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Original Research Article

Deep vein thrombosis risk stratification in intensive care unit patients: a pressing need

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ABSTRACT

Background: Risk stratification of deep vein thrombosis in patients admitted to ICU and incorporating DVT risk assessment score as a regular practice were the aim of the present study.
Methods: This study was carried out in 67 patients admitted in ICU >18 years of age, over one year. Patients with confirmed DVT, <48 hours of stay, thrombocytopenia, diagnosed coagulation disorders, those who have received DVT prophylaxis in last 1 month and those with active bleeding were excluded. It was a cross sectional observational study. A SMART assessment score and pretest probability scoring card was used. Mechanical or pharmacological prophylaxis was given to those with moderate and high risk for DVT.
Results: As per SMART assessment score 4.5%, 41.8%, 6% and 23.9% had no, moderate, high and highest risk of developing DVT. As per the pretest probability scores 76%, 20.9% and 3% were in low, moderate and high-risk group. Both scoring systems are comparable (p=0.001). There was significant association between paralysis (p value was 0.003), central venous access (p value was 0.006), patient bed ridden for >72 hours (p value was 0.009) and risk group.
Conclusions: Prolonged bed rest, paralysis and central venous access are the most important contributing conditions for high risk of DVT. Risk stratification should be routinely performed in ICU. SMART assessment tool and pre-test probability scores are both equally efficacious in identifying high risk patients for DVT. Both mechanical and pharmacological means of DVT prophylaxis are equally effective in preventing DVT.

Keywords: Deep vein thrombosis, Prophylaxis, Risk stratification, Venous doppler

INTRODUCTION

Acute DVT is followed by a complex process of attempted recanalization of the vessel lumen which is mediated by leukocyte infiltration and cell mediated thrombolysis. Rethrombosis would affect the recanalization process and recurrent thromboembolism of up to 47% has been reported in patients inadequately anti-coagulated in the first 3 months after an initial proximal DVT.[1] The clinical behaviour of acute DVT depends on the location of thrombosis.

Pulmonary embolism is the most dangerous complication of acute DVT. As with acute DVT, this usually remains clinically silent, 25-50% of all patients with documented DVT and absence of pulmonary symptoms have been shown to have evidence of PE on lung perfusion scans.[2] The mortality rate of PE is 11% within an hour of presentation and a further 30% among survivors if not recognized.[3]

Venous thrombi are made up of fibrin, red cells, platelets, and leucocytes. Typically, these thrombi are believed to

start in areas of slow or turbulent venous flow such as large venous sinuses or venous valve cusps and also in areas of direct venous trauma. Activation of the coagulation pathway is the crucial step in the initial formation of venous thrombi and it happens due to either local injury or remote release of mediators. Persistent activation of the pathway along with poor flow failing to clear the activated factors results in an imbalance in the pro and anti-thrombotic pathways leading to progression of the thrombus.

Heit and colleagues have listed the following conditions as major risk factors for developing DVT: increasing age, male gender, surgery, trauma, confinement in hospitals or nursing homes, malignancy, neurologic disease, central venous catheter, prior superficial vein thrombosis, and varicose veins.[4] Pregnancy, oral contraceptive pill use, and hormone replacement therapy are independent risk factors in women. Vijayraghavan et al, did a retrospective study on DVT in the South Indian population and showed an incidence of 1.79 / 1,000 population.[5] Agarwal et al, conducted a study in patients undergoing total hip / knee arthroplasty and revealed an overall incidence of DVT in 60% cases in the non-prophylaxis group.[6] This data was comparable to the date from other parts of Asia and West and emphasized the need of thromboprophylaxis.

Prospective registry on venous thromboembolic events (PROVE) conducted in 19 countries enrolled 3526 patients with symptomatic DVT, out of which 667 were from India.[7] DVT was found proximally and in the calf in 54% of Indian patients which is comparable to western data. Bhan et al, in a multicentric study, found an incidence of 23.34% of DVT in the non-prophylaxis group as compared to nil in the group which received mechanical prophylaxis.[8] Lee et al, conducted a retrospective study in CMC Vellore from (1996-2005) to determine the incidence of VTE among hospitalized patients and showed an overall incidence of confirmed DVTs to be 17.46 per 10,000 admissions with 64% being non-surgical non trauma patients.[9] They emphasized the need to aggressively implement DVT risk stratification strategy in medical patients and provide pharmacological or mechanical prophylaxis unless contraindicated.

METHODS

It is a cross sectional observational study. This study was done between January 2013-February 2014.

Inclusion criteria

All patients more than 18 years of age admitted to ICU of Shree Krishna Hospital irrespective of initial diagnosis.

Exclusion criteria

- Patients with confirmed DVT or a high suspicion of suffering from DVT
- Stay of <48 hours
- Thrombocytopenia, coagulation disorders
- Those who received DVT prophylaxis in last one month prior to admission
- Any active bleeding with contraindication for initiating pharmacological prophylaxis.

Enrolled patients were divided according to structured risk stratification system in low, moderate and high risk and studied in a cross sectional manner. A prestest probability score was calculated for each patient (Table 1). It is modified from the Well's score 10 Another risk stratification was based on the SMART tool (Surgical and Medical Patients Assessment of risk for Thrombosis, Table 2).

Author also studied association of each risk factor and comorbid condition with risk groups. All patients with moderate to high risk of DVT were started on either pharmacological or mechanical method of prophylaxis. In case of signs and symptoms s/o DVT venous Doppler were performed with a Logic 400 USG Doppler machine with a 9 MHz probe by a certified radiologist.

Statistical analysis

Chi square test was used to find significant association

Table 1: Pretest Probability Score.

Clinical characteristic	Score
Active cancer (treatment ongoing within previous 6 months or on palliation	1
Paralysis, paresis or recent plaster and immobilisation of the lower limb	1
Recent bed rest of 3 days or major surgery within 3 months requiring anaesthesia	1
Localised tenderness of the deep veins of the leg	1
Entire leg swollen	1
Calf swelling of >3 cms larger than the asymptomatic side measured 10 cms below tibial tuberosity	1
Pitting edema confined to the symptomatic leg	1
Collateral superficial veins (not varicosed)	1
Previously documented deep vein thrombosis	1
Alternative diagnosis as likely as or more likely than deep vein thrombosis	-2

RESULTS

Meta-analysis of the results to establish core relation with a particular level of DVT risk (Table 3) with all the risk factors include in the study, it was found that the following factors positive for the higher risk stratification: Paralysis (Table 4) (p=0.003), central venous access (Table 5) (p=0.006) and prolonged bed rest (Table 6)(p=0.001).

In moderate risk groups none of the patients developed DVT. Only 2 patients had developed DVT, both belonging to high and highest risk groups. No patient developed Pulmonary embolism (Table 3).

There was significant association between paralysis and risk group (p=0.003)(Table 4).

Table 2: SMART assessment tool.

Step 1			
Score 1	**Score 2**	**Score 3**	**Score 5**
Minor surgery	• Major surgery >45 minutes • Laproscopic surgery >45 minutes • Patient confined to bed for >72 hours • Immobilisation plaster cast • Central venous access	• Major surgery with myocardial infarction • Congestive heart failure • Severe sepsis • Medical patients with additional risk factors	• Elective major lower extremity arthroplasty • Hip, pelvis or leg fracture • Stroke • Multiple trauma • Acute spinal cord injury
Step 2			
Clinical	Hypercoagulable state (inherted factors)	Hypercoagulable state (acquired factors)	
• Age 41-60 years • Age over 60 years (2 factors) • History of DVT/pe (3 factors) • History of prior major surgery • Pregnancy or postpartum < 1 month • Malignancy (2 factor) • Varicose veins • Inflammatory bowel disease • Obesity (>20% ideal body weight) • Oral replacement or hormone replacement therapy	• Factor V/ activated protein C • Antithrombin III deficiency • Protein c or s deficiency • Dysfibrinogenemia plasmin • Prothrombin 20210 A • Thrombocytopenia • Homocystinemia	• Lupus anticoagulant • Antiphospholipid antibodies • Myeloproliferative disorders • Disorders of plasminogen and heparin induced hyper viscosity syndrome • Homocysteinemia	
Step 3=1+2			
Step 4			
Low risk (1 factor)	Moderate risk (2 factor)	High risk (3-4 factors)	Highest risk (5 or more factors)
No specific measures Early ambulation	IPC or LDUH (q 12 h) or LMWH or GCS	GCS and IPC (q 12h) or LDUH	GCS and IPC (LDUH or LMWH) or ADH or LMWH oral anticoagulants

There was significant association found between central venous access and risk groups (p=0.006) (Table 5).

There was significant association between bedridden patients and risk (p=0.001) (Table 6). Table 7 shows low risk group 41.8%, moderate and highest group with 23.9% each, high risk with 6% and no risk in 4.5%. Caprini like score was used by Pandey et al and they concluded that 5% patients were of no risk, 5% were of low risk, 7% were in moderate risk, 7.5% high and 75% in highest risk group.

Table 3: Risk factor profile of patients for DVT.

Risk factor	Present
Past h/o major surgery in <12 weeks	2
Malignancy	3
Obesity	2
Paralysis	9
Central venous access	8
Prolonged bed rest for >72 hours	47
Poly trauma	2

Table 4: Individual risk factor association with high risk stratification: risk group and paralysis.

Risk group	Paralysis yes	Paralysis no	Total
Minimum	31	0	31
Significant risk	27	9	36
Total	58	9	67

Table 5: Risk group and central venous access.

Risk group	Central venous access yes	Central venous access no	Total
Minimum	31	0	31
Significant risk	28	8	36
Total	59	8	67

Table 6: Risk group and prolonged bed rest >72 hours.

Risk group	Prolonged bed rest >72 hours yes	Prolonged bed rest of >72 hours no	Total
Minimum risk	18	13	31
Significant risk	2	34	36
Total	20	47	67

Table 7: Risk group assessment and comparison of two stratification systems-risk groups as per SMART assessment tool.

Risk groups	Frequency	Percent	Cumulative percent
No risk	3	4.5	4.5
Low risk	28	41.8	46.3
Moderate	16	23.9	70.1
High	4	6.0	76.1
Highest	16	23.9	100
Total	67	100	

For comparison purpose and statistical analysis risk groups of SMART assessment tool were divided in minimal risk group and significant risk group. The pretest probability score was grouped as a score > or = 2 and <2. Those patients who were classified as significant risk group as per SMART assessment tool had a statistically significant association with higher pretest probability score (p value=0.001). Both scoring systems are there by comparable (Table 7,8,9).

Table 8: Risk groups as pre pretest probability score.

Risk group	Frequency
Low risk	26
Moderate risk	39
High risk	2
Total	67

Table 9: Comparison between two methods of risk stratification.

	Pretest Probability score <2	Pretest Probability score > or = 2	Total
SMART tool group minimal risk	31	0	31
SMART tool group significant risk	20	16	36
	51	16	67

Table 10: Analysis of association between age and DVT risk strata.

Risk group	Age						Total
	0-40	41-50	51-60	61-70	71-80	81-90	
No risk	3	0	0	0	0	0	3
Low risk	6	2	9	3	7	1	28
Moderate	3	2	1	7	1	2	16
High	0	1	2	0	0	1	4
Highest	2	2	5	4	1	2	16
Total	14	7	17	14	9	6	67

Table 11: Statistical analysis of interventional prophylactic methods.

	None	LMWH	Mechanical	Both	Total
Minimum risk	30	0	1	0	31
Significant risk	9	7	17	3	36
Total	39	7	18	3	67

No significant association was found on multiple Scheffe's test in the study (Table 10). Age >60 years, although, was found to be an independent risk factor for DVT as per Caprini et al.

Table 11 shows that out of 36 at risk patients, 27 received either mechanical or pharmacological prophylaxis (75%). In the study population only 2 patients had developed DVT. One belonged to high risk group and the other belonged to highest risk group. Both patients had received prophylaxis. One had received LMWH while the other received mechanical prophylaxis. Both had high pretest probability scores. D dimer and Doppler was positive in both patients. In moderate risk groups none of the patients developed DVT and both mechanical and pharmacological prophylaxis was equally efficacious.

DISCUSSION

The incidence of DVT has not changed significantly over the last 25 years . The prevailing belief that DVT in the ASIAN population is less than in the western population has been disproved by recent studies and there is no reason to believe that it should be any different in India. The incidence of DVT in India is highly underestimated because of lack of adequate studies. There is a paucity of data from autopsied patients as autopsy is being done in very few institutions in India. A clinical practice guideline from the American Academy of Family Physicians and the American College of Physicians summarize the current approaches for the diagnosis of VTE / PE. Recommendation 1: Validated clinical prediction rules should be used to estimate pretest probability of VTE, both DVT and PE and for the basis of interpretation of subsequent tests. Recommendation 2: In appropriately selected patients with low pretest probability of DVT or PE, obtaining a high sensitivity D-dimer is a reasonable option, and if negative indicate a low likelihood of VTE. Recommendation - 3: Ultrasound is recommended for patients with intermediate to high pretest probability of DVT in the lower extremities. Recommendation - 4: Patients with intermediate or high pretest probability of PE require diagnostic imaging studies. The mortality, acute and long term morbidities and resource utilization related to unprevented DVT strongly supports for effective preventive strategies at least for moderate to high risk patients.[11] According to ENDORSE Study of hospitals from 32 countries worldwide, about 65% of surgical patients and 42% of medical patients were found to be at risk of DVT, however only 59% of surgical and less than half (40%) of medically ill patients received thromboprophylaxis.[12] In India, while a comparable portion (45%) of medical in-patients were found to be at risk, only 19% received thromboprophylaxis.[12] According to the guidelines issued by 8th American College of Chest Physicians (ACCP) consensus on Antithrombotic and thrombolytic therapy are: i. For every general hospital, a formal active strategy that addresses the prevention of DVT be developed (Grade IA). ii. Mechanical methods of thromboprophylaxis be started primarily in patients at high risk for bleeding (Grade IA) or possible an adjunct to anticoagulant - based thromboprophylaxis (Grade 2A). iii. For acutely ill medical patients admitted to hospital with CHF or severe respiratory disease or who are confined to bed and have one or more additional risk factors including active cancer, previous VTE, sepsis, acute neurologic disease, or inflammatory bowel disease, thromboprophylaxis with low molecular weight heparin - LMWH (Grade IA), low dose unfractionated heparin-LDUH (Grade IA), or fondaparinux (Grade IA) is recommended for patients having contraindication to anticoagulant prophylaxis, the optimal use of mechanical thromboprophylaxis with graduated compression stocking (GCS) or Intermittent pneumatic compression (IPC) is recommended (Grade IA). iv. For patients admitted to a critical care unit, routine assessment for VTE risk and routine thromboprophylaxis in most is recommended (Grade IA). Patients at moderate risk of DVT, thromboprophylaxis using LMWH or LDUH is recommended (Grade IA).[13] It was found that 54% of patients had some level of risk to develop DVT. Another conclusion author reached was that the risk assessment was carried out in 75% of total admissions which is higher than mentioned in most of the reference studies.

CONCLUSION

DVT risk stratification of critically ill patients should be regularly done as this will help in providing timely DVT prophylaxis of choice. SMART scoring and pretest probability scoring are both comparable and sensitive. There is positive association between high risk and paralysis, central venous line access and bedridden duration of >72 hours. In the moderate risk group, both mechanical and pharmacological means of prophylaxis was equally effective.

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