

3rd icH&Hpsy 2017
3rd International Conference on Health and Health Psychology

**PREVENTIVE MEASURES OF VENOUS THROMBOEMBOLISM
IN THE HOSPITALIZED PATIENT: AN INTEGRATIVE
LITERATURE REVIEW**

Carlos Albuquerque (a)*, Carla Costa (b), Rosa Martins (c), António Madureira (c)
*Corresponding author

(a) CI&DETS - Health School of Viseu - Polytechnic Institute of Viseu, Portugal, cmalbuquerque@gmail.com
(b) Centro Hospitalar Tondela-Viseu, Portugal, costacarlaisabel@gmail.com
(c) CI&DETS - Health School of Viseu - Polytechnic Institute of Viseu, Portugal

Abstract

Venous thromboembolism (VTE) includes two closely associated clinical conditions: deep vein thrombosis (DTV) and its main acute complication, pulmonary embolism (PE). In the hospital setting, venous thromboembolism is a concern because of its high prevalence rate. It is estimated that one in twenty inpatients is at risk of pulmonary embolism, if adequate preventive measures are not applied. These may or may not be pharmacological. In this context, the objective of this study is to identify the non-pharmacological measures recommended to prevent venous thromboembolism in inpatients. An integrative literature review was performed using the PI[C]OD method by searching the following databases: EBSCO host, PubMed, JBI, PEDro, Elsevier-ClinicalKey, Scielo and Google Academic studies published in the period 2006-2016. From the research were included five articles that met the inclusion criteria. The results of the review found that effective mechanical methods comprised graduated compression stockings and intermittent pneumatic compression devices while for nursing care early mobilization and ambulation were identified as preventive measures of VTE. The studies suggest several benefits of using non-pharmacological measures to prevent venous thromboembolism. The differentiated intervention of the nurse specialist in rehabilitation integrated in the multidisciplinary team can be an added value in the adequacy of these measures.

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Keywords: Venous thromboembolism, Deep vein thrombosis, Pulmonary embolism, Preventive measures, Nursing care, Rehabilitation



1. Introduction

Venous thromboembolism (VTE) continues to be considered the third most common cardiovascular disease pathology (Gouveia, Pinheiro, Costa, & Borges, 2016) following acute myocardial infarction and stroke (Goldhaber, 2012). The term VTE is used to define two clinical manifestations that are closely associated: deep venous thrombosis (DVT) and its main acute complication, pulmonary thromboembolism (PTE) (Gharaibeh, Albsoul-Younes, & Younes, 2015). DVT is characterized by thrombus formation in the deep veins of the lower limbs, which may result in partial or total obstruction of blood flow (Miranda, Matiolo, Porto, Marques, & Yoshida, 2015). When a thrombus moves from its site of formation and travels, or embolizes, to the arterial blood supply of one of the lungs can cause pulmonary artery blockage giving rise to PE (Barker, & Marval, 2011).

VTE is considered a serious public health problem due to its high morbidity and mortality rate (Heit, Spencer, & White, 2016). In 2007 this pathology was found to be responsible for about 12% of deaths in Europe (Amaral, & Tavares, 2013) and direct healthcare costs related to VTE in the European Union per year range from 1.5 to 13.2 (Behraves, Hoang, Nanda, Wallace, Sheth, Deipolyi, & Oklu, 2017).

VTE is also a concern for its high prevalence rate in the hospital environment, estimating that one in every 20 hospitalized patients is at risk of developing PTE if they do not receive adequate thromboprophylaxis (França, Sousa, Felicíssimo, & Ferreira, 2011). In the long term complications of VTE such as post-thrombotic syndrome and chronic pulmonary hypertension may arise (Behraves, Hoang, Nanda, Wallace, Sheth, Deipolyi, & Oklu, 2017) which may increase hospital admission days and future hospital admissions. Given the importance of this issue, VTE prophylaxis is one of the most cost-effective measures of clinical practice and is a priority strategy to improve the safety of hospitalized patients (Amaral & Tavares, 2013). It has been the subject of warnings from a number of agencies assessing global health quality such as the National Institute for Clinical Excellence, the Scottish Intercollegiate Guidelines Network, the American College of Chest Physicians, the European Society of Cardiology (Konstantinides, Torbicki, Agnelli, Danchin, Fitzmaurice, Galiè, N. Lang, I, & Collaborators, 2014), among others. The guidelines developed by these organizations recommend that all hospitalized patients be evaluated for VTE risk and that hospitals develop protocols for adequacy of prophylaxis. In this context, according to an adequate risk stratification, several preventive methods of VTE can be used in the hospitalized patient: pharmacological or non-pharmacological. Although pharmacological prophylaxis is already consecrated by clinical experience, non-pharmacological measures also play a prominent role in preventing VTE. Its use is suggested as an alternative for patients at high risk of bleeding where anticoagulant therapy is contraindicated or in conjunction with drug prophylaxis (Bang, Jang, Kim, Yim, Kim, Nam, & Kim, 2014).

2. Problem Statement

Based on framework described above, an integrative review of the literature was carried out, based on evidence-based practice as an approach that leads to the development and / or use of research results in clinical practice. This is one of the research methods used in the foundation of an evidence-based practice

that enables the integration of research results into clinical context, whose purpose is to gather and synthesize research results on a topic that is done in a systematic way (Mendes, Silveira, & Galvão, 2008). In this paper, we present the results of the study. Thus, the development of nursing, as a discipline and profession, has been a strong contribution to the expressive increase of knowledge production, a factor considered as a fundamental tool in suppressing the needs verified in clinical practice (International Council of Nurses, 2012). Yet, according to the same body, the conscious, explicit and judicious use of the best existing evidence helps to make health care decisions to patients. Evidence-based practice involves integrating individual clinical competence with what is best available in the scientific evidence resulting from the research and that aligns the patient's perspective in clinical decision-making.

3. Research Questions

Considering the contextualization of the subject under study, and considering the importance of the practice based on evidence for the professional practice in the area of rehabilitation nursing, the following research question arose:

- "What are the non-pharmacological measures recommended for the prevention of venous thromboembolism in hospitalized patients?"

4. Purpose of the Study

Taking into account the research question, this study aims to identify the non-pharmacological measures recommended for the prevention of venous thromboembolism in the hospitalized patient.

5. Research Methods

An integrative literature review was performed using the PI[C]OD method. As a strategy for the location and selection of studies, three steps were accomplished. Initially a simple search was conducted limited to MEDLINE and CINAHL, followed by an analysis of the words in the titles and abstracts, and the terms used to describe the studies. A search was then conducted on the National Center for Biotechnology Information website at <http://www.ncbi.nlm.nih.gov/mesh> to confirm if the preliminary terms were MeSH terms (Medical Subject Headings). Obtained positive response to:

- #1 MeSH descriptor "Venous Thromboembolism" (explore all trees);
- #2 MeSH descriptor "Deep Vein Thrombosis" (explore all trees);
- #3 MeSH descriptor "Pulmonary Embolism" (explore all trees);
- #4 MeSH descriptor "Nursing Care" (explore all trees);
- #5 MeSH descriptor "Rehabilitation" (explore all trees);
- #6 MeSH descriptor "Exercise Therapy" (explore all trees);
- #7 MeSH descriptor "Intermittent Pneumatic Compression devices" (explore all trees);
- #8 MeSH descriptor "Stockings, Compression" (explore all trees);
- #9 MeSH descriptor "Early Ambulation" (explore all trees);
- #10 MeSH descriptor "Inpatients" (explore all trees).

The following research was conducted between March and November 2016 and included electronic searches in the following databases: CINAHL Complete, MedicLatina, Medline Complete, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, and Nursing & Allied Health Collection: Comprehensive from the EBSCOhost platform supplemented by the PubMed, JBI Library of Systematic Reviews, PEDro, Elsevier-ClinicalKEY, SciELO-Scientific Electronic Library Online and Google Scholar through the Boolean conjugation of all Identified descriptors - # 11 [# 1 OR # 2 OR # 3 AND # 4 OR # 5 OR # 6 OR # 7 OR # 8 OR # 9 AND # 10] (title and subject).

For the databases that do not use the MeSH descriptors, the following Boolean formula was used:

- Venous Thromboembolism OR Deep Vein Thrombosis OR Pulmonary Embolism And Nursing Care OR Rehabilitation OR Exercise Therapy Intermittent Pneumatic Compression devices OR Compression Stockings OR Early Ambulation AND Inpatients.

In the PEDro (Physiotherapy Evidence Database) electronic database the search term was "Venous Thromboembolism" (title and abstract).

The last step consisted of analyzing the list of bibliographic references of all identified studies to extract additional studies if possible.

The first selected sample consisted of 189.494 studies. However, because of the size of the sample, research limiters were applied, and only those studies that had the following requirements were considered: published in Portuguese, English or Spanish; Full text, date of publication in the period from January 2006 to November 2016, participants classified as adults and studies in humans. After its application and after the extraction of duplicates (802), 161.951 were excluded. The detailed and specified search strategy process for each database can be found in Table 1.

Table 01. Research strategy

	Boolean sentence	Database	Identified articles
S1	TI (Venous Thromboembolism OR “Deep Vein Thrombosis OR Pulmonary Embolism) And AB (Nursing Care OR Rehabilitation OR Exercise Therapy OR Intermittent Pneumatic Compression devices OR Compression Stockings OR Early Ambulation) AND (Inpatients)	Via EBSCO: CINAHL Complete MEDLINE Complete MedicLatina Cochrane Database of Systematic Reviews Cochrane Central Register of Controlled Trials Nursing & Allied Health Collection: Comprehensive	265 698 601 53 2146 22896
S2	TI (Venous Thromboembolism OR “Deep Vein Thrombosis OR Pulmonary Embolism) And AB (Nursing Care OR Rehabilitation OR Exercise Therapy OR Intermittent Pneumatic Compression devices OR Compression Stockings OR Early Ambulation) AND (Inpatients)	PubMed	502
S3	“Venous Thromboembolism” (Title/Abstract)	PEDro	18
S4	"Venous Thromboembolism OR Deep Vein Thrombosis OR Pulmonary Embolism And Nursing Care OR Rehabilitation OR Exercise Therapy OR Intermittent Pneumatic Compression devices OR	Elsevier- ClinicalKEY	6

	Compression Stockings”		
S5	Venous Thromboembolism OR Deep Vein Thrombosis OR Pulmonary Embolism	JBI Library of Systematic Reviews	11
S6	(“Venous Thromboembolism” OR “Deep Vein Thrombosis” OR “Pulmonary Embolism”) And (“Nursing Care “OR “Rehabilitation” OR “Exercise Therapy” OR “Intermittent Pneumatic Compression devices” OR “Compression Stockings” OR “Early Ambulation”) AND (“Inpatients”)	Google Académico	228
S7	(“Tromboembolismo Venoso” OR “Trombose Venosa Profunda” OR “Tromboembolia pulmonar”) And (“Papel do Enfermeiro “OR “Reabilitação” OR “Exercício” OR “Dispositivo de compressão pneumática intermitente” OR “Meias de compressão elástica” OR “Mobilização precoce”) AND (“Doente hospitalizado”)	Scielo Google Académico	119

After reading the titles and summaries of the remaining 27.543 studies, it was reduced to 14 because they did not refer to the topic under study (referring only to pharmacological measures). It is important to point out that the entire strategy of research and selection of studies was carried out by two researchers independently. We then analyzed the full text articles (n = 14), based on the application of more rigorous criteria, which were established based on the PI[C]OD methodology (Ramalho, 2005) and are presented in Table 2. In the course of this process, 9 articles were excluded and the corpus of the study was reduced to 5 studies.

Table 2. Inclusion criteria for the study corpus according to the PI[C]OD methodology

Selection criteria	Inclusion criteria
Participants	Adult in a hospital environment. Studies that included adults in the outpatient setting, users under the age of 18 and pregnant women were rejected.
Intervention	Use of non-pharmacological measures to prevent VTE. We excluded studies that refer only to pharmacological measures
Comparisons	If they are described in the literature.
“Outcomes”	Prevention of VTE in the hospitalized patient.
Study design	Experimental and quasi-experimental studies, qualitative and quantitative studies, systematic and integrative literature reviews, literature review articles.

Data were then collected, involving two steps: extraction and synthesis of the data. To that end, the data were extracted from studies that had previously composed the corpus by two reviewers alone, using the instrument "The Joanna Briggs Institute data extraction form for systematic review of experimental / observational studies" JBI (2011). Data extracted included details of interventions, population, study methods, outcomes relevant to the issue under study, and specific objectives. These data were synthesized in a "framework of evidence" (Craig & Smyth, 2004). Tables with the critical evaluation of studies 4 and 5 were also drawn up (studies 1,2 and 3 are of a qualitative nature. The whole process of selection of the corpus of the study was synthesized in the following flowchart (Figure 1).

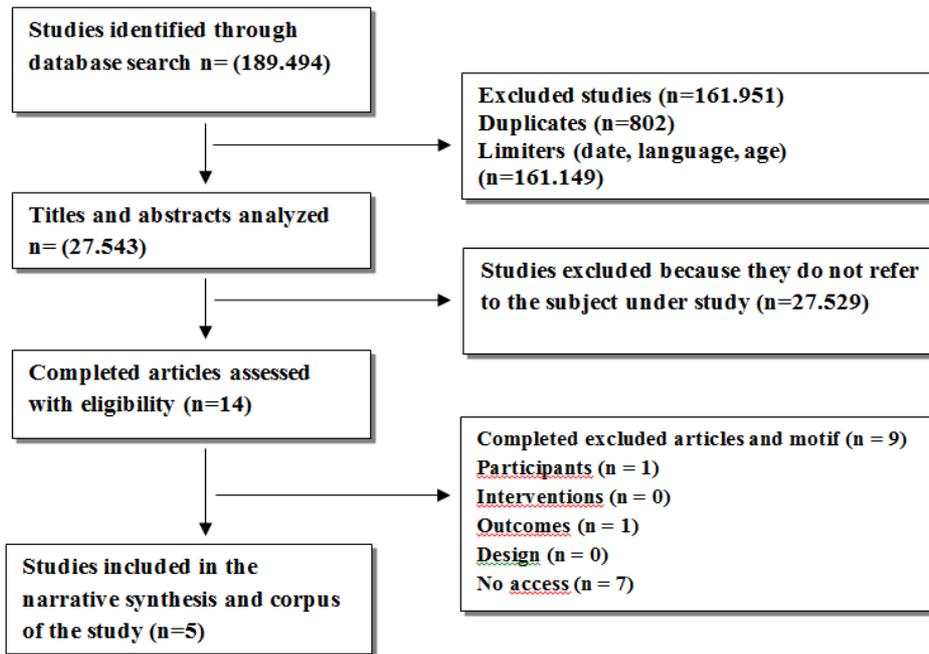


Figure 01. Flowchart representative of the refinement steps of the study corpus

6. Findings

Of the studies identified through the types of research mentioned and the use of the methodology mentioned above, through which a critical evaluation was located, selected and performed based on the selection criteria adopted, only 5 articles were selected for the study corpus.

Following are the main results of the analysis of the selected studies, which were grouped and organized in a table, in order to answer the research question previously stated. Table 4 summarizes the characteristics and dimensions of the studies, thus facilitating their understanding and comparison among them, namely the method, participants / sample, objectives and main conclusions. A descriptive summary is made of the most relevant aspects that each of the included studies cover.

In order to answer the research question "What are the non-pharmacological measures recommended for the prevention of venous thromboembolism in the hospitalized patient?" Studies were used, according to the methodology adopted, by four types: a case study With a qualitative approach (Pinho, Viegas & Caregnato, 2016), a literature review (Vitor, Daou & Góis, 2016; Gusmão, Silva & Azevedo, 2014), a systematic review of the literature (Penha, Damiano, Carvalho, Lain & Serafim, 2009) and a quantitative-randomized clinical trial (Labarere, Bosson, Sevestre, Sellier, Richaud, & Legagneux, 2007).

Table 3 below summarizes the five studies on the efficacy of non-pharmacological measures for the prevention of venous thromboembolism in hospitalized patients.

Table 03. Summary of evidence found

Studies	Study identification (Author, year, Title / type of publication, year / volume / number)	Method	Participants / Sample	Objectives
E1	Pinho, N.G., Viegas, K., Caregnato, R.C.A. (2016). Papel do enfermeiro no período peri-operatório para prevenção da trombose venosa profunda. <i>Rev. Sobecc</i> ; 21(1): 28-36.	Case study with qualitative approach, using semi-structured interview as a data collection instrument	Sample composed of 12 nurses from an inpatient unit, operating room and post-anesthetic recovery room of a trauma hospital in Porto Alegre.	To know how nurses perform the prevention of DVT in patients undergoing surgeries in the peri-operative period; To assess the risk factors for the development of DVT identified by nurses.
Main conclusions	From the content analysis of the interview results, three categories emerged: risk factors for DVT; Preventive measures of DVT and difficulties in the execution of the systematization of the peri-operative nursing assistance. The preventive measures of DVT were: anticoagulants, change of position, use of venous return boot, nursing care, pneumatic compression and physiotherapy. The preventive measure of DVT most mentioned by the nurses was the change of decubitus, emphasizing the importance in moving the patient as early as possible, according to each case. The use of the venous return boot and the compression stockings in the surgical patient, intraoperatively and postoperatively, although they are effective in preventing DVT, are not always used, since the use of these measures is conditioned Medical prescription, revealing lack of autonomy of the nurses.			
E2	Vitor, S.K.S., Daou, J.P., & Góis, A.F.T. (2016). Prevenção de tromboembolismo venoso (trombose venosa profunda e embolia pulmonar) em pacientes clínicos e cirúrgicos. <i>Diagnóstico & Tratamento</i> ; 21(2), 9-64.	Narrative review of the literature.	Text corpus publication from 2015 to 2016.	Discuss the current methods of thromboprophylaxis in clinical patients, especially in cancer patients and surgical patients; To verify the importance of their adherence to health services.
Main conclusions	It has been found that there are two modalities of prevention of DVT, mechanical and pharmacological methods, whose use varies according to surgery and the patient. Mechanical methods increase the velocity of venous flow of the lower limbs, reducing venous stasis, and have a fibrinolytic effect on the vascular endothelium. The mechanical method is more effective in patients with low risk or intermediate, circumstances of impossibility to use anticoagulants, or in situations of very high risk, as a reinforcement for the pharmacological means. Among these methods, there is the compression stocking and intermittent pneumatic compression. It does not benefit high-risk patients, but it reduces DVT by 65% when compared to no prophylaxis.			
E3	Gusmão, G.L., Silva, L.X., & Azevedo, A.S. (2014). Assistência de enfermagem no tratamento da trombose venosa profunda em pacientes críticos. <i>Biologia & Saúde</i> , 15 (4), 50-60.	Narrative review of the literature, qualitative study with exploratory approach	The sample consists of studies with a publication date between 2002 and 2013.	Think on nursing care in view of the importance of the Nursing Diagnosis (NANDA) in the prevention and treatment of DVT to prevent complications in critically ill patients admitted to an Intensive Care Unit.
Main conclusions	It was concluded that there are proven benefits of the stimulation of active and / or passive bed mobilization in the prevention of DVT in hospitalized patients. Early ambulation helps systemic circulation, improves self-esteem, autonomy, pressure ulcer prevention, and minimizes the risks of DVT development.			
E4	Penha, G.S., Damiano, A.P., Carvalho, T., Lain, V., & Serafim, J.D. (2009). Early mobilization in acute stage of deep venous thrombosis of the lower limbs. <i>J. Vasc Bras</i> , Vol. 8, 1, 77-85.	Systematic review of the literature.	Studies with early mobilization associated with low molecular weight heparin and compression therapy (1992-2007).	Research in the scientific literature, especially controlled clinical trials, on the early mobilization of patients with DVT in the lower limbs in the acute phase.
Main conclusions	The benefits of reducing pain and edema, improving quality of life, the therapeutic strategy of early mobilization in combination with anti-coagulation and compression of the leg in deep venous			

	thrombosis have been demonstrated, with no greater risk of relevant outcomes, such as pulmonary embolism and death. The comparison of the evolution of patients at rest in the bed with those who were mobilized early revealed no significant difference in the appearance of pulmonary embolism. Early mobilization may contribute to the reduction of thrombus progression. Early ambulation may be a protective factor. Ambulation in combination with anti-coagulation and leg compression in patients with acute DVT leads to a more rapid regression of clinical signs and symptoms such as pain, edema, hyperemia and temperature rise. Physical exercise accentuates the endogenous fibrinolytic activity manifested as a decrease in plasminogen activator inhibitor. External leg compression, coupled with the ambulation program, provides a reduction in the hydrostatic blood pressure and, consequently, decreases the symptoms and venous signals.			
E5	Labarere, J., Bosson, J. L., Sevestre, M. A., Sellier, E., Richaud, C., & Legagneux, A. (2007). Intervention targeted at nurses to improve venous thromboprophylaxis. <i>International Journal for Quality in Health Care</i> , 19(5), 301-308.	Quantitative study; Randomized clinical trial; Transversal	Patients aged 65 or over.	To compare the efficacy of an intervention directed at physicians and nurses versus physicians in improving venous thromboprophylaxis in elderly patients.
Main conclusions	It was found that a multifaceted intervention aimed at nurses as well as physicians can increase the mobilization frequency of older patients significantly to prevent venous thromboembolism, but does not alter the use of elastic stockings and prophylaxis with anticoagulants.			

7. Conclusion

The prevention of venous thromboembolism in hospitalized patients is particularly important because of the high prevalence of this pathology in this context. There is evidence that prevention is the safest, most effective and cost-effective strategy for reducing VTE morbidity and mortality. Through an adequate risk stratification it is possible to categorize the level of risk for each patient and to adapt prophylactic measures that may be pharmacological and non-pharmacological. The analysis of the 5 articles selected allowed us to answer the research question that guided this study. The mechanical methods were as follows: non-pharmacological measures recommended for the prevention of VTE in the hospitalized patient: mechanical compression stockings and intermittent pneumatic compression devices; Nursing care: early mobilization and ambulation.

Evidence of the results revealed that:

- mechanical methods: - increase the velocity of venous flow of the lower limbs, reducing venous stasis; - Have a fibrinolytic effect on the vascular endothelium; - are more effective in patients with low / medium risk in the impossibility of using anticoagulants; - do not benefit high-risk patients, but reduce DVT by 65% when compared to no prophylaxis;
- early mobilization may contribute to the reduction of thrombus progression;
- ambulation aids systemic circulation, improves self-esteem, autonomy, pressure ulcer prevention and minimizes the risk of DVT development;
- ambulation in combination with anti-coagulation and leg compression in patients with acute DVT leads to a more rapid regression of clinical signs and symptoms such as pain, edema, hyperemia and temperature rise;
- physical exercise accentuates fibrinolytic activity.

These measures corroborate and provide scientific evidence to the guidelines issued by various bodies assessing the quality of health worldwide. This allows us to defend the implementation of a

rehabilitation program whose objectives are: improve the safety of the hospitalized patient; minimize the inabilities and limitations of survivors; contribute to the autonomy and quality of life; gain health gains.

Thus, a rehabilitation program is presented, which includes a set of preventive measures that should be applied to clinical practice after the evaluation of each patient's risk profile (Table 4).

Table 04. Preventive measures of VTE in the hospitalized patient*

Risk Profile	Preventive measures	Recommendation strength
Low Risk (0-1 points)	<ul style="list-style-type: none"> • Early ambulation • Active exercises of the lower limbs 	<ul style="list-style-type: none"> • Level 1B
Moderate/high risk (2/4 points)	<ul style="list-style-type: none"> • Early mobilization: adequate positioning, respiratory functional reeducation techniques; Joint and muscular mobilization techniques (passive, active, active-assisted and active-resisted mobilizations); Bearing, bridge and hook techniques; Scapular and pelvic girdle dissociation techniques; Bedside, orthostatism, transfer to the chair, and ambulation. • In the surgical patient: graduated compression stockings or intermittent pneumatic compression devices 	<ul style="list-style-type: none"> • Level 1B • Level 2C
Very high risk (5 points or more)	<ul style="list-style-type: none"> • Early mobilization: adequate positioning, respiratory functional reeducation techniques; Joint and muscular mobilization techniques (passive, active, active-assisted and active-resisted mobilizations); Bearing, bridge and hook techniques; Scapular and pelvic girdle dissociation techniques; Bedside, orthostatism, transfer to the chair, and ambulation. • In the surgical patient: CPI 	<ul style="list-style-type: none"> • Level 1B • Level 2C

This framework was elaborated according to the Recommendations of the 9th Consensus of the ACCP *Antithrombotic Therapy and Prevention of Thrombosis Guideline* of 2012 and the MAR of Caprini.

*Adapted from: Guyatt, G. H., Akl, E. A., Crowther, M., Gutterman, D. D., & Schünemann, H. J. (2012). Executive summary: antithrombotic therapy and prevention of thrombosis: American College of Chest Physicians evidence-based clinical practice guidelines. *CHEST Journal*, 141 (2_suppl), 7S-47S.

However, despite the evidence of the results of this RIL we are aware that it has some limitations. In this sense, other databases could have been used but limitations in access to them conditioned this restriction; Only free access articles were studied in Portuguese, English and Spanish and we found that there are few studies that refer only to non-pharmacological measures.

Aware of the limitations, we consider that the development of this study was very positive because of the pertinence of the theme and because it is necessary to have more investment by the rehabilitation nursing to show its role in the prevention of this pathology.

As future research, we suggest longitudinal studies that attest to the efficacy of nursing care: early mobilization, ambulation and therapeutic exercises for the prevention of VTE in the hospitalized patient.

This study has implications for the practice:

- Raise the awareness of health professionals at the institution level through training actions in order to provide reflection and understanding of the importance of optimizing VTE preventive measures;
- Disseminate the results of this research at the level of the scientific community through the elaboration of posters, oral communications, publication of an article;
- Develop an action protocol that contributes to the adequacy of preventive measures;
- Sensitize / educate patients and caregivers:
 - Establish an intervention plan directed at combating and / or modifying risk factors,
 - encourage the promotion of healthy lifestyles in which regular exercise is encouraged and a balanced and varied diet in order to prevent and reduce the risk of these events,
 - to plan together with them an appropriate care program, enabling them to continue their care in the post-discharge period;
- Present the proposal for a Follow-up Rehabilitation Nursing Consultation.

Thus, the rehabilitation nurse as well as the rehabilitator assumes the role of educator of the patient and caregivers in a practice not only curative, also acting in the modification and / or combat of risk factors.

Ultimately, VTE prevention should be multidisciplinary, and each institution must develop a strategy that guarantees a successful preventive approach, thus contributing to the improvement and safety of health care provided.

Acknowledgments

We would like to show our gratitude to Librarians of the Library of the Superior School of Health of Viseu for their contribution in the research.

Financing CI&DETS, Health School /Polytechnic Institute of Viseu

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