if indicated. Patients were followed up till 8 weeks post-operatively.

**Results:** A total of 66 patients with fractures of proximal femur were assessed, out of which there were 42 males with mean age of 48.1 years and 24 females with mean age of 58.3 years. A total of 9 cases of radiologically proved DVT were observed. Clinical DVT was seen in 5 of these cases (54%). Complete resolution of thrombus was noted in all the patients, evaluated by Color Doppler at 6 weeks, post diagnosis. Although the majority of the cases (6) occurred in patients beyond 50 years of age, this was not statistically significant.

**Conclusion:** DVT is common in patients with proximal femur fractures and the provision for screening both clinically and radiologically, should be made routine in all such patients. In case of delay in surgery and patient being bed ridden, we recommend thromboprophylaxis in this subset of trauma patients.

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## 1. Introduction

Venous Thromboembolism (VTE) is a common preventable cause of morbidity and mortality in trauma patients who survive the first 24 hours.<sup>1</sup> It includes deep venous thrombosis (DVT) in extremities, pelvic veins and their embolisation to the pulmonary circulation (PE). Reported incidence of DVT varies from 10 to 77%; depending on the types of injuries, patient profiles and modalities of diagnosis.<sup>1–4</sup> DVT clinically presents with limb swelling, calf

tenderness and positive Homan's sign. Pulmonary embolism presents with tachypnoea, tachycardia, chest pain and suffocation; however these conditions remain clinically silent in more than 50% of cases and fatal PE can be the very first manifestation of VTE.<sup>1,3</sup> This is specially true for trauma patients in whom lower limb swelling/pain, chest pain, breathlessness and fever can all occur due to injury per se.<sup>4</sup>

Chemoprophylaxis is reported to be most effective in significantly reducing the incidence of DVT in certain cases of trauma and arthroplasties.<sup>1,2,5</sup> However its usage, in addition to being costly is also associated with side effects like bleeding, wound hematoma and likely increase in infection.<sup>6–9</sup> Thus it is essential to identify the subgroup among trauma patients in whom benefit of DVT prophylaxis is likely to outweigh the risk.

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Proximal femur fractures result from high velocity trauma in younger age groups. They may be associated with injury to vascular structures around the hip and could require prolonged immobilisation.<sup>1,6</sup> Subsequent manipulations during the surgery could cause further insult to the vascular endothelium. As per Western literature, incidence of DVT in pelvi-acetabular injuries varies from 10% to 60%, and about 50% of these thrombi involve the proximal veins.<sup>1–3,10–12</sup>

There is a wide variation in reported incidence of DVT among Asian patients (0–65%). While few studies on Asians patients undergoing high risk surgeries (arthroplasties and pelvi-acetabular surgeries) report incidence of DVT equivalent to the western literature (up to 62.5%); most studies report a very low incidence and advice against routine chemoprophylaxis in this population.<sup>13–20</sup> Some studies have shown that even established thrombi in Asian patients resolve spontaneously without any long term consequences.<sup>20,21</sup> Some other studies report increasing incidence of DVT in India, attributed to increase in life expectancy, changing life styles and better methods of diagnosis.<sup>22,23</sup>

Occasional studies have addressed the DVT risk associated with proximal femur fractures; however 100% thromboprophylaxis for trauma patients is not practiced in most hospitals.<sup>24–26</sup> It thus becomes important to know whether proximal femur fractures per se, constitute a major risk factor for DVT, to require thromboprophylaxis in routine. There is lack of data from Indian population, to assess occurrence of DVT in patients sustaining proximal femur fractures and the present study was conceptualised to evaluate the same.

## 2. Materials and methods

It was a prospective study conducted over a period of one and a half years. All patients with isolated proximal femur fractures presenting to the Advanced Trauma Centre of our institute were included in the study. Patients below 18 years and above 70 years of age, those with renal failure or those allergic to the dye for angiography and patients with high risks for DVT; underlying medical conditions (myocardial infarction, cardiac or respiratory failure, nephrotic syndrome, underlying malignancy, collagen vascular disease); on oestrogen for contraception or on Hormone replacement therapy (HRT). Additionally, those with associated fractures at sites other than the proximal femur, spinal cord injury and blunt trauma to chest or abdomen, were all excluded. These patients were put on chemoprophylaxis. Patients with associated vascular injuries were also excluded, as they were likely to receive Heparin for treatment.

In all included patients, monitoring was done for pulse rates, blood pressure and respiratory rates from the time of admission in the hospital. Adequate hydration was ensured and all patients were encouraged to perform active and passive physiotherapy as tolerated.

After getting informed consents, patients were enrolled in the study. Routine investigations included haemoglobin level, renal function tests, arterial blood gases estimation, coagulogram and d-dimer assay, in all the patients. Delays between injuries and surgeries were recorded for all the patients; a record was also maintained about type of injury, type of anaesthesia used, position during surgery, and duration of surgery. All patients included in the study were encouraged for non weight bearing physiotherapy within 24 hours of surgery. No chemoprophylaxis for DVT was given to patients included in the study. They were evaluated daily for signs and symptoms of DVT and PE; recent onset lower limb swelling, calf tenderness, breathing problems and pleuritic chest pain.

Those patients having evidence of DVT were treated with

subcutaneous Enoxaparin followed by oral Warfarin.

All patients underwent clinical examination daily from the first day onwards, during their stay at the hospital, therefore having close monitoring for DVT. Compression ultrasound, Color doppler study and d-dimer assay were done on day 1st, 7th and then after 2,4 and 8 weeks, post-operatively. In suspected cases for PE, CT angiography was done.

## 3. Results

A total of 66 patients with fracture proximal femur were assessed, operated and studied over one and half years. There were 42 males (mean age 48.1 years) and 24 females (mean age 58.3 years) in the study group. There were 37 isolated intertrochanteric (IT) femur fractures, 17 neck of femur fractures (NOF) and 9 subtrochanteric (ST) femur fractures. The remaining 3 patients had an IT femur fracture with ST extension.

A total of 9 cases of radiologically proved DVT were observed during the study period (13%). Clinical DVT was seen in 5 of these cases.

No DVT developed in the 7 patients in the age group 18–30 years. Out of the 9 cases of radiologically proven DVT, 3 patients were in the age group of 31–50 years, and 6 patients were of more than 50 years of age. There were 4 males and 5 females (Table 1). However the difference in age group and sex were not statistically significant ( $p = 0.19$ ).

Mean delay between the injuries and surgeries was 3 days. Many patients were referred to our centre from peripheral centres, thereby taking time for admission. All patients, except one, were operated under caudal-epidural anaesthesia. General anaesthesia was given due to a failure of spinal-epidural anaesthesia.

Patients with IT or ST femur fractures were operated with either proximal femur nailing or dynamic hip screw on a traction table. In patients with fracture neck of femur, seven patients were operated with partially threaded cannulated screws on traction table, while remaining were operated with bipolar hemiarthroplasty, with patients in lateral position, using the posterior approach. All patient were started with non-weight bearing crutch walking/physiotherapy from the very next day. No thromboprophylaxis was used in any patient. One patient expired intra-operatively, from cardiac cause (was DVT negative in pre-operative period).

In the post-operative period, DVT was suspected on clinical grounds in 16 patients (12- lower limb swelling, 4 -calf tenderness), which resulted in earlier radiological evaluation in these patients. 5 out of these 16 patients were diagnosed with DVT radiologically. The remaining 4 DVT positive patients who did not show any clinical signs, were diagnosed on serial radiological evaluation.

Out of 9 patients diagnosed as DVT positive, 6 were diagnosed by compression ultrasonography and venous color doppler. Out of the other three patients, two patients had doubtful lesion in proximal veins in the Color Doppler. All these 3 cases were diagnosed positive on CT venography.

6 out of the 9 patients who were radiologically positive for DVT had their D-dimer values more than 5. But a total of 15 patients were having their values more than 5; these were generally younger patients and had severe trauma as the mode of injuries.

**Table 1**  
Age and sex distribution of DVT( $p = 0.19$ ).

Age group	No. of patients	Male: Female	DVT positive
18–30 yrs	7	3:4	0
31–50 yrs	18	11:7	3 (1 male 2 females)
>50 yrs	41	28:13	6 (3 males and 3 females)

Rest of the patients had values less than 4. 3 DVT positive patients also had values less than 4.

3 patients with DVT were operated within a week of admission, while 6 cases were operated between 2–4 weeks. All cases of radiologically proven DVT were started on subcutaneous Enoxaparin and switched to oral warfarin once therapeutic INR (2–3) was maintained for 24 hours. The warfarin therapy was continued for 6 weeks when thrombus resolution was evident by normal venous flow on Doppler study, in all of the 9 patients, initially diagnosed to have DVT. Complete resolution of thrombi was noted in all these patients, as evaluated by Color Doppler at 6 weeks.

#### 4. Discussion

Venous thromboembolism is a common complication in post trauma patients.<sup>1,3</sup> Chemoprophylaxis using low molecular weight heparin (LMWH) is the most effective measure against DVT.<sup>5,6</sup> Asians are considered to have lower risk of DVT than Caucasians, and some studies on Asians living in the west support this.<sup>27,28</sup>

However, the studies on orthopaedic patients in this ethnic group, give variable incidence of DVT.<sup>7,15</sup> Some studies suggest that most of the thrombi in this population are distal which resolve spontaneously without any long term consequences; while others report on the contrary.<sup>13,21</sup> There are very few studies for DVT, in orthopaedic patients in India and they do not clear the dilemma. While some studies report very high incidence (similar to western studies), other report low incidence (0%–10%).<sup>15,29–33</sup> Most of these studies have been done on patients undergoing arthroplasties or pelvic surgeries.

Unlike in an elective surgery, pathogenesis of DVT in trauma starts immediately after injury, much before the patient presents to a hospital. Many other factors in addition to the Virchow's triad have been shown to be involved in post traumatic hypercoagulability; production of thrombin starts within 24 hours of trauma and could remain increased for even upto 14 days.<sup>34</sup> Trauma patients also have decreased serum levels of Antithrombin III, due to release of tissue factor in circulation.<sup>34,35</sup> Dehydration, immobilisation and multiple transfusions further add to the state of hypercoagulability.<sup>1,5</sup> The prothrombotic state after major trauma is not limited to the site of injury, but the entire milieu in trauma patients is hypercoagulable, as suggested by frequent location of thrombi at sites distant from the injury, sometimes even in the contralateral limb.<sup>6,34,35</sup> The same reasons may cause failure of thromboprophylaxis and increase the requirement of heparin for desired effect after acute trauma.<sup>6</sup>

Up to 68% of thrombi associated with trauma are proximal, which are more likely for proximal propagation and embolisation than distal thrombus.<sup>1,36</sup> The clinical signs are not reliable in diagnosis of DVT in trauma patients.<sup>1,4,36,37</sup> Fatal PE can occur without prior warning in absence of any clinical signs and even with negative, non invasive surveillance.<sup>4,36</sup> Most trauma cases need some form of surgery, which adds further insult and the manipulation during surgery can result in dislodgement of preformed thrombus.<sup>5,35,37</sup>

It is reported that prevalence of DVT in trauma patients is higher than arthroplasty patients.<sup>5</sup> The pathophysiology of DVT in trauma patients is different from patients undergoing elective surgeries, and most of thrombi in these patients are proximal.<sup>1,3,6</sup> Proximal femur fractures are associated with high velocity trauma, except in older age groups with osteoporotic bones, involving the fractures of NOF and IT femur; the risk of DVT always lingers. By studying Indian patients with isolated proximal femur fractures, we have obtained a significant observation regarding occurrence of DVT in them.

The incidence of DVT in orthopaedic patients varies from 10% to 77% in various studies.<sup>1–4</sup> Whenever CT Venography was used as diagnostic modality, very high incidence of DVT has been reported

like in studies by Aggarwala et al. (45.4%) and Dhillon et al. (50%).<sup>13,15</sup> The reason could be that, by CT venography inconspicuous thrombi are also detected, which do not migrate proximally to cause pulmonary embolism and they dissolve with time, thereby needing no active intervention.

We also used CT venography as diagnostic modality only in those cases where there was either strong clinical suspicion, but finding was not confirmed on compression ultrasound or Color Doppler, or in cases where there was doubtful lesion. CT venography cannot be used as a routine diagnostic modality as there is high radiation exposure and it is also very costly. We had a total of 9 patients diagnosed as DVT positive, out of which only 3 were diagnosed by CT venography.

We lack conclusive literature regarding incidence of DVT in patients with proximal femur fractures, and a screening schedule, to be followed specifically in these patients. Therefore patients with any associated injuries and those with other risk factors had been excluded from the present study. We also had excluded all patients above 70 years of age considering the fact that advanced age is itself a risk factor. Applying these exclusion criteria we obtained a group of patients who had no other acquired risk factors apart from proximal femur trauma itself.

Incidence of DVT in our study is in the range described by various studies (Table 2). All patients who were DVT positive had proximal DVT, the significance of which lies in the fact that they are more prone for PE, but none of the patients actually developed PE. Clinical signs, as a method of detection of DVT were not very reliable. We did not find any association between fracture types and occurrence of DVT. 8 out of the 9 DVT positive cases were of fracture intertrochanteric femur, and 1 case was of fracture neck of femur; but we had 37 cases of fracture intertrochanteric femur (out of total 66 cases), so the results were skewed towards the IT fractures.

We also observed higher incidence of DVT with increasing age. Increasing age is a factor most consistently associated with DVT risk in trauma patients.<sup>1,3,37–39</sup> 6 out of the 9 patients were above age of 50 years, but we had 3 patients in the age group of 30–50.

Though the present study had a small sample size and short follow-up, we found that the patients sustaining proximal femur fractures have high risk for DVT; even in absence of any associated injury or any predisposing medical condition. Previous Indian studies have utilised single diagnostic modalities (Table 2). This is the first study where we have utilised multiple modalities, in addition to the clinical assessments, thereby not leaving any stone unturned to arrive at a definite diagnosis. This course of action will help in not missing DVT in any patients.

Our results suggest that, patients sustaining isolated proximal femur fractures have high occurrence of DVT. Clinical criteria are not very useful in diagnosing DVT; but when present, are suggestive for the same. It can occur even upto 4–8 weeks after injury and in patients of all age groups; however the risk increases with increasing age. However, studies with larger number of patients and longer follow-ups will definitely add to our observations and we recommend further large scale multi centric studies to substantiate our findings.

#### 5. Conclusion

The occurrence rate of DVT is high in patients with proximal femur fractures. The provision of its screening both clinically and radiologically, should be considered in all such patients. In patients above 50 years of age, monitoring should be done at more frequent intervals as these patients have higher incidence of DVT, and many patients have age related co-morbidities, thus increasing their morbidity. We recommend routine chemoprophylaxis for DVT in this subset of trauma patients.

**Table 2**  
Various studies about incidence of deep vein thrombosis in Indian patients after proximal femur fracture.

Serial no.	Studies	Year	Study design	Orthopaedic trauma	Diagnostic modalities	Prophylaxis	Incidence (%)	Remarks
1	Sharma et al. <sup>29</sup>	2002	Prospective	112 hip fractures	Color Doppler	Nil	19.6 (22/112)	High incidence; advised thromboprophylaxis
2	Agarwala et al. <sup>15</sup>	2003	Prospective	18 proximal femoral fractures	Venography	+ LMWH (Dalteparin)	45.4 (5/11) in prophylaxis group; 71.4 (5/7) in non-prophylaxis group	High incidence; advised thromboprophylaxis
3	Agarwala et al. <sup>30</sup>	2005	Prospective	12 patients with femoral neck fracture	Color Doppler	LMWH (Dalteparin)	0 (0/12)	Advised prophylaxis
4	Maini et al. <sup>31</sup>	2006	Retrospective	Femoral neck fractures (271 patients)	NA	Initial 5 years: no prophylaxis; next 5 years: prophylaxis	9.9 (20 in non-prophylaxis group and 5 in prophylaxis-receiving group). No exact data about the number of patients in each group	Significant reduction with prophylaxis
5	Bagaria et al. <sup>32</sup>	2006	Prospective	102 proximal femur fractures	Duplex ultrasonography	Nil	6.8 (7/102)	Low incidence; advised thromboprophylaxis in high-risk group
6	Rajgopalan et al. <sup>33</sup>	2007	Prospective	77 femur fractures	Color Doppler ultrasound	LMWH (Dalteparin)	6.49 (5/77)	Advised prophylaxis

### Conflicts of interest

Nil.

### Conflict of interest

The authors declare compliance with Ethical standards and no conflict of interest.

### Funding source

None.

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