ORIGINAL ARTICLE

The Prevalences, Risk Factors, and Lengths of Hospital Stay of Patients with Suspected Lower Limb Deep Venous Thrombosis in the King Abdulaziz University Hospital, Jeddah, Kingdom of Saudi Arabia

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Abstract

The prediction of risks and the predisposing factors that lead to the formation of blood clots, using appropriate clinical examination is crucial to the treatment of thrombosis. It is important to estimate the length of hospital stays of those clinically suspected of thrombosis. This study evaluated the prevalence of lower-limb deep venous thrombosis and its associated risk factors to predict the lengths of hospital stays of the patients. The 1,201 medical records of patients, aged 16 to 98 years, were collected from the King Abdulaziz University Hospital from January 2013 to December 2015. Their thrombosis were evaluated using a doppler ultrasound and a sonographic assessment. The results of the study revealed the prevalence of thrombosis among 18.9% of the elderly patients, 14.5% in patients with diabetes mellitus, 13.3% in those with hypertension, 17.8% in bed-ridden patients, 12.2% in patients with ischemic heart disease, 20.5% in patients with breast cancer, 5.1% in pregnant women, and 10% in obese patients. No deep venous thrombosis was reported in patients with history of heart failure. Having breast cancer and being old were the major risk factors that were identified among the patients with lower limb deep venous thrombosis.

Keywords

Venous thromboembolism; Lower extremities; Deep vein thrombosis; Prevalence; Risk factors; Hospital stay

Introduction

Deep venous thrombosis (DVT) usually occurs, when there is a formation of blood clots in the deep veins of surgical and non-surgical patients. The life-threatening complications of acute pulmonary embolism, along with other long term complications, can likely be precluded through the accurate diagnosis of acute DVT. These long-term complications include pulmonary hypertension and post-thrombotic syndrome. No symptoms appear among the patients, who are suffering from these complications. However, at times, they could also be presented with redness, pitting edema, superfacial collateral veins, leg swelling, pain, skin wound, and fever. Diagnosing DVT is a clinical challenge, because it resembles other clinical conditions, such as cellulitis, lymphangitis, thrombophlebitis, hematoma, ruptured Baker's cyst, and muscle tears[1–3]. As a result, physicians tend to order the conduct of unnecessary investigations, which subject the patients to unwanted procedures and result in increased healthcare costs. No reliability is achieved in the accurate clinical diagnosis of DVT[4]. The best way to avoid a misdiagnosis or over-treatment is by using a clinical assessment of the pretest probability, as recommended by the Saudi Expert Panel[3]. The patients are classified into two groups or three categories, based on the Wells Score, which is the most prevalent scoring system used herein. The grouping may include a likely DVT group and an unlikely DVT group, whereas, the categories include high, moderate, or low categories[4-7]. The combination of plasma D-dimer measurement with the Doppler ultrasonography of the lower limb provides a gold standard method, as this is highly sensitive, non-invasive, and has high specificity rates[9]. Other imaging modalities, like contrast venography, computed tomography, and magnetic resonance imaging, are alternative diagnostic methods, but are rarely used nowadays, and yet, they are considered as reference standards for DVT diagnosis[10].

As described by Vircow, the three major causes of DVT are venous stasis, intimal damage, and hypercoagulable state[11]. Thus, knowing the risk and the predisposing factors forming the blood clot is crucial to the prediction, the performance of appropriate clinical examination, and the laboratory tests used to confirm or reject the results of the diagnosis, given the fact that only 20% of the patients, who are suspected to have acute lower limb DVT, ended up being diagnosed as positive of the disease[8].

This study evaluateRd the prevalences of acute lower limb DVT in the King Abdulaziz University Hospital (KAUH). The predisposing factors, along with the estimation of the total lengths of the hospital stays of the patients with suspected acute lower limb DVT, were also investigated. There is a significant difference in the reported incidences of DVT in hospitalized patients in developed countries. For instance, the reported incidences range from 48 per 100,000 people in England, whereas, it is 124 per 100,000 people in France[12]. Cardiac disease patients have higher number of incidences of lower limb DVT[13]. The specific treatment given for this condition is the anticoagulation therapy, which reduces the risk of recurrent DVT, pulmonary embolism, and the progression of thrombosis[14–16]. Under serious conditions, doctors provide treatments, like thrombolysis and inferior vena cava filter (IVCF) implants. There is a significant association of venous thromboembolism (VTE), including DVT and pulmonary embolism, with morbidity and mortality[17]. According to Hansson *et al.*[18], there is a 22% recurrence rate of VTE after the first DVT, while the rate is 28% after the second episode.

Materials and Methods

Research Design and Setting

This study had employed a retrospective cross-sectional design that was conducted over a period of 36 months from January 2013 to December 2015 in the KAUH in Jeddah, Kingdom of Saudi Arabia.

Research Sample

One thousand one patients, with ages between 16 to 98 years, were recruited to determine the prevalence of acute lower limb DVT and its associated risk factors in these patients. They were recruited on the basis of their medical histories.

Ethical Consideration

The Ethics Committee of the KAUH, which is known as the Institutional Review Board of Hospitals, had approved this study. This is a retrospective study, and therefore, there is no requirement in soliciting the consents of the patients. However, the data were kept anonymous.

Data Collection

The study included the data of all of the patients with suspected DVT, who were admitted in the hospital from January 2013 to December 2015. The scans of the lower limbs of the patients during their routine examinations were done using a Doppler ultrasound. The sonographic procedures were performed by professional sonologists and sonographers, and the results were reported by experienced radiologists. The data on the patients, including their demographics (age and sex), body mass index, signs or symptoms, sites of their DVT, as well as their risk factors, were recorded.

Data Analysis

The collected data were analyzed using IBM SPSS Statistics for Windows, Version 19.0. (IBM Corp. Armonk, NY USA). The statistical values were represented in the form of frequencies. This technique was used, because it helps in providing the needed analysis on the risk factors and can identify the prevalences of acute lower limb DVT, when the hospital stay of the patient is long. The *P*-value test was used to approximate the statistical inference on the basis of the summary statistics, where $P = 0.05$.

Results

The ultrasound results showed that the prevalence of DVT among the suspected patients was 15.5%, while remaining 84.4% were patients without symptoms of DVT (Table 1).

Table 1. Results of the ultrasound procedure that was applied to the patients with suspected deep venous thrombosis

	Frequency	Percent
Negative	1,015	84.5
Positive	186	15.5
Total	1,201	100.0

Seventy-nine patients were elderly (≥ 60 years old), 32 patients had diabetes mellitus, 26 had hypertension, 13 were bedridden, five had ischemic heart disease, eighthad breast cancer, two were pregnant, and one was obese (Table 2). However, no DVT was reported in patients, who had experienced heart failure. The remaining 43.1% had unidentified risk factors for DVT (Table 2). The patients suffering from breast cancer comprised the highest number of patients with DVT, followed by the old age patients.

With respect to the length of hospital stays of the DVT patients, approximately 70% of the cases were determined whether the DVT disease had occurred in them or not during the first ten days of hospitalization. The mean (± SD) for the number of DVT positive patients was 2.4 (± 3.2), whereas, for the number of negative DVT patients was 16.8 (± 17.9). The mean number of days to diagnose DVT was 11.84 days, while 11.74 days constituted the sufficient amount of time to exclude the presence of DVT in a patient. The observed occurrence of DVT after day 11 was markedly low. In other words, the 11th day of hospitalization was determined as the maximum number of days to make an incisive decision on whether the patient should be discharged or should stay in the hospital for the treatment of DVT or other diseases.

Discussion

Deep venous thrombosis is an important medical disorder to be addressed because of its catastrophic complications that may lead to death. The number of

Table 2. Comparison between patients with and without deep venous thrombosis in terms of risk factors

Risk Factor	Frequency	Percent	Without DVT		With DVT		*P*-value
			n	%	n	%	
Elderly	418	34.8	339	81.1	79	18.9	0.03
Diabetes mellitus	220	18.3	188	85.5	32	14.5	0.05
Hypertension	195	16.2	169	86.7	26	13.3	0.02
Bedridden	73	6.1	60	82.2	13	17.8	0.41
Ischemic Heart Disease	41	3.4	36	87.8	5	12.2	0.03
Breast Cancer	39	3.2	31	79.5	8	20.5	0.33
Pregnant	39	3.2	37	94.9	2	5.1	0.52
Obese	10	0.8	9	90.0	1	10.0	0.43
Heart Failure	12	1.0	12	100.0	0	0	0.72
Others	518	43.1	446	86.1	72	13.9	0.15

DVT: deep venous thrombosis

studies on the DVT in the Middle East region is limited. Venous thromboembolism as a significant cause of morbidity and mortality was highlighted by the study results of Al Sayegh *et al.*[19]. The study was helpful in understanding the epidemiology, etiology, clinical presentation, and the treatment options in improving the patient's safety. Similarly, our study investigated the prevalence of the DVT in the lower extremities, estimated length of hospital stays of the patients, and compared the characteristics of the patients with and without DVT in terms of their risk factors. However, Al-Hameed *et al.*[3] stated that the real cause of the incidence of VTE in the Kingdom of Saudi Arabia is still unknown, but they assumed an incidence of 25,000 cases annually. Since this current study was based on a retrospective design, the incidence rate was not calculated.

This study revealed a prevalence of the DVT in 15.5% (186 patients) of the 1,201 patients, who were suspected to have DVT. Our study results are very similar to those reported in Asian reports, which claimed relatively lower rates of DVT incidences than those found in the rest of the world[20]. For example, the prevalence rate among the Chinese was reported to be 15.12%[21]. In comparison with the studies from the Middle East region, Al-Thani *et al.*[22] studied 6,420 patients, and their diagnosis for DVT confirmed 662 patients (10.3% of their sample population) to be positive, which is also in agreement with the results of other studies[19,23,24]. Likewise, a prevalence of 18.3% was reported by Yamada *et al.*[25] among the hospitalized non-surgical patients. A lower degree of prevalence was reported among the various ethnic groups visiting or living in Jeddah, a multicultural city with diverse ethnic populations, by Keenan and White[26] through their investigation on the relationships between race/ethnicity and the risks of VTE. Fewer number of previous studies, while reviewing the prevalence of DVT under intensive care unit (ICU) setting, had found relatively higher rates of DVT prevalence, which ranged from 11.1% to 31%. These rates were dependent on the investigated population and the type of the provided treatment management[27–29]. Furthermore, Geerts *et al.*[30] reported a higher rate of DVT at 58% in patients, who were admitted for major traumatic injuries and who did not receive thromboprophylaxis.

The significant increase in the occurrence of DVT among older patients that were reported in our study agrees with the findings of a number of previous studies[31–40]. An increase per year from less than 5 per 100,000 in patients, who were under the age of 15 years, to over 500 per 100,000 in patients over the age of 80 years, was also indicated in previous studies[16,41]. Studies conducted by Kreidy *et al.*[42] and Engbers *et al.*[43] have also supported the fact that old age is a major risk factor that may lead to DVT, because it is accompanied by prolonged immobility, increased frequencies of comorbidities, and age-related hypercoagulability. The insignificant differences between DVT-positive and DVT-negative groups was also reported in previous studies[44–46]. There is an agreement between the findings proposed by Gaitini *et al.*[5] and the findings of our study, because it correlates malignancy with the occurrence of DVT. Significant risks of VTE due to anticancer therapy was reported by Horsted *et al.*[47] The patients with newly diagnosed DVT were previously suspected to have cancer[23,25,48-53]. However, the rate on this was markedly lower at 4% in a study conducted in the same hospital, i.e., in KAUH, in the year 2000. This could be explained by the very small sample size of 75 patients in the study[54].

The findings in this current study, as well as in prior studies[5,23,51–53,55], indicate a significant proportion of patients, who were immobilized or bedridden due to DVT. Hence, the importance of close monitoring and providing adequate thromboprophylaxis treatment in such patients was emphasized by Di Minno *et al.*[56]. Other associated risk factors for DVT were DM and hypertension, which were observed in 14.5% and 13.3% of the total number of patients, respectively. Similarly, 28% of the occurrences of DVT and 37% of those with hypertension were reported by Al-Thani *et al.*[22] to involve patients with clinical histories of DM. Diabetes was investigated as an independent predictor of recurrent DVT[22].

A wide range of studies showed the significant association of DVT with the risk factors, like obesity, myocardial infarction, ischemic heart disease, heart failure, cerebrovascular diseases, collagen vascular diseases, trauma, pelvic fractures, and major surgeries[51–53,57–61]. According to McColl *et al.*[62], the risk of VTE increases during pregnancy and during hormone replacement therapy. There was also a strong association between the length of stay in the ICU and the diagnosis of DVT as reported by Wilasrusmee *et al.*[63] The study also showed an increase in the odds of VTE by 7% per day that was spent in the ICU[63].

This study confirmed that patients, who went through an 11-day stay in the hospital were clinically suspected to have DVT. This result is supported by the findings of Michetti *et al.*[59], stating that majority of the VTE episodes were diagnosed on day 4 or later, with a median at day 10. Likewise, D-dimer tests in old comatose patients upon admission and on day 7 were studied by Yamada *et al.*[64]. Their results showed that there is no difference in the D-dimer values among the DVT-positive and negative groups on admission. However, the values became significantly higher on day 7, with P <0.01, which imply the occurrence of DVT on day 7. Marik *et al.*[65] also conducted a study, which took 4–7 days for most ICU patients to be diagnosed with DVT, even with the administration of thromboprophylaxis. Moreover, the diagnosis of DVT was reported in 9.6% of the ICU patients, who were diagnosed during their ICU stays, with a median length of 10 days[66].

The big size of our sample population and the long study period are the major strengths of our study. However, several limitations were encountered in this study. Firstly, our study was limited by its retrospective observational design and by the patients' data, which include their medical histories, clinical characteristics, and their risk factors, which are, in turn, limited to the information that are written in their medical records. The underestimation of the prevalence of the risk factors on VTE may due to these missing information. However, the generalization of the study results should be viewed accurately, because the data were collected from a single center, i.e., the KAUH. Thirdly, the findings were derived from the different clinical departments, which have been addressing the prevalence of DVT. For instance, if the investigation was carried out in the ICU or in the trauma unit, the results would give a higher prevalence level as suggested by other studies. Fourthly, it was not certain, if the clinical pretest probability assessment was performed for all of the patients. Lastly, since the DVT screenings were performed by several technicians, it is assumed they had performed relatively similarly, as they are all professional sonographers, sonologists, and radiologists.

Conclusions

Majority of the cases were presented to be negative, based on the doppler ultrasonography findings. However, it was shown that < 20% of the patients with suspected DVT were actually positive of the disease. In fact, this study reveals a significant relationship among the factors on age, malignancy, being bedridden, DM, hypertension, ischemic heart disease, obesity, and pregnancy with the prevalence of DVT. A major finding of this study showed that the 11th day of hospitalization was determined as the maximum day to make a decisive decision on whether the patient should be discharged or must stay in the hospital for the treatment of DVT or other diseases, which also agrees with the findings of other studies.

Recommendations

This study recommends a strict clinical application of the pretest probability assessment, *i.e.*, the Wells Score, prior to the confirmation of the presence of DVT by diagnostic tests in order to avoid unnecessary investigations and to reduce healthcare costs and efforts. In addition to this, our study recommends increasing awareness among healthcare personnel about the seriousness of VTE and the importance of thromboprophylaxis in the high risk population, because it was found to decrease the occurrence of VTE. The study results also suggest to encourage patients to increase their mobility during their stays in the hospital, because this may decrease their likelihood of developing DVT.

Conflict of Interest

The authors declares that they have no conflict of interest that is related to this study and this article.

Disclosure

The authors did not receive any type of commercial support either in forms of compensation or financial for this study. The authors have no financial interest in any of the products or devices, or drugs mentioned in this article.

Ethical approval and consent to participate

The study was approved by the Ethics Committee of the KAUH in Jeddah, Kingdom of Saudi Arabia, also known as the Institutional Review Board of Hospitals.

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الانتشار وعوامل الخطر وطول مدة الإقامة في المستشفى بين المرضى المصابين بتخثر وريدي عميق في الأطراف

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المستخلص. من الأهمية التنبؤ بالمخاطر والعوامل المؤدية إلى تكون الجلطات الدموية من خلال الفحص السريري المناسب، ومن المهم تحديد العوامل المؤهبة، وتقدير طول فترة الإقامة في المستشفى لأولئك الذين لديهم شبهة سريرية للتخثر الوريدي العميق الحاد للطرف السفلي وتهدف هذه الدراسة إلى تقييم مدى انتشار الإصابة بالجلطات في هذه الأوردة، واستقصاء عوامل الخطر الموجودة لدى المرضى للتنبؤبمدة إقامتهم في المستشفى، وتمت الدراسة بأثر رجعي وجمع ١٢٠١ سجل طبي للمرضى الذين تتراوح أعمارهم بين ١٦-٩٨ سنة من مستشفى جامعة الملك عبد العزيز من يناير ٢٠١٣ حتى ديسمبر ٢٠١٥، و تم تقييم الطرف السفلي باستخدام موجات دوبلر والموجات فوق الصوتية، حيث كشفت نتائج الدراسة عن انتشار الاصابة بجلطات الاوردة العميقة بين ١٨,٩٪ من المرضى المسنين و ١٤,٥٪ في مرض السكري و ١٣،٣٪ في مرضى ارتفاع ضغط الدم و ١٧,٨٪ في المرضى الملازمين للفراش، ١٢,٢ ٪ في مرضى الذبحة الصدرية، ٢٠,٥٪ في مرضى سرطان الثدي، ٥,١٪ في النساء الحوامل، و ١٠٪ في ذوي السمنة، لكن لم يتم اكتشاف المرض في الاشخاص الذين يعانون من فشل القلب الإحتقاني، وخلصت الدراسة أيضا إلى أن سرطان الثدي و العمر المتقدم كانا عاملي الخطر الرئيسين بالنسبة للمرضى الذين يعانون من تخثر وريدي عميق في الأطراف السفلية.