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PREVALENCE OF LOWER LIMB DEEP VENOUS THROMBOSIS ON DOPPLER ULTRASOUND AND ITS ASSOCIATED RISK FACTORS: A SYSTEMATIC REVIEW

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Abstract

Background: *Deep vein thrombosis (DVT) in the lower limbs is a frequent and dangerous disorder that can result in pulmonary embolism. Doppler ultrasound is the suitable diagnostic method since it is non-invasive and sensitive.*

Methods: *The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines but does not include a meta-analysis are adhered to in this systematic review. The purpose of the study is to use Doppler ultrasound and related risk factors to ascertain the prevalence of lower limb deep vein thrombosis (DVT). The databases of PubMed, EMBASE, Scopus, and Cochrane were thoroughly searched.*

Results: *Studies conducted worldwide on the prevalence and risk factors of deep vein thrombosis (DVT) are examined in this systematic review. Involvement of the left leg was most common, with prevalence rates ranging from 3.1% to 57%. Cancer, diabetes, surgery, and previous DVT were major risk factors. These results highlight the significance of identifying populations at risk in order to improve management and preventative tactics.*

Conclusion: *Although the occurrence of DVT varies greatly, common risk factors include diabetes, malignancy, immobilization, and surgery. It is more common in women and elderly persons, and it usually affects the left leg. For high-risk groups, early identification is essential.*

INTRODUCTION

Globally, deep vein thrombosis is a serious health issue with elevated morbidity and fatality[1]. Every year, about 2.5 million people are affected by the dangerous medical condition known as deep vein thrombosis[2]. The development of one or more blood clots in one of the body's big veins, usually in the lower limbs, is known as deep vein thrombosis (DVT)[3]. Deep vein thrombosis (DVT) and pulmonary embolism (PE), collectively referred to as venous thromboembolism (VTE), constitute a major global burden of disease[4]. A potentially deadly complication that might appear early in hospitalization is deep vein thrombosis

(DVT)[5]. Three factors—venous stasis, endothelial damage, and hypercoagulability—are described by Virchow's triad as contributing to thrombosis[6]. Surgery, trauma, pregnancy and puberty, immobility, hospitalization, hormone use, cancer, obesity, and hereditary and acquired hypercoagulable disorders are the primary risk factors. According to a Saudi Arabian study, immobility, trauma and surgery, and the use of oral contraceptives and pregnancy were the main causes of lower limb DVTs. DVT of the lower extremities can also result from vascular disorders, infections, neoplasms, and severe accidents[5].

Numerous major extremity veins, including the iliac, superficial femoral vein, popliteal vein, and common femoral vein, are impacted by DVT. Venous thrombosis restricted to the calf veins was classed as distal DVT, while thrombosis encompassing the femoropopliteal, iliac, or inferior vena cava veins was categorized as proximal DVT[7]. Lower limb discomfort and swelling are typical symptoms of DVT. It may then result in post-phlebitic syndrome by structurally damaging the deep vein valves[8]. Pulmonary embolism, post-thrombotic syndrome, recurrent DVT, and treatment-related problems are the main side effects of deep vein thrombosis. The most common imaging test for patients who may have acute deep vein thrombosis (DVT)is venous ultrasonography[9]. Sonography has become a valuable technique for assessing patients with suspected DVT due to its noninvasiveness, lack of ionizing radiation, and portability. Sonography can diagnose DVT with a sensitivity of up to 88–100% and a specificity of up to 92–100%. Doppler is noninvasive, portable, and rapid to conduct, and it provides a more accurate evaluation of the hemodynamic significance of occlusive disease. A 3.5 MHz convex array transducer and a 5 MHz linear array transducer were used for the ultrasound examination. Visualization of light echogenic intraluminal thrombus, absence of phasic venous flow, absence of flow augmentation, and loss of normal vein compressibility on light probe pressure were among the ultrasonographic criteria used to diagnose acute DVT. Multiple venous collaterals, a recanalised vein lumen with a securely attached thrombus, and the appearance of a bright, echogenic intraluminal thrombus were among the ultrasonographic characteristics of chronic DVT.

METHOD AND MATERIAL

This systematic review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines but does not include a meta-analysis. The study aims to determine the prevalence of lower limb deep venous thrombosis (DVT) using Doppler ultrasound and its associated risk factors. A systematic search was conducted in PubMed, EMBASE, Scopus, and Cochrane databases. Keywords included: "deep venous thrombosis", "lower limb", "Doppler ultrasound" and "risk factors of deep venous thrombosis. Studies that report the prevalence of lower limb deep venous thrombosis (DVT) using Doppler ultrasound, Studies including adult patients, Observational studies, cross-sectional studies, cohort studies, and case-control studies and Studies between 2015 to 2025 were included in my systematic reserch and studies like that do not use Doppler ultrasound for DVT diagnosis or Case reports, reviews, commentaries, and editorials or animal based studies were excluded from the my systematic research

Data extraction

Two reviewers, SK, and MZ extracted data independently, gathering relevant information from the selected papers using a consistent data extraction table based on predefined inclusion criteria. When disputes or uncertainties arose throughout the extraction process, ZN and MA rechecked the data to ensure accuracy and consistency. The extracted data included various key domains: study characteristics (such as the author's name, year of publication, country of study, study design, and sample size), patient-related details (including type of deep vein thrombosis DVT or presenting symptoms), specific DVT information (such as the affected limb and vein involved), demographic variables (including patient age, gender, and severity of disease), and study-specific aspects (such as the type of diagnostic modality and assessment of its risk factors

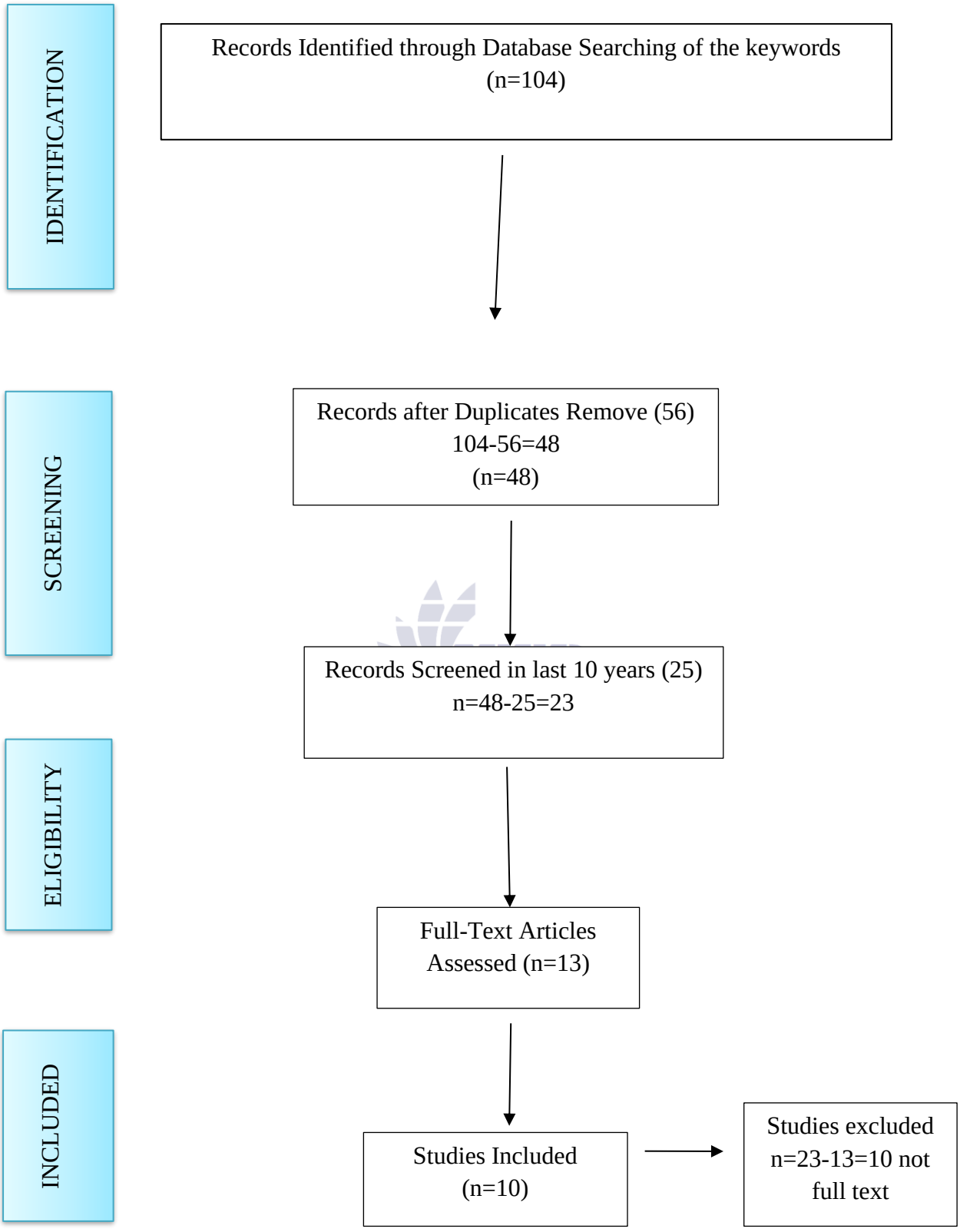

Figure 1: PRISMA flow diagram

RESULTS

Study Selection

Database searches, including those from PubMed, turned up 104 results in all. There were 48 unique records left after 56 duplicates were eliminated. After 25 papers were eliminated through title and abstract screening, 23 publications remained for full-text evaluation. During this phase, a publication date filter spanning from 2015 to 2025 was used, 13 full-text studies out of the 23 articles were possibly qualified. Ten, however, were excluded —two because they were not human research or did not use ultrasound guidance, and eight because the entire texts were not available.10 papers thus satisfied all inclusion requirements and were incorporated into the final analysis. These studies examined lower limb deep vein thrombosis (DVT) and risk factors related to it using ultrasound guidance. An overview of each study's methodology is given in the first table, which also includes information on the authors, sample sizes, ultrasound techniques, evaluation methods, prevalence rates, demographics, and the particular legs and veins affected as seen by Doppler ultrasound. The second table lists the different risk factors for DVT, including prior varicose veins, surgery, trauma, hypertension, pregnancy, heart disease, and cancer.

Table 1: Methodology and quality assessment of included studies

Authors	Year	Area	Size	Study Design	P%	Age	Sex	Limb	Vein affected	US imaging
Farez Abdullah[10]	2017	Saudi Arabia	83	Cross Sectional	15%	Elder 53%	F=76M=23	R=45L=51B=2.4	Not mention	Lower limb Doppler
Bushra HA Abdelmalik[5]	2023	Najran Arabia	60	Retro-spective	57%	Older 40%	F=60M=40	R=15L=75B=10	Popliteal CFV	Triplex Doppler imaging
M. Zaria Ibrahim[11]	2020	Nigeria	252	Retro-spective	43%	Mid age=35%	F=51M=48	R=24L=61B=16	SFV=28PV=19 CFV=26	Venous Doppler
Hilary kamombe zingwre[6]	2021	South Africa	135	Cross-sectional	31%	Mid age=31%	F=76M=24	Not mention	Not mention	Doppler US imaging
S.J Manga[12]	2021	Senegal	64	Retro-spective	3.9%	>60=36%	F=59M=40	R=35L=56B=4	femoral popliteal	Venous Doppler US
YiZheng[13]	2024	China	171	Retro-spective	96%	>50 age	F=53M=47	R=24L=61	Iliac vein=51	Vascular US
Anish Jomy[14]	2024	India kerala	15k	Cross-sectional	3.1%	>55=81%	F=38M=61	Not mention	Affect limb=65%	Doppler US
Gajanan pisulkar[15]	2022	India Megha	202	Observational	Not mention	>60=50%	F=32M=40	Not mention	Peroneal tibial vein	Colour doppler US
Shebang Zhang[16]	2020	China	126	Retro-spective	Not mention	50	F=34M=40	Not mention	Femoral IVC	Doppler US
Fuyou Guo[17]	2019	China henan	196	Retro-spective	31%	>50	F=50M=49	R=23L=62B=14	CMV,PVPEV, PTV	Colour Doppler US

Abbreviations: P= prevalence, size= sample size, limb affected

Table 2: Risk Factors of Deep Venous Thrombosis of included studies

Authors	DM obesity	Trauma Surgery	Pregnancy	CA	History of Varicose vein, DVT	IHD	HP	Symptoms
Farez Abdullah Alaskar[10]	DM=30	Not mention	Not mention	7	Dvt=1.2%	4.8%	1.5%	Acute limb DVT
Bushra HA Abdelmalik[5]	DM=16 obesity =15	Trauma=13 surgery 10	6.7%	13	Not mention	6.7 CHD	Not mention	Acute =56 chronic 38% subacute =5%
M.Zaria Ibrahim[11]	DM=14	Trauma 14	5%	36	Not mention	18%	Not mention	Leg swellings common
Hilary Kamombe Zingwre[6]	Not mention	Surgery 6.9%	12%	12	Dvt=13% Vericose=8.9%	7.6	Not mention	Immobility
S.J Manga[12]	Not mention	Digestive surgery 3.1	4.6%	15	not Mention	6.2%	Not mention	Humans sign, lower limb edema

Yi Zheng[13]	DM=9.2	Surgery 15.8%	not Mention	7.9	Dvt=77% Varicose =76%	Not mention	30.1%	Acute lower extremity Dvt
Anish Jomy[14]	Not mention	Trauma 77	Not mention	32	Dvt=1%	Not mention	61%	Tender, swelling of lower limb
Gajanan pisulkar[15]	Obesity=16	Surgery 41	Not mention	0	Dvt=8%	0%	Not mention	Immobilization >72hr
Shebang zhang[16]	DM=17	Not mention	Not mention	__	11%	8%	25%	Local pain,lower limb swelling
Fuyou guo[17]	DM=1	Surgery 61	Not mention	1	Dvt=,1%	1%	1%	Long term bedridden

DM=Diabetes mellitus, CA= carcinoma History, IHD= Ischemic heart disease, HP=Hypertension

DISCUSSION

Farez Abdullah Alaskar[10] evaluated 83 patients utilizing lower limb Doppler ultrasonography in a 2018 cross-sectional study from Saudi Arabia, revealing a 15% prevalence of DVT. The majority of participants were female (76 out of 83) and elderly (53%). Bilateral DVT was observed in 2.4% of patients, with left limb involvement being somewhat more frequent (51%). DVT in the acute limb was observed. Diabetes (30 patients), cancer (7%), previous DVT (1.2%), ischaemic heart disease (4.8%), and hypertension (1.5%) were important risk factors. DVT prevalence was 57% in a 2023 retrospective study conducted in Najran, Saudi Arabia by Bushra HA Abdelmalik[5] used triplex Doppler imaging to analyses 60 patients. Of the group, 40% were older adults and 60% were female, 75% of DVT cases were in the left leg, and the most frequently affected veins were the popliteal and common femoral. Chronic cardiac disease (6.7%), trauma (13%), cancer (13%), diabetes (16%), obesity (15%), and surgery (10%) were risk factors. There was no history of hypertension, but there was a history of varicose veins or DVT 38% of cases were chronic, 5% were subacute, and 56% of cases were acute, likewise 43% prevalence of DVT was found in a 2020 study conducted by M.Zaria Ibrahim[11] in Nigeria , which evaluated 252 individuals for the condition using venous Doppler. Middle-aged people made up the bulk of cases, and the distribution of cases by gender was almost equal. The superficial femoral, common femoral, and popliteal veins were frequently impacted by DVT in the left leg. Pregnancy, ischaemic heart disease, diabetes, trauma, and a history of malignancy were risk factors, similar study conducted by Hilary kamombe Zingwre[6] in South Africa revealed that 135 patients, the most of whom were middle-aged women, had a 31% DVT rate. Immobility was a prevalent sign of heart disease, varicose veins, malignancy, prior DVT, surgery, and pregnancy history. Another retrospective study shows 3.9% prevalence of DVT in 2021 conducted by S.J Manga[12] in Senegal , which evaluated 64 patients using venous Doppler ultrasound. The majority of participants in the study were over 60 (36%) and were more likely to be female (59%) than male (40%). The left leg had the highest prevalence of DVT (56%), followed by the right leg (35%), and both legs (4%). Most impacted were the popliteal and femoral veins. Pregnancy history (4.6%), cancer (15%), heart disease (6.2%), and intestinal surgery (3.1%) were risk factors; typical symptoms were lower limb edema and immobility, likewise study by Yi Zheng[13] in China in 2024 evaluated 171 individuals and 96% of them had DVT. Nearly equal numbers of patients were male and female, and the majority were over 50. The iliac vein was implicated in 51% of patients, while the left leg was more impacted (61%). Diabetes (9.2%), surgery (15.8%), malignancy (7.9%), and high rates of previous DVT (77%) and varicose veins (76%) were risk factors. Acute symptoms of DVT in the lower extremities were prevalent, and 30.1% of patients had hypertension. In India,[14] Anuh Jomy's survey of 15,000 people, the most of whom were over 55, revealed a 3.1% prevalence of DVT. Sixty-one percent of the injured limbs were male. Trauma (77%), a history of cancer (32%), and hypertension (61%), together with indications of pain and oedema in the lower limbs, were important risk factors. Out of 202 patients, 50% of whom were over 60, were evaluated using color Doppler ultrasound. Observational research conducted by Gajanan pisulkar[15] in Megha, India. According to the study, the most often impacted veins were the tibial and peroneal. No heart disease cases were reported, although risk factors included obesity (16%), surgery (41%), and prior DVT (8%). One of the most common symptoms was immobilization for more than 72 hours , similarly Shebang Zhang[16] conducted a retrospective research in China, evaluating 126 patients with a mean age of 50 using Doppler ultrasonography. Males comprised 40% and females 34%. The IVC and femoral vein were most frequently impacted. Heart disease (8%), diabetes (17%), prior DVT history (11%), and hypertension (25%), were risk factors. Localized pain and swelling in the lower limbs were common complaints. Fuyou Guo[17] conducted a retrospective study in Henan, China, utilizing color Doppler ultrasound to evaluate 196 patients. The results showed that 31% of the patients had DVT, with the majority being over 50. According to the study, DVT primarily impacted the left leg (62%), then the right leg (23%), and finally both legs (14%). CMV, PVPEV, and PTV were the most frequently implicated veins. Diabetes (1%), surgery (61%), ischaemic heart disease (1%), history of DVT (1%), hypertension (1%), and carcinoma (1%), were risk factors. A common

symptom was being bedridden for an extended period of time.

CONCLUSION

The prevalence of DVT across the reviewed studies varies widely, ranging from 3.1% to 96%, influenced by study design, population demographics, and diagnostic methods. Commonly affected veins include the popliteal, femoral, and iliac, with a considerable prevalence in the left leg. Key risk factors frequently identified include diabetes, malignancy, surgery, immobility, prior DVT, and varicose veins. DVT cases were also more likely to be female and older. These results emphasize the necessity of early detection and focused prevention tactics, particularly for high-risk populations.

Limitations and Future Research

There are a number of limitations to this systematic review, including the following: most studies may be region-specific, which limits generalizability to other populations; many studies had small sample sizes or were conducted in single-center settings, which may reduce the external validity of the findings; the risk factor data were inconsistently reported, with some studies lacking detailed statistical analyses; and the heterogeneity among included studies in terms of patient populations, study design diagnostic criteria, and Doppler ultrasound protocols limits the comparability of results; and variations in the experience of sonographers and equipment have also influenced diagnostic accuracy across studies. The retrospective nature of several of the included studies may introduce recall bias and limit the capacity to establish causal correlations between DVT and risk variables. Large-scale, multicenter prospective studies with standardized Doppler procedures and precise risk factor definitions should be the main focus of future research. The quality of the evidence would also be significantly improved by initiatives to adopt consistent techniques and increase uniform reporting across research. Stronger insights into the contributions of particular risk factors to DVT may also be obtained using meta-analyses based on patient data.

Abbreviations

SK= Shamia Kamal
MZ= Muhammad Zubair
ZN= Zari Nawaz
MA= Muhammad Arif

AUTHOR CONTRIBUTION

Author	Contribution
Shamia Kamal	Manuscript writing, Conceptualization, and methodology
Muhammad Zubair	Supervision, review of methodology, and editing of the final draft.
Zari Nawaz	Data extraction, risk of bias assessment, data synthesis, and critical revision of the manuscript.
Muhammad Arif	Quality assessment, formatting, reference management, and proofreading

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