

Comparison of the ultrasonography report by the emergency service with radiology service in suspected DVT patients: A cross sectional study for investigation about pharmaceutical and therapeutic interventions

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Abstract

The present research aimed to compare the ultrasonography reports by the emergency service with the radiology service among suspected DVT patients. The present cross-sectional and diagnostic research was conducted on 150 patients suspected of DVT in lower limb who visited the emergency section of Shahid Mohammadi Hospital in Bandar Abbas in 2017. Patients referring to the emergency section and suspected of DVT received an ultrasound sonography by the emergency service. Then the results obtained from patients' medical records were compared with the radiologists' report of Doppler ultrasound to check the presence or absence of DVT. In terms of gender, 76 patients (50.7%) were male while 74 (49.3%) were female. The precision in the diagnosis of the emergency service was 100% and the diagnostic specificity of the same service was 90.62%. The negative predictive value in the emergency service was estimated at 100% while the positive predictive value in the same service was 93.47%. The precision of 95.3% with a confidence interval of 95% was estimated at 91.1% to 99.5% ($p=0.000$). According to the present findings, it can be concluded that performing an ultrasonography to diagnose DVT in the emergency service enjoys a high sensitivity of 100% and a negative predictive value of 100%.

Keywords: Deep Venous Thrombosis (DVT); radiology; medical emergency; ultrasonography

Introduction

DVT (Deep Venous Thrombosis) is a prevalent disorder with fatal consequences [1]. In the USA, more than

200 thousand people are afflicted with DVT. In other words, per thousand people, 70113 get annually affected by the diseases. Some even believe that the

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population of the affected is even higher as a number of people do not visit hospitals and the disease is not even diagnosed in some others [2]. DVT follows an increasing rate with the growth of age and about one-third of the patients get afflicted with pulmonary embolism which, if not treated on time, can cause a mortality rate of 20%. Within the past three decades, the mortality rate induced by DVT has been decreased. The primary reason for that is the improvement of diagnostic methods which helped to accelerate diagnosis and provided for a better treatment of patients. DVT has non-specific symptoms and the related clinical examinations are insensitive and unreliable.

DVT can cause leg pain or swelling, but also can occur with no symptoms. Increasing age, smoking, pregnancy, inheriting a blood-clotting disorder, having a vein disease, such as varicose veins and being overweight or obese are the several factors which can affect blood flow in the deep veins and increase the risk of DVT. Only about 20-30% of patients affected by DVT have the clinical symptoms and 90% of them end up with fatal and non-symptomatic pulmonary embolism induced by DVT [3,4]. In the majority of therapeutic settings, it is hard for the patient to access a clinical ultrasonography within a short time. Today, new technologies especially ultrasonography devices that can be operated at patient's bed have enabled emergency medics to make more effective diagnosis. Thus, the U.S. medical emergency association guideline concerning DVT recognized ultrasonography as the core of the diagnostic measures taken by the emergency staff [3,5]. Therefore, within the past 15 years, there has been a growing rate of using ultrasonography in the emergency service and several

investigations showed that the emergency medical team are capable of operating ultrasonography as a diagnostic test for DVT. However, a couple of investigations questioned the precision of ultrasonography in the emergency service [6]. The present study aimed to compare the ultrasonography result reported by the emergency service and that of the radiology service for patients suspected of DVT who visited Shahid Mohammadi Hospital in Bandar Abbas.

Materials and methods

Patients

The present research was cross-sectional in type and had a diagnostic value. It was conducted on 150 patients suspected of DVT in lower limbs who visited the emergency section of Shahid Mohammadi Hospital in Bandar Abbas in 2017. These patients were selected in a convenient, purposive sampling method and entered the study in accordance with the inclusion and exclusion criteria. The former were being suspected of DVT as diagnosed by medical emergency specialists and the age equal or above 18. The latter was unwilling to take part in the study.

Research protocol

In advance to the conduction of this research, the required code was obtained from the committee of ethics at Hormozgan University of medical sciences (HUMS.REC.13960163). Moreover, all participants were supposed to announce full consent to take part in the study. The patients visiting the emergency service and were suspected of DVT included those with inflammation and pain in legs without any recent surgery. They were first examined by the attending senior resident and then entered the study. The next step was to obtain and record their demographic information. Then, a portable

ultrasonography was as operated+3 by an attending senior resident or a medical emergency specialist to check the femoral and popliteal arteries and the presence or absence of DVT was recorded in a checklist not shown to the patient. All patients were told in advance that they needed to be examined by a radiology specialist again. Those diagnosed with DVT in the emergency service were immediately treated. Then, the radiologist's report within the 12 hours of the first ultrasonography along with the Doppler ultrasonography showing the presence or absence of DVT were recorded. The ultrasonography model used in the emergency service was SONOACE X8 and that of the radiology service was EA 720. In fact, in the present research, the gold standard was considered in the radiologist's report. The specificity and sensitivity of the report submitted by the emergency service were compared to those of the radiology service. These are the evaluated variables considered in this study.

Statistical analysis

Data were analyzed with SPSS21 software. The sensitivity, specificity, positive and negative predictive values were analyzed. A value of $P < 0.05$ was considered to be statistically significant.

Results

Concerning gender, 76 of the patients (50.7%) were male and 74 (49.3%) were female. 35 patients (23.3%) had a history of a surgery in the past 3 months. The mean age of the patients was 43.9248.13 years in a range of 23 and 63. The mean height of the patients was 1.687.08 meters and their mean weight was 71.72+10.81 kilograms. Their mean BMI was estimated at 25.21+3.60 kg/m². 65 Patients (43.3%) had a BMI of 25-29.99 while 14 patients (9.3%) had a BMI equal or above 30. The positive reports of DVT by the emergency service were 92 cases (61.3%) and 86 cases (57.3%) by the radiology service. The true positive cases (TP) reported by the medical emergency service were 86 while the false positive cases (FP) were 6 in number .

Table 1. The overlap of results reported by the emergency and radiology services

Variable	Result	Radiology result	
		yes	no
Emergency result	Yes	86 (93.5%)	06.0%)
	no	0(0.%)	58(100%)

The number of false negative cases was zero and true negative cases was 58. The relevant information is presented in Table 1. Thus, the sensitivity of diagnosis by the medical emergency service was 100% and the specificity of diagnosis by the same service was 90.62%. The negative predictive value of diagnosis by the medical emergency service was 100% and the positive predictive value was estimated at 93.47%. A formula was used to estimate the precision of diagnosis at 96%. A statistical software was used to estimate

the precision of 95.3% with a confidence level of 95% at 91.1-99.5% ($p < .001$).

Discussion

DVT is a multi-causal disorder which can be explained by a combination of acquired and genetic factors [7]. Venous stasis, coagulopathy and artery endothelial dysfunction are the three main causes of DVT occurrence. These factors set the stage for an increased rate of blood coagulation. The age above 40, obesity, surgery, trauma, long stationary state, hormone-therapy, cigarettes, diabetes, apnea, sleep apnea, infectious diseases and long air trips and chronic

heart failure are among the risk factors [7,8]. In terms of the extent of engagement and rate of coagulation, the symptoms that might emerge are venous stasis, lymphedema and occurrence of ischemia in the surrounding tissues. These people suffer from unilateral edema, hotness and discomfort in one limb. The engaged vein becomes touchable under certain circumstances [9]. Despite the medical advancements, DVT diagnosis remains a challenge as the clinical symptoms do not have the required sensitivity and specificity. Using ultrasonography is the best choice at hand when suspected of DVT. Thus, venous ultrasonography is widely used to diagnose DVT and Doppler ultrasound has been operated as the first non-invasive measure to diagnose DVT [10]. In the present research, 76 patients (50.7%) were male and 74 (49.3%) were female. In some other investigation by Frazee et al. [11] in 1998 in California, 63% of the patients were male. In the study conducted by Garcia et al. [6] in 2014 in Spain, 45% of the patients were male. Moreover, in the work of research by Shiver et al. [12] in 2008 in the US, the population of female patients was twice as large as the male. In their research, Mulcare et al. [3] in 2014 in New York had 39% of male patient participants. In this body of research, the population of female patients was higher than the male.

In the present study, the mean age of the patients was 43.92 ± 8.13 years in a range of 23 and 63. In some other research by Shiver et al. [12], the mean age of the participants was 43 years. In the investigation by Frazee et al., the mean age of the participant visitors was 49 years. However, this mean age in the study by Mulcare et al. [3] was 56 years. In their research, Garcia et al. [6] reported the mean age of the participants as 68 ± 16 years. The same value was

report by Magazzini et al. [9] to be 64 years. In the present study, the mean BMI was estimated at 25.21 ± 3.60 kg/m². 65 Patients (43.3%) had a BMI between 25 and 29.99 and 14 patients (9.3%) had a BMI of equal or above 30. In some other research by Garcia et al. [6], 45% of the patients belonged to the obese weight range (BMI>30). In the study conducted by Mulcare et al. [3], the mean BMI was reported to be 30 ± 7 kg/m². Among the reasons for the different BMIs reported in these studies and that of the present research are racial and geographical divergences. In the present study, the true positive cases reported by the emergency service were 86 in number and the false positive cases were 6. The number of false negative cases was zero while the true negative cases were 58. Therefore, the sensitivity of diagnosis in the medical emergency service was 100% and the specificity of diagnosis in the same service was 90.62%. The negative predictive value of the emergency section diagnosis was 100% while the positive predictive value of the same section was 93.47%. The diagnostic precision of 95.3% with a confidence interval of 95% was estimated at 91.1-99.5% ($p < .001$). In the research by Magazzini et al. [9] conducted in INA was 2004 in Italy, the sensitivity of ultrasonography in the emergency service was estimated at 100% and the specificity was 98%. The positive predictive value reported was 94% and the negative predictive value was 100%. Moreover, in the research by Crisp et al. [13] in 2007 in the US, only one case of false positive case was reported. Thus, in this research, the ultrasonography to reject the possibility of DVT in the emergency section showed a sensitivity rate of 100% and a specificity of 99%. In some other research by Garcia et al. [6] in 2014 in the Spanish context, 45 patients were

reported with a negative ultrasound result at the emergency section while 4 people who had an ultrasound in the radiology section were diagnosed with DVT. %% patients were diagnosed with DVT in the ultrasonography operated in the emergency service. Among these, 50 cases were also confirmed to have DVT by the radiologist's ultrasonography. The rest were reported as healthy. In this research, the sensitivity of the ultrasound operated in the emergency service to diagnose DVT was 93.2%; its specificity was 90%; the positive predictive value was 91.7% and the negative predictive value was 91.8%. In the research by Frazee et al. [11], in a Doppler ultrasound, 18 patients (23.6%) were diagnosed with DVT among whom 14 were also diagnosed with the same disease in the compressive ultrasonography performed in the emergency service. Moreover, two patients were diagnosed, in the emergency service, with an unknown ultrasound result and only two with a negative result. DVT of the proximal arteries was rejected in 58 patients through the Doppler ultrasound imaging, while from this number, 44 cases were also rejected by the emergency ultrasonography too. 10 patients ended up with an undetermined result and 4 with a false positive result. Overall, in 12 cases, the emergency ultrasonography was non-diagnostic; two cases were false negative and four were false positive. Therefore, the sensitivity of DVT diagnosis in the emergency service was 88.9% and its specificity was 75.9%. The negative predictive value in this research was 95.7% while the positive predictive value was 53.3%. In the study conducted by Mulcare et al. [3] in 2014, when the emergency ultrasound imaging was performed by the residents, the sensitivity was 40% in the mutual femoral vein. The same value was 66%

in the Iliac vein, 44% in the femoral vein of thighs and 46% in the popliteal vein. However, when the same ultrasound imaging was done by an attending doctor, the sensitivity in the aforementioned veins was respectively 100%, 66%, 75% and 40%. The specificity of DVT diagnosis in the same veins was as the following when the ultrasound imaging was performed by the residents: 95%, 92%, 96% and 94%. On the other hand, when the ultrasonography was performed by an attending doctor, the same values were respectively 96%, 100%, 100% and 95%. This review of the related research reveals that the sensitivity of DVT diagnosis is usually higher when the ultrasound imaging is performed in the emergency service. It also has a higher negative predictive value and is more rejected than the positive predictive value in diagnosis. However, in the research by Shiver et al. [12] conducted in 2008 in the US, the ultrasonography results reported by the medical emergency team was compared to CT venography to diagnose thrombosis in deep arteries. The sensitivity and specificity in this study were reported to be 86% and 100% respectively. In fact, the sensitivity was lower than specificity. One reason for the difference between this research and the present study is the type of diagnostic standard. In the present study, it was radiologist while in the aforementioned study it was CT venography. Among the limitations of the present research was the different radiologists who performed the ultrasonography, as a diagnostic standard. It is suggested that further research be conducted with larger samples and consider residents and attending doctors' diagnosis as well as that of the same radiologist and consider venography as a standard.

Conclusion

From the results of the present study, it can be concluded that DVT diagnosis by the medical emergency service enjoys a high sensitivity (100%) and negative predictive value (100%). Thus, the negative report rejects the diagnosis. It is suggested that in positive report, there was more than 90% of probability for DVT diagnosis.

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Ethical considerations

In all the procedures of the present research, all patients participated with full informed consent and were ensured of the confidentiality of the information they provided.

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