Pre-exposure prophylaxis of venous thromboembolism and nursing: The reality of a university public hospital

RESUMO | Objetivo: caracterizar o risco de tromboembolismo venoso e uso de profilaxia em pacientes clínicos e cirúrgicos, avaliando a conformidade ou não-conformidade da prescrição de profilaxia medicamentosa. Método: estudo transversal, com 3341 pacientes clínicos e cirúrgicos com protocolo de profilaxia de tromboembolismo venoso preenchido aprovado pelo Comitê de Ética em Pesquisa CAAE 62055616.7.00005411, com dados extraídos de relatório personalizado gerado automaticamente do prontuário eletrônico do paciente em planilha Excel®, do período de março/2017 a dezembro 2017. As análises iniciais foram obtidas a partir de medidas descritivas para as variáveis quantitativas e frequências e percentuais para variáveis categorizadas. Resultados: A taxa global de conformidade foi de 70% e os pacientes clínicos apresentaram maior conformidade de prescrição de profilaxia em relação aos pacientes cirúrgicos. Conclusão: A profilaxia medicamentosa para tromboembolismo venoso é subutilizada, principalmente em pacientes cirúrgicos. Os pacientes clínicos receberam mais profilaxia que os cirúrgicos, predominando a indicação da enoxaparina sódica.
Descritores: Tromboembolia venosa; Profilaxia pré-exposição; segurança do paciente; Educação em saúde; Enfermagem.

ABSTRACT | Objective: to characterize the risk of venous thromboembolism and the use of prophylaxis in clinical and surgical patients, evaluating the compliance or non-compliance with the prescription of drug prophylaxis. Method: a cross-sectional study with 3341 clinical and surgical patients with a completed venous thromboembolism prophylaxis protocol approved by the Research Ethics Committee CAAE 62055616.7.00005411, with data extracted from a personalized report automatically generated from the patient's electronic medical record in an Excel® spreadsheet, from the period from March/2017 to December 2017. The initial analyzes were obtained from descriptive measures for quantitative variables and frequencies and percentages for categorized variables. Results: The overall compliance rate was 70% and clinical patients showed greater compliance with prophylaxis prescriptions compared to surgical patients. Conclusion: Drug prophylaxis for venous thromboembolism is underused, especially in surgical patients. Clinical patients received more prophylaxis than surgical patients, with the indication of enoxaparin sodium predominating.
Keywords: Thromboembolism, venous; Prophylaxi, Pre-exposure; Safety, patient; Education, health; Nurse, registered.

RESUMEN | Objetivo: caracterizar el riesgo de tromboembolismo venoso y el uso de profilaxis en pacientes clínicos y quirúrgicos, evaluando el cumplimiento o incumplimiento de la prescripción de profilaxis farmacológica. Método: estudio transversal con 3341 pacientes clínicos y quirúrgicos con protocolo completo de profilaxis de tromboembolismo venoso aprobado por el Comité de Ética en Investigación CAAE 62055616.7.00005411, con datos extraídos de un informe personalizado generado automáticamente a partir de la historia clínica electrónica del paciente en un Excel® hoja de cálculo, del período de marzo/2017 a diciembre de 2017. Los análisis iniciales se obtuvieron a partir de medidas descriptivas para variables cuantitativas y frecuencias y porcentajes para variables categorizadas. Resultados: La tasa de cumplimiento global fue del 70% y los pacientes clínicos mostraron un mayor cumplimiento de las prescripciones de profilaxis en comparación con los pacientes quirúrgicos. Conclusión: La profilaxis farmacológica del tromboembolismo venoso está infrautilizada, especialmente en pacientes quirúrgicos. Los pacientes clínicos recibieron más profilaxis que los pacientes quirúrgicos, predominando la indicación de enoxaparina sódica.
Palabras claves: Tromboembolismo venoso; Profilaxis preexposición; Seguridad del paciente; Educación en salud; Enfermería

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INTRODUCTION

Venous thromboembolism (VTE) comprises deep vein thrombosis and pulmonary embolism, being the main preventable cause of hospital death and prophylaxis, in carefully evaluated patients, it is the most effective approach to minimize the impact of its occurrence, and it is necessary to improve patient safety in the first hours of hospitalization. [1]

To guide VTE prophylaxis and treatment, the American College of Chest Physicians (ACCP) [2] suggests that each hospital puts in place protocols to identify risks in clinical and surgical patients and believes that, with this methodology, morbidity and mortality can be avoided. It indicates two algorithms, clinical and surgical, which evaluate risk factors and contraindications, taking into account the characteristics of the patients, their pathology and comorbidities. According to the due evaluation, the prophylactic dose is recommended or not.

The risk for developing VTE increases with age and some other variables (previous history of VTE, varicose veins, obesity, etc.) also contribute. It is possible to reduce its incidence, provided that patients at risk are identified already during their admission to the hospital. This stratification allows the medical team to prescribe drug or mechanical prophylaxis, preventing its occurrence. [2] With population aging and the increase in chronic diseases, this prophylaxis assumes even greater relevance. VTE prophylaxis is directly linked to patient safety, as it is considered a preventable adverse event.

The ENDORSE multicenter study (3), evaluated the rate of VTE prophylaxis in several countries and found that, globally, only 30% of surgical patients received prophylaxis, and that in Brazil 46% of eligible surgical patients had adequate coverage. The rate of hospital-acquired VTE, if prophylaxis is not performed, can reach 10-40% after general surgery and 40-60% after hip surgery. [2]

The role of nurses in achieving the objectives of this prophylactic program is highlighted, as they are the professionals responsible for initiating the protocol, performing risk assessment, managing prophylactic medication and also providing guidance at hospital discharge. Nurses are also responsible for constantly evaluating VTE prophylaxis indicators, making comparisons between the different hospitalization units, in order to establish goals and find the difficulties that cause non-prophylaxis or incorrect prophylaxis.

Given the real severity of VTE due to the silent nature of the disease, the importance of recognizing risk factors for the development of VTE and planning adequate hospital care, which depends on the multidisciplinary team, with great performance of the professional nurse, the present study is justified.

The study aimed to characterize the risk of VTE and the use of prophylaxis in clinical and surgical patients, evaluating the compliance or non-compliance with the prescription of drug prophylaxis according to the ACCP recommendations. [2]

METHODS

Cross-sectional, descriptive study carried out in a tertiary hospital of regional reference, which covers a population of approximately one and a half million inhabitants, with a tertiary/quaternary care feature, located in the interior of the State of São Paulo, between March/2017 and December/2017, which adopts the VTE prophylaxis protocol. The research is part of the researcher's doctoral thesis, defended in 2019 and, to date, no other surveys have been carried out in the studied institution to compare the results.

The analysis took place in clinical and surgical patients admitted to the green and yellow ward wards, stroke unit, neurology, medical clinic I, medical clinic II, orthopedics/plastic surgery, intensive care service, coronary care unit and gastric surgery, with a stay of more than 24 hours and with a protocol completed by the nurse in the patient's electronic medical record (EMR).

Data were collected from 3684 medical records with protocols, clinical and surgical. After applying the exclusion criteria, patients with hospitalization for less than 24 hours, under 18 years of age and those who were on therapeutic use of anticoagulants, 343 medical records were excluded. Thus, 3341 completed protocols with at least one risk factor for developing VTE were analyzed.

The protocol is inserted in the electronic patient record (PEP) and its algorithms are called clinical VTE and surgical VTE. When selecting each one, the nurse, during the admission of patients, completes the information and informs the doctor about the risk presented. Thus, the completeness of the protocol depends on both professionals.

The algorithms are easily accessible and all the main information is automatically linked, making the PEP not allow the completion of the filling if there is any gap. Therefore, all patients analyzed had the complete algorithm.

Standard medications for VTE prophylaxis were enoxaparin sodium 20 mg, enoxaparin sodium 40 mg, fondaparinux sodium 2.5 mg and subcutaneous unfractionated heparin sodium 5000 IU.

To characterize the risk of developing VTE and the compliance or non-compliance of the drug prophylaxis prescription, data were extracted from a personalized report automatically generated from the EMR, in an Excel® spreadsheet, after the nurse had filled in the protocol in the patient's medical record.

Manual data collection was performed in all patient records, with

and without prescribed prophylactic medication, to define if there was a contraindication or if the medical prescription was not in accordance with the recommendations, to complete the research database, as this information was not present in the report.

After analyzing the risk stratification of each patient and the time taken to complete the protocol, compliance with drug prophylaxis was evaluated according to the presence or absence of contraindications and the daily dose prescribed.

For statistical analysis, descriptive measures such as mean and standard deviation were obtained for quantitative variables (age, time to complete the protocol) and frequencies and percentages for categorized variables.

Comparisons between means for quantitative variables were made using the t-student test. The associations of the categorized variables with the risk classification were performed using the chi-square test, taking into account the presence or absence of contraindications to the use of drug prophylaxis.

In all tests, the level of 5% of significance or the corresponding p-value was set. All analyzes were performed using the SAS® for Windows v. 9.4.

The study complied with the formal requirements contained in national and international regulatory standards for research involving human beings and was approved by the Research Ethics Committee, CAAE 62055616.7.00005411.

RESULTS

A total of 3341 completed protocols were analyzed, of which 2050 (61%) were clinical protocols and 1291 (39%) were surgical protocols. There was a predominance of males both in the clinical protocol with 1144 (55%) patients, and in the surgical protocol with 722 (56%) patients. The mean age was 63 years for the clinician and 54 years for the surgeon.

Tables 1 and 2 demonstrate the prevalence of risk factors for developing VTE in clinical and surgical patients, respectively. Clinical patients had 6179 risk factors (mean 2.21/patient) and surgical patients 1717 (mean 1.33/patient).

The VTE prophylaxis protocol establishes the need for patient assessment, filling in the risks and prophylaxis indication in the first 24 h of hospitalization, and the clinical protocol was completed with a median of 1.14 days and the surgical protocol with 1.32 days of hospitalization.

It can be observed that 2962 (89%) of the total number of patients analyzed presented risks for the development of VTE and indication for the use of prophylactic medication, being 1785 (60%) clinical and 1177 (40%) surgi-

Table 1. Risk factors found in clinical patients, according to the ACCP algorithm.(2) Botucatu, SP, Brazil, 2017.

Risk factors	N	% of patients
Reduced mobility	1653	81
Age ≥ 55 years	1428	70
Infection	614	30
ICU* admission	463	23
Cerebral Vascular Accident	353	17
Acute myocardial infarction	314	15
Cancer	198	10
Central and swan ganz catheters	184	9
Obesity	177	9
Severe respiratory disease	158	8
Lower limb paresis or paralysis	154	7
Congestive heart failure	112	5
Nephrotic syndrome	90	4
Varicose veins	56	3
Chemotherapy/hormone therapy	53	2
Inflammatory bowel disease	48	2
Previous history of venous thromboembolism	31	1
Active rheumatologic disease	26	1
Thrombophilia	25	1.22
Peripheral arterial insufficiency	20	0.98
Pregnancy and Puerperium	11	0.54
Hormone replacement/contraceptives	11	0.54
Total	6179	

*Intensive Care Unity
Source: Electronic Patient Record, 2017.

cal. Contraindications were evidenced in 114 (8.8%) surgical patients and 265 (13%) clinical patients.

The results also showed that 610 (18%) patients did not receive drug prophylaxis even though there was no contraindication for its use and they were in the group with an indication of risk.

Regarding the surgical patients who were classified as being at high risk for developing VTE and who did not have contraindications, 157 (38%) had no prophylactic prescription and 32 (2%) had a lower dose prescription than recommended. This index was lower in clinical patients (9%).

A particularity found in the medical prescription of 153 (7%) clinical patients is the alternate use of enoxaparin sodium doses of 20 mg and 40 mg during the same period of hospitalization, with the lower dose not being doubled to characterize the complete dose. We can also highlight that 98 (5%) clinical patients were prescribed a reduced dose of enoxaparin of 20 mg because they were elderly patients or because they had renal failure with creatinine clearance <30 ml/min. In surgical patients this feature was not observed.

Despite the evidence presented related to non-compliance, when evaluating the dose of drug prophylaxis prescribed from the global number of patients, the results showed compliance in 2333 (70%) cases, with 1495 (64%) clinical patients and 838 (36%) surgical patients, where enoxaparin sodium was the medication indicated in 48.5% of the cases.

The total number of patients admitted to the sectors during the study period was 6350. Thus, it was observed that, although the VTE prophylaxis protocol is included in the EMR and is easy to fill, only 3684 (58%) of the patients had the algorithm completed.

Table 2. Risk factors found in surgical patients, according to the ACCP algorithm. (2) Botucatu, SP, Brazil, 2017.

Risk factors	N	% of patients
Infection	546	42
ICU* admission	292	23
Central and swan ganz catheters	250	19
Cancer	233	18
Lower limb paresis or paralysis	133	10
Obesity	111	9
Peripheral arterial insufficiency	25	2
Thrombophilia	22	1.70
Chemotherapy/hormone therapy	17	1.32
Severe respiratory disease	16	1.24
Nephrotic syndrome	13	1
Previous history of venous thromboembolism	13	1
Congestive heart failure	10	0.77
Hormone replacement/contraceptives	10	0.77
Varicose veins	6	0.46
Inflammatory bowel disease	6	0.46
Active rheumatologic disease	4	0.31
Pregnancy and Puerperium	4	0.31
Total	1717	

*Intensive Care Unity
Source: Electronic Patient Record, 2017.

DISCUSSION

The profile of hospitalized patients, including clinical (61%) and surgical (39%), corroborates what was found in other studies [1] and differs in other literature. [4-5]

The analysis was performed during the entire period of hospitalization of the patients and not only in the first 24 hours, a fact that allowed observing the prophylaxis as a whole.

The most common risk factors in clinical patients were reduced mobility (81%), age ≥ 55 years (70%) and infection (30%), corroborating the literature. (1,6) Surgical patients, on the other hand, presented infection (42%) and ICU admission (23%) as the main risk factors for developing VTE, differing from the literature cited. [1]

In a study carried out at a university hospital in Houston, Texas, it was observed that patients acquired several risk factors during hospitalization and that the time for VTE onset differed significantly, being longer in the group with a protocol completed during admission. Stresses that the VTE prophylaxis protocol should be carried out upon patient admission and reassessed during hospitalization in order to ensure adequate prophylaxis [4]

Regarding the number of patients classified at risk of developing VTE, the findings corroborate the ENDORSE stu-

dy [3], carried out in 2008 in 32 countries, which shows that more than half of hospitalized patients are at risk.

The presentation of contraindications to the use of drug prophylaxis was relatively low for both clinical (13%) and surgical (8.8%) patients, which is in line with findings in other studies. [1]

It was found that the overall compliance rate related to the prescription of drug prophylaxis was 70%, a result also found in other articles [1] and opposing some authors. [3-7] Enoxaparin sodium was the prophylactic drug of choice (48%), in line with findings in other studies. [3-5,8]

Regarding prophylaxis according to the stratification of clinical and surgical patients, they presented 64% and 36% of adequacy, respectively. In the literature, some concordances [3,9-10] and other disagreements [1,4] can be observed.

The existence of several guidelines, differences between patient profiles and uneven analysis can lead to different results among different authors. [1]

The absence of drug prophylaxis, in patients without contraindication, was lower in medical patients than in surgical patients, although most had a high risk of developing VTE. [1,7]

Compliance was observed in clinical patients regarding the prescription of drug prophylaxis to patients with renal failure and who had creatinine clearance < 30 mL/min, in accordance with the ACCP recommendations. [2] In surgical patients, this adequacy was not found.

In a study carried out with data from 500 patients hospitalized between October 2015 and February 2016 at a university hospital, it was found that the overall rate of prophylactic compliance for VTE was 42.1%, clinical patients with more adequate prophylaxis than surgical patients. It also demonstrated that the inadequacies present during hospitalization of clinical patients are due to the prescription/dose of inappropriate medication and not due to the absence of prophylaxis, unlike the surgical patient. [7]

This fact can also be verified in our study. It also clarifies that incorrect risk stratification, lack of knowledge of the protocol and rotation of resident physicians responsible for assisting the wards of university hospitals are factors that may contribute to the non-prescription of drug prophylaxis in surgical patients.

> “The risk for developing VTE increases with age and some other variables (previous history of VTE, varicose veins, obesity, etc.) also contribute.”

In a study carried out by Araújo et al (2022) [5], in the Federal District, showed that 75.5% of the surgical patients studied received a prophylactic dose, while 25% did not, in contrast to the data found in our study. This demonstrates that the thromboembolism prophylaxis scenario, in relation to our study, has changed.

Concern about the risk of bleeding, especially in the postoperative period, incorrect risk stratification and lack of knowledge of the VTE protocol are also factors that contribute to the non-performance of prophylaxis. [7]

Despite the protocols being included in the EMR and being easy to handle, the algorithms were completed in only 58% of hospitalized patients, which favors that the institution does not know in detail the VTE risk profiles of its patients, making it less capable in decision-making regarding the prophylaxis to be adopted. [1]

A study carried out in a public university hospital in São Paulo with 369 patients showed that VTE prophylaxis has multiple implications for the professional nurse, from qualified observation of the risks of disease developments, to communication with the medical team in order to ensure the implementation of prophylaxis, whether pharmacological or mechanical. [9] VTE is a preventable adverse event in hospitalized patients who need attention and care, and risk stratification becomes important and essential for all patients. In surgical patients, the nursing assessment should begin in the preoperative period and extend into the postoperative period. [11]

Soares et al (2018), report that there is an effort to diversify measures to carry out VTE prophylaxis that promote adherence of the medical team in filling out the protocols. The use of tools such as continuing health education can facilitate this process. [12]

Review article highlights that there is little evidence about which specific interventions are really effective to increase prophylaxis rates. However, it points out that some studies support the association of educational actions and technological approaches, with alerts and clinical decisions based on these tools. [9,13]

To minimize this problem, there is a need for permanent/continuing education associated with other strategies for the involvement of the multidisciplinary team, in addition to massive and continuous dissemination of the VTE prophylaxis protocol. [12,14]

When well structured, health education promotes changes with improvement in the work process and in the skills and attitudes of professionals. [15]

One of the limitations of the study was the lack of understanding of the reasons that lead to the non-prescription of prophylaxis and the failure to complete the protocol in all hospitalizations of patients in the units studied, opening space for conducting a survey in future research.

It is pertinent to highlight the autonomy of the professional nurse at the beginning of the protocol, as well as in the evaluation of the patient during hospitalization and, mainly, carrying out discharge guidelines to those who receive drug prophylaxis at home. Nurses are essential to inform patients about the importance of VTE prophylaxis, as they influence them about the therapies used, encouraging them. [16]

CONCLUSION

Drug prophylaxis for VTE is underused in inpatients, especially surgical patients. Regarding compliance with the protocol, clinical patients received more prophylaxis than surgical patients, with enoxaparin sodium being predominant.

To minimize this problem, there is a need for permanent/continuing education associated with other strategies to involve the multidisciplinary team, in addition to massive and continuous dissemination of the VTE prophylaxis protocol, especially in teaching hospitals, with the active participation of nurses.

Referências

1. Farhat FCLG, Gregório HCT, Carvalho RDP. Evaluation of deep vein thrombosis prophylaxis in a general hospital. J Vasc Bras. 2018; 13;17(3):184-92. doi:10.1590/1677-5449.007017

2. Guyatt GH, Eikelboom JW, Gould MK, et al. Approach to outcome measurement in the prevention of thrombosis in surgical and medical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest. 2012; 141(2 Suppl):e185S-94S. .doi:10.1378/chest.11-2289

3. Cohen AT, Tapson VF, Bergmann JF, Goldhaber SZ, Kakkar AK, Deslandes B, et al. Venous thromboembolism risk and prophylaxis in the acute hospital care setting (ENDORSE study): a multinational cross-sectional study. Lancet. 2008; 371(9610):387-94. doi:10.1016/S0140-6736(08)60202-0

4. Tatara AW, Ruegger M, Adeola M, Putney D. Time to occurrence based on risk stratification of hospital-acquired venous thromboembolism: a retrospective observational cohort study. J Pharm Pract. [Internet]. 2018 [cited Sep 10, 2019];31(6):651-7. Available from: https://journals.sagepub.com/doi/full/10.1177/0897190017735423

5. Araujo WS, Matos RS, Gomes JRAA, Quirino GMC, Itacarambi LR, Lucena HGL, et al. Profilaxia para tromboembolismo venoso em pacientes cirúrgicos de um hospital geral. Health Residences Journal-HRJ. 2022; 3(14): 343-355. https://doi.org/10.51723/hrj.v3i14.372

6. Lima I, Ferreira EB, Rocha PRS. Stratification of risk for venous thromboembolism in patients of a public hospital of the Federal District. Cogitare enferm. [Internet]. 2019 [access 14OCT2020]; 24. Available at: http://dx.doi.org/10.5380/ce.v24i0.56741

7. Curtarelli A, Correia e Silva LP, Camargo PAB, Pimenta REF, Jaldin RG, Bertanha M. Venous thromboembolism, can we do better? Profile of venous thromboembolism risk and prophylaxis in a University Hospital in the State of São Paulo. J Vasc Bras. 2019; 18:e20180040: 1-9. doi.org/10.1590/1677-5449.004018

8. Santana CS, Takahashi EAS, Bressa JAN, Souza AM. Analysis of cost-minimization in venous thromboembolism prophylaxis in hospitalized patientes. Braz J Hea Rev. 2019; 2(6): 6178-6187. https://doi.org/10.34119/bjhrv2n6-113

9. Couto TZ, Domungues TA, Vasconcelos Morais SC, Lopes JL, Lopes CT. Risk of venous thromboembolism and implementation of preventive measures in medical patients. Enferm Clin. 2020; 30(5):333-9. doi.org/10.1016/j.enfcli.2018.12.005

10. Silva MAM, Figueiredo MV, Carmo MH, Rezende PRL, Grigório TS, Jesus-Silva SG, et al. Impacto de protocolo de profilaxia de tromboembolismo venoso na qualidade das prescrições médicas. Revista Ciências em Saúde. 2019; 9(1): 3-9. https://doi.org/10.21876/rcshci.v9i1.853

11. Raymundo SRO, Lobo SMA, Hussain KMK, Hussein KG, Secches IT. What has changed in venous thromboembolism prophylaxis for hospitalized patients over recent decades: review article. J Vasc Bras. 2019;18:e20180021: 1-11. https://doi.org/10.1590/1677-5449.002118

12. Soares JAS, Pereira LM, Freitas DF de, Bicalho AH, Sousa BV de O, Filho OC, et al. Tromboembolismo venoso: profilaxia medicamentosa em pacientes clínicos de alto risco. REAS [Internet]. 30dez2018 [citado 8fev.2022]; (19):e229: 1-9. Available from: https://acervomais.com.br/index.php/saude/article/view/229

13. Gomes ET, Assunção MCT, Lins EM, Püschel VAA. Nursing in mechanical prevention of venous thromboembolism in surgical patients. Rev Esc Enferm USP. 2021;55:e03738: 1-6. https://doi.org/101590/S1980-220X2020002703738

14. Almeida NR, Pereira LDL, Alvim HGO. Triggering factors of venous thromboembolism (VTE). Revista JRG De Estudos Acadêmicos. 2021; 4(8): 213–21. https://doi.org/10.5281/zenodo.4630923

15. Bastos MP, Fecher GC, Carneiro CEG, Silva DGO, Menezes LF, Alves WFP. Panorama retrospectivo na visão de enfermeiros do programa de capacitação profissional - trainee num hospital privado. Nursing [Internet]. 10 de dezembro de 2021 [citado 15 de fevereiro de 2022]; 24(283):6664-9. Disponível em: http://revistas.mpmcomunicacao.com.br/index.php/revistanursing/article/view/2068

16. Dunn N, Ramos R. Preventing venous thromboembolism: the role of nursing with intermitente pneumatic compression. Am J Crit Care. 2017 March; 26(2): 164-67. http://doi:10.4037/ajcc2017504