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Incidence and location of deep vein thrombosis of lower extremity following surgery of tibial plateau fracture

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ABSTRACT

Background: Tibial plateau fractures are commonly seen fractures of lower limb. They are challenging to manage since they are mostly associated with soft tissue injuries. Deep vein thrombosis (DVT) is a significant cause of morbidity and pulmonary embolism can even cause mortality in all hospitalized patients, especially after trauma and lower extremity fracture, which further carries risk of significant morbidity and mortality. We aim to evaluate the epidemiological characteristics of postoperative DVT in tibial plateau fractures.
Method: A prospective observational randomized study was performed. A total of 79 patient were included in this study who had proximal tibia fractures. Pre-op ultrasonography was done and post operative ultrasonography was done following proximal tibia plating surgery on day 2. Successive evaluation with USG was done at week 2, week 3 and week 4 for DVT. If DVT is diagnosed it will be managed medically.
Result: A total of 79 patients were included in the study, 28 were females and 51 males. 4 out of 79 patients were diagnosed with DVT following surgery of tibial plateau fracture. Predominantly DVT was seen in male patient of elderly age group who had high energy trauma operated by open reduction with duration of surgery of more than 1 hour. 3 out of 4 patients had distal DVT and 1 had proximal DVT.
Conclusions: Six risk factors were found to be strongly associated with DVT i.e., old age, male gender, high energy trauma, increased preoperative interval, open reduction and prolonged duration of surgery. These epidemiologic data will be helpful in individual assessment, risk categorisation and development of targeted prevention programs.

Keywords: DVT, Tibial plateau fracture, Ultrasound

INTRODUCTION

Tibial plateau fractures are commonly seen fractures of lower limb. They are difficult to manage since they are mostly associated with soft tissue injuries.

Tibial plateau fracture is common fracture following knee injury, represents 1-2% of adult fractures and 32% of peri-knee fractures.[1] They usually occur as a result of high velocity trauma and are common in young age group.

Tibial plateau is one of the most important weight bearing areas of the body with 80% borne by tibia and remaining by fibula. Any fracture in proximity of the joint is very important since restoring articular congruity is an essential step for functional outcome.

DVT a subset of venous thromboembolism (VTE) is a known and significant cause of morbidity, pulmonary embolism (PE), and even mortality in all hospitalized patients, especially after trauma and lower extremity fracture, which further carries risk of significant morbidity and mortality.[2,3]

Tibial plateau fractures are often associated with a poor prognosis because of the associated factors such as

cartilage destruction and soft-tissue envelope damage, as well as complications including compartment syndrome, postoperative infection, knee instability or stiffness, and posttraumatic osteoarthritis.[4-7]

Such complications result in extended hospitalization and delayed recovery after Tibial plateau fractures. A extended period of extremity elevation and restricted mobility place patients at an increased risk for the development of DVT both preoperatively and postoperatively. Hypercoagulation state, trauma stress, and systemic inflammatory response after injury are early factors that contributed to the occurrence of DVT.[8]

Increased duration of extremity elevation and restricted mobility, which is required to allow the soft tissue envelop safe for surgical interventions aggravates the risk of DVT.

Complete understanding of the related risk factors is critical for prevention of occurrence of DVT, and it is of more clinical significance to distinguish between proximal and distal venous thrombosis, which allows more accurate diagnose and a more aggressive therapy for the proximal DVT. [9] The objective of our study is to determine the incidence and risk factors associated with DVT in patients operated for tibia plateau fractures.

METHODS

This study was a prospective observational randomized study performed at MGM medical college and MY hospital, Indore, M.P. during the period from September 2019 to August 2022 after clearance from the scientific and ethical committee of the institute which is one of the biggest tertiary care centres in central India.

Each patient visiting the emergency OPD/ casualty with chief complaint of tibial plateau fractures was evaluated. Primary ATLS protocol was followed and patient was hemodynamically stabilized.

All patient between age 18-70 who had a tibial plateau fracture and are willing for weekly USG venous doppler are included to be a part of the study. All patients with pathological fracture, hyper-coaguable state, preoperative DVT and fracture more than 3 week are excluded from the study.

Patients who fulfilled the inclusion criteria were recruited for the present study after taking pre-informed written consent. All the patients underwent USG Doppler prior to surgery to rule out DVT pre operatively.

All the patients were operated by anterolateral or/and posteromedial plating of proximal tibia depending on the fracture pattern. USG Doppler of the lower limbs was done on day 2, day 7, day 14, day 21, day 28 for screening of external iliac vein, common femoral vein, superficial and deep femoral vein, long saphenous vein, sapheno femoral junction, popliteal vein, short saphenous vein.

The criteria for positivity were based on compressibility, lumen, resting flow, phasic variation, distal augmentation, Valsalva maneuver. DVT involving popliteal vein or proximal to it was defined as proximal DVT while those distal to the popliteal vein will be defined as the distal DVT.

All the data was collected and evaluation was done for determining the risk factors associated with DVT in operated patients of tibial plateau fractures during the first four weeks. All the statistical analysis was done using the SPSS 21.0 software. The sample size was calculated using previous years database of tibial plateau fractures.

RESULTS

A total of 79 patients were included in the study who had tibial plateau fracture.

Out of the total patients included in the study, four patients were diagnosed with DVT post operatively. Three were males and one was female (Table 1).

Out of the total patients diagnosed DVT, two patients had DVT in age 51-60 years and one each in 31-40 years and 41-50 years respectively (Table 2).

All the four patients had high energy trauma. Three patients were operated with open reduction internal fixation and one patient had undergone surgery using MIPPO technique (Table 3).

It was found that all the four patients who had DVT had duration of surgery of more than one hour (Table 4). Two patients who had DVT had preoperative interval from injury to surgery was of three weeks whereas one patient had DVT in preoperative interval one week and two weeks respectively (Table 5).

Table 6 shows association of Schatzker type with DVT which shows that DVT was found in patient with high energy trauma. 50% for type IV, 25% for type V and 25% for type VI.

It was observed that three patient had DVT distal to knee and one patient had DVT proximal to knee (Table 7).

Table 1: Association between the sex group and DVT.

Sex		Final outcome		Total
		Positive	N and clear	
Female	Count	1	27	28
	%	25	36	35.4
Male	Count	3	48	51
	%	75	64	64.6
Total	Count	4	75	79
	%	100	100	100

Table 2: Association between the age group and the DVT.

Age group (Years)		Final outcome		Total
		Positive	N and clear	
20-30	Count	0	32	32
	%	0	42.7	40.5
31-40	Count	1	17	18
	%	25	22.7	22.8
41-50	Count	1	25	26
	%	25	33.3	32.9
51-60	Count	2	1	3
	%	50	1.3	3.8
Total	Count	4	75	79
	%	100	100	100

Table 3: Association between method of surgery and DVT.

Method of surgery		Final outcome		Total
		Positive	N and clear	
MIPPO	Count	1	45	46
	%	25	60	58.2
Open reduction	Count	3	30	33
	%	75	40	64.6
Total	Count	4	75	41.8
	%	100	100	100

Table 4: Association between duration of surgery and DVT.

Duration of surgery (Hour)		Final outcome		Total
		Positive	N and clear	
<1	Count	0	41	41
	%	0	54.7	51.9
>1	Count	4	34	38
	%	100	45.3	48.1
Total	Count	4	75	79
	%	100	100	100

Table 5: Association between pre-operative interval and duration of surgery.

Preop interval (Week)		Final outcome		Total
		Positive	N and clear	
1	Count	1	33	34
	%	25	44	43
2	Count	1	24	25
	%	25	32	31.6
3	Count	2	18	20
	%	50	24	25.3
Total	Count	4	75	79
	%	100	100	100

Table 6: Association between Schatzker type and DVT.

Schatzker type			Final outcome		Total
			Positive	N and clear	
I	Low energy trauma	Count	0	1	1
		%	0	1.3	1.3
II		Count	0	12	12
		%	0	16	15.2
III		Count	0	17	17
		%	0	22.7	21.5
IV	High energy trauma	Count	2	14	16
		%	50	18.7	20.3
V		Count	1	18	19
		%	25	24	24.1
VI		Count	1	13	14
		%	25	17.3	17.7
Total		Count	4	75	79
		%	100	100	100

Table 7: Location of DVT.

Location of DVT		DVT
Distal	Count	3
	%	75
Proximal	Count	1
	%	25

DISCUSSION

Among 79 patients evaluated in the present study, 40.5% (32/79) belonged to 20-30 years age group followed by 32.9% (23/79) for age group 41-50 years, 22.8% (18/79) for age group 31-40 years and least 3.8% (3/79) patients belonged to 51-60 years age group respectively.

The average age of patients was 35.28±10.01. The results of our study were comparable to Li et al and Zhu et al.[8-11] Males showed a higher prevalence i.e., out of 79 patients 64.6% (51) compared to females i.e., 35.4% (28/79). The male to female ratio was found to be 1.82:1.

The results of our study were comparable to Zhu et al and Li et al who stated male preponderance.[8,11] Most of the fractures in our study were due to high energy trauma i.e., 62% (44/79) and secondly by low energy trauma i.e.,38% (35/79). 51.9% of the patient had duration of surgery of <1 hour and the remaining proportion 48.1% had duration >1 hour. All the patient who had DVT had duration of surgery more than 1 hour. In our study Two out of four patients who had DVT had preoperative interval of 2-3 week. Out of 4 patients who developed DVT incidence being 5.06%, 3 were identified below the knee (Distal DVT) and 1 was identified above the knee (Proximal DVT). Incidence of 1.26% for proximal and 3.8% for distal DVT was observed.

The limitations of our study were short sample size, loss to follow up, investigator bias in diagnosing the condition aptly.

CONCLUSION

DVT is a very common complication which are usually silent. It can cause pulmonary thromboembolism which can be threatening and add to morbidity and mortality of the patient. Through our study we conclude that there are 6 risk factors which are strongly associated with DVT-Increased age, male gender, energy of trauma, open reduction increased preop interval and prolonged duration of surgery. These epidemiologic data may be helpful in individual assessment, risk stratification and development of targeted prevention programs.

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