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Incidence of deep venous thrombosis and stratification of risk groups in a university hospital vascular surgery unit

Incidência de trombose venosa profunda e estratificação dos grupos de risco em serviço de cirurgia vascular de hospital universitário

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Abstract

Background: There is a knowledge gap with relation to the true incidence of deep vein thrombosis among patients undergoing vascular surgery procedures in Brazil. This study is designed to support the implementation of a surveillance system to control the quality of venous thromboembolism prophylaxis in our country. Investigations in specific institutions have determined the true incidence of deep vein thrombosis and identified risk groups, to enable measures to be taken to ensure adequate prophylaxis and treatment to prevent the condition. **Objective:** To study the incidence of deep venous thrombosis in patients admitted to hospital for non-venous vascular surgery procedures and stratify them into risk groups. **Method:** This was a cross-sectional observational study that evaluated 202 patients from a university hospital vascular surgery clinic between March 2011 and July 2012. The incidence of deep venous thrombosis was determined using vascular ultrasound examinations and the Caprini scale. **Results:** The mean incidence of deep venous thrombosis in vascular surgery patients was 8.5%. The frequency distribution of patients by venous thromboembolism risk groups was as follows: 8.4% were considered low risk, 17.3% moderate risk, 29.7% high risk and 44.6% were classified as very high risk. **Conclusion:** The incidence of deep venous thrombosis in vascular surgery patients was 8.5%, which is similar to figures reported in the international literature. Most vascular surgery patients were stratified into the high and very high risk for deep venous thrombosis groups.

Keywords: thromboembolism, deep vein thrombosis, risk factors.

Resumo

Contexto: Há lacuna de conhecimento sobre a real incidência de trombose venosa profunda nos pacientes submetidos a procedimentos cirúrgicos vasculares no Brasil. A atual pesquisa pretende corroborar a implementação de um sistema de vigilância e controle sobre a qualidade de profilaxia de tromboembolismo venoso em nosso meio. As investigações, em cada instituição, permitiriam revelar a incidência de trombose venosa profunda e a identificação dos grupos de risco, a fim de assumir medidas para obter profilaxia e terapêutica adequadas contra essa afecção. **Objetivo:** Estudar a incidência de trombose venosa profunda e estratificar os grupos de risco em pacientes internados, submetidos a procedimentos cirúrgicos vasculares não venosos. **Método:** Estudo observacional transversal, que avaliou 202 pacientes da Clínica de Cirurgia Vascular de um hospital universitário, entre março de 2011 e julho de 2012. A incidência de trombose venosa profunda foi determinada por meio de exame ultrassonográfico vascular, realizado em todos os pacientes. Os fatores de riscos de cada paciente foram estratificados de acordo com a escala Caprini. **Resultados:** A média de incidência de trombose venosa profunda na Cirurgia Vascular foi de 8,5%. Em relação aos grupos de risco para tromboembolismo venoso, 8,4% foram considerados de baixo risco, 17,3% de moderado risco, 29,7% de alto risco e 44,6% de altíssimo risco. **Conclusão:** A incidência de trombose venosa profunda na Cirurgia Vascular foi de 8,5%, semelhante à registrada na literatura internacional. A maior parte dos pacientes cirúrgicos vasculares é estratificada em alto e altíssimo risco para trombose venosa profunda.

Palavras-chave: tromboembolismo; trombose venosa profunda; fatores de risco.

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■ INTRODUCTION

Deep venous thrombosis is the greatest cause of in-hospital deaths worldwide and, paradoxically, the most avoidable.¹ Among elderly patients, annual rates of mortality due to deep venous thrombosis and pulmonary thromboembolism are 21% and 39% respectively.² In 2010, it was estimated that there are 900,000 cases of thromboembolism per year in the United States and that one third of these lead to death. Additionally, around 4% of the survivors exhibit pulmonary hypertension with significant restrictions to daily activities and quality of life.³

It has been estimated that 25% to 50% of patients with deep venous thrombosis will develop postthrombotic syndrome, which can cause considerable reductions in quality of life.⁴

In view of the above, measures should be taken to reduce the numbers of deaths and complications caused by venous thromboembolism, through identification of risk factors and prescription of appropriate prophylaxis.

Caprini has proposed a more individualized assessment of these risk factors. The model is widely used in research and serves as a reference for appropriate prophylaxis, particularly for high-risk patients.⁵

The University of Michigan Health System adopted this model and used it to assess 8,216 patients to establish the best forms of prophylaxis, and the results of that study are considered the best evidence in support of the validity of the Caprini scale.⁶

In Brazil, Deheinzeln et al.⁷ used both the Caprini and the American College of Chest Physicians models for identification of risk factors to assess the quality of prophylaxis against deep venous thrombosis given to patients in four hospitals in São Paulo.

In each institution, these investigations revealed the true incidence of deep venous thrombosis and enabled identification of risk groups, which in turn made it possible to adopt measures based on the best scientific evidence in order to prevent this severe condition.

In vascular surgery in particular, the incidence of deep venous thrombosis is unclear and figures reported in the literature vary. Those studies that do exist are not recent and were based on small samples.

■ OBJECTIVE

To determine the incidence of deep venous thrombosis and stratify its risk factors in patients admitted to a University Hospital for treatment by the vascular surgery service.

■ PATIENTS AND METHODS

This study was approved by the Research Ethics Committee under document number 231/05 (SISNEP: CAAE 0231.0.203.000-05).

Additionally, the hospital gave permission for the study to be conducted on its premises.

Patients

A total of 202 patients admitted for treatment by the vascular surgery service between March 2011 and July 2012 were assessed.

Risk factors for deep venous thrombosis

Patients' risk factors were assessed using the model developed by Caprini et al.⁸ (Tables 1 and 2).

Prophylaxis for venous thromboembolism

The seventh and eighth editions of the American College of Chest Physicians' guidelines were used to define the appropriateness of prophylaxis protocols in this study.^{1,9}

Lower limb venous ultrasonography

All patients were examined using lower limb vascular ultrasonography. Patients who aroused clinical suspicion of venous thrombosis while in hospital were sent for vascular ultrasonography on the day the condition was suspected and asymptomatic patients were examined on the day they were discharged from hospital. Both lower limbs were examined, as recommended by the Intersocietal Commission for the Accreditation of Vascular Laboratories (2008).

Statistical analysis

The results of this research were analyzed using SPSS (the Statistical Package for the Social Sciences) 20.0, IBM, United States.

Logistic regression was used to analyze the incidence of venous thrombosis in terms of diagnosis at admission and to determine associations between incidence of deep venous thrombosis and risk factor groups.

The chi-square test was used to identify associations between incidence of venous thrombosis and demographic data.

■ RESULTS

Demographic data

The sex distribution of the sample was 75 (37.1%) females and 127 (62.9%) males.

Patients' anthropometric data exhibited normal distribution, with mean age of 65.1 years (\pm 19.1); mean weight of 69.4 kg (\pm 12.5); mean height of

Table 1. Caprini model.

Scoring	Risk factors
Risk factors that score 1 point	Age 41 to 60 years Major surgery (less than 1 month) Lower limb varicose veins History of inflammatory intestinal disease Recurrent lower limb edema Obesity (BMI>25 kg/m ²) Acute myocardial infarction Congestive heart failure Sepsis (<1 month) Severe lung disease (<1 month), including pneumonia Chronic obstructive pulmonary disease
Risk factors that score 2 points	Age 60 to 74 years Arthroscopic surgery Cancer (prior or present) Major surgery (>45 minutes) Laparoscopic surgery (>45 minutes) Bedridden patient (>72 hours) Immobilization of limb (plaster/splints) Central venous access
Risk factors that score 3 points	Age over 75 years Prior history of venous thrombosis or pulmonary embolism Family history of thrombosis Factor V Leiden positive Prothrombin 20210 A positive Lupus anticoagulant positive Elevated serum homocysteine Elevated anti-cardiolipin antibodies Heparin-induced thrombocytopenia Congenital or acquired thrombophilia
Risk factors that score 5 points	Lower limb joint replacement Fracture in pelvis, thigh or leg (<1 month) Stroke (1 month) Polytrauma (<1 month) Spinal injury – paralysis (<1 month)
Risk factors for women only, scoring 1 point	Contraceptives or hormone replacement therapy Pregnancy or postnatal period (<1 month) History of unexplained still birth or repeat spontaneous abortions (>3), prematurity with toxemia or restricted development

Source: Caprini et al.⁸

Table 2. Classification of patients into groups by risk factors.

Risk group	Score
Low	0 or 1 point
Moderate	2 points
High	3 and 4 points
Very high	5 or more points

Source: Caprini et al.⁸

1.65 m (standard deviation: 0.9) and mean body mass index of 24.6 kg/m² (standard deviation: 3.8).

Diagnoses at admission

Table 3 lists the patients’ diagnoses at admission. Logistic regression detected an association between acute arterial ischemia and deep venous thrombosis (odds ratio [OR]=13.4; 3.06-59.27, p=0.01) (Table 4).

Risk factors

Table 5 lists the frequency distribution for risk groups. It was observed that 74.3% of the patients were classified as high or very high risk.

Deep venous thrombosis was not detected in any of the low risk vascular surgery patients. The incidence was 17.6% (three patients) in the moderate risk group. Deep venous thrombosis incidence rates were 23.5% (four patients) and 58.8% (10 patients) in the high and very high risk groups respectively.

Overall incidence of deep venous thrombosis

The total incidence of deep venous thrombosis in vascular surgery patients was 8.5% (17 patients).

Table 3. Diagnoses on admission for vascular surgery.

Diagnosis	Number of patients	Percentage (%)
Peripheral arterial disease – critical ischemia	80	39.2
Diabetic foot (infectious)	60	29.8
Acute arterial ischemia	14	7.0
Lower limb traumas	14	7.0
Diabetic foot (infectious) and sepsis	13	6.5
Others	7	3.6
Aortic disease	6	3.0
Peripheral aneurysm	4	2.0
Cerebrovascular disease (EVA/TIA)	2	1.0
Diabetic foot (infectious and angiopathic)	1	0.5
Peripheral arterial disease – asymptomatic and claudicant	1	0.5
Total	202	100

EVA: encephalic vascular accident; TIA: transitory ischemic attack.

Table 4. Associations between deep venous thrombosis and admission diagnoses.

Diagnosis	p	Odds ratio
Trauma	0.54	-
Diabetic foot (infectious)	0.84	0.84
Diabetic foot (infectious) and sepsis	0.99	0.00
Diabetic foot (infectious and angiopathic)	1.00	0.00
Peripheral arterial disease – asymptomatic and claudicant	1.00	0.00
Peripheral arterial disease – critical ischemia	0.29	1.99
Peripheral aneurysm	0.98	8.08
Acute arterial ischemia	0.01 *	13.4
Cerebrovascular disease (EVA/TIA)	0.99	0.00
Aortic diseases	0.99	0.00
Others	0.52	6.61

EVA: encephalic vascular accident; TIA: transitory ischemic attack. * p<0.05

Table 5. Frequencies of deep venous thrombosis risk groups in vascular surgery patients.

Risk group	Number of patients	Percentage (%)
Low	17	8.4
Moderate	35	17.3
High	60	29.7
Very high	90	44.6
Total	202	100.0

DISCUSSION

In order to be in a position to reduce the incidence of thromboembolic events, it is necessary to determine the true incidence of venous thrombosis and stratify its risk factors, classifying them by risk.

In the present study, venous ultrasonography was employed as a trustworthy method for diagnosis of deep venous thrombosis in view of the fact that it has practically replaced venography because of its high sensitivity and specificity, accessibility and good cost-benefit profile.^{10,11}

Goodacre et al.¹² conducted a meta-analysis in which they concluded that ultrasonography offers sensitivity of 96.4% for diagnosis of proximal deep venous thrombosis and 75.2% for distal venous thrombosis, with specificity of 94.3%.

Venous ultrasonography also enables investigation of deep venous thrombosis differential diagnoses.

Incidence of deep venous thrombosis

The objective of the present study was to determine the true incidence of deep venous thrombosis among patients admitted for non-venous vascular surgery, since the incidence rate of deep venous thrombosis is unclear in this specialty and reports in the literature vary. Those studies that do exist are not recent and were based on small samples, as described below. This is probably the largest sample of patients studied in Brazil to date.

Prospective studies of vascular surgery patients who had not been given any type of prophylaxis found deep venous thrombosis incidence rates of 21% (18 out

of 86 patients) using venography and 15% (15 out of 98 patients) using vascular ultrasonography.^{13,14}

An assessment of 142 patients treated with a variety of vascular surgical procedures and given pharmaceutical and mechanical prophylaxis found a deep venous thrombosis incidence of 10%.¹⁵

However, the various different types of vascular procedures involved should also be taken into consideration because surgical procedures to the aorta tend to be associated with high venous thromboembolism rates. Hollyoak et al.¹⁶ observed a 12% incidence of thromboembolism (six out of 52 patients) among patients treated using surgical procedures to the aorta and a 9% incidence (five out of 54 patients) for infrainguinal revascularization procedures.

This difference in incidence of venous thrombosis when procedures involve the aorta was also detected by Farkas et al.¹⁷ Their randomized study assessed patients who had been given pharmaceutical prophylaxis and treated with lower limb revascularization and surgical procedures involving the aorta. Deep venous thrombosis incidence rates were 3.4% in the infrainguinal revascularization group, 7% for aortofemoral revascularization procedures and 8% for aortic aneurysm repair.

Other studies have also shown that incidence rates of deep venous thrombosis tend to be higher among patients treated with surgical procedures involving the aorta, varying from 18% to 30%.^{18,19}

The incidence of deep venous thrombosis among the vascular surgery patients studied here (8.5%) was similar to the studies cited above.

This analysis showed that the type of vascular surgery procedure is of relevance and can possibly influence the deep venous thrombosis incidence rate. Just 3% were admitted for aortic conditions. In contrast, in 39% the reason for admission was peripheral arterial disease (critical ischemia).

Another interesting feature of this study is that it is not limited to analyzing the variations related to diagnosis at admission. The study also illustrates the paradigm shift that has taken place in treatment of aortic conditions and peripheral arterial diseases in these patients. The majority of revascularization treatments were conducted using endovascular techniques, whether to treat atherosclerotic disease in aortic and iliac segments, or for infrainguinal segments. Conventional surgical treatment of abdominal aortic aneurysms has been practically replaced by endovascular repair. This feature means that the results of this study provide pioneer data on the incidence of deep venous thrombosis with relation to use of endoluminal treatment.

The results of this study show that there is an association between deep venous thrombosis and acute arterial ischemia ($p=0.01$). This correlation is not reported in the extant literature. However, it is known that acute arterial ischemia of an extremity is a clinical emergency, with mortality rates of 15% to 20%, amputation rates greater than 25%, fasciotomy rates of around 25% and a greater than 20% rate of acute renal failure.²⁰ This serious clinical picture associated with comorbidities means that such patients are considered at high or very high risk for venous thrombosis. As is stated in the literature, patients with acute arterial ischemia should be investigated for deep venous thrombosis.²¹ This association, detected here, merits further research.

CONCLUSIONS

The incidence of deep venous thrombosis was 8.5% between March 2011 and July 2012. None of the low risk patients had deep venous thrombosis. The incidence rates of deep venous thrombosis in the moderate, high and very high risk groups were 17.6% (three patients), 23.5% (four patients) and 58.8% (10 patients) respectively.

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Critical revision of the article: TPN, RJP
Final approval of the article*: AO, TPN, RJP, JOLM
Statistical analysis: JOLM
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