

Invest in Nursing for Global Health: Deep Vein Thrombosis - Diagnosis and Preventive Management in Bhaktivedanta Hospital & Research Institute

Snehal Suhas Mayekar¹, Prerna Ghosh²

Deep vein thrombosis (DVT) and pulmonary embolism (PTE) are known as venous thromboembolism (VTE). DVT occurs when a thrombus (a blood clot) forms in deep veins of the body, usually in the lower extremities (Paydar et al, 2016). These clots usually develop in the lower leg, thigh, or pelvis, but they can also occur in the arm. DVT and pulmonary embolism (comes under venous thromboembolism) are common pathologies that can affect both healthy individuals as well as medical or surgical patients. The prevalence of deep vein thrombosis in various series involving the Western population ranges from 15 percent to 40 percent among patients undergoing major surgical procedures. Autopsy studies document that 50 percent of all patients dying in hospital have DVT. Around 10–30 percent of these patients have pulmonary embolism secondary to proximal DVT. The majority of patients with post-operative DVT are asymptomatic. Complications like pulmonary embolism can be lethal.

Venous thrombosis commonly involves lower limbs, affecting most frequently 6 calf veins, which are involved in virtually 100 percent of symptomatic, spontaneous lower extremity DVT. It is believed that the DVT is less prevalent among the Indians and Asians. The exact data regarding the incidence of DVT in the pre-operative and post-operative patients in India is still lacking. In different hospitals it is differing, and uniformity is lacking. Often the minor occurrence which is the most common thing, goes unnoticed.

Deep venous thrombosis is a preventable and treatable cause of death among hospitalised patients. Nurses' knowledge and proper assessment can play a major role in improving deep venous thrombosis prevention care. Hospitalised patients are at risk of venous stasis, and with the presence of other factors, they are at increased risk of DVT compared to patients in the community.

DVT prophylaxis can be primary or secondary. Primary prophylaxis is the preferred method with the use of medications and mechanical methods

to prevent DVT. Secondary prophylaxis is a less commonly used method that includes early detection with screening methods and the treatment of subclinical DVT.

There have been very few studies on DVT in pre-operative period in hospitalised patients. In this study we used Wells' Clinical tool for the early detection of DVT.

Populations affected: About 70 percent of hospital admissions both in medical and surgical wards and critical area patients develop some sort of DVT. In this population the incidence varies with underlying disease, the intensity of screening programme, and the testing modality.

DVT criteria at initial physical assessment of each patient by nurses play vital role for early detection of DVT. Staff identify the patients based on risk factor and categorise the patients low, moderate and high probability. In spite of advances in imaging facilities such as Doppler, venous ultrasound may not be always available in all peripheral hospitals. Due to delay in the diagnosis, the treatment also gets delayed resulting in wastage of time and risk to patient's life. Therefore, a clinical scoring system had been developed in the hospital by the nurses.

The aim of this study was to determine the accuracy of Wells criteria as a predictive tool in diagnosis of DVT in suspected patients. The present study was conducted to determine the effect of nursing interventions, based on the Wells results.

Objective

Early identification and prevention of deep vein thrombosis through initial assessment of Wells criteria for DVT.

Methodology

Study Setting: The study was a prospective, observational one conducted by the nurses during the period between January 2022 to June 2022 to determine the effect of nursing interventions, based on Wells score at the department of general surgery, intensive care unit, medical and surgical ward at Bhaktivedanta Hospital and Research Institute.

The authors are: 1. Assistant Manager Nursing-Quality & Training, 2. Nurse Educator, both at Bhaktivedanta Hospital & Research Institute, Srishthi Complex, Sector-2, Mira Road (East), Thane-401107 (Maharashtra).

Source of Data: All patients who were admitted; initial assessment and reassessment done by the nurses based on Wells score using Wells clinical tool, till the patients were discharged at Bhaktivedanta Hospital and Research Institute.

Method of Data Collection: The relevant data was collected by using:

- Detailed history of patients who came with lower limb swelling were clinically examined and suspected to have DVT.
- Wells clinical tool.

Inclusion criteria: Patients aged above 18 years and patients with lower limb swelling were included in the study; patients admitted in Bhaktivedanta Hospital & Research Institute.

Exclusion criteria: Patients below 18 years or pediatric patient of DVT were excluded.

Sample size: 134 patients admitted to our hospital for a period of six months according to inclusion criteria.

Type of Study: It was a prospective time-bound study.

Design of the study: 134 patients who came with lower limb swelling were clinically examined and suspected of having DVT. Based on Wells criteria these patients were split up as low, intermediate, and high-risk categories and diagnosis confirmed with DVT.

Literature Review

Deep vein thrombosis (DVT) refers to the formation of thrombosis within the deep veins, dominantly occurring in the pelvis or lower limbs. This clinical syndrome has gained attention as one complication of DVT, pulmonary embolisation, can be fatal. Therefore, early detection and systematic management of DVT and related complications are essential in managing it. The clinical understanding of DVT-related diseases has improved over recent decades.

In this review, we aim to summarise recent literature published within the past few years. [Int J Clin Exp Med 2018; 11(3): 1551-1561. www.ijcem.com / ISSN:1940-5901/IJCEM0060561]

Currently, one of the most popular and most frequently used scales in clinical practice is the Wells scale, which is shown in Table 1.

Clinical Assessment

Wells clinical prediction criteria for DVT: A score of +1 was assigned for active can-

cer (treatment ongoing or within the previous 6 months or palliative); paralysis, paresis or recent plaster immobilisation of the lower extremities; recently bedridden for more than 3 days or major surgery within 4 weeks; localised tenderness along the distribution of the deep venous system; entire leg swollen; calf swelling more than 3 cm when compared to the asymptomatic leg (measured below tibial tuberosity); pitting oedema (greater in the symptomatic leg); and collateral superficial veins (non-varicose).

Alternative diagnosis as likely or greater than that of DVT was assigned a score of -2.

The total score was calculated using all these parameters and the patients were categorised into risk groups as low risk ≤ 0 points, intermediate risk = 1 or 2 points, high risk ≥ 3 points.

Subjects underwent colour doppler for confirmation so that efficiency of the test viz the correlation between Wells score and colour doppler can be determined.

Outcomes and Measures

In accordance with the points allotted in evaluation of patients with suspected DVT, patients were divided into three groups, reflecting probability of DVT of the lower limbs. Points score of -2 to 0 or less indicated a low probability of occurrence of DVT, a score of 1 or 2 points indicated a moderate probability of occurrence of DVT and 3 to 8 indicated a high probability.

Diagnosis

Accurate and prompt diagnosis of DVT is necessary because thrombi left untreated can cause life

Table 1: Wells criteria for DVT for the prediction of Deep Vein Thrombosis*

Clinical feature	Score
Active cancer (treatment ongoing or within previous 6 months or palliative)	1
Paralysis, paresis, or recent plaster immobilisation of the lower extremities	1
Recently bedridden for more than 3 days or major surgery, within 4 weeks	1
Localised tenderness along the distribution of the deep venous system	1
Entire leg swollen	1
Calf swelling by more than 3 cm when compared with the asymptomatic leg (measured 10 cm below tibial tuberosity)	1
Pitting oedema (greater in the symptomatic leg)	1
Collateral superficial veins (non-varicose)	1
Previously documented deep vein thrombosis	1
Alternative diagnosis as likely or greater than that of deep-vein thrombosis	-2

*Wells et al, 2003

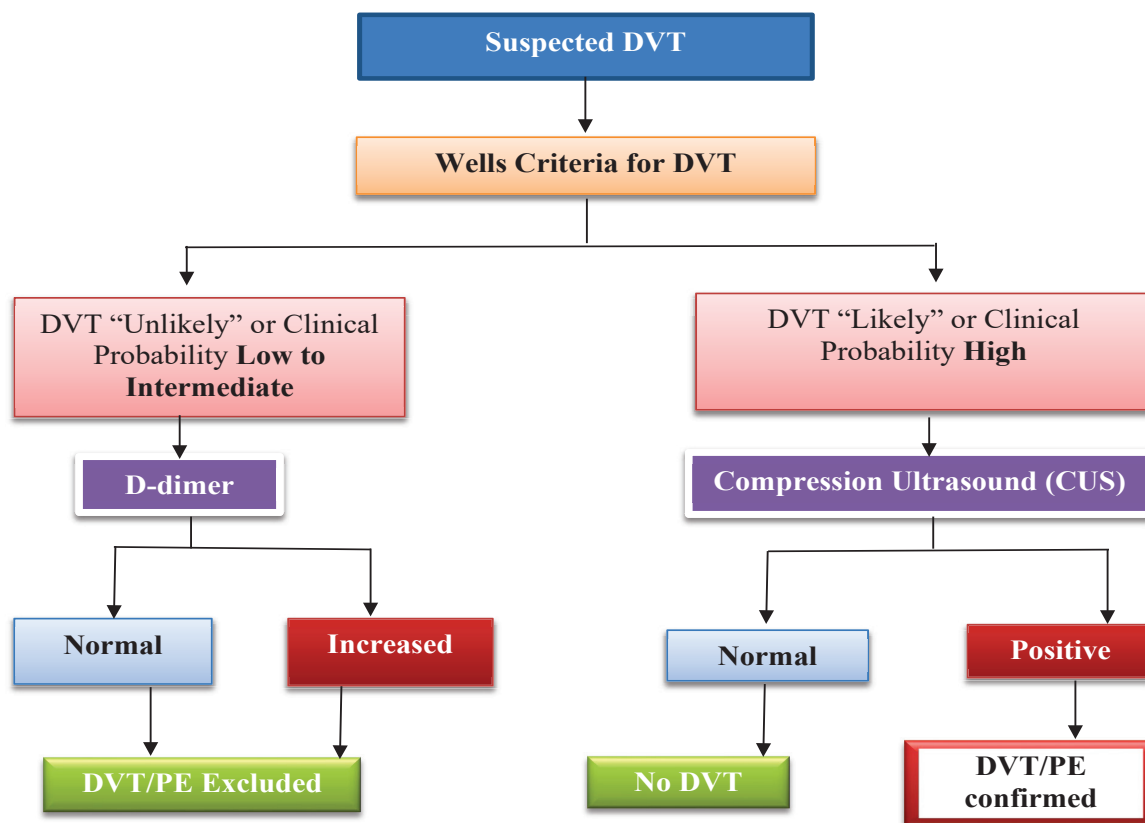


Fig 1: Flowchart of the protocol demonstrating potential use of Wells criteria for DVT surveillance and risk stratification in trauma and surgery patients.

threatening complication like PE. The well-established evidence-based manner to diagnose DVT or venous thrombus embolism is the comprehensive evaluation combining systematic clinical risk factors, symptoms, and signs (Fig 1). The first step is to determine the patient's risk of DVT according to clinical features (including medical history and physical examinations). While many structured clinical probability scoring systems have been promoted to stratify patients, the most recommended model that has been highly studied and widely applied is the Wells score. Based on medical presentation and risk factors, the original Wells score model classified the patients with DVT into three groups (low-probability group, moderate-probability group, and high-probability group).

Following methods are in use to diagnose DVT.

1. Well scoring system
2. D-dimer
3. Venous ultrasonography
4. Contrast venography
5. Magnetic Resonance Imaging (MRI)

Prevention

General risk factors for DVT can be clinically prevented.

Warwick et al proposed a safe and effective protocol for prevention of DVT which has been widely accepted by the surgeons and anaesthetists.

1. General procedures

- Anaesthesia - Epidural anaesthesia can enhance the blood flow and thus reduce the risk of DVT by approximately 50 percent. Additionally, for prevention of spinal haematomas, neuraxial anaesthesia and chemical prophylaxis should be avoided before surgery.
- Surgical technique: Meticulous operative manipulated skill can effectively reduce the release of thromboplastins. Prolonged torsion of main veins may cause endothelial injuries.
- Mobilisation: Mobilisation should be adopted in the early stage post-operatively, which may improve the blood flow in veins.

2. Physical methods

Graduated compression stockings: These can have the incidence of DVT; the below-knee types and the above-knee types may have the similar effectivity, if the stockings are properly woven and well-fitted

Intermittent plantar venous compression: The weight bearing intermittent pressures on the ve-

nous plexus around the lateral plantar arteries guarantee the normal flow of blood from the sole of the foot, and enhance the venous blood flow in the leg. The mechanical foot-pump can mimic this physiological mechanism providing intermittent plantar venous compression in bedridden patients. Previous studies have confirmed the thromboprophylaxis efficacy of this device in patients with hip fracture and patients who received hip arthroplasty or knee arthroplasty.

Intermittent pneumatic compression of the leg: This device can facilitate the post-operative improvement of blood flow in the lower-extremity deep veins and prevent venous sluggish or stasis; it has been widely used for prevention of DVT.

Chemical methods: Unfractionated heparin, low-molecular-weight heparins (LMWH), Penta saccharide (fondaparinux), and factor Xa inhibitors are the most effective chemical agents for prevention of DVT.

Unfractionated heparin carries a risk of aggravated haemorrhage postoperatively, requires laboratory monitoring, and increases incidence of heparin-induced thrombocytopenia. Therefore, it is not recommended in senile patients.

Low molecular weight heparin is safer and more effective than unfractionated heparin due to its superior haematological and pharmacokinetic natures, and pharmaceutical monitoring is unnecessary during its administration. [Int J Clin Exp Med 2018; 11(3): 1551-61 www.ijcem.com / ISSN:1940-5901/IJCEM0060561]

Subsequently, all patients immediately (time frame between inclusion and ultrasound test was several minutes) underwent deep vein doppler study of the lower limbs performed by radiologist in the primary care setting and none of the patients was referred to the other hospital. The ultrasound was performed. To confirm DVT a compression ultrasound (CUS) test was established. Both the proximal portion and the distal deep venous system of the lower limbs were analysed.

D-dimer concentration was not assessed in patients with suspected DVT. Our research team decided to perform ultrasound of deep veins

in all clinical probability groups including patients in low probability group for DVT and ruling out DVT suspicion based on D-dimer level was not necessary. The ultra-sonographers were not aware of the value of Wells scale points score.

The study group of patients was observed over a 10-day period after CUS a (compression ultrasound) test in primary care setting. Patients were aware of symptoms of DVT and/or PE (dyspnoea, tachypnoea, and chest pain) and follow-up was based on the presence of symptoms of DVT and/or PE in anamnesis.

Results

We analysed the relationship between the quantitative variable. Variable is defined on an ordinal scale (incidence of DVT versus Wells scale count).

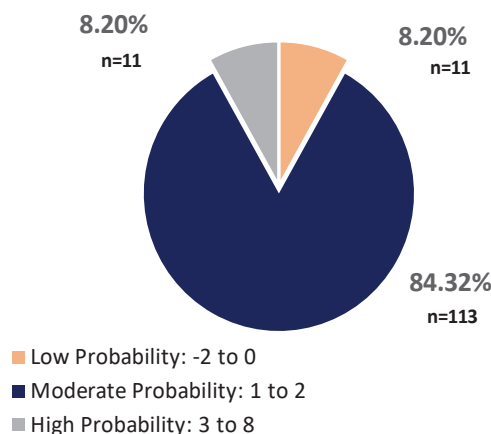
In the period of 6 months (January 2022 to June 2022) a total number of 134 patients (male 74, female 60) with symptoms suggestive of DVT of the lower extremities entered the study. After physical examination the probability of DVT of the lower extremities was assessed, using the Wells scale. As a group of high probability 11 patients were classified: 113 as a moderate probability group; and 11 as the low one.

The relationship between the number of points on the Wells scale, and confirmed cases of DVT are presented in Table 2 and Fig 2.

Out of 134 patients were having high probability, 11 (8.20%) were having moderate probability while 113 (84.32%) were with moderate probability. In the period of low probability DVT incidence was in lower extremities in 11 (8.20%) cases. It comes out that identification of moderate

Table 2: Points on the Well's scale vs confirmed DVT cases

Total	Low probability: -2 to 0	Moderate probability: 1 to 2	High probability: 3 to 8
134	11 (8.20%)	113 (84.32%)	11 (8.20%)



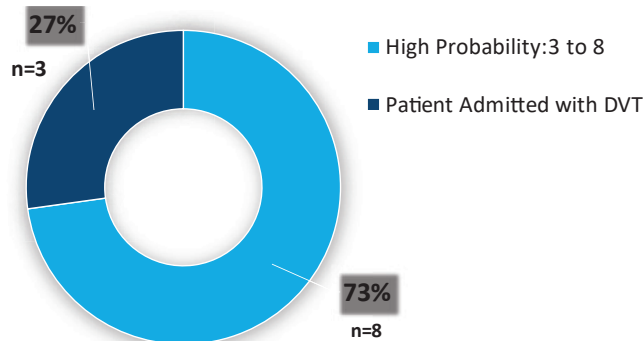
Findings Identification of lower, moderate and higher probability on initial stage by using Wells criteria.

Prevent DVT with simple measures and without financial burden on patient.

Fig 2: Wells scale and confirmed cases of DVT (n=134)

Table 3: Point on Wells scale as associated with confirmed cases and admitted with DVT

Total	Low probability: -2 to 0	Moderate probability: 1 to 2	High probability: 3 to 8	Patients admitted with DVT
134	11 (8.20%)	113 (84.32%)	8 (5.97%)	3 (2.23%)



Findings – By using Wells criteria 3 admitted patients had DVT & 8 admitted high probability patients didn't develop DVT

Fig 3: Wells criteria with high probability of patients

and higher probability patient at their initial stage with the help of Wells criteria facilitates to prevent with simple measures and without financial burden on patient.

The relationship between the number of points on the Wells scale, and confirmed cases of DVT and patient admitted with DVT are presented in Table 3 and Fig 3.

Thus the Wells criteria enables to found out DVT patients and prevent further damage in DVT.

Out of 134 patients with a high probability 11

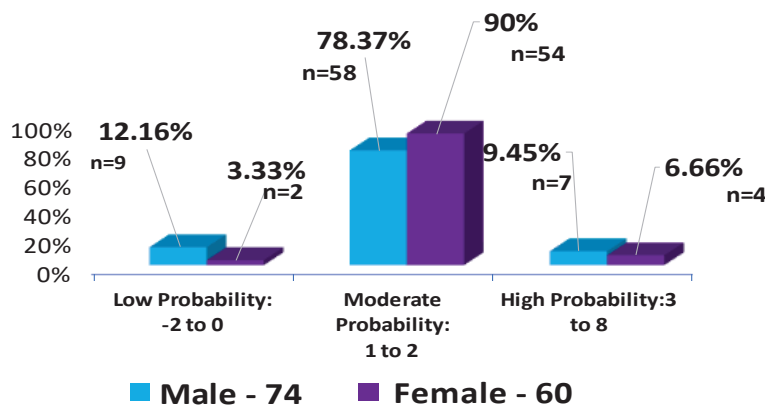
(8.20%) were with moderate probability (n-113, 84.32%). In the period of low probability DVT of lower extremities, 8 (5.97%) patients were admitted with DVT while with high probability there were 3 (2.23%).

The relationship between the number of points on the Wells scale and confirmed episodes of DVT in male and female patient is shown in Table 4 and Fig 4. In the period of 6 month of study, total number of patients was 134. Out of 134, 74 male and 60 female were diagnosed with DVT.

The relationship between the number of points

Table 4: Points on Wells scale as associated with confirmed episodes of DVT I male and female

Gender	Total	Low probability: -2 to 0	Moderate probability: 1 to 2	High probability: 3 to 8
Male	74	9 (12.16%)	58 (78.37%)	7 (9.45%)
Female	60	2 (3.33%)	54 (90%)	4 (6.66%)



Findings- Male and female criteria show the gender difference for developing risk of DVT.

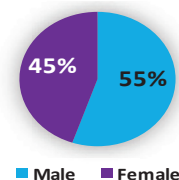
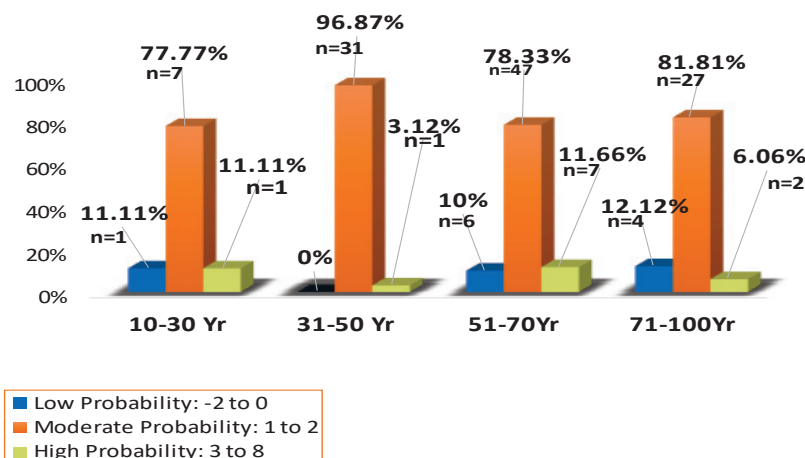


Fig 4: DVT in male and female patients.

Table 5: Points on Wells scale as associated confirmed episodes of DVT according to age

Age	Total	Low Probability: -2 to 0	Moderate Probability: 1 to 2	High Probability: 3 to 8
10-30 Yr	9	1 (11.11%)	7 (77.77%)	1 (11.11%)
31-50 Yr	32	0 (0%)	31 (96.87%)	1 (3.12%)
51-70 Yr	60	6 (10%)	47 (78.33%)	7 (11.66%)
71-100 Yr	33	4 (12.12%)	27 (81.81%)	2 (6.06%)



Findings - Age difference show, risk of DVT, early age can also affect for DVT. The significant observation indicates that the 19 years of old male patient have DVT

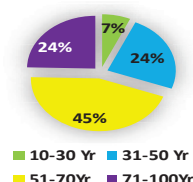


Fig 5: Wells scale and confirmed episodes of DVT according to age group.

on the Wells scale and confirmed episodes of DVT according to age group in Table 5 and Fig 5. In the male group (n=74), 7 (9.45%) were having high probability, 58 (78.37%) had moderate probability and 9 (12.16%) were in low probability range.

In the period of 6 months of study, out of 134 patients in the age range 10-30 years there were 9 persons; 1 (11.11%) had high probability, 7 (77.77%) had moderate probability and 1 (11.11%) had low probability of DVT

Age between (31-50 years, n=32): 1 (3.12%) was in high probability, 31 (96.87%) had moderate probability and no patient was found in the low probability.

Age between 51-70 years, n=60: 7 patients (11.66%) had high probability, 47 (78.33%) had moderate probability and 6 (10%) had low probability of DVT.

Age between 71-100 years, n=33: 2 (6.06%) were having high probability moderate probability n had and 6 (12.12%) low probability of having chances of developing DVT. Age-wise analysis shows risk of DVT; early age can also affect development of DVT. The incidence of DVT increases with age, and DVT is very rare in childhood.

Discussion

The aim of this study was to determine the effect

of nursing interventions, based on Wells score results. The Wells scale was originally designed as an auxiliary tool for assessment. In patients of low risk there is no need for admission or pharmacological prophylaxis in patients with symptoms suggestive of DVT.

In the period of 6 months of study out of 134 patients 9 were in the age range 10-30 years, 9 with high probability 1 (11.11%) had high probability and 7 (77.77%) moderate probability and 1 (11.11%) had low probability of DVT.

The significant observation indicates that in the 10-30 years group (n=9), one 19 years male patient was having DVT. Here we found that blood clot can happen at any age while they are more common in adults. The review of literature shows blood clot such as DVT can also happen in children and teenagers, so there is no normal age for people to get a DVT.

In this study we got the observation of high probability (n=11, 8.20%), but among this group (n=3, 2.23%) patients come with DVT; conservative treatment was started for them for prevention of further damage.

It is worth emphasising that a comparable number of patients with suspicion of DVT entered our study. After identification of moderate and high probability risk of DVT, prophylaxis was im-

plemented such as DVT pump (Flow Tron Pump), early mobilisation, if patients are immobilised as per diagnosis for more than 3 days e.g., Pelvic, Hip or Leg surgery. Planter and flexion movement, contraction, and relaxation of body parts were done.

We found a highly accurate Wells scale performance, when used by primary care nurses in assessing clinical probability of deep venous thrombosis of the lower limbs. It should be emphasised that in the groups of patients with moderate and low clinical probability of DVT the rate of confirmation by CUS thrombosis was low and not one of the patients with negative CUS in the 10 days follow-up period expressed a new event of DVT. This was a very significant observation indicating that early identification and implementing prophylaxis measures are useful in prevention of DVT in patients who are at risk.

Conclusion

The results of the present study showed that using the Wells score for early identification of the at-risk patients and nursing interventions helps prevention of DVT. Appropriate nursing interventions were also effective in reducing the incidence of non-pitting oedema in the lower extremities. Nurses can prevent DVT after identifying at-risk patients by using screening tools.

Diagnosis of DVT presents a clinical challenge for physicians. Risk-factor evaluation with Wells scoring system, D-dimer examination, and venous ultrasonography can facilitate the prediction and identification of DVT. Mechanical and pharmacological prevention methods are recommended in high-risk patients, while the primary objectives of therapeutic agents are to prevent complications following expansion of thrombus.

In our study conducted on 134 patients the Wells criteria was used in primary care setting demonstrated a high degree of accuracy. In patients with high probability of DVT, Wells Criteria for DVT accurately predicted the suspected patients. This can benefit the patients in future to treat them before it gets complicated and do not hamper their day-to-day activities improving their quality of life.

Recommendations

All patients should be evaluated in terms of the risk of developing DVT at the time of admission. Then we can detect at-risk patients early and start preventive nursing measures. Initial assessment of each patient by applying Wells criteria for DVT helps in early identification and prevention of DVT. Instead of D-dimer, ultrasonography (doppler study) of deep veins should be performed by the physician. Use DVT pump during long-term surgeries as preventive measure.

It is recommended that further studies and research be conducted on initial assessment with applying Wells criteria for DVT for assessment of the patients. Start preventive nursing measures, including anti-embolism stockings, exercise, and elevating legs above the heart level, begin from the first moment of admission to the ward.

References

1. Paydar S, Sabetian G, Khalili H, Fallahi J, Tahami M, Ziaian B et al. Management of deep vein thrombosis (DVT) prophylaxis in trauma patients. *Bulletin of Emergency & Trauma* 2016 Jan; 4(1): 1
2. Wells PS, Anderson DR, Rodger M, Forgie M, Kearon C, Dreyer J, et al. Evaluation of D-dimer in the diagnosis of suspected deep-vein thrombosis. *N Engl J Med* 2003; 349: 1227-35. doi: 10.1056/NEJMoa023153
3. Dybowska M, Tomkowski WZ, Kuca P, Ubysz R, Jóźwik A, Chmielewski D. Analysis of the accuracy of the Wells scale in assessing the probability of lower limb deep vein thrombosis in primary care patient's practice. *Thrombosis Journal* 2015 Dec; 13(1): 1-5
4. Coon WW, Willis's 3rd PW, Keller JB. Venous thromboembolism and other venous disease in the Tecumseh community health study. *Circulation* 1973; 48: 839-46
5. Esmon CT. Inflammation and thrombosis. *J Thromb Haemost* 2003; 1: 134 1348
6. Heit JA, Cohen AT, Anderson FJ. Estimated annual number of incidents and recurrent, non-fatal venous thromboembolism (VTE) events in the US. Abstracts of the American Society of Hematology 47th annual meeting, December 10-13, 2005, Atlanta, GA. *Blood* 2005; 106 (11)
7. Humphries J, McGuinness CL, Smith A, Waltham M, Poston R, Burnand KG. Monocyte chemotactic protein-1 (MCP-1) accelerates the organization and resolution of venous thrombi. *J Vasc Surg* 1999; 30: 894-99

Corrigendum

In Sept-Oct 2022 (Vol CXIII, No 5) issue of NJI, under the article "Effectiveness and Implications of a Structural Hands-on Training on OSCE for Nursing Faculties: A Pilot Project by the Trained Nurses Association of India" at p.199, last author name is missing. Accordingly, (1) after name of 15th author may be added, ", Settepalli Jasmindebora¹⁶"; (2) At bottom under affiliation may be added in last"; 16. Professor, SGT University, Gurugram (Haryana)".

The error is regretted. - Editor.