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ASSESSMENT OF RISK FACTORS FOR POSTOPERATIVE DEEP VEIN THROMBOSIS IN PATIENTS UNDERGOING MAJOR ABDOMINAL SURGERY

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Abstract

Background: *The development of postoperative deep vein thrombosis (DVT) remains a significant cause of morbidity and potential mortality in patients undergoing major abdominal surgery. Identifying risk factors is essential to guide preventive strategies and reduce the burden of thromboembolic complications.*

Objectives: *To assess the frequency and associated risk factors of postoperative DVT in patients undergoing major abdominal surgeries.*

Study Design & Setting: *This was a cross-sectional analytical study conducted at Shaikh Zayed Hospital Lahore over six months.*

Methodology: *A total of 120 patients aged 18 years and above who underwent major abdominal surgeries were enrolled using non-probability consecutive sampling. Patients with known coagulopathies, preoperative DVT, or on chronic anticoagulation therapy were excluded. Demographic, clinical, and surgical data were collected. Postoperative DVT was assessed using clinical signs and confirmed by duplex Doppler ultrasonography between postoperative days 3 to 7. Data were analyzed using SPSS version 25.0, and p-values <0.05 were considered statistically significant.*

Results: *The mean age of patients was 52.6 ± 13.4 years, with 56.7% males. The overall frequency of postoperative DVT was 15%. Statistically significant risk factors for DVT included age >60 years (p=0.004), obesity (p=0.027), diabetes mellitus (p=0.023), malignancy (p=0.045), operative duration >180 minutes (p=0.006), blood transfusion (p=0.018), and omission of prophylactic anticoagulation (p=0.001).*

Conclusion: *Postoperative DVT is a common complication following major abdominal surgery. Early identification of high-risk patients and implementation*

of appropriate thromboprophylaxis can significantly reduce thromboembolic events.

INTRODUCTION

Deep vein thrombosis (DVT) is a significant postoperative complication that carries the risk of substantial morbidity and mortality, particularly when associated with major surgical procedures.[1] Among surgical disciplines, major abdominal surgery is recognized as a high-risk category due to multiple contributing factors such as extended operative times, prolonged immobilization, tissue trauma, and altered coagulation profiles.[2,3] DVT involves the formation of a thrombus within the deep venous system, most commonly in the lower extremities, and if not diagnosed and managed timely, it may progress to life-threatening pulmonary embolism (PE).[4,5]

The pathophysiology of DVT centers around Virchow's triad, which includes venous stasis, endothelial injury, and hypercoagulability. Venous stasis occurs due to prolonged immobility and decreased muscle contractions that impair blood flow, especially in the lower extremities.[6,7] Endothelial injury, often triggered by surgical manipulation, vascular trauma, or the presence of central venous catheters, leads to the exposure of subendothelial tissue and activation of platelets.[8] Simultaneously, the body's response to surgery results in a hypercoagulable state due to increased levels of clotting factors, reduced fibrinolysis, and inflammatory cytokine release. This environment favors thrombus formation, particularly in the deep veins where blood flow is slower. Once formed, the thrombus can enlarge and propagate proximally, or fragments may dislodge and travel to the lungs, causing a pulmonary embolism.[9,10]

Numerous studies have documented that patient-specific factors such as increasing age, obesity, previous history of thromboembolism, malignancy, and inherited thrombophilia considerably increase the risk of postoperative DVT.[11,12] Additionally, perioperative elements like the type and duration of surgery, anesthesia, and the extent of intraoperative blood loss have also been implicated. Surgical stress leads to a prothrombotic state characterized by endothelial injury, venous stasis, and activation of the coagulation cascade—a triad first described by Virchow.[13]

Despite advances in prophylactic strategies, including early ambulation, mechanical devices such as compression stockings, and pharmacological interventions like low molecular weight heparin (LMWH), DVT continues to present a clinical challenge, especially in low- and middle-income countries (LMICs) where standardized preventive protocols are not consistently implemented. Moreover, asymptomatic DVT cases often go undiagnosed, and only manifest when complications such as PE develop, further underscoring the importance of targeted risk assessment and prevention.[14]

This study aims to assess and identify the risk factors associated with postoperative DVT in patients undergoing major abdominal surgeries. By evaluating a combination of demographic, clinical, and surgical variables, we seek to highlight the predictors most significantly associated with thrombotic risk. Given the increasing burden of abdominal surgeries and the potentially fatal consequences of DVT, there is a pressing need to refine our understanding of associated risk factors. Identifying high-risk patients preoperatively is critical to implementing evidence-based thromboprophylaxis. The findings from this study may contribute to the development of risk stratification models and enhance perioperative care strategies to prevent thromboembolic events in surgical populations.

MATERIALS AND METHODS

This cross-sectional analytical study was conducted at the Department of Surgery, at Shaikh Zayed Hospital Lahore over six months from November 2024 to April 2025 after approval from the institutional ethical review board. A total of 120 patients undergoing major abdominal surgery were included in the study through non-probability consecutive sampling. The sample size of 120 was calculated using OpenEpi software, keeping a confidence level of 95%, a margin of error of 5%, and taking an expected frequency of postoperative DVT of 15% based on previous literature.

Patients aged 18 years and above, of either gender, who underwent elective or emergency major abdominal procedures (including but not limited to gastrointestinal resections, hepatobiliary surgeries, and oncologic abdominal surgeries) were included. Patients with known coagulation disorders, those on preoperative anticoagulation therapy, pregnant women, or patients with pre-existing lower limb DVT confirmed by Doppler ultrasonography were excluded.

Data were collected using a predesigned proforma that included demographic details (age, sex, BMI), clinical parameters (comorbidities such as diabetes, hypertension, malignancy), and surgical factors (type of surgery, duration, blood loss, need for transfusion, and type of anesthesia). All patients were evaluated postoperatively for signs and symptoms of DVT such as unilateral limb swelling, tenderness, warmth, and pain. Duplex Doppler ultrasonography was performed between postoperative days 3 to 7 or earlier if clinical suspicion of DVT arose. Risk factors were assessed and correlated with the presence or absence of DVT. All patients received standard postoperative care, and thromboprophylaxis was administered as per hospital protocol, which included mechanical methods and pharmacological agents such as low molecular weight heparin unless contraindicated.

Data were analyzed using SPSS version 25.0. Categorical variables such as gender, presence of comorbidities, and occurrence of DVT were presented as frequencies and percentages. Continuous variables such as age, BMI, and duration of surgery were expressed as mean ± standard deviation. Chi-square test or Fisher's exact test was used for comparison of categorical variables, while independent t-test was applied for continuous variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1 presents the baseline demographic and clinical characteristics of the 120 patients included in the study. The mean age of the patients was 52.6 ± 13.4 years. Males comprised the majority with 68 patients (56.7%), while females were 52 (43.3%). The mean BMI was 27.9 ± 4.8 kg/m², with 39 patients (32.5%) classified as obese (BMI ≥ 30). Among the comorbidities, 45 patients (37.5%) were diabetic, 50 (41.7%) were hypertensive, and 36 (30.0%) had underlying malignancy. A smoking history was noted in 24.2% of cases, while 11 patients (9.2%) had a previous history of DVT.

As shown in Table 2, elective surgeries were more frequent (70.8%) compared to emergency procedures (29.2%). The mean duration of surgery was 174.2 ± 46.8 minutes, and the average estimated intraoperative blood loss was 422.5 ± 188.7 mL. Blood transfusion was required in 32 patients (26.7%). General anesthesia was administered in the majority of cases (85.0%), and 92.5% of the patients received prophylactic anticoagulation postoperatively.

Table 3 displays the frequency of postoperative DVT in the study population. Out of 120 patients, 18 (15.0%) developed postoperative DVT, while 102 (85.0%) did not show any evidence of thrombus formation based on clinical examination and duplex Doppler ultrasonography.

Table 4 illustrates the association of various risk factors with the development of postoperative DVT. Patients aged above 60 years were significantly more likely to develop DVT (55.6% vs. 21.6%, p = 0.004). Obesity was also significantly associated, with 55.6% of DVT patients having a BMI ≥ 30 (p = 0.027). Diabetes mellitus (61.1% vs. 33.3%, p = 0.023) and malignancy (50.0% vs. 26.5%, p = 0.045) were also statistically significant risk factors. A longer duration of surgery (>180 minutes) was present in 66.7% of patients with DVT compared to 30.4% in those without (p = 0.006). Patients requiring blood transfusions were more likely to develop DVT (50.0% vs. 22.5%, p = 0.018). Notably, omission of prophylactic anticoagulation was significantly associated with DVT occurrence (27.8% vs. 3.9%, p = 0.001). No statistically significant difference was found for gender (p = 0.526) or type of surgery (elective vs. emergency, p = 0.129).

Table 1: Baseline Demographic and Clinical Characteristics of Patients (n = 120)

Variable	Frequency (%) or Mean ± SD
Age (years)	52.6 ± 13.4
Gender	
- Male	68 (56.7%)
- Female	52 (43.3%)
BMI (kg/m²)	27.9 ± 4.8
Obesity (BMI ≥ 30)	39 (32.5%)
Diabetes Mellitus	45 (37.5%)
Hypertension	50 (41.7%)
Malignancy	36 (30.0%)
Smoking History	29 (24.2%)
Previous DVT History	11 (9.2%)

Table 2: Surgical and Postoperative Variables

Variable	Frequency (%) or Mean ± SD
Type of Surgery	
- Elective	85 (70.8%)
- Emergency	35 (29.2%)
Duration of Surgery (minutes)	174.2 ± 46.8
Estimated Blood Loss (mL)	422.5 ± 188.7
Blood Transfusion Required	32 (26.7%)
Type of Anesthesia	
- General	102 (85.0%)
- Regional	18 (15.0%)
Prophylactic Anticoagulation Given	111 (92.5%)

Table 3: Frequency of Postoperative Deep Vein Thrombosis

DVT Status	Frequency (%)
DVT Detected	18 (15.0%)
No DVT	102 (85.0%)

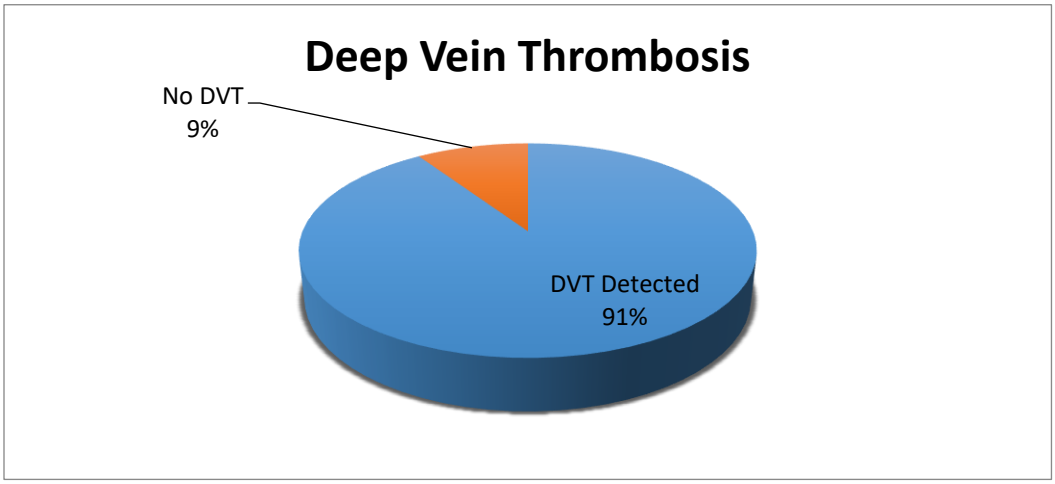

Figure 1: Frequency of Postoperative Deep Vein Thrombosis

Table 4: Association of Risk Factors with Postoperative DVT

Risk Factor	DVT Present (n = 18)	No DVT (n = 102)	p-value
Age > 60 years	10 (55.6%)	22 (21.6%)	0.004
Female Gender	9 (50.0%)	43 (42.2%)	0.526
Obesity (BMI ≥ 30)	10 (55.6%)	29 (28.4%)	0.027
Diabetes Mellitus	11 (61.1%)	34 (33.3%)	0.023
Malignancy	9 (50.0%)	27 (26.5%)	0.045
Duration >180 mins	12 (66.7%)	31 (30.4%)	0.006
Emergency Surgery	8 (44.4%)	27 (26.5%)	0.129
Blood Transfusion Given	9 (50.0%)	23 (22.5%)	0.018
Prophylaxis Omitted	5 (27.8%)	4 (3.9%)	0.001

DISCUSSION

Deep vein thrombosis (DVT) is a serious postoperative complication that can lead to life-threatening pulmonary embolism. Patients undergoing major abdominal surgery are at increased risk due to prolonged immobilization, tissue trauma, and hypercoagulable states.[15] The condition is influenced by both patient-related and surgical factors, including age, obesity, malignancy, and procedure duration. Virchow's triad—venous stasis, endothelial injury, and hypercoagulability—explains the underlying mechanism of thrombus formation.[16] Early diagnosis and prophylaxis are essential to reduce morbidity and mortality. This study aims to assess risk factors contributing to postoperative DVT in abdominal surgery patients.

In our study involving 120 patients undergoing major abdominal surgery, the incidence of postoperative deep vein thrombosis (DVT) was found to be 15%, which is comparable to the 12.3% incidence reported by Li et al. (2021) in their cohort of 390 patients. Similar to their findings, age was a significant risk factor; we observed that patients over 60 years had a markedly higher occurrence of DVT (55.6% vs. 21.6%, p=0.004), corroborating Li et al.'s identification of age >50 years as an independent risk factor. While Li et al. also highlighted hypertension and elevated D-dimer as key factors, our study found diabetes mellitus and malignancy to be significant comorbid conditions associated with DVT (p=0.023 and p=0.045 respectively), differing slightly from their findings where diabetes was not statistically significant.

Our results align closely with Muleledhu et al., who reported a 15.9% DVT rate in a population with a mean age of 58.4 ± 9.59 years and substantial comorbidities including hypertension (65.9%) and diabetes (47.7%). Our mean patient age of 52.6 years and similar prevalence of diabetes (37.5%) and hypertension (41.7%) further support the demographic and clinical overlap between these patient populations.[16] Unlike Muleledhu et al., we found no significant gender association with DVT, consistent with Li et al.'s and Kuttanchettiyar et al.'s observations.[16,17]

Comparing to Aylin et al. (2018), who reported a much lower prevalence of venous thromboembolism (5.6 per 10,000 postoperative patients) but also highlighted malignancy in 27.6% and comorbid diseases in 46.3%, our malignancy prevalence was 30%, with malignancy showing a significant association with DVT.[18] Additionally, Aylin et al. noted low utilization of pharmacologic thromboprophylaxis (24.4%), whereas in our study, prophylactic anticoagulation was administered to 92.5% of patients, yet 15% still developed DVT, emphasizing that while prophylaxis reduces risk, it does not eliminate it, particularly in high-risk groups.[18]

Lorchaivej et al. (2022) reported a lower postoperative DVT incidence of 5.4% in 112 patients, but importantly found malignancy in 39.3% of patients and identified age >60 years and perioperative blood transfusion as independent risk factors. These findings parallel our results where prolonged surgery time (>180 minutes) and blood transfusion significantly increased DVT risk (p=0.006 and p=0.018 respectively).[19] Their higher malignancy prevalence and lower DVT incidence

could be due to differences in patient selection and prophylaxis protocols.

In contrast, Kuttanchettiyar et al. (2018) documented a very low DVT incidence of 1.19% among 334 postoperative patients, with minimal use of thromboprophylaxis, indicating a possible underdiagnosis or lower baseline risk in their population.[20] Our substantially higher incidence likely reflects differences in patient risk profiles, diagnostic rigor (routine Doppler assessment in our study), and inclusion criteria.

Overall, our findings affirm that postoperative DVT remains a significant risk in major abdominal surgery, with age, obesity, diabetes, malignancy, prolonged surgery, transfusion, and inadequate prophylaxis being key contributors. These risk factors are largely consistent with previously published data, although prevalence rates vary, underscoring the importance of patient selection, diagnostic strategies, and thromboprophylaxis adherence in different clinical settings.

This study provides focused insight into DVT risk factors specifically among patients undergoing major abdominal surgery, a high-risk group often under-monitored in low-resource settings. A standard diagnostic modality (duplex Doppler) was used for all patients to ensure accuracy. Inclusion of both elective and emergency surgeries adds generalizability. However, the single-center design may limit external validity. The cross-sectional design restricts causal inference. Additionally, asymptomatic DVT before surgery may have gone undetected due to lack of routine preoperative Doppler screening.

CONCLUSION

Postoperative DVT occurred in 15% of patients undergoing major abdominal surgery, with age >60, obesity, diabetes, malignancy, longer operative time, transfusion, and lack of prophylaxis identified as significant risk factors. Early identification and targeted prevention strategies are essential. Integrating risk assessment protocols can improve surgical outcomes and reduce thromboembolic complications.

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