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Thrombosis: concept analysis as a theoretical contribution to qualify the clinical practice of nurses

Trombose: análise de conceito como subsídio teórico para qualificar a prática clínica de enfermeiros

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ABSTRACT

Objective: to analyze the concept of thrombosis and identify its applications, defining attributes, antecedents, consequences, and empirical references. **Method**: a concept analysis was carried out using Walker and Avant's framework. **Results**: the most cited defining attributes were thrombus, Virchow's triad, and total/partial impairment of blood flow. The most frequent antecedents were cancer/chemotherapy, thrombophilia, and diabetes. Several manifestations composed the consequences, according to the compromised vascular bed. The most cited were stroke or transient ischemic attack, acute myocardial infarction, and pulmonary thromboembolism. The empirical references were related to clinical examinations, coagulation tests, and risk scores. Computed tomography was the most cited imaging test. **Conclusion**: The analysis of the thrombosis concept showed the use of this term in the current literature, its defining attributes, antecedents, consequences, and empirical references. This study adds knowledge to nurses' clinical practice and can contribute to the refinement of standardized language systems.
Descriptors: Thrombosis; Concept Formation; Nursing.

RESUMO

Objetivo: analisar o conceito de trombose e identificar aplicações, atributos definidores, antecedentes, consequentes e referenciais empíricos. **Método:** análise de conceito, segundo Walker e Avant. **Resultados:** os atributos definidores mais citados foram trombo (s), tríade de Virchow e comprometimento total/ parcial do fluxo sanguíneo. Os antecedentes mais frequentes foram câncer/uso de quimioterápicos, trombofilias e diabetes. Várias manifestações compuseram os consequentes, conforme o leito vascular comprometido. Os mais citados foram: acidente vascular cerebral ou acidente isquêmico transitório, infarto agudo do miocárdio e tromboembolismo pulmonar. Os referenciais empíricos se relacionaram a exames clínicos, testes de coagulação e escores de risco. A tomografia computadorizada foi o exame de imagem mais citado. **Conclusão:** a análise de conceito de trombose evidenciou o uso deste termo na literatura atual, bem como os atributos definidores, antecedentes, consequentes e referenciais empíricos. Este estudo agrega conhecimento à prática clínica de enfermeiros e pode contribuir com o refinamento dos sistemas de linguagens padronizadas.
Descritores: Trombose; Formação de Conceito; Enfermagem.

INTRODUCTION

Thrombosis represents the underlying mechanism of cardiovascular diseases, which are often important health problems[1]. The disease is configured in various clinical manifestations due to the possibility of occurring in arterial or venous vascular beds and, thus, compromising different tissues and systems[1-2].

Arterial thrombosis is directly related to atherosclerosis and represents the leading cause of mortality in the world, commonly manifesting as acute myocardial infarction (AMI), cerebrovascular accident (CVA)/transient ischemic attack (TIA), and peripheral arterial obstructive disease[1,3]. Venous thrombosis is described as venous thromboembolism (VTE), which is divided into deep vein thrombosis (DVT) and pulmonary thromboembolism (PTE), which

represents the third most common cardiovascular disease in Western countries[4].

The impact of thrombotic events on the health of individuals is undeniable, as well as on health services costs[4-5]. However, there are potentially preventable risk factors that can be monitored and controlled through lifestyle guidance, including smoking cessation, eating behavior, obesity control, physical activity, early mobilization in the hospital environment, and adequate use of anticoagulants, among others[6].

Thus, the need for multiprofessional health teams to direct efforts toward the early identification and control of these factors in individuals susceptible to thrombosis is highlighted[6]. When considering the various environments in which nurses work, these professionals play an important role in directing and managing individuals at risk for thrombotic events, whether in hospital or outpatient units and community services.

Studies with robust methodologies demonstrate the impact of nurses' actions in improving crucial aspects of preventing thrombosis[7-9]. In different randomized clinical trials, interventions guided by nurses contributed to self-efficacy for health promotion behaviors, corroborating to improve in physical activity levels, weight reduction, abdominal circumference reduction, and blood pressure control[7-9].

Despite the relevance of the role of nurses, in a study conducted in Brazil that compared the self-perceived and objective knowledge of 81 nurses about venous thromboembolism, only 13% indicated that they were confident to act in the prevention and orientation of patients to prevent VTE[10]. In the same survey, around 33% answered objective questions correctly on the disease, and 44.4% performed a risk assessment of only a few patients[10]. Similarly, in a mixed-methods study with 234 nurses from nine countries, about 57% indicated low to acceptable confidence in aspects related to training or professional development related to thrombosis and hemostasis[11].

Despite the thrombosis phenomenon being initially described in 1856, in nursing, there are no studies aimed at clarifying the concept behind this event. In a single conceptual analysis study found on the topic, nurses' proactivity in the prevention of venous thromboembolism was conceptualized[12], and specific knowledge, education, and training were indicated as factors for improving proactivity[12].

The consistent knowledge about the conceptual elements of thrombosis and its respective risk factors corroborates the clinical practice of nurses, both in the early identification of susceptible individuals and in the anticipatory implementation of care. It is observed that, although nursing interventions have the potential to prevent thrombotic events[7-9], there are gaps in nurses' knowledge regarding the concept of thrombosis and the recognition of risk factors, which can become important obstacles in the implementation of preventive care[10-12].

From this perspective, this study was designed to analyze the concept of thrombosis in the current health sciences literature and identify its applications, defining attributes, antecedents, consequences, and empirical references. It is understood that this investigation will provide subsidies to understand the expanded concept of thrombosis and correlate it with the clinical and scientific practice of nurses, providing operational definitions on the subject that can be applied in intervention studies conducted by nurses, in training and qualifications for the nursing team, as well as in the refinement of standardized language systems.

METHOD

A concept analysis was carried out using Walker and Avant's framework[13], which proposes to elucidate the definition of a concept and identify its attributes to develop a homogeneous way of understanding terms. In nursing, this methodology has been used to define terms of clinical practice and contribute to developing and refining nursing diagnoses[14].

In this framework, eight steps are proposed[13]: 1 – choosing a concept, 2 – determining the purpose of analysis, 3 - identifying all uses of the concept, 4 - defining attributes, 5 - identifying a model case, 6 - identifying other cases, 7 - identifying antecedents (events that precede/risk factors for thrombosis) and consequences (events that occur after thrombosis), and 8 - defining empirical referents (ways of measuring thrombosis in clinical practice)[13].

In step 1, the concept selected was "thrombosis" and, in step 2, the objectives of this conceptual analysis were: to define the meaning of thrombosis in the current health sciences literature through the defining attributes of the concept, to identify the antecedents and consequences of the concept, and describe the empirical references[13]. Steps 3 to 8 were conducted based

on an integrative literature review[15], with the following guiding questions: What is the definition and characteristics of thrombosis described in the recent health sciences literature? What are the risk factors for thrombosis, and what are its respective consequences? What are the ways to detect/evaluate it in clinical practice?

The search for studies was conducted to collect current information on the subject, thus including publications from the last five years (January 2015 to July 2020). The search took place between August and October 2020 in the databases via the US National Library of Medicine (PubMed), the Scientific Electronic Library Online (SciELO), and the Cumulative Index to Nursing and Allied Health Literature (CINAHL). Access to the full texts was through the Portal of Periodicals of the Coordination for the Improvement of Higher Education Personnel (CAPES), SciELO, and PubMed. The following Health Sciences Descriptors (DeCS) were used: trombose, trombosis, thrombosis. The following Medical Subject Headings (MeSH) terms were used: thrombosis, venous thrombosis, risk factors, physiopathology, and the keyword: arterial thrombosis. These search terms were combined as follows: ((((thrombosis) OR venous thrombosis) OR arterial thrombosis)) AND ((risk factors) OR physiopathology) in PubMed; trombose OR trombosis OR thrombosis in SciELO; and thrombosis AND risk factors AND physiopathology in CINAHL.

Studies available in full format, online, written in English, Portuguese or Spanish, and who answered the study's guiding questions were selected. Editorials/letters, theses/dissertations, case studies/case reports, points of view, and books were excluded. Duplicate articles were counted only in the first database where they were found. Data collection was performed using an instrument developed by the researchers with the following information: database researched, title, language, authors, journal, country of study, year of publication, objective, study design, method, how the authors defined thrombosis, which are the risk factors and consequences of thrombosis, and which are the diagnostic tests or risk scores for thrombosis.

The selected publications were grouped using a Microsoft Excel® spreadsheet and sent to Zotero® bibliography manager software. Data were extracted, critically analyzed, and categorized based on the study objectives. The ethical aspects were respected, observing the authenticity of the researched authors' ideas, concepts, and definitions.

A researcher searched and selected publications by reading the titles, selecting those related to the study's theme, then reading the abstracts and using the inclusion criteria. Subsequently, the findings were discussed with another researcher, and finally, a thorough reading of the full texts was carried out, and those who still did not answer the study's guiding questions were excluded from further data analysis.

RESULTS

One hundred forty-two publications were included (Figure 1). The studies were predominantly from the United States (27.5%), followed by the United Kingdom (9.8%), Italy, and Brazil (7% each). Nine publications were from China (6.5%), seven from Poland (5.0%), and 53 were from other countries (37.2%). Mostly the studies consisted of literature reviews (57.7%), followed by observational, case-control, and cross-sectional studies (33.8%), and 12 publications (8.5%) had designs such as systematic reviews and meta-analyses, among others. The most frequent language was English (91.6%). The distribution of studies was similar between periods, 31 (21.8%) in 2015, 29 (20.4%) in 2017, 23 (16.2%) in 2016 and 2019, 20 (14.1%) in 2018, and 16 (11.3%) in 2020.

Of the 142 studies, 64 (45%) contributed to identifying the application of the concept and elucidated the defining attributes of thrombosis. Four main categories were identified that refer to the applications of the concept: mechanism of thrombosis formation[3,16–18], the influence of risk factors[19–20], health implications of thrombosis[21–23], and types of thrombosis[24–26].

Most authors defined thrombosis as total or partial obstruction of a blood vessel by the formation of a thrombus or thrombus fragments (which have become dislodged from the heart or anywhere in the vascular tree)[16,20-21,27]. It was inferred from the analyzed studies that thrombosis occurs in the presence of factors that generate imbalances in the procoagulant, anticoagulant, and fibrinolytic systems or that impact the components of Virchow's triad[3,17,21-22,28]. Depending on the vascular bed affected, the disease has different manifestations representing the underlying mechanism of serious health diseases[2,17,22,29]. The defining attributes of thrombosis are shown in Table 1 and converge with the conceptual definition of thrombosis mentioned above. The

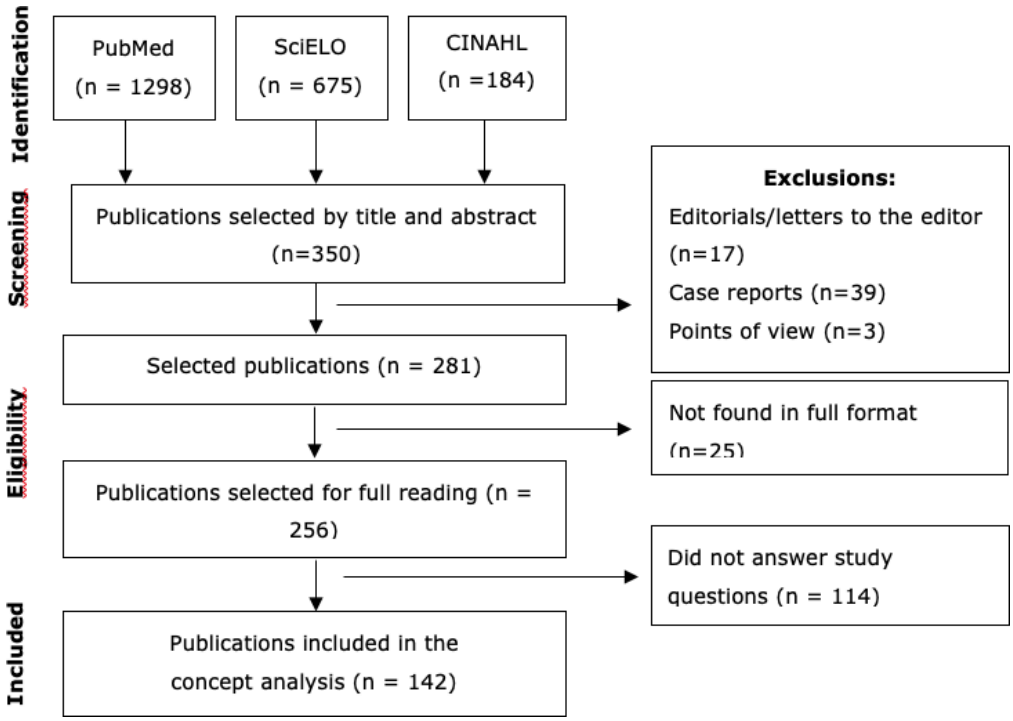

Figure 1 - Flowchart for the selection of studies from the databases. Porto Alegre, RS, Brazil, 2020
Source: Elaborated by the authors, 2020.

most frequent was "thrombus", followed by "Virchow's triad" and "total or partial impairment of blood flow".

A model case was developed to demonstrate the practical application of the concept, and the contrary case to exemplify a situation in which the concept and its respective attributes are not present[13]. Both cases are fictitious and constructed by the authors of the study.

Model case: Paulo, 75 years old, male, married, self-employed. Smoker and hypertensive, with irregular treatment. He arrived at the emergency room, brought by family members, with reduced consciousness, aphasia, right hemiparesis, and labial commissure deviation starting an hour ago. Relatives brought an echo-Doppler performed the week before, with evidence of atherosclerosis in the left carotid artery. On examination, the patient had a blood pressure of 185/110 mmHg, a heart rate of 114 bpm, an irregular and full pulse, and capillary blood glucose of 148 mg/dl. Cranial computed tomography showed findings of cerebral artery thrombosis.

Contrary case: Luiza, 45 years old, female, telephone operator, divorced. She had a metallic heart valve, anticoagulated for six months. She had no other comorbidities and did not use other medications. She arrived at the anticoagulation clinic with the result of an echocardiogram without the presence of thrombi in cardiac structures. Upon physical examination, the patient was lucid and oriented in time and space. Isochoric, photoreactive pupils, without motor deficit, blood pressure of 120/80 mmHg, heart rate of 84 bpm, regular rhythm. Heated and perfused extremities. The patient had an international normalized ratio (INR) = 3.0.

The antecedents and consequences of the concept of thrombosis are shown in Figure 2. The most prevalent empirical references were computed tomography exams and their respective variations, such as angiotomography and tomography venography, cited in 32 articles (22.5%). The second most frequent was the ultrasound/echo-doppler exam, identified in 27 (19%) publications, followed by magnetic resonance in 19 (13.3%) and transthoracic echocardiography in 18 (12.6%). The dosage of d-dimers was indicated in 12 (8.4%) studies, and some authors also indicated the use of risk scores, such as the Geneva, Padua, and Caprini scores, the CHA_2DS_2-VASc score, and the Wells Clinical Prediction

Table 1 - Frequency of the defining attributes of thrombosis. Porto Alegre, RS, Brazil, 2020

Defining attributes	n (%)*
Thrombus	30 (31.1)
Virchow's triad	28 (19.7)
Total or partial impairment of blood flow	22 (15.5)
Thromboembolism	20 (14.0)
Imbalance between procoagulant, anticoagulant, and fibrinolytic factors	19 (13.3)
Atherosclerotic plaque rupture/erosion	17 (11.9)
Blood clot	9 (6.3)
Prothrombotic state	5 (3.52)

Source: Elaborated by the authors, 2020.
*n (%): absolute frequency (relative frequency).

rule[25,30–34], which, despite not indicating the existence of thrombosis, represent important guides regarding the probability of developing thrombosis or thromboembolism.

DISCUSSION

This study aims to present the results of a concept analysis of thrombosis. The findings indicate that thrombosis has a complex pathophysiological mechanism and generates impairment of blood flow by the formation of thrombi in arteries/veins or by the embolization of thrombi that have dislodged from the heart or anywhere in the circulatory system[3,16,20-21,27,29].

Some authors have conceptualized thrombosis as a pathological process of coagulation triggered by factors that impact the balance of procoagulant, anticoagulant, and fibrinolytic systems (for example, atherosclerotic plaque rupture) or that affect components of Virchow's triad (blood stasis, endothelial injury, and hypercoagulability) [3,16-17,21-22,28,35].

Eight essential attributes were identified, the most frequent being "thrombus", followed by expressions that reveal the triggers of this phenomenon, such as "Virchow's triad", "imbalance between procoagulant, anticoagulant, and fibrinolytic factors", "rupture/atherosclerotic plaque erosion" and "prothrombotic state".

Rudolf Virchow's Triad, the second most frequent attribute, was described in 1856, indicating three essential components that, when present, predispose to thrombus formation[35]. The first two components relate to acquired factors, such as immobilization, smoking, and surgery, and the last one represents inherited or acquired hypercoagulable states[35].

Although this triad has been revised since then, the recent studies identified in this analysis agree with the postulate, especially when referring to venous thrombosis, and add the important role of the inflammatory response in thrombogenesis[35]. In arterial thrombosis, the presence of significant vascular injury in the form of atherosclerotic plaque rupture with consequent disturbance of blood flow and platelet aggregation, forming the so-called atherothrombosis, stands out[1,29,36].

Thrombi formed in situ have embolization potential depending on the site of formation (bifurcation sites), blood flow conditions (shear force), and characteristics of thrombus stability, corroborating that thrombotic manifestations are related to the impairment of blood flow locally or by dissipating into the bloodstream and compromising smaller-caliber vascular beds[29].

Uses of the thrombosis concept were found in publications on the mechanism of thrombosis formation[3,16–18], the influence of risk factors[19–20], the health implications of thrombosis[21–23], and types of thrombosis[24–26]. In this concept analysis, 28 consequences that represent the variety of manifestations that individuals with thrombosis may present were found. The most frequent consequences of thrombosis were CVA or TIA, followed by AMI and PTE. It should be stressed that death was the fifth most cited consequence, revealing the magnitude of thrombotic events.

The most cited empirical reference was computed tomography and the corresponding variations. Regarding the selection of antecedents of the concept, 53 were identified, and the most prevalent were cancer or use of chemotherapy drugs, thrombophilia, obesity, and previous history of thrombosis. It is also noteworthy the identification of classic risk factors for cardiovascular diseases, such as diabetes, hypertension,

Antecedents	**n (%)***
Cancer/Chemotherapy	48 (33.8)
Thrombophilia	43 (30.2)
Obesity	41 (28.8)
History of thrombosis	38 (26.7)
Autoimmune diseases; advanced age	35 (24.6)
Surgery; pregnancy	34 (23.9)
Infection/sepsis	33 (23.2)
Physical trauma	31 (21.8)
Diabetes mellitus; pulmonary hypertension; smoking	28 (19.7)
Immobility	27 (19.0)
Oral contraceptives; post-childbirth	23 (16.1)
Central venous catheter; peripherally inserted central catheter; cardiac insufficiency	22 (15.4)
Dyslipidemias; kidney disease; hormone replacement	21 (14.7)
Atherosclerosis	20 (14.0)
Change in clotting factors; myeloproliferative diseases	19 (13.3)
Atrial fibrillation/flutter	18 (12.6)
Inflammatory bowel disease	17 (11.9)
Intravascular procedures	16 (11.2)
Anemia/sickle cell disease	15 (10.5)
Hyperhomocysteinemia	13 (9.1)
Non-adherence or inadequate anticoagulation	11 (7.7)
Dehydration; chronic inflammatory diseases; family history of thrombosis; prolonged or recent hospitalization	10 (7.0)
Non-O blood type/blood transfusion	9 (6.3)
Sedentary lifestyle	8 (5.6)
Metabolic syndrome	7 (4.9)
Heart valve prostheses	6 (4.2)
Structural heart changes; atherogenic diet; Chronic obstructive pulmonary disease; paroxysmal nocturnal hemoglobinuria; SARS-COV2/COVID infection; impaired mobility	5 (3.5)
Anxiety/depression/stress; ventricular or circulatory assist device; critical/severe illness; extended trip	4 (2.8)
Low socioeconomic level; newborns and premature babies	3 (2.1)
Endocarditis; hyperglycemia; venous insufficiency	2 (1.4)
Consequences	n (%)*
Ischemic stroke/transient ischemic attack	58 (40.8)
Myocardial infarction	40 (28.1)
Pulmonary thromboembolism	38 (26.7)
Pain/edema in the extremities	16 (11.2)
Death	15 (10.5)
Changes in skin color on the extremities	11 (7.7)
Peripheral arterial disease	10 (7.0)
Dyspnea or tachydyspnea; headache	9 (6.3)
Neurological deficit; chest pain	8 (5.6)

Mesenteric ischemia	7 (4.9)
Cardiac insufficiency; sensory change	6 (4.2)
Intracranial hypertension syndrome	5 (3.5)
Post-thrombotic syndrome	4 (2.8)
Rales, changes in heart sounds and jugular distention; hemoptysis; renal insufficiency/infarction; convulsion, cardiogenic shock	3 (2.1)
Multiple organ infarction; positive Homans' sign or Neuhof's sign; amputation; claudication; abdominal pain	2 (1.4)
Fatigue; pulmonary hypertension	1 (0.7)

Figure 2 - Antecedents and consequences of thrombosis. Porto Alegre, RS, Brazil, 2020
Source: Elaborated by the authors, 2020.

*n (%): absolute frequency (relative frequency) of each antecedent or consequent of thrombosis.

and sedentary lifestyle, in addition to situations acquired from a prothrombotic state, such as pregnancy, puerperium, and surgeries.

Individuals with cancer have a four to five-fold increase in the risk of developing VTE, an event that represents the second most common cause of death in these individuals[37]. Blood stasis is related to prolonged bed rest and vascular compression by tumor masses, causing, for example, vessel damage through the action of cancer cells, intravascular devices, and chemotherapy itself, and hypercoagulability results from the relationship between clinical risk factors, tumor cells and the host response[37].

Thrombophilia, the second most frequent antecedent, represents a group of hereditary (protein C, S, and antithrombin deficiency; factor V Leiden mutation; and prothrombin gene mutation) or acquired (antiphospholipid syndrome) alterations that cause a state of predisposition to arterial or venous thrombosis[38]. Despite this susceptibility, the prevalence in the population is low, but the presence of other factors, such as venous or arterial catheters, trauma, dehydration, pregnancy/puerperium, sepsis, and smoking, among others, increase the risk of thrombosis[38].

Obesity, like the other antecedents, is associated with a prothrombotic state, especially because it generates an inflammatory environment, insulin resistance, and disorder in the hemostatic system. A review study[19] found that dietary and lifestyle interventions that support weight loss improve these aspects and control clotting factors, preventing thrombotic events. Moreover, patient education is crucial for this to be achieved and physical activity associated with diet control should be seen as a unique intervention worked together with patients[19].

Converging with interventions focused on the prevention of thrombotic events, studies have demonstrated the importance of nursing actions for the management of other antecedents identified in this study, such as arterial hypertension, obesity, diabetes, and the patients' level of knowledge. In a randomized clinical trial conducted with 142 adults with type 2 diabetes mellitus, individuals who received education on diabetes self-management guided by nurses showed significant improvement in glycated hemoglobin (HbA1c), blood pressure, body weight, and diabetes self-management. Furthermore, the beneficial effect of the intervention continued to accumulate at the end of the research, generating sustained improvements in clinical outcomes, lifestyle, and psychosocial aspects evaluated[39]. Patients who received actions guided by nurses improved their level of physical activity, medication adherence, and increased knowledge about risk factors for the prevention of new ischemic events demonstrated in a systematic review with meta-analysis of 3,568 patients after ischemic stroke and TIA[40].

Some antecedents found are conditions acquired by patients in the hospital environment in which nurses are frequently exposed, such as surgical intervention, prolonged immobilization, and use of central or peripheral venous catheters. The role of nurses is important in the process education of patients regarding these risks. A quasi-experimental study with 40 patients to evaluate the effect of training on educational guidelines and self-care practices for the prevention of venous thrombosis conducted by nurses identified an improvement in the levels of knowledge of patients about the disease[41].

Another review study listed nursing care in the postoperative period, such as teaching and promotion of early mobilization, promotion of adequate nutrition and hydration, application of compression stockings, and the adequate administration of prophylactic drugs for thrombosis, which resulted in a reduction in the time of hospitalization and VTE incidence in the analyzed studies[42].

Concerning the risk of thrombosis due to the use of invasive devices, in a study with meta-analysis, the application of best practices in the placement of peripherally inserted central catheters conferred a low risk of venous thrombosis and bloodstream infection when compared with central catheters[43]. In the national reality, qualified nurses play a leading role in the insertion of these catheters, and the choice, early indication, and adequate maintenance of this device provide greater safety to the patient.

The indicated data demonstrate the importance of the nurses understanding the mechanism of thrombosis development, being able to intervene early, and anticipating health problems. Furthermore, recognizing risk factors subject to independent nursing intervention or joint and multi-professional action is desirable for the search for more assertive results and improved patient adherence, whether in the context of continuity of treatments or in maintaining a healthier lifestyle to prevent thrombotic events.

As a limitation of the present study, it is highlighted that, despite the combination of descriptors, some studies may not have been included due to flaws inherent to the search strategy. However, it is believed that the results presented contribute to the scientific advance of nursing, as this is an unprecedented study, conducted by a theoretical model of concept analysis according to Walker and Avant's framework, based on a broad review of the literature that subsidizes the nurse in the prevention of thrombosis and anticipatory care implementation.

CONCLUSION

This study enabled the conceptual analysis of thrombosis and the identification of the most frequent defining attributes, such as "thrombus", "Virchow's triad", and "total or partial impairment of blood flow". A broad identification of antecedents was carried out, in which cancer and chemotherapy, thrombophilia, and diabetes were the most frequent antecedents. The consequences of thrombotic events were varied and represented a high impact on the population's health, such as CVA/TIA, AMI, and PTE. Empirical references were mainly related to imaging tests, coagulation tests, and risk scores, with computed tomography being the most cited in the studies.

The definition of thrombosis identified in this study can be applied in the development of research tools and instruments, as well as in the improvement of standardized nursing languages. Besides the benefits above, the elucidation of the concept of thrombosis and the identification of its respective antecedents and consequences can contribute to training aimed at the nursing team, as well as assist in the decision-making of nurses in the face of individuals susceptible to thrombotic events, individually or together with multi-professional teams, being able to intervene early in the elaboration of a care plan for those with greater risks related to thrombosis.

CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

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