

One in Twenty-five Patients is suffering from Deep Vein Thrombosis in Tibebe Ghion Specialized Hospital Bahir Dar, North West Ethiopia

Workineh Mengesha (✉ mgworkineh@gmail.com)

Bahir Dar University

Netsanet Fentahun

Bahir Dar University

Teshome Mosisa

Bahir Dar University

Habtamu Woretaw

Bahir Dar University

Article

Keywords: Prevalence, deep vein thrombosis, Doppler ultrasonography, lower extremity trauma

Posted Date: June 21st, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1329521/v2>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: Trauma leads to significant physiologic changes that result in patients at elevated risk for thromboembolism. Deep vein thrombosis is a serious condition with an incidence of 10% to 30% of people dying within 1 month. To date, there is a paucity of evidence regarding deep vein thrombosis after musculoskeletal trauma in Ethiopia.

Objective: To assess the prevalence of deep vein thrombosis and its associated factors in lower extremity trauma patients in Tibebe Ghion Specialized Hospital, Bahir Dar, Ethiopia.

Methods: Institutional-based cross-sectional study design was conducted on 196 lower extremity trauma patients from April 1, 2021, to July 30, 2021. Data were collected by using an interview administered questionnaire and Doppler ultrasound examination was used to detect the presence of deep vein thrombosis after taking informed consent from patients. Data analysis was done using SPSS Windows Version 26. Binary logistic regression was used to identify factors associated with deep vein thrombosis. A P-value < 0.05 was considered statistically significant.

Result: The prevalence of deep vein thrombosis was 4.1%. The age of the patient greater than 60 years (AOR= 16.32; 95% CI: 1.02, 260.06); injury severity scores greater than or equal to 15 (AOR= 33.08; 95% CI: 3.60, 303.65); any comorbidity (AOR= 8.62; 95% CI: 1.10, 67.50), and length of hospital stay greater than 20 days (AOR= 8.77; 95% CI: 1.20, 64.44) were associated factors of deep vein thrombosis occurrence.

Conclusion: The prevalence of deep vein thrombosis was lower in the study area compared to other studies. Age, injury severity score, any comorbidity, and length of hospital stay were independent risk factors. Attention should be given to patients with Age, injury severity score, any comorbidity, and length of hospital stay to prevent deep vein thrombosis occurrence.

Introduction

Deep vein thrombosis (DVT) is the formation of a blood clot in a deep vein that can lead to pulmonary embolism (PE), or post-thrombotic syndrome (PTS). Deep Vein thrombosis is a serious condition with an incidence of 10–30% of death after diagnosis within 1 month and most of the patients with DVT have long-term complications. Deep venous thrombosis is the third common cardiovascular condition next to myocardial infarction and stroke, and due to the aging population, it is nowadays a growing public health problem(1).

Trauma patients have the highest risk of developing DVT(2). Trauma leads to significant physiologic changes that result in patients at elevated risk for thromboembolism. Serum levels of inflammatory cytokines, procoagulant microparticles, and thrombin are increased following traumatic injury. The increment of systemic inflammatory response results in a hypercoagulable state that increases the risk of developing DVT. Virchow's Triad (Hypercoagulability, endothelial injury, and venous stasis) is the set of

conditions that contributes to venous thrombosis., Virchow's Triad is often present due to post-operative immobilization and protected weight-bearing following orthopedic surgery in trauma patients (3).

Low-molecular-weight heparin (LMWH) and compression stockings are commonly used as prophylaxis in orthopedic surgery. In the absence of prophylaxis, the incidence of DVT is estimated to be up to 56% in high-risk patients (4). Deep vein thrombosis could occur in both the injured and uninjured legs with a trend toward a higher incidence in the injured leg. Mok et al. reported that the incidence rate of DVT in the uninjured limb is 14.3% (5). To date, there is a paucity of evidence regarding deep vein thrombosis after musculoskeletal trauma in Ethiopia. Therefore, this study aimed to assess the prevalence of deep vein thrombosis and its associated factors in lower extremity trauma patients who present in Tibebe Ghion Specialized Hospital, Bahir Dar, Ethiopia.

Methods And Materials

Study area and period

The study was conducted in Tibeb Ghion Specialized Hospital (TGSH), Bahir Dar, Ethiopia. Tibeb Ghion Specialized Hospital is one of the largest specialized referral hospitals in the Amhara region and the country at large. It is a specialized public hospital and one of the university hospitals in the country. The hospital is a new referral teaching hospital in the Amhara region, and it is established by Bahir Dar University in 2018 G.C. TGSH, currently runs residency programs in seven specialties. The hospital provides a tertiary level health care service and it is administered by Bahir Dar University. The hospital has more than 500 beds, all over 65 beds are dedicated to Orthopedic Surgery cases. The study was conducted from April 1, 2021 to July 30, 2021.

Study design and population

An institutional based cross sectional study design was applied. The study population was sampled patients with lower extremity trauma who were admitted in the orthopedics department, TGSH from April, 2021 to July, 2021 G.C. and that fulfill the inclusion criteria.

Sample size determination and sampling technique

The sample size was determined using single population proportion formula with the following assumptions: the prevalence of deep vein thrombosis (50%), 95% of the confidence interval, and 5% marginal error and total source population at Tibeb Ghion Specialized Hospital was 400. The final sample size was 196. Systematic sampling technique was used from source population who fulfilled the inclusion criteria.

Data collection tool and procedures

Standard questionnaire adapted from similar articles and modifications based on local resource. The questionnaire was composed of socio-demographic characteristics, Comorbid illness (Hypertension,

Heart disease, Diabetes mellitus, Gangrene, Varicose vein, previous history of deep vein thrombosis, HIV/AIDS, Cancer), Associated injury (Spinal cord injury, Head injury, Vascular injury, Thoracoabdominal injury), Patient behavioral factors (Smoking, Alcohol abuse, Obesity), Treatment type and Injury related (Injury severity score (ISS), Length of hospital, American society of anesthesiologists (ASA) score), types of injury, and deep vein thrombosis characteristics. Year one orthopedic residents was involved for data collection and one porter assigned to took patients to radiology department for ultrasonography. Supervision of the data collection process was made by the principal investigator. The supervisor crosschecked for completeness and consistency of collected data daily.

Definition of terms and operational definitions

Lower extremity trauma

trauma which includes body of the person from hip to toes.

Deep vein thrombosis

Deep vein thrombosis (DVT) means a blood clot (thrombus) in the deep venous system of the leg. The presence of deep vein thrombosis will be measured using Doppler ultrasound examination if there is visualization of thrombus, absence of flow, lack of compressibility, and lack of augmentations.

Injury severity score (ISS)

an established medical score to assess trauma severity. A major trauma is defined as the injury severity score being greater than 15.

Data quality control

Data collection formats was properly designed and data collectors was trained well and supervised by the investigator. Informed consent was taken from patients. Pre-testing was done to ensure that data collectors are clear with the content and techniques of gathering the data. Every datasheet was checked and evaluated by the investigator after collection for its completeness.

Data processing and analysis

Data were coded, entered into and analyzed using SPSS Windows Version 26 for analysis. Descriptive statistics were computed for categorical data and presented by the use of tables, graphs. Continuous variables were summarized using means, median, mode, and standard deviation. Binary logistic regression was applied to see association between exposure variables and deep vein thrombosis. The statically significant association was declared at p-values < 0.05.

Ethical consideration

Ethical clearance was obtained from I ethics review committee of BDU, College of Medicine and Health Sciences. Data collection was performed based on declaration of Helsinki. Support letter was obtained from TGSH Confidentiality of patient information was maintained by taking the data anonymously. The data extracted from questioners used for the study and every data kept confidential by securing personal information in passwords. All patients with the diagnosis of DVT were linked to appropriate physicians for medical management.

Results

Sociodemographic characteristics

A total of 196 patients with the diagnosis of lower extremity trauma were included. The ages of patients were range from 18-80 with mean of 35.8 years. One hundred sixty four (83.7%) patients were males. A total of 66 (33.7%) and 100 (51%) patients can't read and write and are farmers respectively. (Table 1)

Table 1
Sociodemographic characteristics of study participant in TGSH, Bahir
Dar Amhara region, Ethiopia April 2021-July 2021G.C (N = 196).

Variable	Category	Percent (Frequency)
Age(years)	Mean \pm SD	35.8 \pm 15.54
	Median (min; max)	35(15;80)
	\leq 60 years	91.3%(N = 179)
	> 60 years	8.7%(N = 8.7)
Gender	Male	83.7%(N = 164)
	Female	16.3%(N = 32)
Religion	Orthodox	93.4%(N = 183)
	Muslim	4.6% (N = 9)
	Protestant	2% (N = 4)
Marital status	Married	68.9%(N = 135)
	Unmarried	31.1%(N = 61)
Residence	Urban	45.9%(N = 90)
	Rural	54.1%(N = 106)
Educational status	Can't read and write	33.7%(N = 66)
	Can read and write	29.1%(N = 57)
	Primary school	8.7%(N = 17)
	Secondary school	15.3%(N = 30)
	Tertiary level	13.3%(N = 26)
Occupation	Farmer	51%(N = 100)
	Civil servant	15.8%(N = 31)
	Merchant	8.7%(N = 17)
	Solider	8.7%(N = 17)
	Student	11.2%(N = 22)
	Driver	3.1%(N = 6)
	House wife	1.5%(N = 3)

Patient related characteristics of study participant

Majority of patients was American Society of Anesthesiology score 1(76%). The mean arterial pressure of patients was 82 with the minimum of 46.6 and the maximum of 108.3. (Table 2)

Table 2
Patient related characteristics of study participant in TGSH Bahir Dar
Amhara region, Ethiopia April 2021-July 2021G.C (N = 196).

Variable	Category	Percent (%) / number
Body mass index	< 18kg/M2	3.1%(N = 6)
	18-25Kg/M2	83.7%(N = 164)
	> 25KG/M2	13.3%(N = 26)
Mean arterial pressure	Mean \pm SD	81.9 \pm 8.03
	Median (min; max)	80.00(46.6;108.3)
ASA score	ASA 1	76%(N = 149)
	ASA 2	22.4%(N = 44)
	ASA 3	0.5%(N = 1)
	ASA 4	1%(N = 2)
Comorbid illness	Yes	9.7% (N = 19)
	No	90.3%(N = 177)
	Hypertension	3.6% (N = 7)
	Heart disease	1%(N = 2)
	Diabetes mellitus	0.5%(N = 1)
	HIV/AIDS	3.6%(N = 7)
	Cancer	1%(N = 2)
Smoking	Yes	1%(N = 2)
	No	99%(N = 194)
Alcohol use	Yes	38.8%(N = 76)
	No	61.2%(N = 120)

Injury related characteristics of study participant

The injury severity score in most of the patient was less than 15(81.1%). Most of the patients stayed in the ward more than 3 days (89.3%). About 7.1% of patients had vascular injury. In 84.7% of patient's surgery was performed and most of the surgery took less than 2 hrs. From the mode of immobilization external fixator was done in 35.7% of cases. (Table 3)

Table 3
Injury related characteristics of study participant in TGSH, Bahir Dar, Amhara region, Ethiopia April 2021-July 2021G.C (N = 196).

Variable	Category	Percent (Number)
Injury severity score	Mean \pm SD	9.3 \pm 4.4
	Median (min; max)	9(4;27)
	< 15	81.1%(N = 159)
	\geq 15	18.9%(N = 37)
Length of hospital stay	Mean \pm SD	14.3 \pm 9.67
	Median (min; max)	13(1;63)
	\leq 3 days	10.7%(N = 21)
	> 3 days	89.3%(N = 175)
Associated injury	Yes	11.7% (N = 23)
	No	88.3% (N = 173)
	Head injury	4.1%(N = 8)
	Chest injury	2% (N = 4)
	Abdominopelvic injury	5.6%(N = 11)
	Spinal cord injury	1%(N = 2)
Vascular injury	Yes	7.1%(N = 14)
	No	92.9%(N = 182)
Surgery done	Yes	84.7%(N = 166)
	No	15.3%(N = 30)
Duration of surgery	< 2hrs	68.9%(N = 135)
	\geq 2hrs	15.8%(N = 31)
Mode of fracture immobilization	External fixator	35.7%(N = 70)
	Intramedullary nail	24.5%(N = 48)
	Skeletal traction	12.2%(N = 24)
	Plate	6.1%(N = 12)
	Posterior slab	11.2%(N = 22)
	Cast	5.1%(N = 10)

Variable	Category	Percent (Number)
	TBW	2%(N = 4)
	Not immobilized	3.1%(N = 6)
Mobility status	Immobile	54.1% (N = 106)
	Mobile	45.9%(N = 90)

Pattern of mechanism of injury, Blood transfusion and Diagnosis

Majority of patients presented with bullet injury (38.8%). Most of the diagnosis is tibial fracture (42.3%). Sixteenth percent of cases was transfused cross matched blood. (Table 4)

Table 4
 Pattern of mechanism of injury and diagnosis of study participant TGSH,
 Bahir Dar Amhara region, Ethiopia April 2021-July 2021G.C (N = 196).

Variable	Category	Percent (%) / number
Mechanism of injury	MVA	7.7%(N = 15)
	RTA	27.6%(N = 54)
	Fall down	20.4%(N = 40)
	Stick	4.1%(N = 8)
	Stone	1.5%(N = 3)
	Bullet	38.8%(N = 76)
Diagnosis	Femur neck fracture	4.6%(N = 9)
	Peritrochantric fracture	6.1%(N = 12)
	Femur shaft fracture	34.7%(N = 68)
	Tibia fracture	42.3%(N = 83)
	Patellar fracture	2.6%(N = 5)
	Ankle fracture	4.1%(N = 8)
	Calcaneal fracture	3.1% (6)
	Extensive soft tissue injury	2.6%(N = 5)
Blood transfusion	Yes	16.3% (N = 32)
	No	83.7% (N = 164)
	≤ 2 units	8.2%(N = 16)
	≥ 3 units	8.2%(N = 16)

Prevalence of deep vein thrombosis (DVT)

The prevalence of deep vein thrombosis among patients with the diagnosis of lower extremity trauma was 4.1%.

Associated Factors of Occurrence of deep vein thrombosis

Binary logistic regression analysis was used to analyze the presence or absence of association between independent and dependent variables. Lower extremity trauma patients age`s greater than 60 years were 16 times more likely to develop deep vein thrombosis compared to age less than 60 years (AOR = 16.32; 95% CI: 1.02, 260.06).

Patients with injury severity score greater than 15 were 33 times more likely to develop deep vein thrombosis compared to injury severity score less than in a patient with less than 15 (AOR = 33.08; 95% CI: 3.60, 303.65). Patients who had any comorbidity were 9 times more likely to develop deep vein thrombosis compared to had no any comorbidity (AOR = 8.62; 95% CI: 1.10, 67.50). Patients with length of hospital stay greater than 20 days were 9 times more likely to develop deep vein thrombosis compared to length of hospital stay from 1–20 days (AOR = 8.77; 95% CI: 1.20,64.44). (Table 5)

Table 5
binary Logistic Regression Analysis of factors related to occurrence of DVT TGSH, Bahir Dar, Amhara region, Ethiopia April 2021-July 2021G.C (N = 196).

Variable	Category	Deep vein thrombosis		COR (95% CI)	AOR (95% CI)
		Yes	No		
Age	≤ 60 years	5	174	1	1
	> 60 years	3	17	7.457(1.612–34.487)	16.315(1.023, 260.062))
Injury severity score	< 15	1	158	1	1
	≥ 15	7	30	36.867(4.375-310.643)	33.082(3.604, 303.646)
Any comorbidity	Yes	3	16	6.450(1.410, 29.499)	8.617(1.100, 67.501)
	No	5	172	1	1
length of hospital stays	1–20 Days	4	151		1
	> 20 days	4	37	4.081(.975, 17.084)	8.774(1.195,64.437)

Discussion

The present study showed that the overall prevalence of deep vein thrombosis in lower extremity trauma patients is about 4.1%. It was lower than in a retrospective study at the Orthopedics and Traumatology Clinic in Cluj-Napoca, Deep vein thrombosis was present in 29.7% of Doppler-ultrasound examined patients after they examined 175 patients((19). Similarly In a serious of 125 patients ,study done in India, the prevalence of deep vein thrombosis was 8.5% after they examined by color Doppler ultrasound(9). A prospective study of lower limb orthopedic trauma patients in Tianjin Hospital, China analyzed 547 patients, median age 39.6 years, DVT developed in 12.4% (95% confidence interval: 9.7–15.2%), most occurring with femoral shaft fractures (30.6%), 15.8% occurred with hip fractures, 14.5% with fractures

around the knee and 10.8% with fractured tibia and fibula. Over half of DVTs (56.7%) developed within 3 days following injury.

In this study patients with age greater than 60 years was found 16.32 times more likely to develop deep vein thrombosis when it is compared with age less than 60 years old. This finding is similar to a study done to assess incidence and risk factors of deep vein thrombosis among patients with pelvic trauma; the rate of DVT in patients over the age of 60 years was 71.4%(13).

In this study patients with injury severity score greater than 15 was found 33 times more likely to develop deep vein thrombosis when it is compared with injury severity score less than 15. This finding is similar with a study done in America in 2007 on incidence and risk factors of venous thromboembolism in trauma patients on 507patients: Patients with injury severity score of ≥ 15 and 25 had higher DVTs compared with the ones with lower injury severity score levels(25).

In this study ASA score, and types of anesthesia were no association with the development of deep vein thrombosis, but study done by Whitting et.al showed ASA score and types of anesthesia had association with development to deep vein thrombosis(3).

In this study any comorbidity and length of hospital stay was associated with the development of deep vein thrombosis. This finding is similar with a study done in other area.(26). Concerning the strength of the study, this study employed prospective study to recruit lower extremity trauma patients. Due to small nature of the case, associated factors of occurrence of deep vein thrombosis had large odds ratio with wide confidence interval.

Conclusion

The magnitude of deep vein thrombosis was lower compare to pervious study. Majority of deep vein thrombosis happened to femur shaft fracture patients. Bullet injury took the majority regarding the mechanism of injury. Age, injury severity score, any comorbidity and length of hospital stay were independent associated factors of deep vein thrombosis.

Abbreviations

DVT	Deep Vein Thrombus
PE	Pulmonary Embolism
PTS	Post Thrombotic Syndrome
LMWH	Low-Molecular-Weight Heparin
TGSH	Tibebe Ghion Specialized Hospital

BDU	Bahir Dar University
SPSS	Statistical Package for Social Sciences
CMHS	College of Medical and Health Sciences
GC	Gregorian calendar
SRP	Student Research Program
ISS	Injury Severity Score
ASA	American Society of Anesthesiologist

Declarations

Acknowledgments

Authors would like to acknowledge staffs of Tibebe Ghion Specialized Hospital, for their kind collaboration and the study participants for providing the necessary information.

Funding

Fund for data collection was obtained from Bahir Dar University, College of Medicine and Health Sciences

Availability of data and materials

The datasets supporting the conclusions of this article are included within the article.

Authors' contributions

WM, TM, and HW assisted in the conception of the study, developed the proposal, involved in the method development, analysis, interpretation of the findings, and the development of a manuscript. NF involved in interpretation of the findings, development of a manuscript. And edited and provided guidance for content to enhance the quality of the manuscript.

Computing interests

The authors declare that they have no competing interests.

References

1. Mulatu A, Melaku T, Chelkeba L. Deep Venous Thrombosis Recurrence and Its Predictors at Selected Tertiary Hospitals in Ethiopia: A Prospective Cohort Study. *Clin Appl Thromb.* 2020;26.

2. Chu CC, Haga H. Venous thromboembolism associated with lower limb fractures after trauma: dilemma and management. *J Orthop Sci.* 2015;20(2):364–72.
3. Whiting PS, White-Dzuro GA, Greenberg SE, Vanhouten JP, Avilucea FR, Obremskey WT, et al. Risk factors for deep venous thrombosis following orthopaedic trauma surgery: An analysis of 56,000 patients. *Arch Trauma Res.* 2016;5(1):5–10.
4. Fuchs S, Heyse T, Rudofsky G, Gosheger G, Chylarecki C. Continuous passive motion in the prevention of deep-vein thrombosis. A randomised comparison in trauma patients. *J Bone Jt Surg - Ser B.* 2005;87(8):1117–22.
5. Qu SW, Cong YX, Wang PF, Fei C, Li Z, Yang K, et al. Deep Vein Thrombosis in the Uninjured Lower Extremity: A Retrospective Study of 1454 Patients With Lower Extremity Fractures. *Clin Appl Thromb.* 2021;27.
6. Sems SA, Levy BA, Dajani K, Herrera DA, Templeman DC. Incidence of deep venous thrombosis after temporary joint spanning external fixation for complex lower extremity injuries. *J Trauma - Inj Infect Crit Care.* 2009;66(4):1164–6.
7. Cafferata HT, Morrison S, Duer C, Depalma RG, McIntyre J, Johansen KH. Venous thromboembolism in trauma patients: Standardized risk factors. *J Vasc Surg.* 1998;28(2):250–9.
8. Yang SD, Ding WY, Yang DL, Shen Y, Zhang YZ, Feng SQ, et al. Prevalence and risk factors of deep vein thrombosis in patients undergoing lumbar interbody fusion surgery. *Med (United States).* 2015;94(48):1–6.
9. Kapoor CS, Mehta AK, Patel K, Golwala PP. Prevalence of deep vein thrombosis in patients with lower limb trauma. *J Clin Orthop Trauma [Internet].* 2016;7:220–4. Available from: <http://dx.doi.org/10.1016/j.jcot.2016.07.003>
10. New T, Journal E, Downloaded M, Society MM. 10.3400/avd.oa.12.00049. 1994;
11. Geerts WH, Bergqvist D, Pineo GF, Heit JA, Samama CM, Lassen MR, et al. Prevention of venous thromboembolism: American College of Chest Physicians evidence-based clinical practice guidelines (8th edition). *Chest.* 2008;133(6 SUPPL. 6):381S-453S.
12. Kakkar AK, Mueller I, Bassand JP, Fitzmaurice DA, Goldhaber SZ, Goto S, et al. Risk Profiles and Antithrombotic Treatment of Patients Newly Diagnosed with Atrial Fibrillation at Risk of Stroke: Perspectives from the International, Observational, Prospective GARFIELD Registry. *PLoS One.* 2013;8(5).
13. Wang P, Kandemir U, Zhang B, Wang B, Li J, Zhuang Y, et al. Incidence and Risk Factors of Deep Vein Thrombosis in Patients With Pelvic and Acetabular Fractures. *Clin Appl Thromb.* 2019;25:1–7.
14. Sharma H, Maini L, Agrawal N, Upadhyay A. Incidence of deep vein thrombosis in patients with fractures around hip joint: a prospective study. *Indian J Orthop.* 2002;36(3):37–9.
15. Wilson D, Cooke EA, McNally MA, Wilson HK, Yeates A, Mollan RAB. Altered venous function and deep venous thrombosis following proximal femoral fracture. *Injury.* 2002;33(1):33–9.
16. Georgopoulos G, Hotchkiss MS, McNair B, Siparsky G, Carry PM, Miller NH. Incidence of deep vein thrombosis and pulmonary embolism in the elective pediatric orthopaedic patient. *J Pediatr Orthop.*

- 2016;36(1):101–9.
17. Jr SN, Connor DO, Kaul S, Sharma J, Napolitano M, Simonian G, et al. Early Detection of Deep Venous Thrombosis in Trauma Patients. 2020;12(7):1–9.
 18. Stannard JP, Singhanian AK, Lopez-Ben RR, Anderson ER, Farris RC, Volgas DA, et al. Deep-vein thrombosis in high-energy skeletal trauma despite thromboprophylaxis. *J Bone Jt Surg - Ser B*. 2005;87(7):965–8.
 19. Pop D V, Dis MT, Apostu D, Oltean-dan D, Gabri Z, Mester A, et al. Incidence of deep vein thrombosis in lower limb fractured patients. 2020;(February).
 20. Y Lu 1, B Ma, R Guo, Y Wang, J Zhang, Y Wu, G Pang, J Xin, W Ye, Y Zou, X Wang, K Hitos, P Curtin JF. No Title. Deep vein Thromb trauma a Prospect study Low limb Orthop trauma patients Tianjin Hosp China [Internet]. 2007;165–70. Available from: <https://pubmed.ncbi.nlm.nih.gov/17489081/>
 21. Douillet D, Nemeth B, Penaloza A, Le Gal G, Moumneh T, Cannegieter SC, et al. Venous thromboembolism risk stratification for patients with lower limb trauma and cast or brace immobilization. *PLoS One*. 2019;14(6):1–15.
 22. Van Adrichem RA, Debeij J, Nelissen RGHH, Schipper IB, Rosendaal FR, Cannegieter SC. Below-knee cast immobilization and the risk of venous thrombosis: Results from a large population-based case-control study. *J Thromb Haemost* [Internet]. 2014 Sep [cited 2021 Apr 2];12(9):1461–9. Available from: <http://doi.wiley.com/10.1111/jth.12655>
 23. Syed FF, Beeching NJ. Lower-limb deep-vein thrombosis in a general hospital: Risk factors, outcomes and the contribution of intravenous drug use. *QJM - Mon J Assoc Physicians*. 2005 Feb;98(2):139–45.
 24. Karcutskie CA, Meizoso JP, Ray JJ, Horkan D, Ruiz XD, Schulman CI, et al. Association of mechanism of injury with risk for venous thromboembolism after trauma. In: *JAMA Surgery* [Internet]. American Medical Association; 2017 [cited 2021 Apr 2]. p. 35–40. Available from: <https://jamanetwork.com/>
 25. Sharma OP, Oswanski MF, Joseph RJ, Tonui P, Westrick L, Raj SS, et al. Venous thromboembolism in trauma patients. *Am Surg*. 2007;73(11):1173–80.
 26. Deep venous thrombosis in a university teaching hospital, Addis Ababa, Ethiopia - PubMed [Internet]. [cited 2021 Apr 2]. Available from: <https://pubmed.ncbi.nlm.nih.gov/9803638/>