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Incidence of Deep Venous Thrombosis Following Fixation of Fractured Lower Extremity

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Abstract: *This study aimed to evaluate the rate of deep venous thrombosis (DVT) after fixation of fractured lower extremities .This study was carried out at Rabat Hospital in Khartoum Sudan from January 2016 and March 2018 included 176 patents with lower limbs fractures 96% of them fixated by variables types of fixations (plaster, traction, external fixation and traditional bone setter (TBS)) while 4% of them having no fixation. Each fractured extremity was assessed for the presence of DVT using Duplex ultrasonography concerning the period before restoration, fracture wound pattern and complexity, and type of fixation. The data of the study analyzed using Statistical Package for the Social Sciences (SPSS) version 22. This study included 176 patients, 129 male and 47 female the mean of their age is 49.8 years and revealed that 22 had a DVT event, 60 of patients their fractures immobilized by plaster, 4 of them were developed DVT. 67 of the patients used traction, eleven of them having DVT. No DVT detected on six events that underwent external fixation while the largest percentage of DVT event (3out of 7) 42.9% noted on patients that used TBS. Among the 36 patients without fixation, four events developed DVT. The long time before immobilization of fracture the high risk of DVT According to the period of time pre-fracture immobilization the time before restoration divided into six groups within first hour, two to four hours, 5 to 7 hours, 8 to 10 hours and more than 10 hours the DVT events was 14.8%, 5.7%, 7.7%, 11.1%, 20%, 11.4% respectively .The multiple fractures with open wound showed a greater risk for DVT. The fractures calcified according to the wound pattern and complexity to single closed, single open, multiple closed and multiple open the overall DVT event rate was 13.6%, 8.3%, 11.5% and 12.5 respectively. This study concluded that the rate of DVT was high on complex fractures, delayed immobilization and on fractures that immobilized by TBS.*

Keywords - *Lower Extremity _ Deep vein thrombosis _ Fixation_ Traditional bone setter_ Incidence*

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I. Introduction

The incidence of DVT after hip and knee surgery can be more than 60%, with up to 13% subsequently having pulmonary emboli.[4] Despite the benefits of chemical prophylaxis, chemical prophylaxis can be costly and cause wound healing complications.[14]Temporary external fixation followed by internal fixation for open complex fractures of the lower limbs serves as damage control1–3 and stabilisation.[10, 11, 12, 13] Complex lower-limb fractures and immobilization are risk factors for deep vein thrombosis (DVT).[5] The rate of DVT after temporary joint-spanning external fixation for complex lower-limb fractures was 2.1% when low-molecular-weight heparin (LMWH) prophylaxis was used.[15]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.[7, 8] Some recent studies report an increasing incidence of VTE in the Indian subcontinent.[6, 9] This study evaluated the rate of DVT after occurring of lower-limb fracture concerning the fixation condition, fracture wound pattern and complexity and the time before restoration.

II. Material And Methods

Study Population

A total of 176 patients included in this study, 129 males and 47 females their age ranged between 18 and 86 years mean ±SD (49.8±19.5 years) during the period Between January 2016 and March 2018, presented with fractured lower extremities. Patients were thoroughly evaluated concerning the type of fixation, fracture

pattern, associated injuries, the time before restoration and VDUS findings. Consent was obtained from patients, and the study was reviewed and approved by an institutional review board.

Ultrasound Examination Protocol

Immediately upon patient admission to the ultrasound (US) department, the affected limb was assessed for DVT by VDUS using a Sonoline G 60S US imaging system; Siemens – Germany, equipped with a high frequency (7–10 MHz) linear probe. Gray-scale images and color and spectral Doppler waveforms were recorded without and with compression and from the long axis, respectively using UP-D898MD digital, black-and-white A6 printer; Sony and UPP-110S high-density standard US thermal paper roll (110 mm×20 m). Distal augmentation maneuvers were performed with manual calf compression while investigating the common femoral vein (CFV), superficial femoral vein (SFV), and popliteal vein (POPV) segments. US examination was considered to be negative if there was a normal blood flow in CFV, SFV, and POPV with the vessel lumen fully compressible and filled with color. DVT was diagnosed if the vessel wall was not compressed. US scanning was conducted with the patient in the supine position with the head raised from 15 to 30 degrees. The investigated leg was outwardly rotated at the hip with the knee slightly. In the short axis, starting at CFV and advancing into the distal external iliac vein (EIV), the transducer was moved moderately inferiorly to completely scan CFV and SFV throughout the thigh and to scan POPV from a posterior approach throughout the popliteal fossa. Probe compression was applied at 1 to 2 cm intervals for all vein sections, with each section evaluated for complete compressibility and for the presence of any intraluminal echoes suggestive of thrombus. Longitudinal inspections were applied to assure the presence of intraluminal echoes seen on short axis imaging and to obtain Doppler spectral waveforms of venous hemodynamics in CFV, SFV, and POPV. The patients who were diagnosed with DVT of a CFV, SVF, and/-or POPV received warfarin and dalteparin for three months. The international normalized ratio (INR) was used to monitor warfarin treatment. Once the INR was greater than 2, dalteparin was stopped, and warfarin continued.

Statistical Analysis

Study results were initially summarized as means ± standard deviations (SD) tables and on graphs. The analysis was performed with the Statistical Package for the Social Sciences (SPSS) version 22 for Windows; Microsoft.

III. Results

Table (1) shows Cross tabulation of Fracture Type versus DVT

Fracture Type * DVT Crosstabulation					
			DVT		Total
			No DVT	DVT	
Fracture Type	Single Closed	Count	102	16	118
		% of Fracture Type	86.4%	13.6%	100.0%
	Single Open	Count	22	2	24
		% of Fracture Type	91.7%	8.3%	100.0%
	Multiple Closed	Count	23	3	26
		% of Fracture Type	88.5%	11.5%	100.0%
	Multiple Open	Count	7	1	8
		% of Fracture Type	87.5%	12.5%	100.0%
Total		Count	154	22	176
		% of Fracture Type	87.5%	12.5%	100.0%

Table (2) shows the period of time that taken between fracture occurring and the time of performing fixation

			DVT		Total
			No DVT	DVT	
Time before restoration	within first hour	Count	46	8	54
		% within Time before restoration	85.2%	14.8%	100.0%
	(2-4)hours	Count	33	2	35
		% within Time before restoration	94.3%	5.7%	100.0%
	(5-7)hours	Count	12	1	13
		% within Time before restoration	92.3%	7.7%	100.0%
	(8-10)hours	Count	8	1	9
		% within Time before restoration	88.9%	11.1%	100.0%
	more than10 hours	Count	24	6	30
		% within Time before restoration	80.0%	20.0%	100.0%
	no restoration	Count	31	4	35
		% within Time before restoration	88.6%	11.4%	100.0%
Total		Count	154	22	176
		% within Time before restoration	87.5%	12.5%	100.0%

Table (3) shows Type of Restoration * DVT Crosstabulation

			DVT		Total
			No DVT	DVT	
Type of Restoration	plaster	Count	56	4	60
		% within Type of Restoration	93.3%	6.7%	100.0%
	external fixation	Count	6	0	6
		% within Type of Restoration	100.0%	0.0%	100.0%
	traction	Count	56	11	67
		% within Type of Restoration	83.6%	16.4%	100.0%
	TBS	Count	4	3	7
		% within Type of Restoration	57.1%	42.9%	100.0%
	None	Count	32	4	36
		% within Type of Restoration	88.9%	11.1%	100.0%
Total		Count	154	22	176
		% within Type of Restoration	87.5%	12.5%	100.0%

Table (4) shows frequencies of DVT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No DVT	154	87.5	87.5	87.5
	DVT	22	12.5	12.5	100.0
	Total	176	100.0	100.0	

IV. Discussion

The study takes place between January 2016 and March 2018, 129men and 47 women (mean age, 49.8 years).According to the results of this study, fractures of the lower extremities were classified according to the complexity, and wound pattern either in single closed, single open, multiply closed, or multiple open. The DVT was found in 16 (13.6%) patients with single closed fractures, 2 (8.3%) patients with single opened fractures, 3 (11.5%) patients with multiple closed fractures, one (12.2%) patient with multiple closed fractures, and one (12.5%) patients with multiple opened fractures. Such as that by Takahiro Niikura et al. [16], in which the authors evaluated the rate of venous thromboembolism (VTE) after complex lower limb fracture surgery without pharmacological prophylaxis. A total of 154 (87.5%) patients had no DVT, while 22 (12.5%) patients had lower limb DVT. Table (1)

It should be noted that the time before restoration divided into six groups the fixation of the first group done within the first hour of trauma events which contained 54 patients (30.7%), the DVT events was(14.8%), the 2nd group within two to four hours contained 35 patients (19.9%), the DVT events was(5.7%), the 3rd group within five to seven hours which contained 13 patients (7.4%), the DVT events was(7.7%), the 4th group within eight to ten hours contained 9 patients (5.1%), the DVT events was(11.1%), the 5th group the fixation done after ten hours of fracture occurring which this group involved 30 patients (17.0%), the DVT events was(20.0%), the last group contained 35patients (19.9%) without fixation. the DVT events was(11.4%), Table (2). Immobilization more than 4 days was the most common risk factor present in patients with DVT. A study by Abelseth.1 G et al suggested a higher DVT incidence in more proximal fractures, but little risk of embolization. Thrombus formation proximal to the popliteal fossa is rare. Older age, longer operating times, and longer times before fracture fixation all correlate with an increased incidence of DVT.[1]

In this study, fractures of the lower extremities were classified according to the type of fixation, complexity (simple or compound fracture), persistent wound and the period of time that taken between fracture occurring and the time of performing fixation either by plaster, traction, external fixation or TBS none fixated fractured patient considered the fifth type of fixation. Six patients (3.4%) fixated by external fixation no one of them have DVT, 67 patients (38.1%) by traction, eleven (16.4%) of them were developed DVT, 7 patients (4.0%) used TBS, three out of them (42.9%) afflicted by DVT. And 36 patients (20.5%) procedure code listed as (None) with free lower extremities no fixation done, four (11.1%) of them were developed DVT. Table (3). Sharma et al[16] conclude that the post-TBS complications present a heavy burden to the hospital and consume a large amount of government exchequer. These complications stretch even further the already bursting workload and Bed-capacity of the hospital. Orthopaedic Surgeons , Physicians and other staff of the hospital are forced to spent a lot of their busy time looking after these patients. What is ridiculous is that in spite of the true scenario,

common people still believe that TBS is the best for their bone and soft tissue problems. People only present to the hospital if and when serious complications arise. The available literature suggests that this trend is present in many developing nations throughout Africa, Asia and South America.[16] Concerning the above results we believe that the TBS procedure is the most high risk facture of DVT may be due to unsuitable local tight materials that damaged or obstructed the lower limb veins.

In this study, the overall prevalence of DVT in fractured lower extremities was (12.5%) Table (4), immobilization alone is not a strong enough predisposing factor to affect the incidence of DVT in patients with fracture lower extremity. However, the risk of DVT increases significantly in patients with 3 or more predisposing factors.

V. Conclusion

This study concluded that the rate of DVT was high on complex fractures, delayed immobilization and on fractures that immobilized by TBS.

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