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Original Research Article

In-Hospital Prevalence and Risk Factors of Deep Vein Thrombosis Following Elective Major Abdominal Surgery: A Prospective Observational Study

Seema P. Sune[1], Bhagwan Aname[2], K. V. Arpitha Nayaka[3]

[1]Associate Professor Department of Surgery, Dr Rajendra Gode Medical College and Hospital Amravati
[2]Assistant Professor, Department of Surgery, Dr Rajendra Gode Medical College and Hospital Amravati
[3]Senior Resident, Department of Surgery, Dr Rajendra Gode Medical College and Hospital Amravati

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Corresponding Author: Dr. Seema P. Sune
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Abstract:

Background: Deep vein thrombosis (DVT) is a major cause of preventable morbidity and mortality after major abdominal surgery. Although pharmacological thromboprophylaxis is recommended internationally, mechanical methods alone are still commonly used in many low- and middle-income healthcare settings. The true burden of postoperative DVT under this strategy remains under-reported. This study aimed to determine the in-hospital prevalence of DVT and identify associated risk factors among patients undergoing elective major abdominal surgery.

Methods: This prospective observational cohort study included 200 consecutive adult patients undergoing elective major abdominal surgery at Dr. Rajendra Gode Medical College, Amravati, India, following Institutional Ethics Committee approval (2023). All patients received mechanical thromboprophylaxis using graduated compression stockings and intermittent pneumatic compression devices. Bilateral lower-limb Doppler ultrasonography was performed in all patients before hospital discharge. Demographic, clinical, and intraoperative variables were recorded. The primary outcome was the prevalence of objectively confirmed postoperative DVT.

Results: The overall in-hospital prevalence of DVT was 15% (29/200). Colectomy had the highest DVT prevalence (25.7%), followed by gastrectomy (14.0%) and liver resection (13.3%). Age >65 years, body mass index (BMI) >30 kg/m², prolonged operative duration (>180 minutes), and prior venous thromboembolism were significantly associated with DVT ($p < 0.05$).

Conclusion: A substantial burden of postoperative DVT was observed in patients receiving mechanical thromboprophylaxis alone after major abdominal surgery. Risk-stratified incorporation of pharmacological prophylaxis may significantly reduce thromboembolic complications in high-risk patients.

Keywords: Deep Vein Thrombosis, Abdominal Surgery, Thromboprophylaxis, Doppler Ultrasound, Surgical Outcomes.

Introduction

Venous thromboembolism (VTE), deep vein thrombosis (DVT) and pulmonary embolism are some of the major causes of preventable morbidity and mortality among hospitalized surgical patients [1,2]. Major abdominal surgery causes a hyperpro-thrombotic condition, which is caused by endothelial injury, inflammatory response, venous stasis due to anesthesia and immobilization, and postoperative hypercoagulability. Postoperative DVT remains a major health system burden across the world despite the current advancements in perioperative care.

Surgeries that are at high risk of postoperative VTE include colorectal, gastric and hepatobiliary surgeries [3,4]. These are somewhat prolonged procedures that require a lot of tissue dissection and are mostly done to patients with malignancy, obesity or advanced age. Accordingly, the American College of Chest Physicians recommends a combination of mechanical and pharmacological thromboprophylaxis against patients undergoing major abdominal surgery, particularly in combination with other risk factors [5-7].

Nevertheless, in everyday practice, pharmacological prophylaxis is not given due to concerns on bleeding and surgical drains, cost, and monitoring, especially in low- and middle-income countries. Though efficient in lessening venous stasis, mechanical methods fail to attend to hypercoagulable state that surgery causes and thus might be inadequate when administered alone [8].

Under-diagnosis is another significant limitation to estimate postoperative DVT. Most thrombotic complications manifest themselves without symptoms during the initial phases of postoperative care. Duplex Doppler ultrasonography is a routine procedure that enables the objective identification of symptomatic and asymptomatic DVT and more precise estimation of postoperative thrombotic burden [9].

The current research was done to measure the in-hospital incidence of postoperative DVT and the risk factors in patients who undergo an elective major abdominal surgery with a spinal thromboprophylaxis regimen.

Materials and Methods

Study Design and Setting: The study was a prospective observational cohort study that was carried out in the Department of Surgery, Dr. Rajendra Gode Medical College and Hospital, Amravati, Maharashtra, India. In 2023, the research was approved by the Institutional Ethics Committee.

Participants: Two hundred non-surgical adult patients (>18 years) with major abdominal surgery (colectomy, gastrectomy, liver resection, and other major gastrointestinal surgery) who are under an elective setting were used. Surgeries out of emergency were not included.

Thromboprophylaxis: Mechanical thromboprophylaxis was administered to all the patients through the use of graduated compression stocking and intermittent pneumatic compression. Pharmacological anticoagulation was not regularly given.

Data Collection: Baseline data was age, sex, BMI, comorbidity, malignancy status and history of venous thromboembolism. Procedures type and operating time were the operative data.

DVT Surveillance: Doppler ultrasound of lower limbs was performed bilaterally on all patients prior to discharging them. The major endpoint was in-hospital postoperative DVT.

Statistical Analysis: Change of associations was checked by chi-square test. A p- value of less than 0.05 was taken as significant.

Results

Two hundred patients were compared. Table 1 presents baseline characteristics. The average age was 58.4 +- 12.6 years and 25% of them are older than 65 years. Obesity (BMI >30 kg/m2) was observed in 30%, malignancy in 41 and 40 percent of procedures were over 180 minutes.

Table 1: Baseline characteristics (n=200)

Variable	Value
Age >65 years	50 (25%)
Male sex	124 (62%)
BMI >30 kg/m²	60 (30%)
Malignancy	82 (41%)
Prior VTE	20 (10%)
Operative time >180 min	80 (40%)

The distribution of procedures is shown in Table 2.

Table 2. Surgical procedures

Procedure	Patients
Colectomy	70
Gastrectomy	50
Liver resection	30
Other	50

The overall in-hospital DVT prevalence was 15% (29/200). Procedure-specific DVT rates are shown in Table 3. Colectomy had the highest burden (25.7%).

Table 3: DVT prevalence by procedure

Procedure	DVT (%)
Colectomy	25.7
Gastrectomy	14.0
Liver resection	13.3
Other	0

Risk factor associations are presented in Table 4. Advanced age, obesity, prior VTE, and prolonged surgery were all significantly associated with postoperative DVT.

Table 4: Risk factors associated with DVT

Risk factor	DVT (%)	p-value
Age >65 years	24	0.003
BMI >30 kg/m²	25	0.005
Prior VTE	25	0.040
Operative time >180 min	25	0.002

Discussion

Such a prospective observational cohort study proves the high in-hospital burden of deep vein thrombosis following an elective major abdominal surgery when the use of mechanical thromboprophylaxis is only available. The prevalence of overall postoperative DVT was 15% which was very high in patients who had undergone colectomy and had prior clinical risk factors. These results possess significant implications to perioperative thromboprophylaxis plans in resource constrained surgical units.

The prevalence of DVT in our cohort of patients is similar to what has been reported in the historical surgical groups before pharmacological anticoagulation became a routine practice. In the general surgical patients, postoperative DVT was reported between 15% and 30 percent in large studies that were carried out during the pre-prophylaxis era [7,10-12]. Conversely, in comparison, more recent series with combined mechanical and pharmacological prophylaxis, show a much lower rate, usually less than 5% [5,10]. The fact that our study showed a 15 per cent burden to have persisted heavily, therefore, points heavily on the fact that the mechanical means are not sufficient in ensuring a full counteraction against the hypercoagulable state created by major abdominal surgery.

There were obviously procedure-specific variations in the thrombotic risk. Colectomy had the greatest prevalence of DVT (25.7%), which is consistent with large population-based studies which have shown that colorectal surgery is one of the most at risk postoperative VTE procedures amongst general surgical operations [3]. This association could be attributed to a number of mechanisms, such as a longer operative period, a lot of tissue dissection, bowel manipulation, and high rates of prevailing malignancy and inflammatory conditions in this patient population. These factors work in harmony to enhance endothelial injury, platelet activation and systemic coagulation pathway activation, which produced an ideal environment of thrombogenesis.

Old age became a major predictor of postoperative DVT. The incidence of thrombosis was more than twice in patients aged 65 years and above than in younger patients. Key factors contributing to such an increased risk include age-related dysfunction of endothelium, decreased fibrinolytic activity and elevated levels of coagulation factors in a baseline [11]. Moreover, the elderly become mobilized later postoperative, commonly with an augmented comorbid disease burden, which contributes to deep vein stasis and thrombotic vulnerability, further.

Another strong predictor of post-operative DVT in our cohort was obesity. The DVT prevalence of patients with BMI of above 30 kg/m2 was 25% with both mechanical and metabolic factors attributed to thrombosis. High intra-abdominal pressure, dysfunctional venous drainage, and fat-tissue-induced inflammation favor a pro-thrombotic environment of obese patients [6]. The results prove the necessity to consider obesity as a key weighting in clinical risk stratification tools like a Caprini score.

The risk factor that was strongest intraoperative was prolonged operative duration. The rates of deep vein thrombus were three times higher amongst patients whose operations took over 180 minutes than with patients whose operations took less time. The long surgical time is related to long venous stasis, increased tissue damage, increased inflammatory mediators release, and slowed postoperative mobility, all of them significantly increase the risk of thrombosis. This observation demonstrates that especially bold thromboprophylaxis is required in patients who are confronted with complicated or lengthy abdominal operations [13, 14].

History of a venous thromboembolism in the past was also linked to a significantly high risk of postoperative DVT [15]. This is because the idea that prior VTE is one of the best predictors of future thrombotic events is already established probably because of the continued pro-thrombotic inclination, endothelial dysfunction, or genetic disposition. These patients become one of the most high-risk groups, where mechanical prophylaxis is obviously insufficient [16].

Weaknesses of this study include the fact that routine Doppler ultrasonography is used to assess outcomes. Numerous DVTs do not have symptoms after surgery and a clinical diagnosis alone may not identify the actual disease burden by as much as 50. The organized screening of patients at discharge allowed us to capture both symptomatic and asymptomatic events in order to have a better representation of thrombotic risk in post-operative setting in this group of patients.

Nevertheless, this research is also a limitation. The surveillance duration was confined into in-hospital phase and late post discharge thromboembolic events were not included. A number of studies have

indicated that a high percentage of VTE postoperative is experienced after hospital discharge especially in abdominal and cancer surgery. So most likely our prevalence is understated on the real 30-day postoperative DVT burden. Also, lack of pharmacological prophylaxis comparison group restricts direct measurement of the protective effect of anticoagulation in which such a group is absent.

In spite of these shortcomings, our clinical implications are evident. A purely mechanical approach to thromboprophylaxis has a significant proportion of non-protected patients at risk of postoperative DVT, especially patients of advanced age, obese patients, and the long-duration surgery, or patients with history of thromboembolism. A more pragmatic yet cost-efficient alternative in an environment where universal anticoagulation is not yet implemented can include a risk-stratified strategy inclusive of pharmacological prophylaxis among high-risk patients.

Conclusion

Mechanical thromboprophylaxis is linked with high-risk postoperative DVT with the use of elective major abdominal surgery. Pharmacological prophylaxis could also be used to prevent otherwise preventable thromboembolic adverse events and this was observed more in high-risk patients such as those who had obesity, advanced age, extended surgical duration, or a history of venous thromboembolism. This is in keeping with an already established idea that prior VTE is among the best predictors of future thrombotic episodes, probably because of persistence of pro-thrombotic predisposition, dysfunction of endothelium or genetic predisposition. These patients form a very high-risk group of which mechanical prophylaxis is obviously insufficient.

The application of routine Doppler ultrasonography in terms of outcome assessment can be considered one of the strengths in this study. A number of postoperative DVTs are asymptomatic and the use of clinical diagnosis only may undervalue the true disease burden to a 50 percent reduction. We managed to capture both asymptomatic and symptomatic events because we screened all patients before discharge, which gave a better representation of the postoperative thrombotic risk in this patient group.

Nevertheless, this work also has its flaws. The surveillance was restricted to the in-hospital period and late post-discharge thromboembolic events were missed. Some of the studies have revealed that they found that a great percentage of postoperative VTE is post-hospital discharge especially after abdominal and cancer surgery. Thus, the prevalence values we report were probably a low estimate of the actual 30-day postoperative DVT burden. Also, without a pharmacological prophylaxis comparison group we are limited in our ability to directly measure the protective impact of anticoagulation in this cohort.

In spite of these limitations our clinical implications are evident. A mechanical-alone thromboprophylaxis approach exposes a significant number of patients to the risk of postoperative DVT, especially those who are elderly, obese, have a long surgery, or who have a history of thromboembolism. Even in the environment where pharmacological prophylaxis of high-risk patients with a risk-stratified approach using anticoagulation with the absence of routine anticoagulation is implemented, the risk-stratified high-risk patient-based approach with pharmacological prophylaxis against high-risk may be a viable and cost-effective solution.

Conclusion

When mechanical thromboprophylaxis is used to prevent postoperative DVT, the risk of this problem among elective major abdominal surgery is high. Pharmacological prophylaxis can be used to prevent preventable thromboembolic complications in high-risk patients, especially patients who are obese, aged, undergoing prolonged surgery, or have had thromboembolism.

Ethics Statement: The Institutional Ethics Committee of Dr. Rajendra Gode Medical College and Hospital, Amravati approved this study (2023). Informed consent was secured by means of written consent.

Conflict of Interest: The authors declare no conflicts of interest.

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