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Original Research Article

Assessment Card for Deep Vein Thrombosis

Prevalence of Deep Vein Thrombosis in Postoperative Patients Using Risk Assessment Card: An Observational Study

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Abstract: Venous thromboembolism (VTE) is a medical condition where blood coagulation happens most frequently in the veins of the limb, crotch, or arm. The most dreaded complication of deep vein thrombosis (DVT) is pulmonary embolism (PE), possibly lethal. The incidence of VTE in India was 17.46 per 10,000 hospital admissions. Given the high incidence, the current study was undertaken. The present study was done with the aim to know the prevalence of administration of prophylaxis of DVT in postoperative patients using a risk assessment card at a tertiary care centre named Siddhartha Medical College, Vijayawada, Andhra Pradesh, in India. Objectives of the study include studying the impact of DVT risk assessment cards on the prevalence rates of prophylaxis administration in postoperative patients and establishing the current rates of thromboprophylaxis in post-operative surgical patients. This observational study was done on 60 patients scheduled for various surgeries from July 2020 to December 2022. 60 patients were randomized into groups: A and B, each containing 30 patients, depending on the phase. Group A (Phase I) included patients before introducing the risk assessment card for DVT. Group B (Phase II) included patients after introducing the risk assessment card for DVT. Results showed that most patients in both study phases were aged below 40 years. Most of the patients were males. Most of the patients belonged to the low-risk category. The two groups have no significant difference in the mean risk score. Mechanical and drug prophylaxis incidence was significantly higher in group B or phase II patients. Introducing risk assessment cards for DVT for Inpatient (IP) case sheets was an effective and cost-effective way of improving overall prophylaxis for DVT.

Keywords: Deep vein thrombosis, Postoperative pain, Pulmonary embolism, Risk assessment card, Thromboprophylaxis.

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1. INTRODUCTION

Venous thromboembolism (VTE) is a medical condition in which blood coagulation happens most frequently in the veins of limb, crotch, or arm -profound vein apoplexy, deep vein thrombosis (DVT). It can disseminate to the lungs (pulmonary/ aspiratory embolism, PE).[1] Together, DVT and PE are grouped as venous thromboembolism or VTE. Types of Thrombosis include profound vein apoplexy (DVT), in which blood coagulation structures in a profound vein, typically the leg, crotch, or arm. Aspiratory\Pulmonary embolism (PE), in which blood coagulation happens when a thrombus breaks and goes to the lungs, obstructing some or all of the blood supply of the lung. DVT, along with PE, is considered VTE. Most thrombi that form in deep veins below popliteal trifurcation will resolve spontaneously without producing any symptoms.[2] Around 60–70% of patients with symptomatic VTE develop DVT.[3] VTE is the significant reason for most patients' grimness, morbidity, and mortality. It is a major cause of health and financial burden that affects the community.[4] VTE can cause serious clinical outcomes in both males and females. The appropriate administration of antithrombotic agents and nonpharmacological interventions can prevent [5-6] most of these complications and deaths.[7] Many methods are available to detect suspected VTE, including checking for D-dimer levels, apart from imaging techniques.[8]The most dreaded complication of DVT is PE, which is possibly lethal. This post-thrombotic syndrome happens in 20 to 50% of patients and may cause lifelong limb pain, oedema, heaviness, and leg ulcers.[9-10] stasis, hyper-coagulable state, and vessel injury (VIRCHOWS' TRIAD) make patients inclined toward advancing VTE, particularly in postoperative patients. Considering the high pervasiveness of VTE, improving thromboprophylaxis for postoperative patients is the need of the hour. Thromboprophylaxis has been demonstrated to be exceptionally viable at forestalling VTE and its ramifications. PE occurs when thickened blood enters the pneumonic blood vessel course. Most PEs occur due to profound DVT in the legs, arms, or pelvis and occasionally from the jugular vein or second-rate vena cava. Pulmonary embolism is the most common avoidable cause of morbidity and demise among patients in India. Yet, VTE in general – and pulmonary embolism, in particular, are considered major public health problems. Moreover, single-photon emission CT, CT venography, positron emission tomography (PET), and different magnetic resonance imaging (MRI) techniques, including MR direct thrombus imaging, have been evaluated in various clinical studies. Patients with thrombocytopenia, osteoporosis, or hypoaldosteronism should not be given thromboprophylaxis.[11-13]

1.1. Thrombogenic mechanism of high-risk factors for DVT

Surgery and leg trauma increases DVT risk by causing vessel damage, blood coagulability, stasis, and reduced fibrinolysis. Increasing age, immobilization, cerebrovascular accident, obesity, heart failure, anemia, varicose veins, usage of oral contraceptive pills, and pregnancy cause stasis. Malignancy causes vessel damage and blood coagulability. There are various mechanisms responsible for DVT. Increased blood coagulability, stasis or stagnation, and elevated clotting factors constitute Virchow's triad, responsible for developing DVT.

Table 1: Precipitating factors and possible mechanisms of DVT

Precipitating factors	Stasis	Blood coagulability	Damage to vessels	Fibrinolysis
Trauma	Positive	Positive	Positive	
Previous surgery	Positive	Positive	Positive	Positive
Age	Positive			
Obesity	Positive			
Pregnancy	Positive			
Anemia	Positive			
Heart disorders	Positive	Positive		
Usage of OCPs	Positive			Positive
Malignancy		Positive	Positive	Positive
Cerebrovascular accident	Positive			

The incidence of VTE in India was 17.46 per 10,000 hospital admissions. Cancer was the most common predisposing factor for VTE, followed by postoperative status.[14-16] The current study was undertaken because of the high incidence. The present study was done to know the prevalence of DVT in postoperative patients using a risk assessment card at a tertiary care centre named Siddhartha Medical College, Vijayawada, Andhra Pradesh, South India. The objectives are to study the impact of DVT risk assessment cards on the prevalence rates of prophylaxis administration in postoperative patients and to establish the current rates of thromboprophylaxis in post-operative surgical patients.

2. MATERIALS AND METHODS

2.1. Ethical considerations

Permission was obtained from the Institutional ethical committee (Registration no: ECR/633/INST/AP/2014/RR-19 and Reference no: IEC/2019/037/SMC) attached to Siddhartha Medical College, Vijayawada, before conducting the study. Informed consent was taken from every patient who participated in the study.

2.2. Type of study and duration

This is a prospective, observational study. The study is observational, as we are not providing any treatment or intervention to study participants as part of the study. Patients posted for surgeries at our tertiary care centre from July 2020 to December 2022 were taken as a study sample.

2.3. Sample size

As per the previous study [17], the prevalence of DVT was 5% among postoperative patients. Using Epi Info Software, the sample size was calculated as per the population survey model: $N=Z^2PQ/E^2$, where N=sample size, Population proportion: 5%, Q=1-P, E-Error: 5%, Confidence level:90%. After calculation, the minimum sample size came to 52. So, we included 60 patients considering a few dropouts. Patients were divided randomly into two groups.

Group A: 30 Patients- Phase I- Before introducing the risk assessment card for DVT.
Group B: 30 Patients: Phase II- After introducing the risk assessment card for DVT.
Randomization was done using computer-generated software.

2.4. Inclusion criteria

Patients above 18 years of either gender are admitted to the general surgery department for certain medical procedures.

2.5. Exclusion criteria

Pregnant and lactating women
Patients with:

- Contraindications to mechanical prophylaxis.
- Arteriosclerosis
- Venous ulcer
- A history of thromboprophylaxis
- Recent graph
- Gangrenous limb
- Peripheral Vascular Disease
- Doppler with a pressure index below 0.8
- Cellulitis
- Limb deformity
- More thigh circumference.

Patients who are contraindicated for pharmacological prophylaxis for low molecular weight heparins:
Patients with:

- Haemophilia
- H/O of haemorrhagic stroke
- Severe liver disease
- Active gastrointestinal bleed
- Accelerated hypertension
- Chronic liver disease with varices
- Who underwent eye surgery recently.
- Who was conservatively managed for hepatic and splenic injuries.
- Thrombocytopenia, osteoporosis, and hypoaldosteronism.

2.6. Study procedure

A detailed history, clinical examination, basic blood investigations, chest x-ray, venous doppler of the affected limb, and ECG were taken for all the patients. Comorbidities are taken into account during the assessment of the patients during this study. After the patients had been explained the procedures, informed consent was obtained, and the patients were divided into two groups (A and B).

2.7. Risk assessment card for DVT

It is a card used for screening. It included points of interest of the patient, definitive rules, and hazard factors. It includes 4 items A, B, C, and D. If the score is above 5 points, then the risk is considered highest. The risk assessment card is shown below (Table 2).

Table 2: Risk assessment card for DVT stratification[18]

A	B
• Minor surgery that is planned	• Age above 60 years
• Age of patient: 41-60 years	• Malignancy or chemotherapy
• History of prior major surgery below 1 month	• Immobilized plaster cast
• Pregnancy or postpartum below 1 month	• Bedridden for more than 72 hours
• Varicose veins	• Central venous accesses
• Irritable bowel disorder	
• Usage of oral contraceptives	
• Obesity	
• Swollen legs	
C	**D**
• History of DVT	• Stroke
• Myocardial infarction	• Multiple trauma
• Age above 75 years	• Spinal injury
• Chronic obstructive pulmonary disorder	
• H/O thrombosis	
• Chronic heart failure	
• Severe infection or sepsis	
• Abnormal lung function	
• Myeloproliferative disorder	
• Respiratory assistance	
• Thrombophilia	

The total score of O indicates no risk, 1 indicates low risk, 2 indicates moderate risk, 3-4 indicates high risk, and more than 5 indicates highest risk.

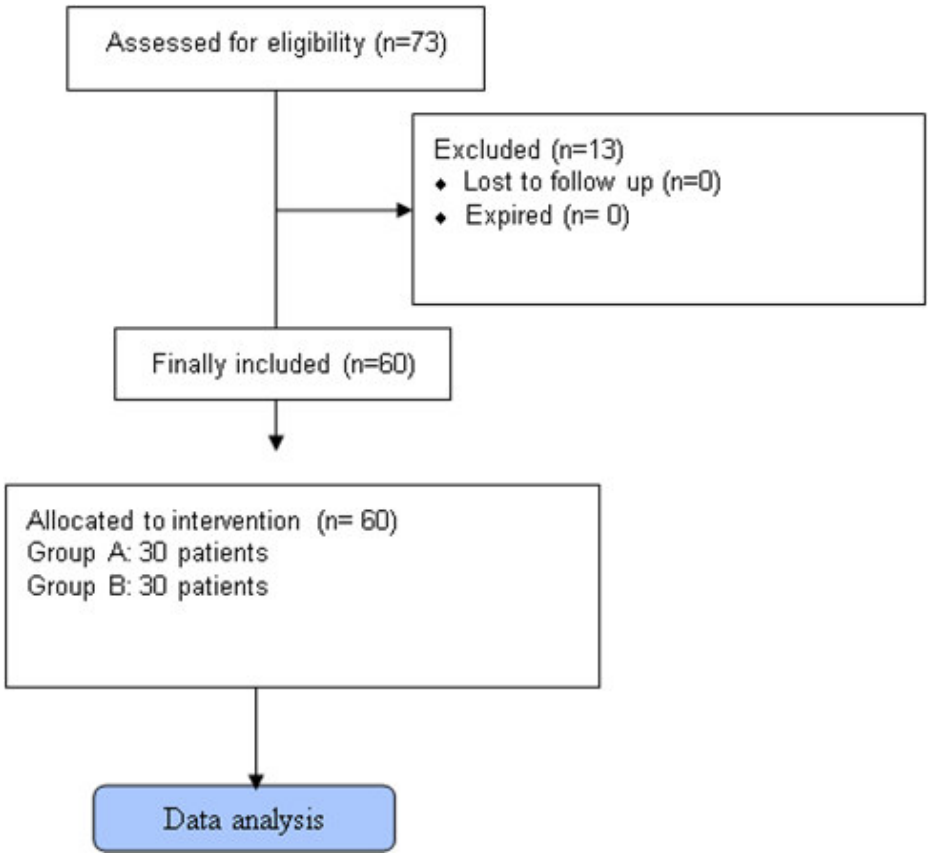

Fig 1: Consort flow diagram

Figure 1: The above consort flow diagram shows how many patients were assessed for eligibility or screening. 13 patients were excluded, and finally, 60 patients were included in the study, among which 30 patients belonged to group A and 30 patients belonged to group B.

2.8. Content validity of the DVT assessment tool

The vital clinical features identified by surgeons were consistent with those parameters already listed in the previous studies, supporting the tool's content validity. Some vital clinical features include calf swelling, pain, changes in skin temperature, discoloration of the skin, tight skin on limbs, and distended veins. It is also advisable to look for other signs, including increased shortness of breath, enhanced respiratory rate, reduced oxygen saturation, and tachycardia, as these clinical features suggest impending pulmonary embolus.

2.9. High-risk diseases

This category includes anemia, cardiovascular disorders, and malignancy. They are associated with high blood viscosity. Cardiovascular diseases include myocardial infarction, heart failure, cerebrovascular, vascular accident, previous DVT, and varicose veins. Table 4 shows the incidence of high-risk disorders among DVT patients.

2.10. Procedure during the 1st phase of the study

1. Patients admitted to the ward before the medical procedure were evaluated for their danger of VTE.
2. The patients were surveyed if they required thromboprophylaxis
3. Then, information was gathered concerning whether patients were getting prophylaxis in the post-employable time frame.
4. The gathered information was organized and investigated, agreeing on the danger class using measurable strategies.
5. The span of this stage was 6 months

2.11. Procedure during the 2nd phase of the study

1. DVT prophylaxis evaluation cards were created in light of the American College of Chest Physicians (ACCP) rules among qualified patients
2. Awareness was made among treating specialists on the utilization of evaluating cards for VTE hazard appraisal.

Each hazard appraisal card had the accompanying part: a. Patient segment information b. Risk elements and arrangement of patients into hazard gatherings. The contra-signs for thromboprophylaxis. d. Recommended routine for each gathering. Conventions for VTE prophylaxis depended on the eighth ACCP rule 19. We recorded whether the patient required DVT prophylaxis. The effect achieved by the DVT prophylaxis hazard evaluation cards was surveyed and contrasted.

3. STATISTICAL ANALYSIS

The data collected was entered in MS Excel 2021, and analysis was carried out using statistical software named Epi info version 7.2.5 free version. Frequencies and percentages were used. Comparison between groups A and B was made using students' t-tests and chi-square tests. P value less than 0.05 is considered significant.

4. RESULTS

This observational study was done on 60 patients scheduled for various surgeries from July 2020 to December 2022. 60 patients were randomized into groups: A and B, each containing 30 patients, depending on the phase. Group A (Phase I) included patients before introducing the risk assessment card for DVT. Group B (Phase II) included patients after introducing the risk assessment card for DVT. The following are the parameters:

4.1. Age

There is no significant difference in the mean age of patients in groups A and B.

Table 3: Mean age of patients

Age	Phase I or Group A	Phase II or Group B
Mean age	41.23±14.09	44.2±14.45 years
P value	0.42	

Table 3 shows the mean age of patients in both groups. The mean age of patients in group A was 41.23±14.09 years, and the mean age in group B was 44.2±14.45 years. There is no significant difference in the mean age between groups A and B, as per the T-test (P=0.42).

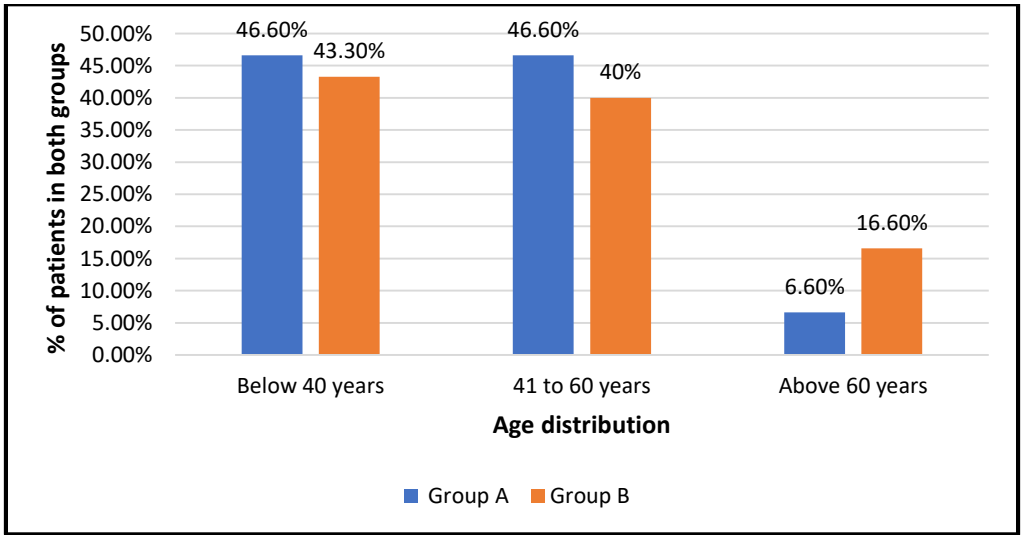

Fig 1: Age distribution of patients

Figure 1 shows the age distribution of patients in both groups. Most of the patients were aged below 40 years. The next most common age group was 41 to 60 years. Only 23.2% of patients were aged above 60 years.

4.2. Gender

Overall 63.3% of patients were males.

Table 4: The Gender Distribution of Patients

Gender	Group A	Group B	Total
Males	60%	66.6%	63.3%
Females	40%	33.3%	36.7%
Total	30	30	60

Table 4 shows the gender distribution of patients in groups A and B. 63.3% were males. 60% of patients were males in group A, and 66.6% were males in group B.

4.3. Risk category of patients

Most of the patients belong to low-risk patients in the current study.

Table 5: Risk category of patients

Risk category	Group A(N=30)	Group B(N=30)
Low risk	56.6%	6.66%
Moderate risk	26.6%	30%
High risk	13.3%	46.6%
Highest risk	3.3%	16.6%

Table 5 shows the risk category of patients between the two groups. Most patients belonged to a low-risk category, followed by high-risk, moderate-risk. The highest risk is seen at least only in 10% of patients overall.

4.4. Overall Demographic Variables

The following table shows overall demographic parameters.

Table 6: Demographic variables

Demographic parameters	Group A	Group B	P value
Mean age	41.23±14.09	44.2±14.45 years	0.42
Females	40%	33.3%	0.34
Males	60%	66.6%	
Low risk	56.6%	6.66%	0.58
Moderate risk	26.6%	30%	
High risk	13.3%	46.6%	
Highest risk	3.3%	16.6%	

Table 6 shows the overall demographic variables of patients between the two groups. There is no significant difference in the mean age or gender, or risk profile of patients between groups A and B in the current study.

4.5. Mean risk of patients

There is no significant difference in the mean risk score of patients between the two groups.

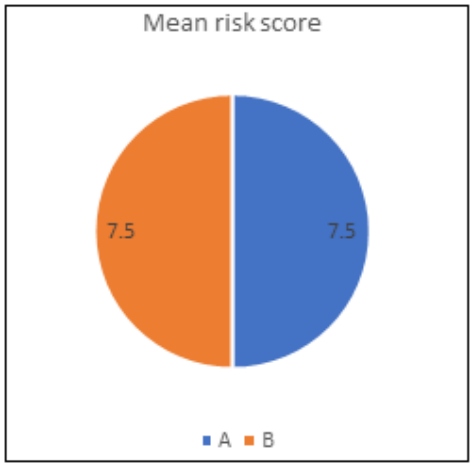

Fig 2: Mean risk score of patients

P VALUE 0.251

Figure 2 shows the mean risk score of patients of the two groups. There is no significant difference in the mean risk score of patients in both groups. The mean risk score in group A and B patients was 7.5.

4.6. Incidence of mechanical prophylaxis

There is a significant difference in the incidence of mechanical prophylaxis between the two groups. The overall incidence of mechanical prophylaxis is 61% in the current study.

Table 7: Incidence of mechanical prophylaxis

Prophylaxis	Group A(N=30)	Group B (N=30)	Total
No	66.65	10%	38%
Yes	33.3%	90%	61%
Chi-square:	20.37		
Highest risk	0.0001		

Table 7 shows the incidence of mechanical prophylaxis in both groups. It was 90% in group B patients and 33.3% in group A patient. It was significantly more in group B patients(p=0.0001).

4.7. *Incidence of Pharmacological Prophylaxis*

There is a significant difference in the incidence of pharmacological prophylaxis between the two groups. The overall incidence of drug or pharmacological prophylaxis is 40%.

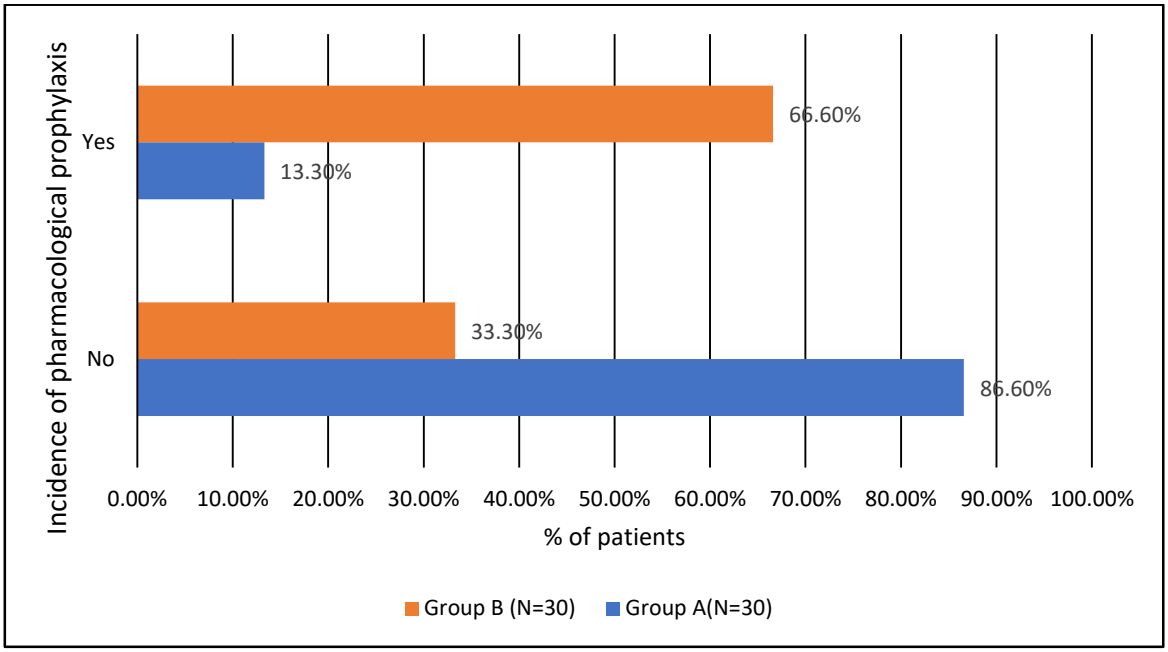

Fig 3: Incidence of pharmacological prophylaxis

Figure 3 shows the incidence of pharmacological prophylaxis in both groups. It was 66.6% in group B patients and 13.3% in group A patients. It was significantly more in group B patients(p=0.0001).

4.8. *Incidence of drug prophylaxis in 24 hours after surgery*

Table 8: Incidence of drug prophylaxis in 24 hours after surgery

Prophylaxis	Group A(N=30)	Group B (N=30)
No	93.3%	40%
Yes	6.6%	60%
Chi-square:	19.2	
Highest risk	0.0001	

Table 8 shows drug prophylaxis in both groups. It was significantly more in group B or phase II patients than in phase I or group A.

4.9. *Incidence of drug prophylaxis 5 days after surgery*

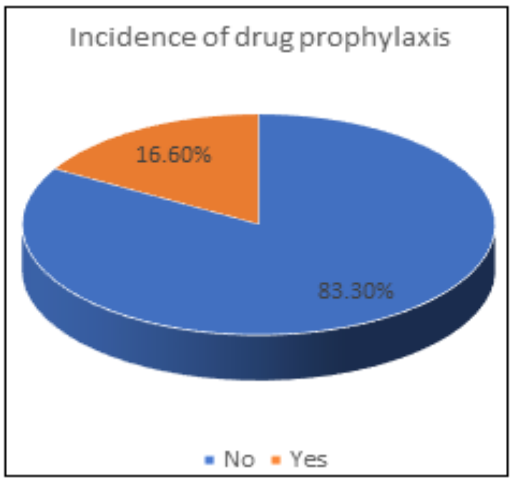

Fig 4: Incidence of drug prophylaxis 5 days after surgery

Figure 4 shows drug prophylaxis in both groups after 5 days. It was significantly more in group B or phase II patients compared to phase I or group A patients. (p=0.006)

4.10. Frequency of bleeding

Table 9: Frequency of bleeding in both groups		
Incidence of bleeding	**Group A(N=30)**	**Group B (N=30)**
No	96.6%	90%
Yes	3.3%	10%
Chi-square:	1.07	
Highest risk	0.30	

Table 9 shows the incidence of bleeding in both groups. There was no significant difference in the incidence of bleeding between the groups(p=0.30). It was 3.3% in Group A and 10% in Group B.

4.11. Incidence of mechanical prophylaxis as per risk factor category

Most of the patients belonged to the high-risk category for mechanical prophylaxis. Among all risk groups considered, statistically significant increased use of mechanical prophylaxis was observed in a high-risk group(category III) by indicating a good prognosis.

Table 10: Incidence of mechanical prophylaxis as per risk factor category		
Risk category	**Group A(N=30)**	**Group B (N=30)**
Low risk or category I	3.33%	3.33%
The moderate risk or category II	20%	26.6%
High-risk or category III	6	43.3%
The highest risk or category IV	3.33%	16.6%

Table 10: 3.33% of patients belonged to low risk. 43.3% of group B patients were of high risk, and 16.6% were the highest risk or category IV patients.

4.12. Incidence of drug prophylaxis as per risk factor category

Most of the patients belonged to the high-risk category for drug prophylaxis. Among all risk groups considered, statistically significant increased pharmacological / drug prophylaxis use was observed with the high-risk group (category III), indicating the best prognosis. Out of 41 patients eligible to receive pharmacological prophylaxis (excluding low-risk groups -where pharmacological prophylaxis is not recommended),58.5% (24 patients) were given drug prophylaxis after administering risk assessment cards for DVT. High-risk groups are considered beneficial with the combined use of drugs and mechanical prophylaxis.

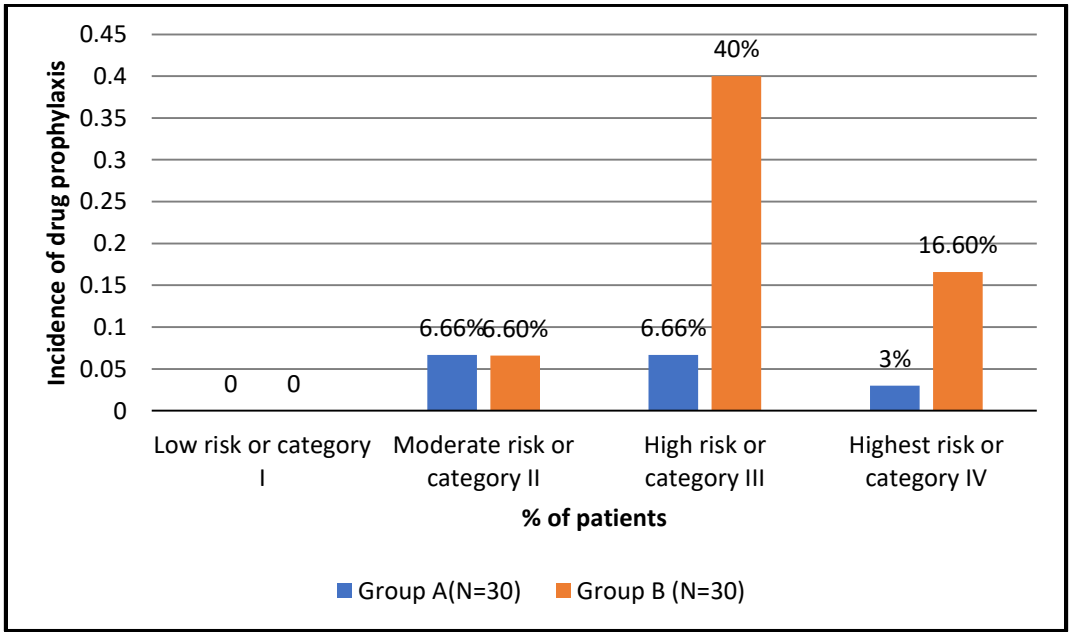

Fig 5: Incidence of drug prophylaxis as per risk factory category

Figure 5: No patient belonged to low risk. 6.66% of patients belonged to moderate risk. 40% of group B patients were high-risk, and 16.6% belonged to the highest risk or category IV.

4.13. High-risk diseases and incidence of DVT

Table 11: Shows high-risk disease incidence among DVT patients.

High-risk disease	Incidence of high-risk disease among DVT patients
HTN	6%
Diabetes	12%
Malignancy	24%
Varicose veins	18%
Heart disorders	24%
Previous DVT	36%
Anemia	12%

Table 11 shows the relation between high-risk disorders among DVT patients. Previous DVT showed the highest incidence, followed by heart disorders, varicose veins and malignancy, diabetes, anemia, and hypertension.

5. DISCUSSION

The current study identified patients at high risk of developing DVT using risk assessment cards developed by ACCP to initiate early thromboprophylaxis. Most VTEs can be avoided using various risk assessment models (RAM) and thromboprophylaxis, but VTE prophylaxis was largely underutilized[20-21] The incidence of DVT is around 25 to 40% in the general surgery department, as per previous studies.[22-23]American Society of Hematology guidelines[24-26] for managing VTE recommended prophylaxis for hospitalized and non-hospitalized medical patients. Strong recommendations included providing drug or pharmacological VTE prophylaxis in acutely ill inpatients at acceptable bleeding risk and using mechanical prophylaxis when bleeding risk is unacceptable. They are against using direct oral anticoagulants during hospitalization and pharmacological prophylaxis after hospital discharge. Conditional recommendations included not using VTE prophylaxis routinely in long-term care patients or outpatients with minor VTE risk factors. The panel conditionally recommended using graduated compression stockings or low-molecular-weight heparin in long-distance travelers only if they are at high risk for VTE.The incidence of VTEs is 30% to 100% more among African-Americans than whites.[27-28] There is no gender predominance for DVT. Still, males are more likely to have recurrent DVTs as per Faria et a.[29]Our study patients are divided based on risk assessment cards into low, moderate, high, and highest-risk groups. It was found that most of the patients were aged below 40 years, most of them were males, and most of the patients belonged to the low-risk group as per the risk assessment card ACCP. Most of the patients belonged to the high-risk category for drug prophylaxis. Among all risk groups considered, statistically significant increased pharmacological / drug prophylaxis use was observed with the high-risk group (category III), indicating the best prognosis. Out of 41 patients eligible to receive pharmacological prophylaxis (excludes-risk risk group -where pharmacological prophylaxis is not recommended),58.5% (24 patients) were given drug prophylaxis after administering risk assessment cards for DVT. High-risk groups are considered beneficial with the combined use of drugs and mechanical prophylaxis. Serdar and Knudson et al. analyzed 450,375 patients and found 6 factors independently significant for VTE in trauma patients. These factors were: age above 40 years, lower extremity fracture with AIS (abbreviated injury score) more than 3, ventilator days > 3, head injury with AIS ≥ 3, venous injury, and a major operative procedure.[30]In the DRAT study, a prospective pre-and post-intervention study done among medical inpatients, DVT and bleeding risks were stratified using Risk Assessment Model (RAM). Among 286 patients, 142 belonged to the pre-intervention group, and 144 belonged to the post-intervention group. The overall prevalence of DVT prophylaxis use was found to be 10.8%. Thromboprophylaxis prescribing increased from 64.8% to 68.1% after the implementation of DVT, the risk assessment tool. DRAT intervention was found to be a significant predictor of thromboprophylaxis usage.[31]Zhou et al. did a retrospective case-control study with 902 patients in each arm who examined the VTE discriminatory capacity of RAM and Padua score in medical patients admitted to a large general hospital in China. The authors showed a linear relationship between the Caprini RAM and the risk of VTE. The high-risk classification was linked to an increased risk of VTE, as per the odds ratio.[32]Fritz et al. did a study on DVT risk stratification. 330 adults were included. Compared to institution-based VTE RAM, providers stratified patients at a higher VTE risk than institution-based VTE RAM. VTE incidence was found to be 0.3%. The study found a significant discordance between providers' VTE risk assessment and the one predicted by RAMs. [33]Raphael et al. did a study on a French cohort that included 1,881 patients with a first symptomatic VTE. During a 4.8-year follow-up after discontinuing anticoagulation therapy, 12.2% of patients had symptomatic recurrent VTE. Subjects with unprovoked VTE had a 2-times increased recurrence risk compared to subjects with VTE and major transient risk factors. [34]

5.1. Limitations

The study was conducted only among patients admitted to the general surgery department, which may not be the representative population. The sample size in the study needs to be bigger for the generalization of results. , But a wide range of age- all patients above 18 years, the inclusion of both genders and risk categories are strong indicators that the sample was a fair representation of common clinical settings under investigation. Patients were followed up only for 6 months. Most of the risk factors in patients may persist even after hospitalization.

6. CONCLUSION

Introducing risk assessment cards for DVT in patients' case sheets was an effective and cost-effective way of improving

overall prophylaxis for DVT. The overall incidence of mechanical prophylaxis is 61% in the current study, and drug prophylaxis is 40%. Due to the high incidence, we recommend the appropriate use of prophylactic methods based on risk category stratification, which helps to reduce the incidence of thromboembolism.

7. ACKNOWLEDGMENTS

We sincerely thank the Principal and Superintendent and Institutional ethics committee of Siddhartha Medical College, Vijayawada. We want to thank all our patients who participated in the study.

8. AUTHORS CONTRIBUTION STATEMENT

Dr. Kari Veerabhadra Swamy and Dr. Ravi Kumar Kathi collected patient data through a case record form. Dr. Mude Sarala did the statistical analysis. Dr. Megavath Motilal designed and planned the entire study. All the authors drafted and approved the final version of the manuscript.

9. CONFLICT OF INTEREST

Conflict of interest declared none.

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