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**ORIGINAL ARTICLE**

# A Study on Screening for Deep Vein Thrombosis in Post Operative Patients

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## Abstract

**Introduction:** Deep vein thrombosis (DVT), a significant post-operative complication leads to severe outcomes, including pulmonary embolism, which is often fatal. Several researches indicate that the prevalence of DVT varies geographically, with a comparatively lower prevalence among Asian populations compared to Western counterparts. Risk factors for DVT include malignancy, pregnancy, prolonged immobilization, and endothelial damage arising due to surgical interventions. This study aims to investigate the incidence of DVT in post-operative participants undergoing major abdominal surgeries and evaluate the associated risk factors so as to highlight the importance of timely prophylaxis and screening. **Methods:** This cross-sectional study was conducted at a tertiary care teaching hospital, among a total of 100 participants who underwent elective or emergency major abdominal surgeries for a time duration of minimum half an hour. A structure study proforma was used as a study tool, and the primary outcome of interest was the occurrence of DVT in the lower limbs, assessed using bilateral lower limb Doppler ultrasonography on postoperative days 3 and 5. Data were analyzed using SPSS version 27. **Results:** Our study observed that 21% of participants developed DVT, with the highest occurrence among those with pregnancy-related complications (100%), followed by trauma/injury (22.22%), and gastrointestinal perforations (19.04%). The duration of surgery was directly proportional to DVT occurrence. Additionally, none of the participants who received prophylactic low molecular weight heparin (LMWH) developed DVT. **Conclusion:** This study highlights the significant incidence of DVT in major abdominal surgery procedures, emphasizing the importance of early identification and preventive measures, particularly among high-risk subgroups. Routine DVT prophylaxis and targeted interventions to improve surgical outcomes and patient safety are to be considered in major abdominal surgeries.

**Keywords:** Deep vein thrombosis, prophylaxis, major abdominal surgery, risk factors

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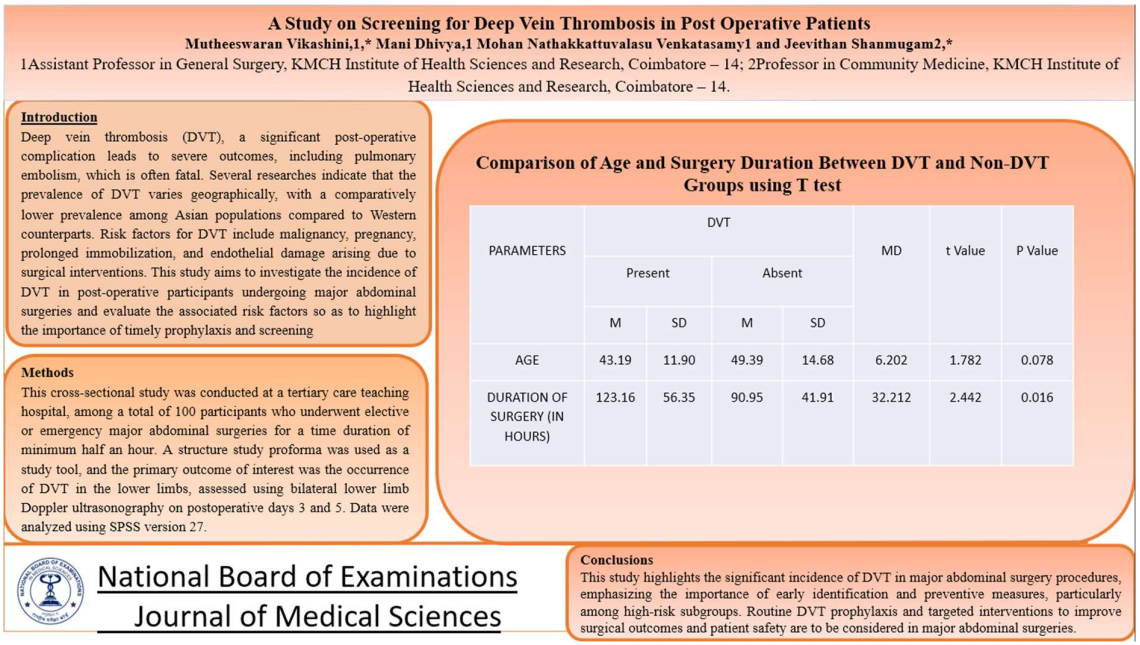
## Graphical Abstract




## Introduction

Deep vein thrombosis (DVT) a significant post-operative complication which may even lead to severe fatal outcomes including pulmonary embolism [1]. Studies indicate that the prevalence of DVT varies with ethnicity with Asian populations reporting lower incidences compared to Western counterparts [2,3]. Malignancy, pregnancy, prolonged immobilization, and endothelial damage from surgical interventions are major risk factors for DVT [2].

Deep vein thrombosis (DVT) s considered to occur due to the interplay of risk factors outlined in Virchow's triad: venous stasis, endothelial injury, and hypercoagulability. Prolonged immobility, surgery, trauma, cancer, obesity, and genetic predispositions such as Factor V Leiden are the common causes associated with the occurrence of DVT. Hormonal influences due to Pregnancy/oral contraceptives intake further increases the risk. The usual location of thrombus is in the lower limbs, with potential complications of pulmonary embolism and post-thrombotic syndrome [4].

Colour Doppler Ultrasound is regarded as the gold standard for DVT diagnosis. It is a non-invasive procedure and an effective means to identify asymptomatic cases and facilitate timely intervention [5]. Despite these advancements in diagnostic techniques and prophylaxis, DVT still goes undetected in high-risk participants due to the absence of symptoms [5,6].

Preventive strategies include the use of low molecular weight heparin (LMWH) which have been shown to significantly reduce the risk of thrombus formation in post-operative participants. However, the administration of prophylaxis varies, particularly in emergency surgeries, which affects the overall outcome [7,8]. This study aims was designed to find out the incidence of DVT in post-operative participants undergoing major abdominal surgeries, and

understand he associated risk factors among those undergoing major abdominal surgery.

## Materials and Methods

The cross sectional study was conducted at a tertiary care teaching hospital, involving participants from the departments of General Surgery, Vascular Surgery, Surgical Gastroenterology, and Obstetrics and Gynaecology. Institutional Human Ethics Committee (IHEC) clearance was obtained prior to the start of the study and all ethical procedures were adhered to, including providing participants with a Patient Information Sheet (PIS) and obtaining written informed consent (IC). A total of 100 willing participants who underwent elective or emergency major abdominal surgeries lasting more than 30 minutes during the period from January 2019 to October 2020 were included in the study. Participants who underwent head, neck, and orthopaedic surgeries, those in the paediatric age group, those ambulated early, and those on anticoagulant therapy were excluded. Data were collected using a predesigned structured study proforma, which included demographic details, clinical variables, surgical details, and the administration of Low molecular weight Heparin (LMWH) as prophylaxis. The primary outcome of interest was the occurrence of deep vein thrombosis (DVT) in the lower limbs, which was assessed using bilateral lower limb Doppler ultrasonography on postoperative days 3 and 5. DVT was defined by the presence of a non-compressible, hyper-echoic thrombus in the venous column. Data were recorded in Microsoft Excel and analyzed using SPSS version 27. Categorical variables were expressed as percentages, and continuous variables as mean ± standard deviation. The chi-square test was used to evaluate associations between categorical variables, while the Student's t-test was applied for continuous variables, with a p-value of $<0.05$ considered statistically significant.

## Results

A total of 100 participants were included in the study, with a mean age of 48.09 ± 14.33 years (range 17-79 years). The majority (70%, n=70) were males, with the highest age distribution in the 51-60 years group (31%). The mean duration of surgery was 116.40 ± 55.05 minutes, with most surgeries being of emergency type (80%) and a significant portion lasting 1-2 hours (38%). Prophylactic low molecular weight heparin (LMWH) was administered to 75% of the participants, while 25% did not receive it. Deep vein thrombosis (DVT) was detected in 21% of participants (n=21), with 95.23% of cases being unilateral and 4.77% bilateral; left-sided DVT was the most common (62%). Carcinoma-related complications (28%) and gastrointestinal perforations (21%) were the leading diagnoses (Table 1).

Table 1. Demographic and Clinical Characteristics of Study Participants and DVT Outcomes

| | | F | % |
|---|---|---|---|
| Age (in years) | Less than 20 | 2 | 2 |
| | 21-30 | 11 | 11 |
| | 31-40 | 22 | 22 |
| | 41-50 | 18 | 18 |
| | 51-60 | 31 | 31 |
| | 61-70 | 13 | 13 |
| | More than 70 | 3 | 3 |
| Sex | Male | 70 | 70 |
| | Female | 30 | 30 |
| Duration | Less than one hour | 31 | 31 |
| | 1 – 2 hr | 38 | 38 |
| | 2-3 hrs | 23 | 23 |
| | 3- 4 hrs | 8 | 8 |
| Heparin | Given | 75 | 75 |
| | Not Given | 25 | 25 |
| Type of surgery | Emergency | 80 | 80 |
| | Elective | 20 | 20 |
| DVT | Present | 21 | 21 |
| | Not present | 79 | 79 |
| DVT side | Left | 13 | 13 |
| | Right | 7 | 7 |
| | Bilateral | 1 | 1 |
| Diagnosis | Carcinoma related Complication | 28 | 28 |
| | Gastro-intestinal Perforation (Gastric/DU/ Jejunum / Ileal) | 21 | 21 |
| | Trauma / Injury (Blunt injury or stab injury) | 18 | 18 |
| | Hernia related complication | 8 | 8 |
| | Pregnancy related complication | 7 | 7 |
| | Intestinal Obstruction | 7 | 7 |
| | Others | 11 | 11 |

The study found that out of 100 participants, 21% developed deep vein thrombosis (DVT), with varying occurrence across different diagnoses. Notably, pregnancy-related complications had the highest DVT occurrence at 100%, followed by trauma/injury at 22.22%, gastrointestinal perforations at 19.04%, and carcinoma-related complications at 17.85%. Hernia-related complications and

intestinal obstructions showed no cases of DVT. Among the "Others" category, 9% experienced DVT. These results highlight the significant risk of DVT in specific conditions, particularly pregnancy-related complications, underscoring the need for targeted preventive strategies in high-risk groups (Table 2).

Table 2. Distribution of DVT based on diagnosis

| Diagnosis | Frequency | DVT Occurrence | % of DVT |
|---|---|---|---|
| Carcinoma related Complication | 28 | 5 | 17.85 |
| Gastro-intestinal Perforation (Gastric/DU/ Jejunum / Ileal) | 21 | 4 | 19.04 |
| Trauma / Injury (Blunt injury or stab injury) | 18 | 4 | 22.22 |
| Hernia related complication | 8 | 0 | - |
| Pregnancy related complication | 7 | 7 | 100.0 |
| Intestinal Obstruction | 7 | 0 | 0 |
| Others | 11 | 1 | 9% |
| **Total** | **100** | **21** | |

The comparison of age and surgery duration between participants with and without deep vein thrombosis (DVT) revealed notable differences. The mean age of participants without DVT was higher (49.39 ± 14.68 years) compared to those with DVT (43.19 ± 11.90 years), but this difference was not statistically significant (MD = 6.202, t = 1.782, p = 0.078). However, the mean duration of surgery was significantly longer in participants with DVT (123.16 ± 56.35 minutes) compared to those without DVT (90.95 ± 41.91 minutes), with a statistically significant difference (MD = 32.212, t = 2.442, p = 0.016) (Table 3). The incidence of DVT is high in participants who underwent emergency surgeries for trauma, chronic obstruction, prolonged labour which is about 75% when compared to 15% in those who had elective surgeries. There is no significant difference in the incidence.

Table 3. Comparison of Age and Surgery Duration Between DVT and Non-DVT Groups using T test

| PARAMETERS | DVT | | | | MD | t Value | P Value |
|---|---|---|---|---|---|---|---|
| | Present | | Absent | | | | |
| | M | SD | M | SD | | | |
| AGE | 43.19 | 11.90 | 49.39 | 14.68 | 6.202 | 1.782 | 0.078 |
| DURATION OF SURGERY (IN HOURS) | 123.16 | 56.35 | 90.95 | 41.91 | 32.212 | 2.442 | 0.016 |

The analysis revealed significant associations between gender, heparin administration, and the occurrence of deep vein thrombosis (DVT). A higher proportion of males were in the non-DVT group (75.9%) compared to the DVT group (47.6%), whereas females were more represented in the DVT group (52.4%) compared to the non-DVT group (24.1%). This difference was statistically significant ($\chi^2 = 6.341$, p = 0.012). Additionally, none of the participants who received heparin developed DVT, while all DVT cases (100%) occurred in participants who did not receive heparin, showing a highly significant association ($\chi^2 = 79.747$, p = 0.000). These findings highlight the protective effect of heparin prophylaxis and the potential influence of sex on DVT risk (Table 4).

Table 4. Association between Sex and Heparin Administration with DVT Occurrence using chi-square test

| PARAMETERS | Sub category | DVT | | | | CSV | P VALUE |
|---|---|---|---|---|---|---|---|
| | | Absent | | Present | | | |
| | | F | % | F | % | | |
| SEX | Male | 60 | 75.9 | 10 | 47.6 | 6.341 | 0.012 |
| | Female | 19 | 24.1 | 11 | 52.4 | | |
| HEPARIN | Not given | 4 | 5.1 | 21 | 100.0 | 79.747 | 0.000 |
| | Given | 75 | 94.9 | 0 | 0.0 | | |
| Procedure | Emergency | 18 | 22.5 | 62 | 77.5 | 0.542 | 0.46 |
| | Elective | 3 | 15 | 17 | 85 | | |

The incidence of DVT is high in participants who underwent emergency surgeries for trauma, chronic obstruction, prolonged labour which is about 22.5% when compared to 15% in those who had elective surgeries. There is no significant difference in the incidence.

**Discussion**

In our study, the mean age of participants was 48.09 ± 14.33 years, with the highest incidence of deep vein thrombosis (DVT) observed in the 51-60 years age group (31%). The risk of DVT is known to increase with age, particularly in individuals over 50 years, as also reported in studies conducted in South India and other parts of the country, which highlight similar age distributions for DVT occurrence [1,2]. Gender distribution revealed a male predominance (70%), yet a higher proportion of females developed DVT (52.4% of DVT cases) compared to males (47.6% of DVT cases). While males are traditionally considered at higher risk for DVT, certain risk factors like pregnancy, prolonged labor, and hormonal influences may contribute to the increased incidence in females [2,3].

The overall incidence of DVT in our cohort was 21%, which is higher than that reported in some Indian studies. For instance, a study conducted in South India documented a lower postoperative DVT incidence, possibly due to differences in surgical populations and varying use of prophylaxis [1]. Emergency surgeries had a higher incidence of DVT compared to elective surgeries, consistent with findings that acute conditions, limited preoperative

optimization, and associated comorbidities in emergency cases predispose participants to thrombus formation [4,5].

The study found that longer surgery durations were associated with a higher risk of DVT, with a mean duration of 90.95 ± 41.91 minutes in the non-DVT group compared to 123.16 ± 56.35 minutes in the DVT group ($p = 0.016$). Similar difference was observed in other studies [2,6].

A significant finding was that none of the participants who received prophylactic low molecular weight heparin (LMWH) developed DVT, while all cases occurred in participants who did not receive it ($p < 0.001$). This underscores the well-established effectiveness of LMWH in reducing thrombotic events, as corroborated by both national and international guidelines on venous thromboembolism management [3,7].

All the participants with pregnancy-related complications (100%), followed by trauma/injury (22.22%), gastrointestinal perforations (19.04%), and carcinoma-related complications (17.85%) had DVT. These conditions are associated with hypercoagulable states, venous stasis, and endothelial injury, which are the core components of Virchow's triad which leads to occurrence of DVT [2,8,9].

## Conclusion

Deep Vein Thrombosis is one of the complications arising after a major abdominal surgery. The influence of risk factors such as emergency surgeries, pregnancy-related complications, trauma, and carcinoma on DVT occurrence has been well documented from this study also. The protective role of prophylactic low molecular weight heparin (LMWH) has also been established. Routine screening for DVT, LMWH in high risk patients undergoing abdominal surgeries are recommended.

## Statements and Declarations

### Conflicts of interest

The authors declare that they do not have conflict of interest.

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