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Original Article

Anaesthesia Section

Deep Venous Thrombosis Prophylaxis Practices in Surgical Intensive Care Unit Patients: A Cross-sectional Study

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ABSTRACT

Introduction: Deep Venous Thrombosis (DVT) is one of the critical complications which can occur in patients subsequent to surgeries. The patients in Surgical Intensive Care Units (SICU) have increased propensity to have DVT due to prolonged immobilisation, invasive interventions and other risk factors. It is important to prevent DVT as this can lead to catastrophic Pulmonary Embolism (PE) and balance the risk of haemorrhages due to pharmacotherapy.

Aim: To observe the DVT prophylaxis methods and to compare the incidence of DVT in the different methods used in SICU.

Materials and Methods: The present study was a prospective cross-sectional study in which 62 patients, aged between 18-70 years admitted in SICU for more than or equal to two days, were included in the study. Patients on drugs affecting cardiovascular system and having significant co-morbidities and coagulation abnormalities, that can impact the occurrence of DVT, were excluded. All patients were followed-up till 28 days or ICU discharge, whichever was later. Patients were evaluated for type of prophylaxis for DVT that included any of mechanical interventions {such as stockings or Sequential Compression Devices (SCD)} or pharmacotherapy (Low molecular weight heparin or Unfractionated heparin) or a combination of both. Statistical analysis was carried out using Student's t-test and Chi-square test.

Results: Thirty (48.39%) patients were given both mechanical and pharmacotherapy, 12 (19.35%) had used only mechanical interventions and 20 (32.26%) had used pharmacotherapy alone for DVT prophylaxis. The overall incidence of DVT was 3.33% (one patient) for patients receiving both mechanical and pharmacotherapy whereas it was 10% (two) for those receiving pharmacotherapy alone and 16.67% (two) for those using mechanical intervention alone. Incidence of haemorrhage was highest in pharmacotherapy alone {three patients (15%)}. The overall dose of drugs used as pharmacotherapy was the least in those receiving dual interventions compared to that of patients receiving pharmacotherapy alone.

Conclusion: Pharmacotherapy and pressure stockings together are an ideal therapy for DVT prophylaxis.

Keywords: Anticoagulant, Heparin, Pharmacology, Stockings

INTRODUCTION

The DVT occurs in the deep draining veins of the extremities with a propensity to appear in large veins of the lower extremities. More recently, the term Venous Thrombo-Embolism (VTE) has been used to refer both DVT and PE [1]. VTE is the third most common cardiovascular disorder after myocardial infarction and cerebro-vascular accident. The mortality rate known for thromboembolic events is significantly high and the 28-day fatality rates are reported to be 9% for DVT and 15% for PE [2].

The aetiology of DVT can be inherited, acquired or a combination of both [3]. Extensive epidemiological studies of patients with thromboembolism have identified several factors that enhance the risk of DVT development [4-6]. These factors include age, gender, family history, obesity, limb weakness, direct trauma to the leg, surgery, history of previous thromboembolism, heart failure and use of oral contraceptives. Majority of ICU patients have one or more of the above mentioned risk factors for DVT [4]. These patients are further made susceptible to DVT during their ICU stay due to the following factors: recent surgery, prolonged immobilisation, sepsis and vascular injury from indwelling central venous catheters or other invasive interventions [7]. The optimal approach for VTE prophylaxis in critically ill patients is a challenge of balancing the reduction in the incidence of DVT and PE without risking an increase in catastrophic haemorrhages [8].

This study was designed to assess the number of patients at risk for DVT in SICU and various forms of practices implemented for its prophylaxis.

MATERIALS AND METHODS

This was a prospective, cross-sectional study that was carried out between February 2020 to April 2020 in Department of Anesthesiology and Critical care, Dr DY Patil Medical College, Hospital and Research Centre, Pimpri, Pune, Maharashtra, India. Prior ethical clearance was obtained from the Institutional Ethics Committee (Research Protocol No. IESC/FP/2020/19). Informed consent of the patients was obtained. In case the patients were unable to give informed consent due to altered sensorium, the same was sought from their attendees.

The aim of the study was to observe the DVT prophylaxis methods and to compare the incidence of DVT in the different methods used in SICU. A total of 62 patients were recruited. Twelve patients received mechanical prophylaxis alone, 20 patients received pharmacotherapy alone and 30 patients received both mechanical and pharmacological therapy.

Sample size calculation: The sample size was estimated to be 62 patients (incidence of 11%) based on a study by Major KM et al., [9]. The confidence interval was set at 95%, with a study precision of 7.5% using WinPepi statistical package. The patients were distributed in different groups based on discretion of treating intensivist and surgeon regarding need for pharmacotherapy or mechanical therapy or both leading to an uneven group size.

Inclusion criteria

1. Patients admitted in SICU aged between 18-70 years of age for ≥2 days.
2. Haemodynamically stable patients with all routine investigations within normal limits.

3. Patients who were not on drug altering the coagulation profile.
4. Availability of informed consent.

Exclusion criteria

1. Patients with major neurological, cardiac, respiratory, metabolic, renal, hepatic disease that can effect coagulation profile.
2. Patients with documented DVT/PE before or within 48 hours of ICU admission:

Study Procedure

Patients were assessed daily for the presence of DVT, form of prophylactic treatment received and complications, if any. All patients were followed-up closely until 28 days or ICU discharge (whichever was later). Method of DVT prophylaxis given (Mechanical/Pharmacological/Both) was noted. Mechanical prophylaxis included use of DVT stockings (inflation pressure ranging from 30-40 mmHg) or use of SCD (inflation pressure ranging from 50-120 mmHg for at least 18-20 hours a day). Pharmacological management included Low molecular weight heparin (LMWH) (30-40 mg subcutaneously 12 hourly). LMWH (enoxaparin) is the standard pharmaco-prophylactic measures practiced in most of the hospitals [10,11]. None of the patients were given unfractionated heparin in the study.

STATISTICAL ANALYSIS

The statistical analysis was done by evaluating the quantitative data that was analysed by using unpaired student's t-test whereas qualitative data was analysed by Chi-square test. The p-value was considered as significant at a value of <0.05 set at 95% confidence intervals.

RESULTS

The mean and SD of the age of patients was 50.36±6.8 years. Male participants were 42 (67.74%) and female participants were 20 (32.26%).

Mechanical prophylaxis had highest incidence of DVT but the difference was non-significant. Combined intervention was the most commonly used prophylactic measure [Table/Fig-1].

Intervention	Type of prophylaxis n (%)	Incidence of DVT n (%)	p-value (chi-square test)
Mechanical prophylaxis alone	12 (19.35%)	2 (16.67%)	0.332
Pharmacotherapy alone	20 (32.26%)	2 (10%)	
Both mechanical and pharmacotherapy	30 (48.39%)	1 (3.33%)	

[Table/Fig-1]: Type of intervention and incidence of DVT.

The groups were comparable regarding incidence of haemorrhage with a non-significant p-value of >0.05 as depicted in [Table/Fig-2].

Type of prophylaxis	Incidence of haemorrhage
Mechanical prophylaxis alone	0 of 12 (0%)
Pharmacotherapy alone	3 of 20 (15%)
Both Mechanical and Pharmacotherapy	1 of 30 (3.33%)
p-value (Chi-square test)	0.136

[Table/Fig-2]: Type of intervention and incidence of haemorrhage.

The mean doses of enoxaparin used in pharmacotherapy alone and both mechanical therapy and pharmcotherapy groups were 63.69±15.2 and 42.33±7.85 mg/day, respectively and these were significantly (p<0.001) higher in pharmacotherapy alone group as depicted in [Table/Fig-3]. It should be noted that for mechanical prophylaxis in dual prophylaxis group, 15 patients used stockings and 15 used SCDs with mean doses of enoxaparin as 42±5.92 and 42.67±9.61 mg/day, respectively.

Fifteen patients (50%) used SCDs and 15 (50%) used DVT stockings in dual mechanical and pharmacotherapy prophylaxis group,

Low molecular weight heparin (Enoxaparin)	Dose (mg/day)
Pharmacotherapy alone (n=20)	63.69±15.2
Both Mechanical and Pharmacotherapy (n=30)	42.33±7.85
Both Mechanical and Pharmacotherapy stockings (n=15)	42±5.92
Both Mechanical and Pharmacotherapy sequential compression devices (n=15)	42.67±9.61
p-value (Student's t-test)	p<0.001

[Table/Fig-3]: Mean dose/day of pharmacotherapy.

whereas in mechanical therapy alone group, 8 (66.67%) used DVT stockings and 4 (33.33%) used SCDs as depicted in [Table/Fig-4].

Type of mechanical therapy	Patients with mechanical and pharmacotherapy	Patients with mechanical therapy alone
DVT stockings	15 (50%)	8 (66.67%)
Sequential compression devices	15 (50%)	4 (33.33%)
Total	30 (100%)	12 (100%)

[Table/Fig-4]: Type of mechanical therapy.

DISCUSSION

The DVT is the formation or presence of thrombus in deep veins, occurring most commonly in the lower extremities and rarely in upper extremities. Whereas, an obstruction of the pulmonary artery or its branches by a thrombus results in the development of PE; most likely source being an embolisation from deep veins of the legs and occurs approximately in one-third of patients with DVT. Hence, prevention of DVT significantly decreases the incidence of a serious and life-threatening condition called PE [12]. Hoyt DB and Swegle JR suggested that aggressive prophylaxis, a high index of suspicion, and definitive diagnosis and treatment are essential to decrease the morbidity and mortality rates from DVT in patients admitted in SICU [13].

Harris LM et al., noted that screening of SICU patients is indicated because of a high prevalence of asymptomatic disease which was found to be 7.5% in 294 patients admitted in SICU [14]. Normally, a balance between the procoagulant and anticoagulant factors present in the blood prevents the intravascular formation of thrombus. Presence of one or more factors constituting the triad of Virchow (venous stasis, endothelial injury and hypercoagulability) can contribute to the development of DVT. Hospitalised patients are at risk of venous stasis and with the presence of other factors, they are at increased risk of DVT and this increases the risk of PE. Prophylaxis of DVT constitute methods that target either the venous stasis (mechanical methods) or the hypercoagulability (pharmacological methods) of the vascular system.

The overall incidence of DVT was 3.33% (1 of 30 patients) for patients receiving both mechanical and pharmacotherapy whereas it was 10% (2 of 20) for patients receiving pharmacotherapy alone and 16.67% (2 of 12) for patients using mechanical interventions. In a study by Kumar A et al., it was noted that the incidence of DVT was 0.8% with prophylaxis in patients admitted in SICUs [15]. A study by Miri M et al., noted incidence of 3.5% in ICU patients [16].

Incidence of haemorrhage was highest in pharmacotherapy alone group (n=3 of 20; 15%), no patients in mechanical intervention had haemorrhagic episode whereas one patient in dual intervention group (n=1 of 30) had haemorrhage. The overall dose of drugs used as pharmacotherapy was lesser in those receiving dual interventions compared to that of patients receiving pharmacotherapy alone. This explains lesser incidence of haemorrhagic manifestations in combined group when compared to pharmacotherapy alone group. Fraisse F et al., noted higher incidence of bleeding in patients receiving pharmacotherapy for DVT prophylaxis than those not receiving any pharmacotherapy [17]. Cook DJ and Crowther MA suggested use of optimal DVT prophylaxis in order to prevent

development of DVT in patients at risk and this should be balanced with risk of bleeding [18].

In a systematic review by Kakkos SK et al., in the IPC (Intermittent Pneumatic Compression) group, the incidence of DVT was noted to be 4.10% [19], whereas, in the combined group (IPC+ pharmacotherapy), it was 2.19%, showing a reduced occurrence of DVT in favour of the combined group. Moreover, anticoagulant addition to the IPC increased the risk of any bleeding as compared to IPC alone. Nevertheless, patients admitted in SICU need to be regularly evaluated for development of DVT. Dagadaki O et al., suggested periodical ultrasound assessment of the peripheral venous system in intensive care unit patients to screen for DVT [20].

Limitation(s)

The sample size was limited and the findings cannot be extrapolated to all the patient populations. Only American Society of Anesthesiologists (ASA) Grade III patients were included. The study evaluated adult patients and excluded elderly ones above 70 years and those with significant co-morbid conditions as these are potentially confounding factors and may be associated with increased risk for bleeding manifestations as well as thromboembolic complications; thereby leading to a bias in study findings.

CONCLUSION(S)

It was noted that a mix of mechanical and pharmacological measures are associated with reduced incidence of DVT. The overall dose of drugs used as pharmacotherapy was the lesser in those receiving dual interventions compared to that of patients receiving pharmacotherapy alone. Pharmacotherapy and pressure stockings together are an ideal therapy for DVT prophylaxis, as per this study. However, it is suggested that similar studies should be conducted with a higher patient participation and a long term follow-up.

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