

Effect of Intermittent Pneumatic Compression Device on Reducing Deep Venous Thrombosis Occurrence among Trauma Patients

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ABSTRACT

Background: Deep vein thrombosis remains a significant global disease burden and is the leading cause of inpatient mortality in injured patients. As such, measures to prevent Deep Vein Thrombosis (DVT) should be taken. Intermittent Pneumatic Compression Devices (IPCDs) are essential for preventing deep vein thrombosis by enhancing venous blood flow and reducing venous stasis. They provide a safe, non-invasive method of thromboprophylaxis. IPCDs help compensate for impaired muscle pump activity following injury or surgery. Their use contributes to improved circulation and reduced risk of thromboembolic complications in critically ill trauma patients. **Objectives:** The study aimed to evaluate the effect of intermittent pneumatic compression device on reducing deep venous thrombosis occurrence among trauma patients. **Methods:** The study was carried out at a trauma intensive care unit at Trauma Hospital of Assiut University, Egypt, using a quasi-experimental research design. A convenient sampling of 60 patients was used. Four tools were utilized to collect data- patient assessment tool, DVT risk factor assessment, DVT Incidence monitoring, and patients' outcomes tool. **Results:** The outcomes revealed that study populations were at high risk (0.0% and 43.3%), study versus control group for developing DVT, the difference between study populations was statistically significant (P -value=0.001*), There were significantly less thrombotic events in the patients that received intermittent pneumatic compression as compared to the control group, (3.3% and 26.7%), and Length of stay at Intensive Care Unit (ICU) was statistically significant, and on ventilation (P -value=0.029*), shorter in the intervention group. **Conclusion:** The use of an intermittent pneumatic compression device significantly reduced the occurrence of deep venous thrombosis among trauma patients (3.3% versus 26.7%) and was associated with shorter durations of mechanical ventilation and ICU stay. As a safe, non-invasive method of thromboprophylaxis, the device offers a practical nursing intervention for lowering thromboembolic risk in critically ill trauma patients. **Recommendations:** Implementation of Intermittent Pneumatic Compression device is effective and can decrease deep venous thrombosis incidence in trauma patients.

Keywords: Deep Venous Thrombosis; Intermittent Pneumatic Compression Device; Occurrence; Trauma Patients

INTRODUCTION

Venous Thromboembolism (VTE) is a major complication among trauma patients and is associated with substantial morbidity and mortality. It is a lethal complication, causes longer duration of mechanical ventilation, and prolonged ICU length of stay (Permpikul *et al.*, 2022). The very high VTE prevalence in patients with both current and past traumatic injuries remains an important contributor to inpatient mortality. The initiating DVT is frequently subclinical; however, its sequelae, Pulmonary Embolism (PE), is the third most common cause of death from trauma and can occur within 24 hours of injury. The high mortality is thus also partly related to trauma itself, the third most common cause of death overall and a major public health problem (Kim *et al.*, 2024).

Venous thromboembolism is a clinical term that encapsulates the continuum of events between the DVT and PE. In its essence, DVT is the formation of thrombus in the deep venous system and partial or complete occlusion of the affected vessel. Deep vein thrombosis commonly occurs in the lower extremities. The most

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common local symptoms of DVT are poor perfusion, edema, regional pain, and local change in skin color (Daniel *et al.*, 2025). The most critical issue in DVT is embolization and dislodging of a clot, resulting in the pulmonary artery's blockage and a subsequent PE. A proximal DVT is another classification of DVT based on anatomic sites. The thrombus that occurs only in the calf veins is known as distal, while VTE at the popliteal vein level is proximal (Ryu *et al.*, 2024). Development of DVT is strongly influenced by a combination of predisposing factors related to Virchow's triad—venous stasis, endothelial injury, and hypercoagulability. Immobility due to prolonged bed rest, surgery, or trauma significantly increases venous stasis and the likelihood of clot formation, while advanced age and obesity further elevate risk by impairing venous return and promoting a prothrombotic state (Dharani *et al.*, 2025).

IPCDs have been available for nearly three decades as a treatment method, consisting of a cuff placed on either the upper or lower extremity which periodically inflates, altering venous hemodynamics in the lower extremity (Lott *et al.*, 2024). IPCD has been used to prevent PE and DVT in hospitalized patients in a safe and efficient manner. IPCD is thought to have two distinct ways of preventing VTE. Increasing venous blood flow velocity is the first, and fibrinolysis is the second. Stasis and hypercoagulability are the two Virchow's triad pathways that IPCD uses to prevent VTE. Additionally, it is hypothesized that IPCD activates endothelial cells and increases nitric oxide release through the third pathway of Virchow's triad. The Intermittent Pneumatic Compression (IPC) is worn on the patient's leg and consists of a fabric sheath with a pump attached (Liang *et al.*, 2025). Periodically, the device delivers pumped air, which guarantees that the blood is displaced proximally and the deep venous systems are compressed. The vessels refill distally when the cuff deflates, promoting blood flow and sustaining pulsation. By reducing the level of plasminogen activator inhibitor, the stimulating effect of the fibrinolytic activity in the venous walls also contributes to the reduction of VTE. By simulating patient movement, IPC increases venous return, encourages fibrinolysis, and prevents VTE by causing muscle contraction and relaxation (Zeng & Wu., 2023).

Trauma is a risk factor for VTE. The mortality from DVT has been reported to be 13% to 48%, and that from PE 25%. The incidence of VTE among trauma patients ranges from 14% to 59% if thromboprophylaxis is not used and 3.6% to 33% among the seriously injured patients receiving thromboprophylaxis with anticoagulants (Bassa *et al.*, 2025). Nurses are instrumental in bringing the VTE prevention guidelines to the bedside and are thus able to improve patient safety by lessening the VTE burden. The evidence shows that orthopedic nurses can provide both pharmacologic and mechanical prophylaxis to patients at risk for VTE, and that high-quality nursing care is associated with changes in clinical practice and patient outcomes (Hu *et al.*, 2025). DVT is a topic that requires full knowledge of its risk factors, clinical presentation, and evidence-based approaches before being managed. As the first-line staff members, nurses are the ones who administer the appropriate prophylaxis (Al-Mugheed & Bayraktar, 2023).

Aim of the study

The aim of this study is to evaluate the effect of intermittent pneumatic compression device on reducing deep venous thrombosis occurrence among trauma patients, in the Trauma Intensive Care Unit of Assiut University Trauma Hospital.

Research hypothesis

Hypotheses (1)

The present study hypothesized that implementing Intermittent pneumatic compression will reduce deep venous thrombosis occurrence among traumatic critically ill patients.

Hypotheses (2)

The present study hypothesized that implementing of Intermittent pneumatic compression will have better outcome among traumatic critically ill patients.

METHODOLOGY

Setting

A quasi-experimental method was implemented to conduct this study. The study was conducted at a trauma

intensive care unit at Trauma Hospital of Assiut University, Egypt; data was collected from July to December 2024. A convenient sample of 60 patients was used in accordance with the inclusion criteria. The sample size was calculated by using the Epidemiology Information 2000 software program based on expected numbers of critical-care cases in previous studies, with a 95% confidence level, 80% power, an expected prevalence of critically ill of 95% and a 5% maximum allowable error; the result was a minimum of 54 subjects, to which six subjects were added to allow for attrition. Those patients were divided non-randomly into two groups (control and intervention groups).

Inclusion Criteria

The study included adult patients aged 18 years and older, of both sexes. with recent trauma patients admitted to trauma intensive care unit.

Exclusion Criteria

Patients were excluded from the study if they had lower-extremity pathology (patients with other trauma, fractures, edema, burn, or amputation of the lower extremities), history of DVT, identified DVT at the time of presentation, fluid restricted, contraindications to exercise, and malignancy in trauma patients.

Study tools

Data collection was conducted using four tools: (*Tool I*, the Patient Assessment Tool, was developed by the researcher to gather socio-demographic data (age, gender) and clinical data. *Tool II*, the DVT risk factor assessment sheet, (adopted from Autar, 1996; used by Ashrafi *et al.*, 2022), was designed to assess the patient at risk for DVT; It comprised seven risk categories including: increasing age, and Body Mass Index (BMI), immobility, special DVT risk, trauma, surgery, and high-risk disease, the final score is determined as follows: No risk < 6 scores, Low risk 6-10, Moderate risk 11-14, and High risk >15. *Tool III*, monitoring DVT incidence tool was developed by the researcher and used by (Ramadan *et al.*, 2019), to assess DVT leg manifestation such as calf pain, tenderness, skin warmth of the leg, skin color, swelling of limbs, calf erythema and monitor DVT incidence by using Doppler ultrasonography. DVT was objectively diagnosed using duplex Doppler ultrasonography of the lower extremities, performed by a qualified healthcare professional. The examination was conducted when DVT was suspected based on clinical manifestations, and the diagnosis was confirmed based on the Doppler ultrasonography findings *Tool IV*, the Patient Outcome Tool (adopted from Gaspard *et al.*, 2015), used to assess rate of incidence of DVT, length of ICU stay, duration of mechanical ventilation, and mortality rate.

The research procedure was divided into three phases: planning, implementation and evaluation. In the planning phase, approval was obtained from hospital administration. The feasibility and clarity of instruments was established in a pilot test of 6 patients (10% of the sample). The content validity of instruments was established through examination by a committee of five critical-care nurses and two anesthesia/intensive care physicians, which yielded a Content Validity Index (CVI).

Reliability

Following comprehensive literature synthesis, the measurement tools were finalized and their internal consistency substantiated through Cronbach's alpha coefficient analysis, as follows: tool I: $r = 0.737$, tool II: $r = 0.743$, tool III: $r = 0.781$, tool IV: $r = 0.785$.

Implementation Phase

Control group participants were treated according to the standard institutional policy, which consisted of repositioning every 120 minutes and 20 minutes of concurrent lower-extremity flexion–extension exercises each hour for 14 days. Intervention group participants received intermittent pneumatic compression therapy every 8 hours. The device was evaluated for effectiveness by DVT risk factor, ICU length of stay, mechanical ventilation, ICU mortality, and overall VTE incidence in trauma patients. According to reports, IPC works well for fibrinolysis when applied for two hours a day, IPC was found to increase endogenous fibrinolysis, tissue factor inhibitor, and plasminogen activator (Amer *et al.*, 2023).

IPC device was applied according to the manufacturer's instructions and the standardized nursing care protocol throughout the study period. Before each application, patients were assessed for contraindications,

proper cuff size was selected, and the sleeves were positioned correctly on both lower limbs to ensure effective sequential compression. The device was routinely inspected to verify appropriate inflation–deflation cycles and proper functioning. During therapy, nurses monitored skin integrity, peripheral perfusion, patient comfort, and device performance, while maintaining uninterrupted treatment whenever clinically feasible. Adherence to a standardized application protocol and regular monitoring helped ensure consistent intervention delivery, maximize the effectiveness of venous thromboembolism prophylaxis, and minimize device-related complications (Zhang *et al.*, 2024).

Intermittent Pneumatic Compression (IPC) Device

The Intermittent Pneumatic Compression (IPC) device used in this study was the Talley Group IPC system (Model Type T19, Talley Group Ltd., Romsey, Hampshire, England, UK). The device was applied according to the manufacturer's instructions and the standardized nursing care protocol throughout the study period. The device consists of an inflatable three-chamber leg sleeve connected to an electrically driven pneumatic pump that provides sequential distal-to-proximal compression (Homdee *et al.*, 2026). Each compression cycle lasts approximately 75 seconds, consisting of 30 seconds of sequential inflation followed by 45 seconds of simultaneous deflation, with leg pressure maintained at 40–60 mmHg. The device was applied to the patient's calves three times daily at approximately 8-hour intervals, with each application session lasting 20 minutes. Skin and neurovascular evaluations were performed prior to each IPC application and every 8 hours. The standard care group received standard care, which included risk assessment for DVT upon admission, repositioning every 2 hours and performing a 20-minute supine 3-way simultaneous flexion–extension exercise program of the upper and lower extremities (Junior *et al.*, 2025).

Nursing staff role in implementing IPCD and DVT prevention

The nursing team conducts a thorough DVT risk assessment to find and diagnose patients at risk. This helps promote early active and passive mobilization. They also educate patients and their families about the high-risk factors for DVT, early symptoms, proper IPCD use, and precautions. Critical care nurses play an important role in preventing DVT and quickly identifying its symptoms. The nurse should adjust DVT prophylaxis based on the patient's risk level: low, moderate, high, or extremely high. As part of IPC, the nurse should decide if the patient needs mechanical prophylaxis. Additionally, she should raise the patient's legs 10 to 20 degrees above heart level and change the patient's position every two hours (Yuan *et al.*, 2025).

Evaluation phase

In this stage, the effectiveness of IPC in reducing deep vein thrombosis in trauma patients was evaluated based on patient-level data including length of ICU stay, duration of mechanical ventilation, ICU mortality, and VTE incidence, obtained from the trial dataset.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 27. Qualitative variables were presented as frequencies and percentages, whereas quantitative variables were summarized as means and standard deviations. Between-group comparisons of categorical variables were performed using the chi-square test or Fisher's exact test, as appropriate. Independent samples t-tests were used for between-group comparisons of quantitative variables measured at a single time point.

Ethical Consideration

This study received ethical clearance from the Faculty of Nursing Research Ethics Committee at Assiut University, Egypt with references number 1120240829 on 1st July 2024.

RESULTS

As shown in Table 1, two groups of intervention and control were compared to ensure their similarity in the basic features of the patients involved in the study. For this purpose, the group comparability was verified by the overall non-significant difference ($P > 0.05$). In particular, the mean age of the patients was 39.37 ± 10.80 (intervention) and 40.47 ± 11.09 (control), and the absence of a significant difference was confirmed ($P = 0.640$). The dominant number of males was noted in the study (86.7%) and control (63.3%) groups. Head trauma was the

most frequent diagnosis, accounting for 56.7% and 53.4% of the study and control groups, respectively.

Table 1: Distribution of Patients According to Demographic and Clinical Data Related to Both Groups

Demographic and Clinical Data		Study Group n=30		Control Group n=30		P-Value
		N	%	N	%	
Age Group	18 - < 35 yrs.	11	36.7	10	33.4	0.640
	35 - < 50 yrs.	14	46.7	12	36.7	
	50 - < 65 yrs.	5	16.7	8	26.7	
		Mean $\pm$ SD 39.37 $\pm$ 10.80		Mean $\pm$ SD 40.47 $\pm$ 11.09		
Gender	Male	26	86.7	19	63.3	0.074
	Female	4	13.3	11	36.7	
Diagnosis	Spinal Cord Injury	6	20.0	3	10.0	0.452
	Head Trauma	17	56.7	16	53.3	
	Chest Trauma	3	10.0	7	23.3	
	Pelvic Trauma	4	13.3	4	13.3	

Chi square test for qualitative data between the two groups

Independent T-test quantitative data between the two groups

*Significant level at p value < 0.05, **Significant level at p value < 0.01

Table 2 on Day 7, two-thirds (66.7 %) of the patients in the intervention group were found to be at low risk according to the Autar scale, and their distribution significantly differed from that of the control group (P < 0.05). On Day 10, less than half of the control group's patients (43.3 %) remained at high risk, and their distribution significantly differed from that of the study group (P < 0.05). The Autar-score distributions on Day 7 and Day 10 therefore significantly differed between the two cohorts (P < 0.05). The linear mixed-effects analysis demonstrated a statistically significant effect of time on Autar Scale scores (P < 0.001). The group $\times$ time interaction was also statistically significant (P = 0.008), indicating that the pattern of change in Autar scores over the three assessment days differed significantly between the study and control groups. The overall group effect was borderline statistically significant (P = 0.051).

Table 2: Distribution of Patients According to Autar Score Related to Both Groups

Autar Score	Study Group n=30		Control Group n=30		P –Value
	Mean ± SD		Mean ± SD		
1 st day	7.53 ± 2.33		9.17 ± 2.45		0.078
	N	%	N	%	
No Risk: < 6 scores	6	20.0	2	6.7	
Low Risk: 6 – 10	21	70.0	19	63.3	
Moderate Risk: 11-14	3	10.0	9	30.0	
High Risk: >15	0	0.0	0	0.0	
	Mean ± SD		Mean ± SD		0.001*
7 th day	8.43 ± 2.37		12.13 ± 2.71		
	N	%	N	%	
No Risk:< 6 scores	6	20.0	0	0.0	
Low Risk: 6 – 10	20	66.7	7	23.3	
Moderate Risk: 11-14	4	13.3	15	50.0	
High Risk: >15	0	0.0	8	26.7	
	Mean ± SD		Mean ± SD		0.001*
10 th day	7.23 ± 2.16		12.60 ± 2.97		
	N	%	N	%	
No Risk:< 6 scores	10	33.3	1	3.3	
Low Risk: 6 – 10	16	53.3	5	16.7	
Moderate Risk: 11-14	4	13.3	11	36.7	
High Risk: >15	0	0.0	13	43.3	
Time Effect					< 0.001*
Group Effect					0.051
Group × Time Interaction					0.008*

Chi square test for qualitative data between the two groups

Independent T-test quantitative data between the two groups

*Significant level at p value < 0.05, **Significant level at p value < 0.01

A linear mixed-effects model between the two groups

Table 3 reveals that the control cohort displayed substantially higher frequencies of deep vein thrombosis manifestations namely calf pain, tenderness, localized warmth, swelling, erythema, and claudication relative to the intervention group ($p = 0.001$). All assessed lower-limb DVT signs exhibited statistically significant between-group differences ($P < 0.05$).

Table 3: Distribution of Patients According to Deep Venous Thrombosis Leg Manifestation Related to Both Groups

Deep Venous Thrombosis Leg Manifestation		Study Group n=30		Control Group n=30		P-Value
		N	%	N	%	
Calf Pain	Yes	5	16.7	17	56.7	0.001*
	No	25	83.3	13	43.3	
Calf Tenderness	Yes	0	0.0	16	53.3	0.001*
	No	30	100	14	46.7	
Warmth of The Leg	Yes	1	3.3	26	86.7	0.001*
	No	29	96.7	4	13.3	
Swelling of Limbs	Yes	3	10.0	21	70.0	0.001*
	No	27	90.0	9	30.0	
Calf Erythema	Yes	4	13.3	12	40.0	0.001*
	No	26	86.7	18	60.0	
Signs of Claudication	Yes	1	3.3	13	43.3	0.001*
	No	29	96.7	17	56.7	

Chi square test for qualitative data between the two groups.

*Significant level at p value < 0.05 .

Figure 1 shows incidence of DVT within this study population based on the findings obtained through Doppler Ultrasound is displayed. Of the patients enrolled into the control group, a total of 26.7% are diagnosed with DVT based on Doppler findings.

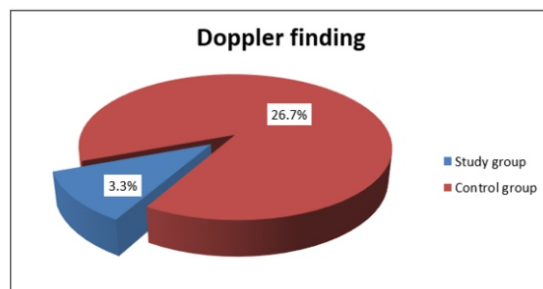


Figure 1: Distribution of Patients According to Doppler Finding and Incidence of DVT Related to Both Groups.

Table 4 shows Comparative analysis demonstrated superior outcomes in the intervention group, as evidenced by substantially abbreviated durations of mechanical ventilation (3.50 ± 0.760 days versus 7.13 ± 1.25 days) and intensive care unit stay (7.50 ± 0.73 days versus 10.60 ± 1.43 days), alongside a markedly diminished incidence of deep vein thrombosis (26.7% versus 3.3%). DVT incidence was significantly lower in the IPC group than in the control group (3.3% vs. 26.7%). The risk ratio was 0.125 (95% CI: 0.017–0.939), indicating an 87.5% relative reduction in the risk of DVT. The absolute risk difference was –23.3 percentage points (95% CI: –40.4 to –6.3).

Table 4: Distribution of Patients According to Patient's Outcome Related to Both Groups

Patients' outcome	Study group n=30		Control group n=30		P-value
	Mean ± SD		Mean ± SD		
Duration of Mechanical Ventilation	3.50 ± 0.760		7.13 ± 1.25		0.001*
Length of Intensive Care Unit Stay	7.50 ± 0.731		10.60 ± 1.43		0.001*
-	N	%	N	%	-
Deep Venous Thrombosis Incidence	1	3.3	8	26.7	0.029*
Intensive Care Unit Mortality	7	23.3	9	30.0	0.748

Chi square test for qualitative data between the two groups, Independent T-test quantitative data between the two groups

*Significant level at p value < 0.05 , **Significant level at p value < 0.01

Figure 2 shows the correlation between Autar scale and DVT incidence of study and control groups. There was positive correlation between Autar scale and the incidence of DVT.

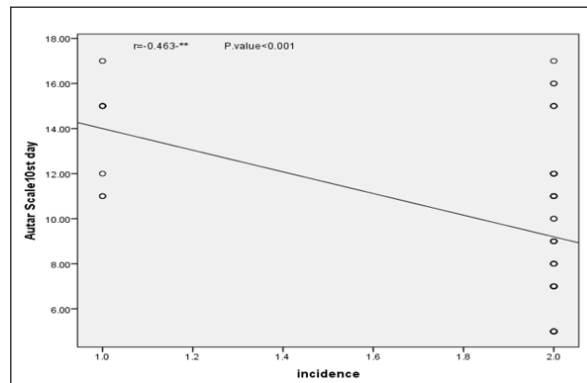


Figure 2: Correlation between Autar Scale and DVT Incidence among Study Sample (n=60)

DISCUSSION

About 10 million people around the world develop VTE each year. Although common among hospitalized patients, the DVT and PE occurrence, together known as VTE Sarkar *et al.* (2023). The present study demonstrated that implementation of a standardized IPC nursing care protocol was associated with a marked reduction in the occurrence of DVT among critically ill trauma patients. The incidence of DVT was substantially lower in the intervention group than in the control group, indicating that consistent application of IPC may contribute to reducing venous thrombotic events in this high-risk population (Liang *et al.*, 2025).

Nurses play a crucial role in reducing DVT when using IPCDs. They assess patients' DVT risk, ensure correct IPCD application and fit, monitor device effectiveness and skin integrity, and educate patients and families on proper use and mobility encouragement. Through continuous monitoring and adherence to nursing protocols that include IPCD use, nurses significantly lower the incidence of DVT in hospitalized and immobile patients (Shaaban *et al.*, 2021).

Potential confounding factors were considered during the design and analysis of this quasi-experimental study. Variables known to influence the risk of deep vein thrombosis (DVT), including age, sex, body mass index, severity of trauma, level of immobilization, duration of mechanical ventilation, comorbidities, use of pharmacological thromboprophylaxis, and baseline coagulation profile, may have affected the study outcomes. To minimize the influence of these factors, both groups were recruited from the same trauma intensive care unit during the same study period, identical inclusion and exclusion criteria were applied, and baseline demographic and clinical characteristics were compared before the intervention (Zuo *et al.*, 2026).

This study aimed to evaluate the impact of IPCD on DVT occurrence among trauma patients. Regarding the demographic data of the patients Results are consistent with Arabi *et al.* (2019) & Mohamed *et al.* (2025); who reported no significant age discrepancy between cohorts ($P > 0.05$), the study and control groups exhibited comparable demographic profiles without statistical significance. The studied populations' mean ages were 39.37 and 40.47 years, with standard deviations of 10.80 and 11.09 years, and this is in accordance with Alamri *et al.* (2023); who found that the mean age of studied populations was 44.2 ± 19.7 years; and Qian *et al.* (2024); who found that the mean age the mean age of participants varies from 35.8 ± 15.54 years to 48.28 ± 14.54 years. This is due to Advancing age has been identified as a key risk factor for DVT due to various physiological changes that occur with aging, including decreased venous return, reduced physical activity, and potential comorbid conditions such as cardiovascular disease, obesity, and diabetes.

Concerning gender distribution, more than half of patients were males (86.7% male, 13.3% female) there is considerable variation. Results are in line with Birhane *et al.* (2024); Show dominance in male participants 83.7% were males. The present study demonstrates that more than half of patients diagnosed with head injury (56.7%), with no significant between-group difference ($P > 0.05$) that aligns with Mohammed *et al.* (2021); who similarly observed head trauma as the most prevalent injury type followed by thoracic trauma and also found no significant group difference ($P = 0.498$).

Regarding Autar score assessments, in this study, the stratification of DVT risks was classified into four; they are no risk, low risk, moderate risk, and high risk of DVT. The results showed that 33.3% of the study patients had no risk, 53.3% had low risk 13.3% had moderate risk, and none of them had high risk of DVT. The control group exhibited a statistically significant increase in risk of DVT ($P < 0.05$), Similarly Ashrafi *et al.* (2022); revealed that the stratification for DVT risk was as follows: 0% very low risk, 21.9% low risk, 66.7% moderate risk, and 11.4% high risk. Another study of Alemu *et al.* (2024); revealed that the mean risk score for DVT was 5.15, with 67.56% classified as having a high to very high risk for DVT which is not in agreement with Arabi *et al.* (2019); who found no difference between experimental and control groups. The documented reduction could be due to the ability of the intermittent pneumatic compression devices to enhance venous return, which minimizes the risk of DVT.

According to this study, a statistically significant distinction in DVT leg manifestations including calf pain (56.7%), swelling of limbs (70%), and warmth of the leg (86.7%), between the study and control groups ($P < 0.05$). This may be due to the effect of compression of the lower vein in the study group subjects which accelerated blood flow and prevent venous stasis and interrupt process of thrombus formation, Thieme *et al.* (2024). Supported by Mitiku *et al.* (2024), who found that pain and swelling are the most consistent and prominent symptoms of Deep Vein Thrombosis (DVT), reported in 100% of cases in several studies. Other common signs include pitting edema (77.9%), skin discoloration (57.1%), and local tenderness (53.7%).

The present study revealed that 26.7% of patients in the control group developed deep vein thrombosis (DVT), as confirmed by Doppler ultrasonography. This finding is supported by Al-Sharydah *et al.* (2023), who reported that the incidence of proximal DVT among trauma patients ranged from 14.7% to 27.3%, depending on the diagnostic method and characteristics of the trauma population. Thus, the 26% incidence observed in the present study falls within the upper range reported in previous trauma populations. The authors also emphasized that routine ultrasound surveillance facilitates the detection of clinically silent DVT among high-risk trauma patients.

In contrast, a recent systematic review and meta-analysis by Zuo *et al.* (2026), including 186 studies and 203,880 critically ill patients, reported a pooled DVT incidence of 11.6% among patients admitted to trauma ICUs. This rate was considerably lower than the 26% observed in the control group of the present study. The difference may be explained by variations in injury severity, patient characteristics, and duration of immobilization, thromboprophylaxis practices, and DVT detection strategies.

As regard outcome criteria, in this study, the duration of mechanical ventilation and the length of ICU stay were significantly shorter in the intervention group compared with the control group ($P = 0.001$). Additionally, the incidence of deep venous thrombosis (DVT) was significantly lower in the study group (3.3% vs. 26.7%, $p = 0.029$), while ICU mortality did not differ significantly ($P = 0.748$). This may be due to the improvement in circulation achieved by intermittent pneumatic compression device, resulting in speedy recovery and discharge. These findings were supported by Gaspard *et al.* (2015); who reported that the mean LOS on ICU and number of days on MV among patient receiving mechanical Prophylaxis were lower than that in chemical Prophylaxis group. These findings are consistent with Sinsakolwat *et al.* (2025); indicating that effective thromboprophylaxis and ICU care protocols reduce the incidence of DVT and are associated with

shorter ICU stays and durations of mechanical ventilation.

Concerning, duration of mechanical ventilation, the current results agreed with Mohammed *et al.* (2021), who reported that mean duration of mechanical ventilation was (6.97 ± 3.00 versus 13.63 ± 6.26) with statistically significant difference between study and control groups (P -value < 0.05). Regarding to length of ICU stay, this study supported with Dhakal *et al.* (2019); who reported that mean length of stay was (7.8 ± 8.7 among patient receiving combination of pharmacological and sequential versus 6.2 ± 8). Also, the study reported that use of Sequential Compression Devices was associated with decreased VTE incidence. Regarding mortality rate, the current study revealed that there was no statistically significant difference between control and study groups (P -value > 0.05). These finding agreed with Zhang *et al.* (2018); who reported that the sequential pneumatic compression group had mortality rate of 10.75% compared to 12.89% in the control group.

Regarding to incidence of deep venous thrombosis of study sample, the finding of the current study revealed that it was noticed that more than quarter of control group (26.7%) DVT occurred to them respectively, with statistically significant difference between study and control group (P -value < 0.05) respectively. These findings agreed with Ibrahim *et al.* (2015); who studied (The effect of mechanical prophylaxis on preventing of DVT among trauma patients), the findings showed that DVT incidence reduced after applying IPC devices. Furthermore: Wang *et al.* (2020); who reported reduce incidence of venous thrombosis when use pneumatic compression as thromboprophylaxis in critically ill patients. And supported by Kakkos *et al.* (2022) ; reported ICU DVT incidence varies widely, often 10–30% with standard prophylaxis., Wang *et al.* (2023); reported a DVT incidence of 3.5%, similar to the 3.3% in study group.

The research revealed a statistically significant relationship between Autar scale scores and DVT. The result is in agreement with that of Khali *et al.* (2023); who researched Autar scale–based nursing among patients in orthopedic surgery, and the conclusion was that a higher Autar scale was associated with increased risk of DVT and that dedicated nursing was able to reduce DVT significantly ($P < 0.05$). The documented reduction could be due to the ability of the intermittent pneumatic compression devices to enhance venous return, which minimizes the risk of DVT. IPCD and early detection of DVT symptoms in trauma patients are crucial. This can help lower ICU stays, DVT rates, and expenses.

Limitation

The primary limitation of this study was the sample size, which prevented the results from being applied to other clinical locations around the world. The study only included trauma patients. Practicality and compliance problems were common. Patients found devices uncomfortable and frequently removed them.

Future Scope

Future studies should use larger, randomized, multicenter samples to confirm the effectiveness of IPC in preventing DVT among traumatic critically ill patients. Implementation outcomes such as acceptability, adoption, feasibility, fidelity, adherence, and sustainability of the nursing protocol should be evaluated. Continued studies should examine different IPC schedules and their cost-effectiveness within a multimodal DVT prevention strategy.

CONCLUSION

This study demonstrates that the implementation of the IPCDs was associated with significant improvements in several important clinical outcomes among critically ill patients. Patients in the intervention group experienced a significantly shorter duration of mechanical ventilation and a reduced length of intensive care unit (ICU) stay compared with the control group. The IPCDs also effectively reduced the incidence of

DVT. In high-risk environments, their use ought to be taken into account as part of a holistic approach for patient care. Further research is needed to optimize their application, standardizing protocols for use, monitoring, and assessing outcomes that matter in clinical practice.

RECOMMENDATION

According to current guidelines, IPCDs should be incorporated into standardized VTE-prevention protocols for critically ill trauma patients at increased risk of DVT. VTE and bleeding risks should be assessed regularly to guide individualized selection of mechanical or pharmacological prophylaxis. IPCDs should be applied consistently according to standardized nursing procedures, with regular monitoring of device function and patient tolerance.

CRedit Authorship Contribution Statement

E.A.M: Conceptualization, Methodology, Writing, Original Draft. **M.A.E.A:** Data Curation, Formal Analysis, Visualization. **M.A.A:** Data Curation, Visualization.

All authors contributed to data analysis, participated in drafting and revising the manuscript, approved the final version for publication, and agreed to be accountable for all aspects of the work.

AI Assistance Declaration

The authors declare that generative AI tools (ChatGPT and Microsoft Copilot) were used only for language enhancement and grammar correction during the preparation of this manuscript. The authors have carefully reviewed and revised the content and taken full responsibility for the final version of the manuscript.

Conflict of Interest

The investigators affirm that no competing interests exist.

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