THE WORK OF NURSES IN THE CENTRAL STERILE SUPPLY DEPARTMENT AND ITS IMPLICATIONS FOR PATIENT SAFETY

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The association of health care and infections is considered a significant public health problem. The processing of health products is considered a complex activity within the context of health facilities, whose main objective is to avoid the occurrence of any adverse event related to their use. Nowadays, not only the potential transmission of infection-causing microorganisms is concerning, but also their toxic products or the occurrence of reactions because of residues from products used for cleaning, disinfection, and sterilization of health products.

A circumstance recently broadcasted in the media reports that the lack of sterilization of instruments used in a cataract surgery campaign caused the contamination of 22 patients by *Pseudomonas bacteria*, resulting in numerous consequences, such as sight loss, removal of the eyeball, in addition to other intangible losses, thus, confirming the failure of the safety standards regarding the surgical instruments used in those procedures.

Failures in cleaning, disinfection, and sterilization of health products may result in significant institutional cost, and patient morbidity and mortality. Proper cleaning, disinfection, and sterilization procedures have been emphasized in various publications documenting the rise in infection after inappropriate processing of items of patient care.

The main target in this context, the Central Sterile Supply Department (CSSD) is characterized by unique characteristics, daily challenging the manager in this area with regard to the environment, the structure, and the proper processing of health products in a safe, efficient, and a financially viable way. For such, professionals in this department should be aware of up-to-date market trends, technological advances associated to the complexity of surgeries and the surgical instrumentation design and still must follow the rules, laws, and recommendations to their practice, in addition to attend client's expectations.

In a broader understanding on the determination of the health–disease process, it is important that professionals in the health team have an integrated view of the challenges and resources needed to fight those.

When considering the complexity of the CSSD mission, the work processes in this place cannot be considered simple, repetitive, and of minor importance within the institution. Nowadays, the CSSD practices are based on scientific evidence, which point out to severe consequences for the assistance given to patients when recommendations are not followed, such as undervaluing stages of material processing, thinking that a process may substitute another, and that flaws may be compensated. Thus, the monitoring of each phase in the processing of health products as well as the description of all standard operational procedures are considered essential[1].

The attitude of each employee working in the CSSD and the work of nursing supervisor directly influences the feasibility of the safe care toward the surgical patient, even if the care is indirect, ensuring the reproducibility of the process in its entirety. These attitudes permeate the possibility of tracking all the phases of material processing regarding hospital infection control in case of a necessary recall of health products.

It is noteworthy that statistical measures are important so that the goals are defined, increasingly challenging the perception of safety regarding the infections of surgical sites.

Such goals may only be achieved through constant efforts from a multidisciplinary team, involving professionals of the Hospital Infection Control Service of the CSSD, in the Surgical Center of Clinical Engineering, the Supplies, the Hospital Hygiene Service, the management, and administrative sectors, which interact in the context of prevention practice to hospital infections.

Managers responsible for these teams need to master the skills that are relevant to their fields in order to avoid errors that cause violations of the security process, thus respecting the surgical patient who becomes more fragile during surgical procedures.

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BIOSECURITY IN CENTRAL STERILE SERVICES DEPARTMENT: THE DOUBTS OF PROFESSIONALS*

Biossegurança no Centro de Materiais e Esterilização: dúvidas dos profissionais

Bioseguridad en el Centro de Materiales y Esterilización: dudas de los profesionales

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ABSTRACT: Objective: This work aims at knowing the doubts health professionals may have about biosecurity in Central Sterile Services Department (CSSD), and reflect upon the answers. **Methods:** This is a qualitative, descriptive exploratory study. The research was about a well known Brazilian website, which offers a discussion list by e-mail. 2,260 messages were sent to this list in 2014. The sample was composed by 109 messages containing topics about biosecurity in CSSD; interpreted using the Bardin's Content Analysis. **Results:** Four theme categories emerged from the most frequent questions: chemical solutions, equipment and materials, Law, and process validation. Both in questions as in answers analyzed, there was a strong relation between the CSSD and Hospital Infection Control. **Conclusions:** Most professionals who referred questions were nurses. The most frequently asked questions on biosecurity related to the solutions used, equipment and materials. The answers were based on existing legislation and issued by professionals with experience.
Keywords: Equipment safety. Nursing. Materials.

RESUMO: Objetivos: Conhecer as dúvidas dos profissionais da saúde sobre biossegurança no Centro de Materiais e Esterilização (CME) e refletir sobre as respostas emitidas. **Método:** Estudo exploratório descritivo qualitativo. O cenário da pesquisa foi um site nacional reconhecido que dispõe uma lista de discussão por e-mail. O *corpus* foram 2.260 mensagens enviadas à lista de discussão em 2014; a amostra foi composta por 109 mensagens com conteúdo relacionado à biossegurança no CME. Utilizou-se para interpretação dos dados a Análise de Conteúdo de Bardin. **Resultados:** Na análise emergiram quatro categorias temáticas das dúvidas mais frequentes denominadas: soluções; equipamentos e materiais; Legislação; e validação do processo. Evidenciou-se forte relação entre CME e Controle de Infecção Hospitalar (CIH), tanto nos questionamentos quanto nas respostas. **Conclusão:** A maioria dos profissionais que encaminharam dúvidas foram enfermeiros. As dúvidas mais frequentes sobre biossegurança relacionavam-se a soluções usadas, equipamentos e materiais. As respostas foram fundamentadas na legislação vigente e emitidas por profissionais com experiência.
Palavras-chave: Segurança de equipamentos médicos. Enfermagem. Material.

RESUMEN: Objetivos: Conocer las dudas de profesionales de la salud sobre bioseguridad en el Centro de Materiales y Esterilización (CME) y reflexionar sobre las respuestas fornecidas. **Método:** Estudio exploratorio descriptivo cualitativo. El escenario de la investigación fue un sitio electrónico reconocido que dispone de una lista de discusión por correo electrónico. 2.260 mensajes fueron enviados a la lista de discusión en 2014; la muestra se compuso de 109 mensajes con contenido relacionado a la bioseguridad en el CME. El análisis de contenido de Bardin fue empleado para la interpretación de los datos. **Resultados:** Emergieron en el análisis cuatro categorías temáticas de las dudas más frecuentes, denominadas: soluciones; equipamientos y materiales; legislación y validación del proceso. Se evidenció una fuerte relación entre el CME y el Control de Infección Hospitalaria, en tanto en los cuestionamientos y en las respuestas. **Conclusión:** La mayoría de los profesionales que refirieron las preguntas eran enfermeros. Las preguntas más frecuentes sobre bioseguridad eran relacionadas a las soluciones utilizadas, a los equipos y los materiales. Las respuestas se basaron en la legislación vigente y fueron emitidas por profesionales peritos.
Palabras clave: Seguridad de equipos. Enfermería. Material.

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INTRODUCTION

Biosecurity consists of a challenge for health professionals, especially in the practical field of a little known sector as the Central Sterile Services Department (CSSD). This support sector is of fundamental importance as it is responsible for the processing of health products (PHP), ensuring patient's safety and allowing the use of materials in appropriate conditions for preparation and sterilization[1].

In the hospital, the CSSD is considered a critical area for processing articles resulting from clinical and surgical interventions, presented, this way, risks to the professionals in this sector, making them more susceptible to occupational accidents[2].

Biosecurity may be focused toward two directions: both in relation to genetically modified organisms and their derivates as for the activities inherent to biotechnology, social and occupational protection of the workers. This research focuses on the later, once that among their objectives is the preservation of health professionals, the community, the environment, and owing to the ethical and legal matters, once that negligence may become a threat[3], resulting in lawsuits.

Regulatory Norm No. 32 (*Norma Regulamentadora nº 32* – NR-32) is about safety and health in the work in health services, being considered a great advance for workers in this area, once they set guidelines for the implementation of measures for health protection and the security of the worker[4]. In order to implement NR-32 in the services, we need investments in physical, material, and personal resources, in addition to the training and motivation of employees and managers, creating new cultural and behavioral concepts[4,5].

In order to standardize all the work and to ensure the safety of the articles processed by the CSSD, the National Health Surveillance Agency (*Agência Nacional de Vigilância Sanitária* – Anvisa) published, in 2012, the Resolution No. 15 (RCD-15), about the requirements of good practices for the PHP, being an important historical milestone for addressing, among other sections, human, safety, and health resources at work and the attributions of the responsible technician[6]. Although the RDC-15 does not specify the professional training of the responsible for this sector (it only mentions that they should have higher education), it is believed that the nurse is the most appropriate professional to hold this position, once their training gives them technical and managerial skills to manage this sector, in addition to having a deep knowledge about the full treatment of the patient[6]. However, it is noticeable that nursing has been losing their interest in working in this area, making room for the work of other health or administrative professionals interested in this sector.

A work badly executed in the CSSD may result in risks for the health of both workers and patients, once that this sector is connected to all hospitals, providing articles for the provision of services, creating an interdependent relationship, in which the quality of the services performed is directly related to the quality and safety of the products processes in the CSSD[7].

It is known that flaws in the CSSD may occur owing to the lack of updated professionals; lack of standardization of the actions; nonadherence to the use of Personal Protective Equipment (PPE); and execution of inappropriate techniques[8].

The work in the CSSD may be compromised by various factors such as inappropriate infrastructure; dynamics in human relations; lack of professional qualification; pressure of the work; and the productivity demand[9]. Therefore, many factors may be related to accidents occurred in this sector such as work overload; wearisome working hours; physical weariness; night shifts; lack of attention; excess of confidence; lack of conditions; lack of technical capacity, etc. The highest risks of exposure of health professionals occur in unsatisfactory working places, disorganization of the services, deficiency of human and material resources, and inappropriate physical areas from the ergonomic point of view[10].

In order to ensure the efficiency and safety of the working processes, it is necessary a constant update and the existence of a committed attitude of the professionals who perform their working activities[9]. The adoption of biosecurity measures is a priority for all sectors and health professionals exposed to occupational hazards, and education is essential; however, the biosafety themes and the CSSD are little discussed in the professional development process of nursing professionals[1].

During the undergraduate nursing course, it was learned the importance of biosecurity in order to ensure care safely, for both the patient and the professional, with the opportunity of learning the theory and having lived the practice in the CSSD. By knowing that many undergraduate nursing courses do not approach the theoretical and practical contents about

this area, there was then an interest in researching about the doubts of health professionals about biosecurity in the CSSD.

The restlessness and the search for knowledge led to the discovery of a nationally recognized website, which debates the doubts of health professionals on the subject. In this context, there came the interest in investigating the following problem of research: which are the most common doubts about biosecurity in the CSSD and how are they discussed and clarified in the website? In order to address the outlined problem, the objectives of this research are defined as getting to know the doubts of health professionals about biosecurity in the CSSD and reflecting on the answers given.

METHOD

It is a descriptive exploratory study with a qualitative approach.

In order to clarify the frequent doubts of health professionals, there is a national website about biological risks aiming at preventing occupational biological risks for their workers. Within this virtual environment, there is a space for discussion via e-mail. This website (http://www.riscobiologico.org/) has the objective of spreading information on occupational biohazard for health professionals by actions of education, research, surveillance, and exchange, disseminating updated information and helping in the technical aspects of matters related to the biohazard for health professionals.

This research considered as a *corpus* all the e-mail messages sent for the discussion group of the website from January to December 2014, totaling 2,260 messages. The sample consists of 109 messages, which met the following inclusion criteria — having been sent to the discussion group in 2014 and presenting doubts regarding the CSSD in their contents.

For the collection of the data, the researcher initially performed the registration on the website in 2012, after learning about it through the indication of the advisor. In the same year, they made their registration in the list of discussion, in order to have access to it. All e-mails received were saved and stored in a file, beginning in January and ending in December 2014. The e-mails had the initial doubts and the answers discussed by the discussion group.

The researcher read the e-mails and, after identifying the theme about CSSD, saved the message in the file. Afterward, they created a flowchart in Excel® containing the quantitative of the doubts, professions which submitted the doubts and answers presented.

There was conducted a Thematic Content Analysis of Bardin[11], according to the stages of:

1. preanalysis: organization of the material, brief reading of the e-mails, and identification of the repetitions and systematizations of the ideas for the analysis;
2. analytical description: categorization of the data by the thematic criteria, grouping the similar theme with the same meaning; and
3. inferential interpretation: data were interpreted through inferences, with the objective of making the results valid and significant.

The analysis was conducted through the full reading of all messages selected and grouped initially by the title of the forwarded message, reaching thus the total of 19, creating precategories related to the repetition of contents of the doubts. After performing again of the full content reading, the repeated registration units (RU) are highlighted, grouped according to the similarity of the doubts and answers, emerging the final categories and subcategories. In the sequence, the counting of the RU was performed, expressed in whole numbers, calculating the percentage.

In the analysis, the professionals who sent their doubts to the website were identified by the initials of their professions, followed by a number to differentiate the subjects. Adding numbers to the letters coded by profession was necessary owing to the quantitative of professionals of the same category. For the e-mails without professional identification, it was chosen to use the abbreviation NI (nonidentified). The research was submitted to the Research Ethics Committee of the University, being approved under endorsement number 93.4017. After approval, we contacted the technician responsible for the website, which authorized the research after receiving the project and approval.

RESULTS

The following professionals with college education were identified in the e-mails: 30 nurses (N), 5 doctors (D), 5 clinical engineers (CE), 5 pharmacists (P), 2 veterinarians (V), and 1 work safety engineer (WSE). Besides those, there were also

identified professionals of technical level: three work safety technicians (WST) and two hospital hygiene technicians (HHT). NI professionals totaled 19.

Chart 1 presents the four final categories, emerged subcategories, RU, and percentage of the main doubts sent for the list of discussion.

It was observed a strong existing relation between the CSSD and the Hospital Infection Control (HIC), both for the questions and the answers.

Solutions

Three subcategories emerged in this category: commercial names; concentrations, dilutions, and validity; and costs. In the subcategory "commercial names", the professionals expressed their doubts regarding which products are more appropriate to perform both high- and low-level chemical disinfection, of a variety of materials used in the hospital area, such as nebulizers, humidifiers, ambus, oxygen extenders, devices used for endoscopy, and surgical instruments, as expressed in the following:

> I'd like to know what is being used for endoscope disinfection [referred to the commercial name of glutaraldehyde] or peracetic acid? (NI1)

> Does anyone have any information based on legislation about the high level disinfection of the peracetic acid in 10 minutes? Does anyone use or know the […]? (N11)

Regarding the doubts, a pharmacist answered:

> The products follow legislation. In the referred case, for disinfectants, it's RDC 35/10, where it is specified the microbiological reports required for the registration, in which the maximum immersion time is the one of the microorganism which takes the longer to be eliminated. (P1)

In the subcategory "concentrations, dilutions, and validity", the main doubt found was about the correct way to dilute several existing solutions, keeping the appropriate concentration in order to ensure the safe processes of cleaning, disinfection, and sterilization, without causing damages to users, according to the following RU:

> What are currently the concentrations x need to rinse for the sodium hypochlorite of the masks used for nebulization/ambu […]? (NI14)

> I've been reading about disinfection [referring to the hypochlorite] […], but there are controversies regarding the dilution and concentration for such practice. I'd like to know what is recommended by Anvisa: 0.02%, 1%, 0.5%? (N26)

In response to the questionings about hypochlorite, a nurse answered:

> Except for items used in case of active pulmonary tuberculosis, I recommend hypochlorite at 0.02%

Chart 1. Categories, subcategories, and amount of registrations units, with corresponding percentages, resulting from the doubts of health professionals about the Central Sterile Services Department in the discussion website, from January to December 2014.

Categories	Subcategories	RU	%
Solutions	Comercial names	124	72.90
	Concentrations, dilutions, and validity	34	20.00
	Costs	12	7.05
	Total RU	170	100
Equipments and materials	Sterilization/disinfection methods	69	40.5
	Instruments	59	34.7
	Reprocessing	12	7.0
	Packaging	11	6.4
	Biofilm	10	5.8
	Maintenance (life, damage, preservation, conservation)	10	5.8
	Total RU	171	100
Legislation	Norms/Rulings	56	50.9
	Law/Legal	37	33.6
	Anvisa	17	15.5
	Total RU	110	100
Validation of the process	Time	39	54.9
	Tests	32	45.1
	Total RU	71	100

RU: registration units.

> for 30 minutes. The solution should be changed every day. (N27)

In the subcategory "costs", some doubts regarding the most expensive solutions appeared; ways to reduce the cost of solution acquisition such as using solutions in a safe way without increasing the costs for the institutions owing to damage or misuse; and the correct way of storage.

> I'm having difficulty in standardizing the purchase of hypochlorite in the stockroom […], but the stockroom is complaining it's expensive, to buy one with higher concentration and then dilute it, they suggested. (NI16)

The answers try to clarify and recommend, as follows:

> […] substitute it with 5% peracetic acid, the cost will be lower and the quality of disinfection better. (NI17)

> And is this whole process cheaper than disposal? (CE5)

> I recommend using peracetic acid. […]. The solution may be used for many days, perfectly monitors, and, if the problem is the cost, you will be surprised. You have many options and prices in the market, powder, liquid, ready-to-use, concentrated, with or without corrosion inhibitors […]. (CE2)

Moreover, in this subcategory, the best price for the acquisition of equipments is discussed, such as ultrasonic washing machines and more modern autoclaves, as alternatives to substitute the solutions as suggested.

Equipments and materials

In the category "equipments and materials", six categories were suggested namely: sterilization/disinfection methods; instruments; reprocessing; packages; biofilm; and maintenance. About the sterilization/disinfection methods, the doubts were related to the methods used to carry out this process in which the solution is used and which choice is more effective, as in the excerpt:

> What material do you use for disinfection of respiratory materials […]? (N25)

Another nurse answered:

> Except for the materials used in cases of active pulmonary tuberculosis, I recommend hypochlorite at 0.02% for 30 minutes. The solution must be changed every day. (N27)

There was a specific question about endoscope disinfection:

> I'd like to know what is being used for endoscope disinfection […]? (NI10)

Including also other doubts that showed up regarding this kind of equipment, followed by the following answer:

> […] we, controllers of hospital infection, recommend that the peracetic acid is used for endoscope disinfection, however, this product reduced the useful life of some devices, especially when not removed the film formed over its lenses which previously received the action of the glutaraldehyde. Currently, there is, in the market, a peracetic acid with more alkaline pH, which favors the conservation of the devices. As for the […] [commercial name mentioned], it is also an excellent product which does not compromise the life of the device, though it has higher cost and needs to be inactivated for disposal. (NI8)

When discussing this topic, the professionals presented more than one way of disinfection/sterilization which may be used for the same material, depending on various factors for its choice such as the institution, the modernity of the equipments used in the CSSD, the indication of the manufacturer, and what is recommended by the HIC, as shown in the following excerpt:

> Does anyone know with what product do I disinfect the esophageal thermometer […]?

The answer was:

> High level chemical disinfection, since the esophageal thermometer is sensitive to high

> temperatures and wouldn't bear thermal disinfection. (P2)

In the subcategory "instruments," the doubts identified were regarding the marking of surgical instruments such as clamps, pneumatic drills, trays, clamps, and others, in addition to the possible biofilm appearance when using some kinds of materials in order to perform this marking, as in the excerpt:

> […] is there a legislation regarding the marking of surgical material? (N8)

The use of tapes to Mark the instruments is discussed, but once again there is the biofilm matter:

> The steam really does not penetrate the layer of tape with adhesive and it stains the instrument and, with the adhesive's drying out, they certainly form a biofilm. There is nothing definitive about instrumental marking other than laser marking. (NI7)

In the subcategory "reprocessing", it is discussed the reprocessing of some materials, which should be single-use; however, for the most various reasons, sometimes they end up being reprocessed following a set of rules.

> I have a doubt about the reprocessing of a material. (N28)

> If the manufacturer says the product is for single use, it mustn't be reprocessed. (N29)

In the subcategory "packages", the doubts focused on which kind of material is safer to pack boxes and other surgical instruments which will go through the sterilization process or which is the best kind of packaging for items that will just go through the sterilization process. The doubts were associated to which kind of packaging is more adequate for each material, considering the costs of each ones, associated to the safety of the process at matter and the rules involved in these processes.

> I'm beginning the activities in a surgical Center and in there they use crepe paper packaging of surgical boxes. I'd like to know if there is any rule prohibiting the use of this material […]. (N1)

> There are still no rules prohibiting this kind of sterile barrier system, but the paper should present appropriate technical specification and being registered in Anvisa. (N1)

In the subcategory named "maintenance", there are questions about the useful life of the equipment/material; damages; preservation and conservation; solutions used to clean, disinfect, and sterilize; and substitution of some products for another, keeping conservation and prolonging the life of the equipments ensuring safety for those who will use those products.

> […] all the laparoscopy instruments should be sterilized, but here in my institution not all video surgery materials may be autoclaved. How is it done in the other hospitals? (N11)

This question was not answered since the answers discuss the change of methods of disinfections and sterilization and the change of more modern equipment (thermoresistant).

> […] the change of the disinfection method from glutaraldehyde to peracetic acid may damage the equipments […] High risk of losing the equipments. (D2)

Legislation

In this category, there are three subcategories namely: "Norms/ Rulings"; "Law/ Legal"; and "Anvisa". In the subcategory "Norms/Rulings," the professionals expressed their doubts in relation to which norm or ruling should they base on to make the decision regarding the product to be used or how to use it and, at the same time, there were doubts about the legal aspects and the laws which regulate the use of products, packaging, substances, and equipments, making these subcategories appear in several moments.

> Does anyone have any information based on the legislation about high level disinfection of peracetic acid? (N11)

> The current legislation for the registration of the High Level Disinfectant (Peracetic) is the RDC 33/2010. (CE4)

In the subcategory "Anvisa," the main doubts were focused on the reprocessing of materials and about which materials are present in the list of the ones that shall not be reprocessed.

> I had this doubt, but with help I was able to solve it. Because it needs to be verified how the manufacturer registered the product in Anvisa, the product I use by […] is registered as for single use, therefore the cannulas of Guedel are not reusable. (N23)

Validation of the process

In the category "validation of the process", there were two subcategories: "time" and "tests".

The subcategory "time" is related to the doubts of the professionals regarding the time a product should remain immersed so that the cleaning or disinfection occurs in an efficient and safe way.

> […] high level disinfection of the peracetic acid in 10 minutes? (N11)

> According to the methodology of the INCQS used for the trial of microbactericidal efficiency the time of contact is of at least 30 minutes. (P1)

In the subcategory "tests", the main doubts were in relation to the tests which should be carried out in order to validate the burdens of sterilization in the autoclaves, what amount of those should be used in each burden, and which is the best location with the objective of ensuring a safe sterilization process.

> […] Four ampoules or it can be used just one inside the autoclave and another as control? (N20)

> What is biological indicator?" (CE1) The answer: "The RDC 15, March 15th 2014, of Anvisa, is very good, it explains about the tests you should use and the frequency. (N21)

DISCUSSION

In the category named "solutions," many doubts referred to the commercial names of such solutions used in all the stages of the process of material preparation (cleaning, disinfection, or sterilization). The professionals wanted to know which was the most efficient, safest, and lowest in cost solution to be used in the institution.

A study[12] points out the difficulty found by the professionals in choosing the enzyme solutions for the cleaning of materials owing to the diversity of the brands in the market lately, each one with their own characteristics. It is noteworthy that most professionals demonstrated knowing which solutions are most commonly used for the cleaning, disinfection, or sterilization; however, for 20% (RU=34), the doubts were about which kind of solution and what concentration of it should be used for each kind of specific material.

Chemical disinfection should be the last option for the processing of thermosensitive materials owing to the complexity of the process, and the risks offered to workers who handle the product and for the environment, when discarded in inappropriate locations[13]. The germicides used for high-level disinfection are the aldehydes (glutaraldehyde, ortoformaldehyde, formaldehyde), the peracetic acid, the hydrogen peroxide, and the electrolyzed water; for the disinfection of the intermediate and low levels, the chlorinated solutions, alcohol, quaternary ammonia, phenols, and iodophors are used[13].

The concentration of the solutions remains the same recommended by the manufacturer for the immersion of the material, what varies is the time of exposure to it in order to occur disinfection of high, medium, and low levels. The RDC 8[14] forbids the sterilization of health products considered critical. The Anvisa reinforced this measure with the publication of RDC 33[15], in 2010, prohibiting the registration of new sanitizing agents in the category of "sterilizing" as a liquid, establishing a deadline for the adequacy of the sterilizing products and hospital disinfections for semicritical articles.

In the category "equipment and materials", there were doubts about methods of sterilization/disinfection directly related to the first category, in which the professionals asked for the most recommended disinfectant solutions and how to use them for the disinfection of the materials. In this category, the subcategory "instruments" was the second more

recommended one, with doubts in relations to all the stages in the process of preparations of the material (cleaning, packaging, and sterilization) of specific instruments such as endoscopy equipment, surgical instruments, nebulizers, ambus, etc.

According to the NR 15[6], all health products subject to processing must go through cleaning by mechanical actions (manual or automated), acting on internal (lumen) and external surfaces, in a way they make the product safe for handling and prepared for disinfections or sterilization. After cleaning, the materials must go through the processes according to their classification such as critical, semicritical, or noncritical products. Some should receive a simple disinfection, others, a high level disinfection or proceed to sterilization depending on the kind of material they are made of[6].

Some professionals reported their doubts in relation to the reprocessing of single use materials. A study[16] approached the classification of the health products as single-use or reusables. The first should be used one single time, however, the reuse of these materials has become a reality, involving a series of issues — technical, economic, environmental, ethical, and legal ones, once they may result in risk to the health of users of these products. The reusable products are considered durable goods and require, for reprocessing, an evaluation of performance, cleaning, disinfection or sterilization, and quality control in all the stages in order to ensure their reuse.

In 2006, Anvisa published the Resolution No. 2.605 with a list of hospital products prohibited to be reused[17]. In case there are any doubts, one should contact the committee of reprocessing of products of the institutions, but if this committee is not implemented, who will decide is the technical responsible for the CSSD, who should evaluate the conditions of the product, the costs for its reprocessing and, if after reprocessing, there will be no risk for users[6].

Another doubt still in relation to the category "equipments and materials" was about the safer kind of packaging to ensure the sterility of the material for longer. The main functions of the package should allow sterilization of the material, keeping their sterility up to the moment of use, and the aseptic removal of the packaging material, protecting them from possible adverse events[13]. The variety of products used to pack the materials to be sterilized is large; therefore, in order to choose which will be the most appropriate casing, it is necessary to take into account a series of factors such as money, financial condition of the institution, waste production, training of the team of employees of the CSSD, etc.[13]. Thus, the packaging gives the material the protection necessary for the maintenance of the sterilization, being directly connected to the conditions of handling, transportation, and storage; thus, the material should be stored in a dry, ventilated place, protected from dirt and large temperature variations — these conditions should always be monitored and events which may put at risk the sterilization of the material[18].

The least expressive doubt was in relation to the formation of biofilm, when for some reason the cleaning of the equipment is not enough or when the solutions used are not according to the dilution. A study on the removal of biofilm, in devices used for endoscopy, pointed out a high risk of developing the biofilm in this kind of equipment, considering they are complex, cannot be disassembled, and are not transparent, which difficults the internal visualization and may compromise the cleaning process[19]; therefore, if the cleaning is not enough, the process of disinfection and/or sterilization will be all compromised.

In the category "legislation", most doubts were in relation to the "Norms/Rulings" and about the laws. Regarding this category, it may be mentioned the RDC 15[6], an essential document for those who work in the CSSD, provides for good practice requirements for the PHP and offers other measures aimed at the safety of the patient and the professionals involved[6]. In addition to those, there are other Resolutions, New Techniques, and Rulings, published by Anvisa, which complement the recommendations for good practices in the CSSD addressing the aspects not discussed by the RDC 15.

In the category "validation of the process", most doubts were focused on the time in which the materials should be exposed in each stage of cleaning, disinfection or sterilization, and what tests should be carried out in order to ensure an effective sterilization at the end of the process. It is known that health users are exposed to risks inherent to an inappropriate processing; when the time is inappropriate, the potential of microorganisms transmission is kept, and the toxicity caused by residues of the solutions used may reach the patient[19].

According to the recommendation from RDC 15[6], each and every burden of sterilized products should be followed by a monitoring with challenge test packaging

with chemical integrators class 5 or 6. As for the monitoring with physical tests, there is a need of registration for each sterilization cicle[6]. The monitoring with a biological indicator should be carried out daily, placing the challenge packaging at the point with the greater difficulty to perform the sterilization of the internal chamber of the autoclave[6]. The results of these tests should be stored in the unit and be available for consultation when requested[6].

Observing the doubts sent to the list of discussion and evaluating the answers issued, it was concluded that most of them were correct — those which were inappropriately answered would be immediately presented the correct solution by another professional. The answers would always be fundamented in existing legal references, with the indications of chapter of norms and legislations available mainly in the websites of the Ministry of Health, Anvisa, and in the website itself.

Although different professional categories have manifested their doubts, it was observed that they were similar and directed in order to ensure the biosecurity of the health products. The existing doubts, if not solved, would represent a risk for the quality of the PHP and consequently health assistance.

FINAL CONSIDERATIONS

This research allowed knowing the doubts about biosecurity related to the CSSD presented by health professionals and their answers, consistent with the existing national reality. It was observed that the most frequent doubts were related to the solutions, equipments, and materials; to the legislation; and to the validation of the process.

It was evidenced that the group of discussions of the website researched is an important tool available to help health professionals to solve their doubts, contributing for a quality health assistance. The doubts were, mostly, solved based on the existing norms and laws that guide the work in the CSSD.

About the solutions, the main difficulties pointed out by the patients were in relation to commercial names, the dilution concentrations, and its validity in order to perform the processing of materials in the CSSD. Regarding equipments and materials, the doubts were about the method of sterilization/disinfection and the concern with marking surgical instruments safely, ensuring the life of the material without affecting the sterilization process. As for the legislation, the main doubts of the professionals are related to which Norms/Rulings or Laws are indicated for the activities developed in the CSSD, in order to ensure the quality of the assistance. In the validation of the process, the professionals expressed their doubts regarding time and which materials should remain in each stage of the processing, in order to ensure an effective cleaning, a safe disinfection, and a fail-safe sterilization process. Besides that, there was also a concern as for the tests carried out in order to ensure that the processes would be fail-safe ensuring user's safety.

Many professions connected to the health area expressed their doubts and answers to the questionings related to the CSSD, although the number of professionals involved in the discussion was of nurses. There were concerned professionals about providing quality assistance, trying to solve their doubts based always on some legal information. It is considered that the website researched offered a sort of opportunities so that the professionals of health areas/managers use it as a source of consultation, working both for the continued education of the specific of the CSSD and in any area related to biosecurity in health services nationwide. The social contribution of this research is inferred, serving to spread the existence of a space where professionals may search for support to their doubts, always with legal support.

As limitations of this study, it may be mentioned the scarce national publications in the nursing area focusing on biosecurity in the CSSD within the last eight years, most publications being previously related, although the legislations have changed especially within the last four years.

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PRACTICE OF SURGICAL ANTIBIOTIC PROPHYLAXIS AND PATIENT SAFETY FACTOR

Prática da profilaxia antimicrobiana cirúrgica como fator de segurança do paciente

La práctica de la profilaxis antimicrobiana quirúrgica como un factor de la seguridad del paciente

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ABSTRACT: Objective: To identify the practice of surgical antimicrobial prophylaxis adopted by professionals working in the operating room. **Method:** A descriptive study with a quantitative approach was conducted in 30 surgical center professionals located in the Northwest of Paraná, Brazil. Data collection occurred in 2012 by direct observation. For analysis, we used descriptive statistics. **Results:** It was found that, in 81 (81%) surgeries, clean, potentially contaminated, and contaminated, surgical antibiotic prophylaxis was performed. However, in most of them (54/66.6%), the antibiotic was administered within 1 hour before the surgical incision. In addition, in six (18.1%) potentially contaminated surgery and one (33%) contaminated, where its use was necessary, the antimicrobial was not used. **Conclusion:** It was evident that this practice violates the current recommendations, which affects their effectiveness in preventing surgical site infection and compromises patient safety.

Keywords: Patient safety. Antibiotic prophylaxis. Perioperative nursing.

RESUMO: Objetivo: Identificar a prática da profilaxia antimicrobiana cirúrgica adotada pelos profissionais atuantes em centro cirúrgico. **Método:** Estudo descritivo com abordagem quantitativa. Participaram 30 profissionais de centro cirúrgico localizado na região Noroeste do Paraná, Brasil. A coleta de dados ocorreu em 2012 por observação direta. Para análise, utilizou-se a estatística descritiva. **Resultados:** Constatou-se que em 81 (81%) das cirurgias, limpas, potencialmente contaminadas e contaminadas, a profilaxia antimicrobiana cirúrgica foi realizada. Entretanto, na maioria delas (54/66,6%), o antimicrobiano não foi administrado dentro de uma hora antes da incisão cirúrgica. Adicionalmente, em seis (18,1%) cirurgias potencialmente contaminadas e em uma (33%) contaminada, em que seu uso é indispensável, o antimicrobiano não foi utilizado. **Conclusão:** Evidenciou-se que esta prática descumpre as recomendações vigentes, o que afeta a sua eficácia em prevenir infecção de sítio cirúrgico e compromete a segurança do paciente.

Palavras-chave: Segurança do paciente. Antibioticoprofilaxia. Enfermagem perioperatória.

RESUMEN: Objetivo: Identificar la práctica de la profilaxis antimicrobiana quirúrgica adoptada por los profesionales que trabajan en un quirúrgico. **Método:** Estudio descriptivo con un enfoque cuantitativo. Participaron 30 profesionales del centro quirúrgico situado en el Noroeste de Paraná, en Brasil. La recolección de datos se produjo en 2012 por medio de la observación directa. Para el análisis, se utilizó la estadística descriptiva. **Resultados:** Se encontró que en 81 de las cirugías (81%) limpias, posiblemente contaminadas y contaminadas, se realizó la profilaxis antimicrobiana quirúrgica. Sin embargo, en la mayoría de ellas (54/66,6%), el antimicrobiano no fue administrado en una hora antes de la incisión quirúrgica. Además, en seis (18,1%) cirugías potencialmente contaminadas y en una (33%) contaminada, en el que es necesario su aplicación, no se utilizó el agente antimicrobiano. **Conclusión:** Se evidenció que esta práctica viola las recomendaciones actuales, lo que afecta a su eficacia en la prevención de la infección del sitio quirúrgico y pone en peligro la seguridad del paciente.

Palabras clave: Seguridad del paciente. Profilaxis antibiótica. Enfermería perioperatoria.

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INTRODUCTION

The surgical adverse events are defined as injury or unintentional complication, owing to an event or omissions, related to the surgical procedure, which result in disability, prolonged hospitalization, or mortality of the patient[1].

The surgical site infection (SSI) is considered a surgical adverse event by the considerable impact on patient's health, by its economic repercussion, and for being a factor to evaluate the quality of care. In Brazil, it is one of the main infections related to health assistance and comprises from 14 to 16% of those found in hospitalized patients[2,3].

The risks of SSI are multifactorial, related to the condition of the patient and the existing practices in health services, such as duration and quality of preoperative hand antisepsis, patient's skin antisepsis, sterilization of materials and instruments, and surgical antimicrobial prophylaxis[2,3].

Several measures are proposed in order to prevent SSI, among which stands out the surgical antimicrobial prophylaxis (SAP), essential in many surgical procedures. It is characterized by the intravenous administration of a prophylaxis antimicrobial agent, so that its bactericidal concentration reaches serum and tissue levels when the incision is performed and during the surgery. This is done in order to reduce the microbial load of intraoperative contamination, and for fulfilling their function successfully, it should be administered up to 1 hour before the surgical incision[2].

This recommendation is on the worldwide agenda of the World Health Organization (WHO) in order to strengthen patient's safety. Concerned with the matter of safety and in order to mitigate adverse events associated to assistance, in 2007, the WHO launched the Global Patient Safety Challenge, aimed at the safety of surgical assistance, with special attention to the prevention of SSI. These standards should be operationalized by a checklist in a surgical room, which establishes that the SAP should be carried out at anesthetic induction[2].

Despite the evidences showing that the appropriate SAP is one of the most effective prevention measures of the SSI[2,4,5], the adherence to this practice remains excessively below the ideal in many hospitals[6-8]. On the national context, this is a scarcely investigated subject[9,10]. Another important fact to highlight is publications describing successful interventions in order to increase the adherence to the SAP; however, the SSI remains a significant problem[11].

In the perspective of nursing, the safety of the patient is an essential component in the quality of nursing care[12]. The issue of safety in the clinical practice of nursing is not only related to the tasks to be performed by the professionals but also encompasses the commitment of these professionals with their code of ethics in order to provide safe, competent, and ethical care[13].

Thus, performing the proper care, at the right time, the right way, to the right person and, therefore, safely in order to achieve the best results possible is the principle that should support the quality of care and direct the practice of perioperative nurses, who excel in providing care in an ethical manner, based on clinical excellence and in the best scientific evidence available[14].

Therefore, this study aimed at filling out this gap of knowledge related to the practice of the SAP adopted by health services in the country. This study also aimed at identifying the practice of SAP adopted by the professionals working in the operating room.

METHOD

A descriptive study with a quantitative approach including 30 health professionals, 5 anesthesiologists and 25 nursing technicians (circulating nurses), was conducted, once any of them could manage the SAP at the moment of observations. It is noteworthy that, in this location, in order to administer the SAP, there is no standardization regarding the professional category responsible for this function. Thus, it was considered as an inclusion criterion to be the subject responsible for the administration of the antimicrobial prophylaxis of surgical patients in the operation room, at the time of observations.

Besides, patients' charts were used as a source of information to verify the medical prescription of the SAP. This is because, in this service, there is no medical or institutionalized conduct regarding this prescription. Thus, the following variations were observed:

1. in patient's chart, the surgeon prescribes the preferred antimicrobial in the preoperative medical prescription indicating the time it should be administered (whether in the pre- or intraoperative period);
2. the surgeon, in the operation room, verbalizes the prescription of the drug and requests the circulating nurse to administer it, without necessarily prescribing them in the patient chart.

Considering these variations of conduct, in addition to the direct observation of professionals in relation to the SAP in

the surgical room, the following information were obtained regarding preoperative medical prescription: name of the antimicrobial and dose and time prescribed for administration of the SAP, in case it was performed in the preoperative period.

The study site was a surgical center with seven operation rooms in the general hospital of Northwestern Paraná, Brazil.

For the construction of the data collection structured instrument, the following variables were collected:

1. characterization of the procedure: surgical specialty, surgery performed, and classification in relation to the potential for contamination; and
2. data regarding the SAP: use of the SAP, professional who administered the SAP, and time of the surgical incision.

For each surgery observed, we considered the appropriateness of the SAP in relation to time according to the international guidelines, endorsed by the Brazilian Ministry of Health, according to the following criteria:

1. antimicrobial administered up to 1 hour before the surgical incision; and
2. antimicrobial administered after umbilical cord clamping in obstetric surgeries[2,3].

An observer was afterwards trained for data collection by means of the direct observation[15] in an operation room. In order to avoid the Hawthorne effect, an incognito observer, student of nursing, would perform the observation during the curriculum practices activities in the surgical center. The student in the operating room monitored the surgical procedure from the moment of the admission of the patient to its end and should consult patient charts, in order to obtain information to fill out of the structured tool of data collection. After the collection of the data, the purpose of this study was explained to the subjects and those who accepted participating had to sign the informed consent form.

Data was collected during the months of August and September 2012, on weekdays, in mornings and afternoons, during two daily hours, totaling 80 hours of observation and 100 procedures observed.

For the storage of the data, *Excel*® software was used. For the analysis, a descriptive analysis was applied. Data were expressed in distribution of absolute and relative frequencies and presented in tables.

This study complied with ethical principles of Resolution No. 466/2012 of the National Health Council and it was approved by the Research Ethics Committee, endorsement 41863 of 2012, CAAE 02835912.2.0000.0104.

RESULTS

In relation to the characterization of the surgical procedures, it was verified the predominance of orthopedics and traumatology surgeries in 38 (38%) cases, followed by gynecology and obstetrics accounting for 23 cases (23%); gastrointestinal surgeries in 12 cases (12%); head and neck, mastology, and otorhinolaryngology surgeries accounting for 5 (5%) cases each; and plastic, nephrology, pulmonology, proctology, urology, and vascular surgeries with 2 (2%) cases each.

With regard to the practice of the SAP adopted by the professionals working in the surgical center, in most procedures observed, the professional responsible for the administration of the SAP in an operation room was the circulating nurse in 54 of them (66.6%), and the anesthesiologist in 27 (33.4%) of the surgeries. In most of the cases, the professionals applied the procedure only after surgeon's request. In some cases observed, the SAP was performed in the preoperative period, according to the medical prescription, which evidences the lack of a standardized practice.

SAP was performed in 81 (81%) surgical procedures. With regard to the classification of the surgeries as for their potential for contamination and use of the SAP, most surgeries were classified as a clean surgery [64 (64%)]. It was observed that the SAP was used in most surgeries observed, meaning, in 49 (76.6%) of the clean surgeries, 27 (81.9%) of the potentially contaminated surgeries, and 2 (66.7%) of the contaminated surgeries. However, it is striking that in 6 surgeries classified as potentially contaminated (18.1%) and in 1 surgery classified as contaminated (33.3%), on which the use of the SAP is imperative, the procedure was not performed, as demonstrated in Table 1.

Table 1. Distribution of surgical procedures in relation to their potential of contamination and use of surgical antimicrobial prophylaxis. PR, 2012.

Potencial of Contamination* (nº of procedures)	Surgical antimicrobial prophylaxis	
	Performed n (%)	Not performed n (%)
Clean (64)	49 (76.6)	15 (23.4)
Potentially contaminated (33)	27 (81.9)	6 (18.1)
Contaminated (3)	2 (66.7)	1 (33.3)
Total (100)	81	19

*No surgical procedures classified as infected was observed.

With regard to the antimicrobial used, the cephalosporins were predominant [73 (90.1%) surgeries], as follows: cefazolin in 56 (69.1%) surgeries, cephalothin in 15 (18.6%) surgeries, metronidazole in 7 (8.7%) surgeries, cefotaxina in 2 (2.4%) surgeries, and gentamicin in 1 (1.2%) surgery.

Regarding the moment of administration of the SAP, in most procedures [54 (66.6%)], it was performed in an inappropriate time, especially for 4 (4.9%) observed surgeries, in which the SAP was administered more than 2 hours before the surgical incision. Besides, a low adhesion to the correct time of administration of the SAP was evident; in a total of 27 (33.4%) surgeries only in 17 (21.0%), the antimicrobials were administered within 1 hour before the surgical incision; or in cases of 10 (12.4%) cesarean sections, the antimicrobials were administered after clamping of the umbilical cord, according to Table 2.

DISCUSSION

It is estimated that around 63 million people are subjected to surgical treatment owing to traumatic injuries (38%), malignancies (19%), and obstetric complications (6%)[16]. These data corroborate to the results found, as there was a predominance of procedures in the specialties of orthopedics and traumatology and gynecology and obstetrics, with 38% and 23%, respectively. The specialty of oncologic surgery was an exception, as the service surveyed is not a reference in these procedures.

Table 2. Distribution of the moment of administration of the antimicrobial prophylaxis in surgical procedures. PR, 2012.

Moment of the administration	n	%
Before performing the surgical incision		
Up to 1 hour	17	21.0
From 1 hour to 2 hours*	1	1.2
More than 2 hours*	4	4.9
After performing the incision		
Up to 1 hour	53**	65.5
More than 1 hour	6	7.4
Appropriateness of the SAP		
Appropriate***	27	33.4
Inappropriate	54	66.6
Total	81	100

*Data observed in the chart of the patient in the operation room; **Of these procedures, 10 (12.4%) were obstetrics, where the antimicrobial prophylaxis was conducted at the correct time, after the clamping of the umbilical cord; ***It was considered appropriate: up to 1 hour before the incision (n=17) and after the clamping of the umbilical cord (n=10).

Regarding the predominant use of cephalosporins, in the international and national contexts, the practice of antimicrobial selection also followed this trend of use, being the prophylactic agent widely used and recommended. They are effective against many gram-positive and gram-negative microorganisms, safe, and of low cost[9,10].

Regarding the contamination potential, there was a predominance of clean and potentially contaminated surgeries. The SSI should be analyzed according to the potential of contamination of the surgical wound, understood as the number of microorganisms present in the tissue to be operated. The risk of infection is higher the greater is the contamination potential. This is why the use of antimicrobials is imperative[3]. There was higher agreement and good evidence supporting the use of prophylactic antimicrobials before all gastrointestinal (including appendicitis), oropharyngeal, vascular (including abdominals and legs), obstetrics and gynecologic procedures, open cardiac surgery, orthopedic prosthetics adaptation, spinal surgery, craniotomies, and even some "clean" procedures. Although there is controversy about the use of prophylactic antimicrobials for clean surgeries, it is well accepted for open cardiac surgery, joint replacement, vascular prosthetics, and craniotomy in which the absolute number of infections is low, but the consequences of any infection are severe[2]. SAP is one of the fundamental measures for the prevention of the SSI[2,3], and the lack of its administration in the cases indicated is unacceptable and may contribute to the increased incidence of infection, considered one of the main avoidable surgical adverse events and extremely harmful to both patients and hospitals, as they impair the safety of the patient and the quality of care[2]. Equally important is the attention for the indiscriminate use of the SAP in the absence of indication, in the cases of clean surgeries, which may contribute for the growth of antimicrobial resistance that is considered to be a global public health problem[17].

In relation to the low adherence to the correct time of administration, in the global context and, regardless the socioeconomic condition of the countries, similar results were observed, in which the adherence to the correct time varies widely and is below the ideal in many hospitals[6-8]. It is noteworthy that an intervention study carried out in Canada, which is a developed country and with more favorable economic conditions than in Brazil, presented a rate of 5.9% of adherence at the correct time of the SAP, in the

preintervention period[6]. Similarly, in Brazil, a variation in the appropriateness of the time of administration of the SAP was also verified [9,10].

As a consequence of the administration of the antimicrobial in inappropriate time, a pioneer study of the association between SSI and the moment of the administration of the SAP demonstrated that a interval longer than 2 hours between the SAP and the skin incisions has been associated with an increase of 6.7 times in the rate of SSI[4].

The availability and accessibility of guidelines for the consultation are important elements to promote the adherence to the practices based on evidences[10,11]. These protocols should share the following recommendations: selection of antimicrobials according to the type of surgery, administration within 1 hour before the surgical incision, discontinuation within 24 hours after surgery, removal of body hair only if necessary by shaving or by the use of shaving creams, and maintenance of the levels of body temperature and glucose within the normality parameters[3,11]. In this study, the Hospital Infection Control Service (HICS) of the investigated institution elaborated a recommendation about the SAP; however, it was unavailable for information and consultation by the professionals in the surgical room, which may be a limiting factor to the use of the SAP at the time recommended.

In addition to that, there are multiple factors that influence the adherence to the SAP, which may be grouped into: individual factors, such as knowledge, attitudes, and beliefs; characteristics of the work team, such as communication, allocation of responsibilities, and clinical resistance for a change; factors that involve the context of care, owing to a level of surgical activity, number of specialties and medical teams working at the same unit; and institutional limitations, such as limited financing and characteristics of the processes or technologies to be implemented[6-8,11,18].

The reflection of these factors, considering their potential modification and future opportunities, may allow a more sensible approach in future opportunities, meaning, the planning of more assertive strategies for the improvement of the adherence to the recommendation of the SAP for the prevention and reduction of the SSI rates[11], as discussed further.

It is noteworthy that the implementation of a practice based on scientific evidence, such as the SAP, requires a movement, by the health services, which is opposite to the naive and simplistic belief that changes and interventions in the work process are immediate and uncomplicated. This movement should incorporate the following premise: changes in the process of health work, as shown in interventions in the work process of a surgical center, are multifaceted, many times intricate and challenging. From this acceptance, the health services may mitigate the deleterious effect of unsuccessful approaches, which result at an end itself, and promote holistic approaches, which result in the improvement of the processes of planning and decision making for the benefit of best practices for the prevention and control of infections related to health care.

Thus, in relation to the strategies to improve the use of the SAP by health services based on the available scientific evidences, it is clear that an integrated approach, which involves institutional aspects in the surgical center context and the process of working, planning, execution, evaluation, and feedback, is more promising and recommended to be adopted in these health services[6,7,9].

It is worth mentioning a prospective study that compared the adherence to antimicrobial prophylaxis both before and after the introduction of a personalized surgical antimicrobial kit. After its introduction in surgeries, there was a significant increase in the administration of the SAP at the appropriate time from 12 to 24%, $p=0.003$. It is emphasized that this kit was standardized by the HICS, prepared in the pharmacy of the hospital and distributed in the operation rooms according to the daily schedule of the surgeries. It consists in a plastic bag containing the antimicrobial agent and an institutional script with the following specifications: dose, moment of the administration, and duration of the postoperative antimicrobial therapy. Externally, there was the identification of the patient[8].

Regarding the surgical center context, a preliminary study is essential in order to determine the appropriate moment of administration of this SAP by the health professionals, regarding the instruction of up to 60 minutes before the surgical incision. For that, the most opportune moment may be determined when observing the mean time from the admittance of the patient in the operation room until the act of surgical incision. Studies show that the variation of this mean time comprises from 20 to 30 minutes. Thus, this would be the most recommended time in order to ensure the SAP in the correct time regarding the current recommendations[2].

In addition to that, the responsibility delegation of the administration of the SAP for a specific member of the team is essential, as this measure reduced the variability of the professionals involved directly in the administration, defined responsibility, and optimized the educational process, by monitoring the use pattern and the performance feedback of the involved people[9,18].

As for the location of the administration of the SAP, variability in the adherence to the SAP related to the place of its administration was observed. This is because it is often performed in one of the hospitalization units, without a clear definition of the responsibility of health professionals who administer it. Thus, the definition and standardization of the place of administration of the SAP are encouraged, namely: in the operation room or anesthetic induction area[6].

In planning, execution, and evaluation, a series of measures are appropriate. The stage of planning must begin with the definition of a multidisciplinary leadership team. The leaders should meet in multidisciplinary teams in order to study and test initiatives, define goals, and establish performance measures, being continuously committed to the improvement of the prevention processes of the SSI[18].

As for the promotion of communication culture, it is important to stimulate the team to perform a succinct and informal conversation in the operation room in order to discuss prevention measures of specific SSI to be adopted for the patient. This initiative of the members of the perioperative team may stimulate them to verbalize worries and suggestions, to create an environment of collective responsibility, and to improve the quality of care[18].

Although the promotion of the communication culture in the process of work in the surgical center is challenging, it may be a rewarding and stimulating experience to the perioperative nurse, as it contributes for the rupture of the dominant practice in surgical centers, which characterizes by the hierarchy, rigidity, and resistance of the processes[19].

All perioperative professionals must be engaged with the culture of communication, which favors the dissemination of everyday discussions about the current strategies of prevention of SSI, as new evidence arises everyday. However, it is recognized the lack of a culture of communication in the Brazilian perioperative scenario. Thus, this is an invitation to overcome the culture of silence, as addressing and verbalizing situations — such as forgetting to hand hygiene, identifying a rupture in a sterile technique, or informing surgical instruments were not properly cleaned — may seem embarrassing or irrelevant, but not expressing them may represent the difference between life and death for a patient[18].

Regarding the SAP protocols, evidences show that elaborated and approved protocols involving the multidisciplinary team increase the appropriate use of the SAP, as they reduce the variability of practice among surgeons and allow an environment of collective cooperation, necessary to ensure the success and sustainability of the implementation[6,18].

In order to meet the strict deadline for the administration of the SAP, the responsible for its administration should have easy access to it; in this way, there are dispensing mechanisms that fulfill this function: storage of standardized antimicrobials in the area of use, by automated distribution system, and personalized kits for each procedure distributed by the pharmacy[7,8].

In order to ensure the proper documentation of the SAP, in places where the registration of surgical assistance is printed out, the inclusion of a specific field for the filling out of these data is recommended. In addition, a printed recommendation with highlight color to be fixed in the patient chart may be a beneficial notification to avoid forgetness or delay in administration. The checklist of surgical safety also fulfills this function, once it is a visual or oral subsidy, which allows the surgical team to exceed the limitations imposed by short-term memory[2].

Before the incorporation of evidence in practice, the promotion of educational actions and training of the SAP and all the professionals involved in this process is stimulated[2]; this includes the professionals working in the surgical center who administer the SAP, surgeons who prescribe the SAP, pharmacists and pharmacy technicians who dispense these drugs, and nurses who manage the nursing care in the surgical center.

The monitoring process is essential to minimize the consequences of misuse. Therefore, the establishment of an intensive surveillance system, analysis of variation, analysis of interventions, promotion of feedback, support to the ones involved, and continued education are necessary[6,9,11].

Regarding the performance feedback, it is suggested that the monthly performance disclosure for working professionals in surgical centers may raise awareness in the involved professionals on their practice and help leading the promotion of strategies for the adaptation of attitudes toward the adherence to the SAP. It is recommended the provision of individualized indicators to the surgeons, anesthesiologists, and circulating nurses involved in the SAP[6,9].

In relation to the professional components, which includes a look into the multidisciplinary team and individually, an important aspect is to ensure medical education[19]. Some doctors may be reluctant owing to their misperception that the protocol rivals their expertise[19].

It is recognized that the recommendations based on robust scientific evidences, many times, are insufficient to transform practice. This is because, in certain health services, what prevails is the control regime, where the institution or professionals say what to be done (implement the protocol)

and expect to have results (adherence). These strategies are inclined to fail, because the members of the team find the mechanisms to neutralize or subvert instructions, which discredit or are seen as a threat to their interests. Thus, it is essential to understand the influence of sociocultural barriers and the subjectiveness of the present in the process of care production, in order to combine strategies that reject a control regime[19].

Implementing strategies for the safety of surgical patients is a task for all those involved in the process: professionals, educators, researches, patients, and managers. In order to verify how much we are collaborating for this process, it is suggested a simple questioning "in case I need an anesthetic-surgical procedure, how safe would I feel in being submitted to a surgery in my own workplace?"[20].

In order to overcome the challenges imposed to the incorporation of practice based on the SAP and to ensure the surgical safety, we cast a look on the following point: we have advanced in scientific production and standard-setting and regulatory aspects regarding the safety of the patient. However, in this study, it is observed that there are inadequacies of their application in the practice, evidencing that the safe SAP is a practice to be consolidated in health services.

For the consolidation of safety practices of patients in health services, it is important to recognize that ensuring the safe and free-of-damage assistance is a responsibility to be shared by all the interested parties, namely: the general society; the patients; clinical nurses, nursing management, and teaching nurses; researchers; managers; doctors; governments and legislative authorities; professional association; and accrediting agencies[12].

However, it is believed that nursing has an immense potential to exercise this role in the implementation and enforcement of the best practices on patient safety, as nurses are involved in health caring of patients in all areas of the health system, 24 hours a day, 7 days a week. Through their surveillance, nurses act out and maintain patients' safety, identifying risk situations that need improvement. Therefore, their "presence" and their knowledge allow performing an essential role in the safety of the patient[13].

Thus, in the perspective of the role of perioperative nurses, it is opportune to make some considerations in relation to the following question: How can the perioperative nurse contribute to strengthen the practices of patient's safety? In order to reflect on this matter, it is proposed a discussion about the nurse and their assisting, managerial, and educational functions.

From the assisting point of view of a nurse, strengthening the practices of safety implies in a wide commitment to the assumptions in the nursing code of ethics, as a professional practice guided by the respect to ethical conducts is a safe practice. In addition, it should commit to the guidelines, guides, recommendations, rules, and resolutions based on current evidences. It is also important to improve their technical–scientific knowledge on patient's safety and other necessary issues, which will support their professional practice, which includes searching for expertise in their area through complementary formation and certification of associations specialized in nursing[12,13,21].

In the general perspective, nurses in leadership positions also have the responsibility to promote a safe assistance. For that, it should stimulate, promote, and create the conditions for the personal and educational development of the nursing professionals under their guidance and supervision, in addition to providing an environment in which the nurse may identify the threats to the patient and have professional autonomy and support for decision-making for the sake of patient safety[12,13,21].

Regarding the educational aspect, nursing teachers should encourage the inclusion of the theme of patient safety in the technical education, undergraduation, and graduation programs according to the order of the Ministry of Health of No. 529 from 2013 in order to develop the skills of critical thinking necessary to the formation of the nurse and nursing teams that are committed to patient safety[22]. Moreover, from the perspective of education in service, the teaching nurses should create opportunities for the education of nurses and other health professionals based on institutional policies and on procedures related to patient safety[12,13,21].

It stands out as a limitation to this study that the present analysis is focused on the practice regarding the specific SAP of a health service. Thus, these results reveal a local problem and, therefore, owing to the sample and being performed in a single surgical center, the data cannot be generalized. In addition, the object of analysis is focused only in some aspects of the SAP, namely: antimicrobial chosen, its use in relation to the contamination potential, professional categories involved, and administration within 1 hour before the surgical incision. The discontinuity within 24 hours after the surgery, duration of the SAP, ideal dose, intervals between doses, and adequacy of the antimicrobials according to the type of surgery were not observed. Furthermore, the adherence to the remaining suitable perioperative measures for the prevention of the SSI, such as removal of body hair,

maintenance of body temperature levels, and glucose within the normality parameters, was not observed.

In addition, another limitation was the non-observance of the effect of the SAP that were administered in inappropriate times in the rates of SSI of the patients who undergone the observed surgeries. It is recommended that the implementation of the SAP as a preventive measure for infections should be related to the measuring of the SSI rates periodically. These analysis and frequent dissemination of the data promote the adherence to the best practices among the professionals working in the surgical center, as they expand the understanding that the prevention of the SSI requires systematic attention, in addition to the antimicrobial agents[11].

There are the important aspects to be considered in national future researches and in the dissemination of national experiences of implementations of strategies for the improvement of the SAP and their impact on the SSI rate. This may stimulate health services, HICS, perioperative nurses, and other professionals involved in the assistance to adopt similar procedures that support the decision-making by the practice based on evidence, in order to qualify the practice of surgical care and patient safety.

CONCLUSION

In this study, in relation to the SAP, it was found that, in most surgeries observed, the professional responsible for its administration in the operation room was the circulating nurse of the room, followed by the anesthesiologist. They, for most of the times, wait for the request of the surgeon to perform the procedure. In addition, as observed in some cases, the SAP was performed in the preoperative period, according to the medical prescription, which shows that there is no standardized practice.

In relation to the choice of the antimicrobial, there was a predominance of cephalosporins. The SAP was carried out in most observed, clean, potentially contaminated, and contaminated surgeries. However, in some surgeries classified as potentially contaminates and contaminated, in which the use of the SAP is essential, this was not performed.

There was inadequacy in relation to the moment of administration of the SAP, occurring well before or after the performing of the surgical incision and not within 1 hour before the surgical incision.

Thus, it is evident that the practice regarding the SAP adopted by the professionals working at the surgical center is not complying with the current recommendations about the prevention and control measures of the SSI, which affects their effectiveness in preventing infection of the surgical site and compromises the safety of the patient.

Knowing the practice regarding the SAP adopted by the working professionals in the surgical center is the first step to be taken by the health services to identify the interfering factors in the implementations and adherence to a practice based on evidences. Besides, this study discussed integrated strategies for the promotion of the use of the SAP by health services, which includes approaching the institutional components, of the context and working process in the surgical center, of the multidisciplinary team, and individually. In relation to the implications for nursing in the interest of patient's safety, it is expected that perioperative nurses recognize themselves as protagonists of this process and may reinvent the praxis in health in a more qualified, compromised, ethical, humane, and safe way.

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THE PREOPERATIVE VISIT AS THE ANXIETY MITIGATING FACTOR IN SURGICAL PATIENTS

A visita pré-operatória como fator atenuante da ansiedade em pacientes cirúrgicos

La visita preoperatoria como un factor atenuante de la ansiedad en pacientes quirúrgicos

Thiago Franco Gonçalves[1], Veronica Cecilia Calbo de Medeiros[2]

ABSTRACT: Objective: To identify if the preoperative visit would be a factor that enables us to minimize the level of anxiety in surgical patients. **Method:** Exploratory prospective research with 20 patients who were subjected to total or partial hysterectomy, for any surgical technique. **Results:** After the application of the State-Trait Anxiety Inventory, it was identified that the control group presented higher anxiety levels when compared to the research group. **Conclusion:** Preoperative nursing visits contributed to the lower level of anxiety among those who receive it.

Keywords: Hysterectomy. Perioperative nursing. Anxiety. Preoperative period.

RESUMO: Objetivo: Identificar se a realização da visita pré-operatória seria um fator que possibilita minimizar o nível de ansiedade apresentado por pacientes cirúrgicos. **Método:** Pesquisa de caráter exploratório prospectivo, com amostra de 20 pacientes que foram submetidas ao procedimento de histerectomia total ou parcial, por qualquer técnica cirúrgica. **Resultados:** Após a aplicação do Inventário de Ansiedade Traço-Estado, foi identificado que o grupo controle apresentou nível de ansiedade superior quando comparado ao grupo pesquisa. **Conclusão:** A visita de enfermagem pré-operatória contribuiu para que o nível de ansiedade seja inferior nos que a recebem.

Palavras-chave: Histerectomia. Enfermagem perioperatória. Ansiedade. Período pré-operatório.

RESUMEN: Objetivo: Identificar si la realización de la visita preoperatoria sería un factor que posibilitaría la minimización del nivel de ansiedad presentado por los pacientes quirúrgicos. **Método:** Investigación exploratoria y prospectiva, con una muestra compuesta por 20 pacientes que fueron sometidas al procedimiento de la histerectomía total o parcial por cualquier técnica quirúrgica. **Resultados:** Después de la aplicación del Inventario de la Ansiedad Seguimiento-Estado, se identificó que el Grupo Control presentó un mayor nivel de ansiedad comparado al grupo de la investigación. **Conclusión:** La visita preoperatoria de enfermería contribuye para que el nivel de ansiedad sea menor en los pacientes que la reciben.

Palabras clave: Histerectomía. Enfermería perioperatoria. Ansiedad. Período preoperatorio.

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INTRODUCTION

Patients who are admitted to health-care institutions to undergo a surgical procedure are usually not informed and advised properly. This lack of knowledge regarding the procedures to which the patient will be submitted triggers many emotions in the individuals[1].

Therefore, these emotions are directly related to the feeling of anxiety, which is defined by the North American Nursing Diagnosis Association as:

> [...] a vague, uneasy feeling of discomfort or dread accompanied by an autonomic response (with the source often nonspecific or unknown to the individual); a feeling of apprehension caused by anticipation of danger. It is an altering signal that warns of impending danger and enables the individual to take measures to deal with threat[2].

Anxiety can also be defined as a "sensation of psychic uneasiness characterized by the fear of impending danger, both real and imaginary"[3]. Stress, on the other hand, is any event, be it real or imaginary, that affects the stability of the body, even if subtly.

The anxiety presented by individuals facing stressful factors can be beneficial when associated with the mechanism of "struggle or escape", where the activation of the central nervous system releases adrenaline and corticoid hormones to promote fast cell activation; however, in situations such as the anesthesia, this feeling may lead to changes in vital signs parameters – due to the same mechanism –, such as blood pressure elevation, dry mouth, sweating, palpitations, shivering, vomit, increased respiratory, and cardiac rate[5,6].

The stressful factor can be internal or external, in cases in which there is a cognitive evaluation of the individual that classified it as a threat (negative stimulus) or a challenge (positive stimulus), when the stimulation of the body occurs because of the release of catecholamine and corticoisteroids[7].

The activation of the hypothalamus, in a stressful event, triggers two types of stimuli: an electrical and a chemical one. The electrical stimulus works on the adrenal medulla, in charge of releasing epinephrine in the bloodstream; and the chemical one, generated by the adrenocorticotropic hormone (ACTH), activates the zona fasciculata of the adrenal cortex, causing the release of cortisol and preparing the body to fight or escape[4].

The general response of adaptation to stress was described by the sequence of how stress manifests itself and interacts with the body and the environment in three stages: warning, resistance, and exhaustion[8].

In the first warning stage, the individuals have sensations that, in some cases, are not attributed to stress, such as paleness, tachycardia, and tachypnea; these are the attempts of the body to provide vital organs with blood, and consequently, energy. During the second stage of resistance, the body tries to reestablish homeostasis, and, if this balance is reached, some of the initial signs and symptoms may disappear; however, if not, the person goes into the third stage of exhaustion[8].

Exhaustion is the body's inability to reestablish base balance, which may lead to irreversible physiological damage[8].

So, there was an attempt to quantify the degree/level of anxiety presented by the individuals.

The State-Trait Anxiety Inventory (STAI) was a result of evaluations and selections from items in three other scales addressed to measuring anxiety: the Taylor Manifest Anxiety Scale, the Welsh Anxiety Scale, and the IPAT Anxiety Scale (Impact = Population x Affluence x Technology)[9].

In this inventory, anxiety is divided into two types: trait and state. Trait (STAI-T) is related to the individual's propensity to face anxiety in the routine, and state (STAI-S) is an isolated, transitory fact resulting from a specific moment in life[10].

A study[11] analyzed 360 surgical patients. Of these, only 1 patient was not anxious, whereas the others comprised the groups of medium (114 individuals; 31.7%) and high (245 individuals, 68.1%) level of anxiety, using the STAI-S Scale.

The preoperative period is the perfect moment for the contact between the nurse and the patient, when the professional can give the necessary information about the anesthetic and surgical procedures and promote an efficient emotional preparation of the patient. The information is vital to minimize the level of anxiety of the patient[12].

The preoperative nursing visit is part of the systematization of the preoperative nursing care, and this is the first stage of this system. Among the activities of the nurse, informing

and advising the patient about the surgery, thus minimizing anxiety, stands out[9].

At the visit, the nurse should transmit the information to the patient individually, focusing on his or her specific needs, making sure the patient knows everything he or she needs to know. It is important to keep a logical sequence of the information, so that understanding is easier[13].

Therefore, if the patient is informed and has no doubts, complications in the postoperative period can be prevented[12].

The motivation to perform this study came from the author's experience, with the anxiety verbalized by patients during admittance to the surgical center, which led to the research question: Could the preoperative nursing visit be an anxiety mitigating factor for patients?

So, this study aims at identifying that the patients who will be visited by nurses before surgery will have lower levels of anxiety indicated by the STAI-S Scale.

OBJECTIVE

To identify if the preoperative visit can be an anxiety mitigating factor for surgical patients.

METHOD

This is an exploratory, descriptive, and prospective study.

The study was conducted in a major private hospital in the state of São Paulo, in the region of ABC. The study was conducted after the Board's and the Research Ethics Committee approval (CAAE n. 44715115.2.0000.0062) in July 2015.

On the basis of the exposed, the STAI-S (Appendix 1) was chosen, since it adjusts to the situation of the patient (the moment of surgery) and the objective of this study. This inventory is composed of a questionnaire containing 20 simple questions and preestablished answers, such as "very much so", "moderately so", "somewhat", and "not at all", and scores are, respectively, 4, 3, 2, 1. So, the values range from 20 to 80 points. The scores obtained in this inventory are characterized as mild anxiety (20 – 40 points), moderate anxiety (41 – 60 points) and severe anxiety (61 – 80 points).

In items 1, 2, 5, 8, 10, 11, 15, 16, 19, and 20 of the anxiety inventory, the scores should be opposite to the others. That is, the scores do not follow the pattern 1 to 4, but 4 to 1 (decreasing order), because these items in the inventory present statements that are opposite to the others.

Inclusion criteria were established to compose the sample of this study, as follows: elective surgical procedures; client/patient admitted to the institution; total or partial hysterectomy; and possibility of communication between the researcher and the client/patient. Illiterate patients were excluded from the sample.

The choice to conduct the study among female patients who were submitted to hysterectomy was based on the premise that this surgery is considered to be mutilating, interfering with their femininity and sexuality[14].

The sample comprised 20 clients/patients who were distributed into two groups: a study group and a control group, selected in a previous raffle, being 10 in the study group and 10 in the control group. The raffle occurred as follows: before data collection, a table was numbered from 1 to 20 (corresponding to the number of participants in the study, and pieces of paper were made with the expressions "with visit" and "without visit", being 10 to each, folded equally, and placed in a dark bag. They were mixed and taken one at a time, thus defining if the visit would or would not be conducted.

When the patient accepted to participate in the study, she was inserted in the list, according to the numerical order. The study group was formed by patients who received the preoperative nursing visit. On the other hand, the control group did not receive it. The visit took place one hour before surgery in a reserved room, respecting and securing the patient's privacy. This sample number was defined according to the time to conduct the study.

In both groups, patients were advised about the objective of the study, guaranteeing the anonymity and the possibility to interrupt their participation at any time, without onus, according to Resolution n. 466/12, from the National Health Council in the Ministry of Health. They were asked to sign the Informed Consent Form, which was also signed by the researcher in charge of the study.

During the visit, the researcher nurse informed the client/patient about the period comprehending the perioperative space (from preparation for the procedure until discharge from the post-anesthesia recovery room). The interviewed party was informed she could interrupt the visit at any time to ask questions, in order to clarify all the doubts.

The research was conducted in the preoperative period, one hour before surgery, in two stages. The first stage had a social questionnaire for the participant to identify personal data, filled out by the researcher. They were asked data (such as age, experiences with other surgical procedures, schooling, and intercurrences in the anesthesia and surgery), which were analyzed and compared with the STAI-S Scale.

The second stage of the research was the application of the STAI-S Scale, immediately after the conclusion of the social questionnaire, still in the preoperative period. This stage can be considered as the third for the study group, because the nursing visit took place before the application of the inventory, and the participant filled out the form, since there were answers regarding how she felt, and that could not suffer interferences from third parties. If the participant had any doubts about the content of the statements in the inventory, she could be advised by the researcher; however, the latter could not interfere in the responses. All the stages of the study were conducted before the patient underwent surgery.

RESULTS AND DISCUSSION

The social results collected in the study are presented separately between the control and study groups to characterize each one better. The same occurs as to the need to identify the age of the participants, once each generation is influenced by different cultures, beliefs, and ways to access information.

Therefore, the mean age of the patients in the control group (group of patients who were not visited by the nurses) was 45.4 years. Referring to schooling, the percentage of patients who had gone to high school was 70%, whereas 10% had incomplete higher education and 20% had complete higher education.

All patients had undergone a surgical procedure before hysterectomy (100%), and only 20% (2 patients) presented some kind of anesthetic or surgical intercurrence, such as nausea, vomit, and pain.

In the study group, mean age was 43.2 years; therefore, both groups had similar mean age. In this group, 40% of the participants had gone to high school, 20% had incomplete higher education, 30% had complete higher education, and 10% had done postgraduate courses.

The percentage of patients who had undergone any surgical procedure before hysterectomy was 100%. Of these, 10% presented anesthetic or surgical intercurrences (dyspnea) and 90% denied such events.

The patients in the control group had an average of 45.8 points in the STAI. Therefore, this group had moderate level of anxiety, whereas the study group had 36.3 points, indicating mild level of anxiety.

The fact that all patients had undergone another type of surgery could contribute with the lower level of anxiety in both groups, once one of the factors for severe anxiety is the threat of the unknown, considering the anesthesia and the surgery environment; however, that was not observed.

It is worth mentioning that this study is considering only the fact that this was not the first experience they had in terms of anesthesia, and that they had been to a surgical center at least once before, but the specificity of the surgery and the reasons why it was indicated should also be considered.

Anxiety is the nursing diagnosis that presents itself more frequently in the preoperative period of patients who will undergo surgery, as shown in a study[15] in which 86.6% patients presented this nursing diagnosis.

As defended in another study[16], it was observed that patients who receive information about the procedures to which they would be submitted during anesthesia and surgery can reduce the stressful factor, and, consequently, the level of anxiety.

This idea is corroborated by another study[17] defending the preoperative nursing visit as a relevant act for biopsychosociospiritual care, making the surgery a more comfortable moment for the patient, thus reducing or preventing stressful events.

Another study[18] showed that the anxiety presented in the preoperative period affects 44.3% patients.

Therefore, it is possible to state that the preoperative nursing visit is an important instrument to be used by the nurse in this period, backed by the Nursing Law n. 7,498/86, art. 11, clause I, paragraph i[19].

Another study[20] mentioned that such orientations should be provided in the mediate preoperative period so that patients have time to understand the information. However, during the study, this variable was not observed, once the nursing visit was conducted in the immediate preoperative period.

The questions asked by most patients in the study group during the nursing visit were not directly related with the surgical procedure or the anesthesia, but, instead, if they would gain weight after the surgery. That shows concern with physical appearance, and not with the possible immediate

and mediate postoperative restrictions that can be caused by hysterectomy. This can be considered as a limiting research factor, since it is not approached in the questionnaire.

CONCLUSION

This study could identify that anxiety, as a nursing diagnosis, is present among patients who will undergo surgery, thus proving the study hypothesis that patients who are visited by nurses before surgery present lower levels of anxiety in comparison to those who are not visited.

It is important to mention that the preoperative nursing visit is part of the perioperative period, and its absence makes the process more fragile, interfering directly with the patient. Anxiety may be psychological; however, it works on the body and produces changes in vital signs, which can lead to the cancellation or postponement of the surgery. That can create more anxiety and become a vicious cycle.

This study aims at contributing with the nursing practice in the preoperative period regarding the emotional care of the surgical patient, which is as important as the physical preparation.

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Appendix 1. Anxiety inventory.

Read the questions below and answer, with an X, the column that indicates how you feel now, before the surgical procedure.

Nº	Question	Not at all	Somewhat	Moderately so	Very much so
01	I feel calm				
02	I feel secure				
03	I am calm				
04	I feel strained				
05	I feel comfortable				
06	I feel upset				
07	I feel presently worrying over possible misfortunes				
08	I feel rested				
09	I feel anxious				
10	I feel “at home”				
11	I feel confident				
12	I feel nervous				
13	I am agitated				
14	I feel like a “nervous wreck”				
15	I am relaxed				
16	I feel satisfied				
17	I am worried				
18	I am very excited and confused				
19	I feel happy				
20	I feel good				

THE ROLE OF THE NURSE ALONG THE PERIOPERATIVE PERIOD IN ORDER TO PREVENT DEEP VEIN THROMBOSIS

Papel do enfermeiro no período perioperatório para prevenção da trombose venosa profunda

Rol del enfermero en el período perioperatorio para la prevención de la trombosis venosa profunda

Nathália Gustavo Pinho[1], Karin Viegas[2], Rita Catalina Aquino Caregnato[2]

ABSTRACT: Objectives: Determining how nurses implement deep vein thrombosis (DVT) prevention during the perioperative period in patients submitted to large surgeries and detecting the risk factors to the occurrences of DVT previously traced by nurses. **Methodology:** A case study with a qualitative approach. A sample of 12 nurses in the inpatient unit, operating room, and postanesthesia recovery room of a hospital specializing in trauma Porto Alegre (RS), Brazil. We used semi-structured interviews with 10 leading questions. For data interpretation, the Content Analysis Method introduced by Bardin was adopted. **Results:** Three final categories came up from the content analysis: risk factors to DVT, preventive measures to DVT, and adversities in implementing the systematization of nursing care in perioperative. **Conclusion:** Nurses perform prevention of DVT with massage, observation, physical examination/assessment, protective measures, and change of position but lack autonomy to apply some preventive measures. They showed several risk factors for the occurrence of DVT according to the literature, proving they have the knowledge about the disease.

Keywords: Venous thrombosis; Perioperative nursing; Disease Prevention.

RESUMO: Objetivos: Conhecer como os enfermeiros realizam a prevenção da Trombose Venosa Profunda (TVP) em pacientes submetidos a cirurgias de grande porte no período perioperatório; e levantar os fatores de risco para o desenvolvimento de TVP identificados pelos enfermeiros. **Método:** Estudo de caso com abordagem qualitativa. Amostra composta por 12 enfermeiros da unidade de internação, centro cirúrgico e sala de recuperação pós-anestésica de um hospital especializado em trauma de Porto Alegre (RS). Utilizou-se entrevista semiestruturada com 10 questões norteadoras. Para interpretação dos dados utilizou-se Análise de Conteúdo de Bardin. **Resultados:** Emergiram três categorias: Fatores de Risco para TVP; Medidas Preventivas de TVP e Dificuldades na Execução da Sistematização da Assistência de Enfermagem Perioperatória. **Conclusão:** Os enfermeiros realizam prevenção de TVP com massagem, observação, exame físico/avaliação, medidas protetivas e mudança de posição, entretanto falta autonomia para aplicar algumas medidas preventivas. Apontaram vários fatores de risco para a ocorrência de TVP conforme literatura, evidenciando conhecimento sobre a patologia.

Palavras-chave: Trombose venosa. Enfermagem perioperatória. Prevenção de Doenças.

RESUMEN: Objetivos: Conocer como los enfermeros realizan la prevención de la trombosis de la vena en los pacientes sometidos a las cirugías de porte grande en el período perioperatorio; y colectar los factores de riesgo para el desarrollo de la trombosis de la vena que fueron identificados por los enfermeros. **Método:** Estudio del caso con el enfoque cualitativo. La muestra fue compuesta por 12 enfermeros de la unidad de hospitalización, quirófano y sala de recuperación post-anestesia de un hospital especializado en traumas en Porto Alegre, Rio Grande do Sul, Brasil. Se aplicó una entrevista semiestructurada con 10 preguntas principales. Se utilizó, para la interpretación de los datos, el análisis del contenido de Bardin. **Resultados:** Se emergieron tres categorías: los factores del riesgo para la trombosis de la vena; las medidas preventivas de la trombosis de la vena y las dificultades en la ejecución de del Sistematización de Atención de Enfermaría Perioperatória. **Conclusión:** Los enfermeros realizan la prevención de la trombosis de la vena con el masaje, la observación, el examen / evaluación física, las medidas de protección y el cambio de posición, pero carecen de autonomía para aplicar algunas medidas preventivas. Ellos mostraron varios factores de riesgo para la aparición de la trombosis de la vena de acuerdo a la literatura, mostrándose el conocimiento sobre la enfermedad.

Palabras clave: Trombosis de la vena. Enfermería perioperatoria. Prevención de Enfermedades.

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INTRODUCTION

The fundamental role of nursing in the perioperative period involves the promotion, maintenance, and recovery of the health of patients who underwent a major surgery. It is important that the nurse has the necessary knowledge in order to evaluate the kind of surgery and identify the occurrence probability of a deep vein thrombosis (DVT)[1].

Some attributions are specific of nurses who work in this service, such as, for example, supervising the nursing actions necessary for each patient; developing rules and routines for each area; knowing how to list the priorities of each patient. Depending on the routine of the health service, the nurse performs the preoperative evaluation of the patient, among others[2].

The systematization of nursing care in perioperative (SNCP) has the objective of developing a "full, continued, participatory, individualized, documented and evaluated assistance"[3].

The perioperative period is defined as the interval that encompasses the preoperative, intraoperative and postoperative phases[2].

The DVT is the development of a blood clot within a venous blood vessel, owing to an inflammatory reaction or trauma, determining total or partial obstruction of the vessel[4]. It may lead to venous thromboembolism (VTE), in which the clot travels through the vessel, subject to developing a pulmonary embolism (PE), which is an important cause of morbidity and mortality[5].

The VTE is considered a public health issue; besides having a high mortality rate, it affects much of the population hospitalized. Another important aspect of this complication is that most deaths caused by VTE could be avoided; however, the pharmacological prevention methods are underused[6]. Since the early twentieth century, it is recommended to prevent VTE among surgical patients; but only in the last 25 years, there was an objective concern about this matter and a deepening of the researches and prophylactic methods[4].

Before undergoing a surgical procedure, the patient must be evaluated by the team regarding their risk factors and the type of surgery they will perform and then determine the risk of developing DVT[7].

The guidelines of the American College of Chest Physicians (ACCP) not only recommend observing whether the patient is under risk of developing DVT and VTE but also advise hospitals to create strategies identifying these risks and, consequently, avoiding mortality[8]. Therefore, it is important to evaluate, in addition to the age of the patient, their physical status and the size of the surgery (major or minor); the so-called medium and major surgeries, including the intrathoracic, intraabdominal, orthopedic, neurological, arterial, and surgeries of high hemorrhagic risk, have higher surgical risk of developing VTE[7].

The drug prophylaxis for VTE, despite effective, does not reduce the incidence of postoperative DVT to zero. Data indicate the incidence of postoperative DVT in cases of hip surgery, when prophylaxis is not carried out, in up to 70% of patients[9]. A process for caring and recovering is necessary, with measures on the control of this complication. The SNCP is essential within a hospital environment in order to implement potentially satisfactory interventions in surgical patients, considering their risk factors and, consequently, providing better assistance[10].

There are not many studies in the nursing area identifying the real role of the nurse in the prevention of DVT in the perioperative period of major surgeries. Besides, the evaluation of the records of intervention regarding this care does not allow the discussion of the preventive actions adopted.

Given the aforementioned facts, this study had the overall objective of getting to know the nurses who performed the prevention of DVT in the perioperative period of patient undergone major surgeries. The specific objective was to raise the risk factors identified by the nurses for the occurrence of DVT.

METHOD

We chose to use a qualitative study design, as this type of research allows interpreting the data of the context researched, in an attempt to seek for new answers to represent reality, revealing the different points of view about the objective of the study[11].

The field of action was a reference hospital in trauma treatment, especially among victims of traffic accidents, work accidents, and violence and burned patients, in Porto Alegre, Rio Grande do Sul, Brazil. The hospital has 264 beds for services of the specialties of traumatology, orthopedics, bucomaxillofacial, neurosurgery, burn victims, plastic surgery, trauma surgery in general, among others. It serves 100% over the Unified Health System [*Sistema Único de Saúde* (SUS)].

Sample intentionally consisted of 12 nurses, 4 from the hospital admission unit (AU), 4 from the surgical center (SC), and 4 for the postanesthesia care unit (PACU) where the major surgery patients remain, in the preoperative, intraoperative and postoperative phases. This study included the nurses who had been working for 1 year or more in the AU, SC, and PACU of the hospital. This study excluded nurses who had not been working in the hospital, due to medical leave or vacations, during the period of data collection.

The technique used was the network sampling (also called "snowball sampling")[12]. In this approach, the first study participants refer others who meet the inclusion criteria.

The data were collected by a semi-structured interview, with a script divided into two parts:

1. identification data of the participant, in order to characterize the subjects. It was decided to name the subjects in the research with the letter "N" meaning "nurse", followed by the number according to the interview;
2. 10 guiding questions for the interview, namely:
    1. What do you understand as SNCP?
    2. In this hospital, how does the SNCP of patients of major surgeries work?
    3. Name some risk factors for the occurrence of DVT in patients undergone major surgeries.
    4. What measures do you judge important for the prevention of DVT?
    5. Do you use measures to prevent DVT in patients of major surgeries? If so, what are those measures?
    6. How is performed the prevention of DVT in patients undergone major surgeries in preoperative, intraoperative and postoperative phases?
    7. Have you ever attended patients of major surgeries who developed DVT or VTE?
    8. If so, we asked: In this patient, were there preventive measures in the perioperative implemented?
    9. Report a case that developed DVT or VTE.
    10. In your point of view, how do you judge the SNCP of patients undergone major surgeries should be carried out for the prevention of DVT?

Each interview lasted approximately 10 minutes.

A pilot study was conducted with two nurses in order to identify whether the interview met the objectives proposed and there was no need for changes. The interviews with nurses in preoperative were conducted in a room of the AU; with the nurses in intraoperative, it was conducted in the nurses' room in the SC; and with the nurses in postoperative, they were conducted in a room located in the PACU.

The interviews were carried out between April and June 2015, recorded in a mobile device and fully transcribed, ensuring the accuracy of the information. In order to interpret the data, the Content Analysis Method was used[13].

The technique followed the three recommended steps:

1. Preanalysis: the transcription of the interviews, the organization of the material, the brief reading of the texts, and the beginning of the systematization of ideas for the plan of analysis were made.
2. Analytical description: categorization of the data, separating by the thematic criteria and grouping all themes with the same meaning.
3. Inferential interpretation: the data obtained were interpreted and unveiled, and inferences were made with the objective of making the results valid and significant.

The analysis was performed after the reading and construction of the map with all the questions and answers in full. After reading and rereading in horizontal and vertical of the first map, repetitions were identified, building the second map, emerging five precategories grouped according to the unit of similar meanings. In the third and last step, the last map with the final categories was built.

The project of this research was submitted via *Plataforma Brasil* to the Research Ethics Committees of the University and the Hospital, being evaluated and approved by the Committee of the University under the number CAAE 39220814.7.0000.5345 and by the Committee of the Hospital under number CAAE 39220814.7.3001.5530.

RESULTS

With regard to the profile of the 12 subjects researched, 11 of them were female subjects; the age varied from 26 to 59 years; and the professional experience, from 3 to 35 years.

In the analysis of content performed, three final categories emerged: risk factors for DVT; preventive measures for DVT; and difficulties in the execution of the SNCP. In these categories, the units of similar meanings were grouped and quantified by the number of times in which the speech lines

of the subjects were repeated, resulting in subcategories, according to Chart 1.

Category: risk factors for deepvein thrombosis

In the first category, named "Risk Factors for DVT", the participants pointed out determinants for DVT as some surgeries, elderly patients and their comorbidities, immobility, obesity, traumas and fractures, and lack of preventive measures. In the subcategory "Surgeries," the participants indicated those of higher risk to develop DVT, such as: hip; acetabulum; femur; brain tumor; spine; plastic; long surgeries; orthopedic surgeries in general; surgeries that complicate; and various kind of surgery concomitantly. In response to one of the questions, which requested the subject to report a case of DVT or VTE, two nurses said:

Chart 1. Categories, subcategories, and quantitative registration units about deep vein thrombosis. Porto Alegre, 2015.

Final categories	Subcategories	Registration Units
Risk factors for DVT	Surgeries	22
	Elderly People and Comorbidities	20
	Immobility	16
	Obesity	7
	Traumas and Fractures	5
	Lack of Preventive Measures	4
Preventive measures for DVT	Anticoagulation	31
	Change of Position	27
	Venous Return Boot	24
	Nursing Care	22
	Pneumatic Tourniquet	5
	Physical Therapy	3
Difficulties in the execution of the SNCP	Inexistence of Systematization	16
	Limitation to Medical Prescription	9
	Measures Based on Experience	6
	Lack of Knowledge and Initiative	4

DVT: deep vein thrombosis; SNCP: systematization of nursing care in perioperative.

> I've seen it in other patients in the hospital hip surgery that had DVT and I've heard stories also of hip replacement surgery where the patient had tromboembolism, it's almost always death (N5).

> [...], but usually they are surgeries with complications, such as trochanteric surgeries, femur surgeries and elderly. Those are the patients with more DVT (N1).

We grouped a subcategory "Elderly People and Comorbidities," because, usually, the elderly patients have other conditions, owing to age, which start being considered as comorbidities. The following were mentioned as risk areas for DVT: elderly patients; clinical or physical impossibility (disorders); and patients of strokes and comorbidities, as reported:

> If the patient is already an elderly, there's suspicion of something, so try to fit into this pre-hospital period some maneuver to avoid they get here and develop DVT (N10).

> We have plenty obese patients here [...]. Diabetes; hypertensive patients; but there are a lot of [risk] factors like that (N9).

In the subcategory "Immobility," risk factors for DVT were mentioned as long stay in the same position and the positioning of the patient.

> So the patient in bed for a long time is a patient that involves a risk, right, of developing thrombosis (N11).

> The risk is the permanence in bed, low mobility and the impossibility of the patient getting out of bed. Clinical or physical impossibility, anyway. But it's the time the patient stays in bed (N4).

"Obesity" has emerged as the forth most mentioned category when asked to the participant: Name some risk factors for the occurrence of DVT in patients undergone major surgeries," according to the following statements:

> Obesity. Patients that stay a long time in bed (N6);

> and she had the issue of being an obese patient [...] (N9);

> age is a predisposing factor and obesity is too, where there's risk of developing thrombosis (N7).

In the subcategory named "Traumas and Fractures," the following were considered as risk factors: large fractures; polytrauma; long bone fracture, and patients with spinal cord trauma.

> Our risk patients that are the SCT (Spinal Cord traumas); patients with stroke who become paretic; so they are high risk patients

> A patient with severe polytrauma, who had severe neurological sequelae, in bed for a long time, came to us in ICU with a very important edema in their right leg [...] (N11).

> So actually [...], the patients stay in bed for too long, specially the elderly patients, patients with long bone fractures [...] (N3).

In the subcategory "Lack of Preventive Measures," the participants mentioned: no use of venous return boots; a lot of resistance from the team, and deficit in human resources.

> Many times a dependent patient had the risk of their own dependency and the human resources which are often deficient (N4).

> Also the lack of preventive measures, in the case of their own, we have the venous return boot that would be used during this period, but it has little acceptance by the team (N1).

Category: preventive measures for deep vein thrombosis

In the second category, named "Preventive Measures for DVT," the respondents pointed out anticoagulation, change of position, venous return boot, nursing care, pneumatic tourniquet, and physical therapy as essential measures for the prevention of DVT. In the subcategory "Anticoagulation," the participants mentioned the use of anticoagulant drugs in the perioperative period for the prevention of DVT:

> The preparation of the patient in the preoperative with the use of intermittent systemic anticoagulants (N1);

> there's also the use of anticoagulants in the perioperative period (N2).

In the subcategory "Change of Position," the participants named preventive measures and mobilization of feet extremities; elevated members; change of position; and early mobilization:

> Stimulate movement; early ambulation of patients who have conditions (N6).

> Moving of the patient in immediate postoperative, as early as possible (N5).

The third subcategory was mentioned as an important measure in the prevention of DVT, the "Venous Return Boot." However, the use of the venous return boot is related to the medical prescription, limiting their use for the prevention of DVT.

> I, in the recovery room, unfortunately can only act if the doctor guides. The nurse in the recovery room can't place the venous return boot on their own. Then the boot is placed with the guidance of the surgeon and has to be prescribed to be executed (N1).

When the respondent was questioned about which measures they use for prevention of DVT, they said:

> Venous return boots only with medical prescription (N8).

In the subcategory "Nursing Care," the following were grouped: postoperative guidance of the patient; massaging; observation; protective measures to avoid complications; improvisation of preventive measures; physical examination/evaluation of the patient; compression stockings; and the knowledge of the nurse team in relation to the prevention of

DVT. When asked: "What measures do you judge important for the prevention of DVT?," the respondents said:

> It to made daily observation of the patient as a whole; to observe if the patient has a good venous return, if the pedis pulse is palpable, if they don't have edema in their lower limbs; specially in lower limbs, but also in upper limbs, to analyze if there's no edema, infiltrated ones; so we have to be very attentive to those things (N11);

> knowledge; trying to mobilize the patient as soon as possible [guiding the patient in the postoperative about moving a lot in order to avoid complications]. I try to, this way, evaluate, check them out in general and look for questioning them about pain or color alteration (N10).

In the fifth subcategory, named "Pneumatic Tourniquet," it was shown as one of the measures used in the prevention of DVT in perioperative.

> Shorter inflation time of the pneumatic tourniquet which is an instrument very used in trauma or orthopedic surgeries (N5).

> In the perioperative it is the care with the [pneumatic] tourniquet, temperature and positioning of the patient (N7).

The last subcategory, named "Physical Therapy," was mentioned by some respondents when asked about how the prevention of DVT was made in patients who undergone major surgeries:

> The preoperative is medicated; venous return boot in the perioperative and also in the postoperative and then there are the physical therapy services (N6).

In the question: "Do you use measures to prevent DVT in patients of major surgeries? If so, which are they?", it was reported:

> They also do Physical Therapy in the postoperative, if they have any kind of paralysis, hemiplegia, they already have the right to physical therapy care, which is very important in prevention (N9).

Category: difficulties in the execution of the systematization of nursing care in perioperative

In the category "Difficulties in the Execution of the SNCP," it was identified the "Inexistence of Systematization" as the subcategory most often mentioned by the participants, in which the need of its creation appeared in participant's speech: basic routines, with some standardized actions being defined, depending on the specialty; difficult to maintain informal planning/organization, both for deficient human resources and for the profile of the institution (trauma hospital); and it is not institutionalized; there is need to implement nursing diagnosis to the prescription of care. Here are some excerpts exemplifying this subcategory:

> [...], but in the postoperative I think there could be done an implementation of the diagnosis, the systematization itself, implementing the systematization with the documentation, evaluation of needs [...] I think it would be very important (N4).

When asked about the functioning of the SNCP, a respondent reported:

> It doesn't work because it's not institutionalized. There is no perioperative systematization. Some routine care of the unit is performed, and in the perioperative it is not performed even because of the shortage of nurses for this kind of care (N5).

The lack of human resources is a factor that interferes in the implementation of the SNCP, in addition to the hospital profile being a complicating aspect:

> Look, I'd say that when we look into the surgical scale we make a plan, but it is very complicated to be kept, since working in a emergency room is subject to a lot of alterations throughout [...] not always all you plan is what you get to do (N2).

The second most often mentioned subcategory was "Limitation to Medical Prescription," where nurses reported having difficulties in planning nursing assistance in order to perform the preventive measures for DVT because

they depend on the medical prescription. They are simple actions, which the nursing professionals know how to perform and are aware of the importance of performing them, but for which they have no autonomy and, somehow, not implementing them can increase the risks for the patient, as exemplified next:

> In the preoperative, even with lower rates of thrombosis, there are also prevention measures taken; if the patient cannot leave their bed, it has physical therapy all the same, but we need medical clearance for everything [...]. This patient couldn't get out of bed, she didn't have medical clearance to get out of bed, then it's much easier for you to perform this prevention (N9).

> We are limited here to prescriptions [referring to medical prescriptions]; even with nursing we take care of the decubitus, the positioning; however the use of pneumatic boots is attached to [medical] prescription and also the use of heparin (N12).

This nursing limitation in the perioperative period hardens the implementation of the SNCP and directly affects the prevention of DVT:

> And nursing has more autonomy in this sense, because I see it very attached to medical prescription; so there's a vision of changes which must be valued (N10).

The "Measures Based on Experience" were proven to be of some relevance for the difficulty in execution of the SNCP.

> We have some measures which are standard routine for each specialty. This systematization was made based on our experience and not on literature measures; we are the ones who set our routines [...] there isn't a very balanced systematization, it depends on the moment of each patient (N1).

When asked about the functioning of the SNCP in major surgeries, a respondent answered:

> We don't have it; the thing is individualized according to the professional who is attending care at that moment; there's nothing written down, to be followed, with a protocol, nothing (N12).

The last subcategory, named "Lack of Knowledge and Initiative," shows how much the professionals did not develop a critical look toward their patients, many times focusing only in the pathology and forgetting about establishing the clinical thinking in case of other symptomatology occurring simultaneously.

> Sometimes a little ignorance from the team itself, that does not pay attention to the factors and will only realize it when the patient is already presenting the symptoms (N10).

> [...] I think there is also a little lack, not only of liberty, but also of initiative for people in nursing to be more attentive to the symptoms, the complication that can happen (N1).

DISCUSSION

In the risk factors for DVT, the subjects interviewed pointed out immobility, age, orthopedic surgeries such as femur, among others, in a similar manner they were mentioned in another study[8], which pointed out higher risk of developing DVT among patients in bed, elderly patients, and patients submitted to femur fracture surgery.

In the SC, the nurse deals with more than one medical team; therefore, an interaction between the professionals with the objective of developing the work in an efficient and effective manner is important [14]. This research identified difficulty in performing the preventive conduct for DVT owing to the resistance of the medical team in prescribing certain effective preventive measures; thus, a better communication between nursing and the medical teams that work in the SC is necessary, with the objective of exchanging experiences in relation to the patient and planning the preventive measure in an interdisciplinary format.

The Brazilian Society of Angiology and Vascular Surgery (*A Sociedade Brasileira de Angiologia e Cirurgia Vascular*)[15], in the rules of clinical orientation for prevention, diagnosis and treatment of DVT, mentions the following as risk factors: obesity, trauma, duration of the surgeries, among others.

The participants interviewed mentioned obesity, traumas, and fractures as risk factors; however, they did not mention varicose veins, general anesthesia, and pregnancy, which are risk factors also pointed out by the Society.

The fracture of the femur increases the risk of VTE; the patients with fracture of the femur revealed higher incidence of PE, also probably as a result of prolonged immobility[8].

In relation to the preventive measures of DVT, the participants pointed out a change in decubitus in order to prevent the DVT, revealing the importance in moving the patient as soon as possible, according to each case. A recent study[8] showed that the incidence of PE (one of the most severe complications of DVT) was higher among patients in bed if compared with those who are not in bed. The change of position of the surgical patient is a measure regarding nursing to carry out, with the objective of preventing not only skin lesions but also DVT[3].

The Brazilian Society of Angiology and Vascular Surgery[15] reinforces the importance of the use of anticoagulants for any kind of surgery. Anticoagulation was the preventive measure most often mentioned by the participants, highlighting the importance of the use of anticoagulants both before and after major surgeries.

The use of venous return boot and compression stockings in surgical patients are efficient regarding the prevention of DVT, considering they help blood flow and, consequently, reduce the venous stasis, one of the risk factors for the development of thrombosis[16-17]. Some participants of the research mentioned the use of compression stockings when possible, in case there are no contraindications for a certain patient. The pneumatic tourniquet is an equipment used by the teams in orthopedic surgery and traumatology. In this preventive measure, the nursing team cannot intervene, because the medical team is the one to decide carrying it out during perioperative.

In relation to the difficulties in the execution of the SNCP, the participants pointed out the lack of human resources in order to be able to perform an appropriate, evaluated, and documented assistance. The lack of knowledge and initiative by the professionals influences the nonadhesion of the systematization. Another study mentions the risk factors previously mentioned; however, it states that the nurse is focused more in administrative activities than in assistance activities and, by lack of clarity in relation to the SNC, ends up wasting a lot of time in the elaboration of the plan of activities[18].

This study corroborates with the literature regarding the difficulty of implementation of the SNCP owing to the reduced number of nurses to perform it[3]. In practice, it is observed that the SNCP is being partially carried out, with the need of implementing a documentation, with the planning of care[19]. Another factor that influences the SNCP is the fact that the profile of the hospital is a trauma emergency room, usually acting upon one specialty, in which the rooms have to be prepared for eventual complications, depending largely on the evolution of the patients, not having a specific systematization[20].

The knowledge and capacitation of the nursing team are factors that can avoid complications in the postoperative[3]; the nursing team should know and be attentive to possible aggravations of the surgery, evaluating individually each patient to prevent the DVT.

FINAL CONSIDERATIONS

This research allowed knowing how the nurses of a reference hospital in trauma performed the prevention of the DVT in the perioperative period of patients submitted to major surgeries. The nursing cares mentioned for the prevention of DVT in the perioperative period were massaging; observation; physical examination/evaluation of the patient; improvisation in protective measures; and change of position. It was found that, from the words of the participants, there is a lack of autonomy for the nurse to apply some preventive measures, such as use of venous return boot and compression stockings, as the use of those are conditioned to the medical prescription. This fact interferes in one of the stages of the SNCP, as it is not possible to plan a full assistance. Besides, there is a deficiency of human resources and lack of knowledge by the team in relation to the systematization process of assistance, complicating the execution of the SNCP.

The nurses pointed out various risk factors for the occurrence of DVT in the perioperative according to the literature, evidencing the knowledge on the pathology; however, varicose veins and pregnancy were not mentioned.

It is important that the nurses have knowledge, ability, and attitude for their empowerment, exercising their role in the health team and modifying the existing practice, still very focused in the biomedical model.

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LARYNGOSCOPE HANDLES REPROCESSING: INTEGRATIVE REVIEW

Processamento de cabos de laringoscópio: revisão integrativa

Procesamiento de los mangos del laringoscopio: revisión integradora

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ABSTRACT: Objective: This is an integrative review study of the scientific literature based on the following guiding question: "What kind of processing is required for the safety reuse of the laryngoscope handle?" **Method:** An integrative review was performed using the following portals and databases: Pubmed, Embase, Scopus, Web of Science, and CINAHL. **Results:** Seven experimental studies were found and the results showed the uncertainty of the classification of the laryngoscope handle in relation to the risk of causing infection, proven by the diversity of reprocessing methods identified. **Conclusion:** We concluded that the laryngoscope handles cannot be considered independent of the blades and, therefore, they are semicritical materials. Considering the microbial and the organic load identified in this review, the recommended minimal processing is cleaning, followed by the high-level disinfection. A small inventory and the lack of access to technologies for reprocessing are not acceptable reasons for improvised recommendations, thus avoiding the certification and the spread of the bad practices.

Keywords: Laryngoscopes. Disinfection. Classification.

RESUMO: Objetivo: Estudo de revisão integrativa da literatura científica com base na seguinte questão norteadora: "Qual o tipo de processamento necessário para a segurança do reuso do cabo de laringoscópio?". **Método:** Foi realizada uma revisão integrativa utilizando os portais e as bases Pubmed, Embase, Scopus, *Web of Science* e CINAHL. **Resultado:** Foram identificados sete estudos experimentais cujos resultados demonstraram indefinição da classificação do cabo de laringoscópio quanto ao risco de causar infecção, comprovada pela diversidade de métodos de processamento. **Conclusão:** Conclui-se que os cabos de laringoscópio não podem ser considerados materiais independentes das lâminas e, portanto, são materiais semicríticos. Levando-se em conta a carga microbiana e orgânica identificada nesta revisão, o processamento mínimo recomendado é a limpeza seguida de desinfecção de alto nível. Um inventário pequeno e a falta de acesso às tecnologias para processamento não são razões aceitáveis para recomendações improvisadas, evitando assim a certificação e propagação de más práticas.

Palavras-chave: Laringoscópios. Desinfecção. Classificação.

RESUMEN: Objetivo: Estudio de revisión integradora de la literatura científica basándose en la siguiente pregunta de investigación: "¿Cuál tipo de procesamiento se requiere para la seguridad de la reutilización del mango del laringoscopio?". **Método:** Se hizo una revisión integradora utilizándose los portales y las bases PubMed, Embase, Scopus, *Web of Science* y CINAHL. **Resultados:** Fueron identificados siete estudios experimentales cuyos resultados demostraron una indefinición de la clasificación del mango del laringoscopio en relación al riesgo de causar infección, comprobada por la variedad de métodos para procesamiento. **Conclusión:** Los mangos del laringoscopio no pueden ser considerados materiales independientes de las láminas y, por lo tanto, son materiales semicríticos. Teniendo en cuenta las cargas microbiana y orgánica identificadas en esta revisión, el procesamiento mínimo recomendado es la limpieza seguida de la desinfección de alto nivel. El inventario pequeño y la falta de acceso a las tecnologías al procesamiento no son razones aceptables para las recomendaciones improvisadas, evitándose así la certificación y la propagación de malas prácticas.

Palabras clave: Laringoscopios. Desinfección. Clasificación.

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INTRODUCTION

The laryngoscope is an instrument composed of a handle, which comprises medium-sized batteries to power a light bulb and is linked to a straight or curved blade[1]. The set consists primarily of heat-resistant stainless steel and/or brass. The companies Takaoka®, Moriya® and HB Defense® instruct on their laryngoscope manuals to remove the batteries and sometimes the lamps before reprocessing.

This equipment is intended for ventilatory access in tracheal intubations, examination of airways, and surgical laryngeal procedures[2]. For a procedure of laryngoscopy, equipment's blade is inserted into the oral cavity of the patient and, therefore, is classified as semicritical material[3]. However, the classification according to the potential to cause infection and the type of reprocessing suitable for the handle has generated controversy in the international literature[4,5] because of the misapprehension that handle and blades are different equipment and the handle, "as do not come in direct contact with the patient", can be classified as noncritical material.

It is an error to consider the laryngoscope handle as noncritical item, as cross-contamination occurs by the hands of the handler while performing the laryngoscopy. Furthermore, despite the inexistence of direct contact with the patient, the cable is connected to the blades, which are semicritical materials that may be contaminated or recontaminate the blade, especially when it is folded downwardly to turn off the light[6,7]. In addition, the knurled finish of the handle surface facilitates the accumulation of dirt[7].

Empirical evidence indicates variation in the reprocessing of laryngoscope handles from just cleaning to sterilization. Disagreement on the classification and reprocessing of laryngoscope handles and blades, in relation to the instructions provided by manufacturers and specialists associations, are also found in the scientific literature[4,7].

Considering the lack of agreement and the variety of reprocessing practices, we identified the need to respond to questions by seeking answers based on scientific evidences[8] and analyze the published studies on the subject, as these materials are potential sources of cross-infection. The objective of this review was to identify the classification of the laryngoscope handle according to the risk of causing infection and highlight the required type of reprocessing.

METHOD

This research is characterized as an integrative review and the methodology consists of performing a comprehensive literature review, discussing methods and research findings, and identifying the need for conducting new studies[9]. The review was performed considering the following steps: definition of the research questions, determination of inclusion and exclusion criteria of studies, definition of the variables of interest that should be extracted, and analysis of results.

The guiding question for this review was: "What kind of reprocessing is required for the safe reuse of the laryngoscope handle?". The criteria for the inclusion of studies were: experimental studies with pragmatic approach, which identified the microbial and organic loads contained in the laryngoscope handles and presented recommendations regarding the type of reprocessing that was adequate, based on the findings. The excluded articles were those that analyzed only the blades.

For the retrieval of the studies the following portals and databases were used: Pubmed, Embase, Scopus, Web of Science, and CINAHL. The keywords used were laryngoscope(s), obtained after consulting the vocabulary Medical Subject Headings (MeSH) prepared by the US National Library of Medicine, in association with the term handle(s). There were no set limits in relation to the language and year of publication and the first included article dated 1994.

A comprehensive search was intentional so that questions could be answered. Keywords were used, as there were no specific descriptors for the laryngoscope handle. The use of additional descriptors or keywords refined the search in a way that prevented the retrieval of the references.

Reading titles and abstracts, making a preselection of the studies that met the inclusion criteria, while the duplicates in different databases were excluded, initially performed the selection of items. A full reading of the study was performed when the abstract did not provide enough information to clearly identify the criteria for inclusion of the study in this review. For final selection, a full reading was performed for all preselected studies.

Two researchers independently conducted the data collection in October 2014 by means of an instrument containing the variables of interest considered in the analysis of the publications: reprocessing of handles in the context of the research, objectives, methods, results, isolated microorganisms, conclusions, and recommendations.

To analyze the studies, we considered the detailed description of the variables of interest, by means of descriptive analysis presented in tables.

Laboratory experimental researches, different from clinical research, are not hierarchical.

As an example, it is not possible to establish an hierarchy of clinical trials in this review, such as the following classification elaborated by Stetler et al.[10]:

- Level 1 – evidence from the meta-analysis of multiple controlled and randomized clinical trials;
- Level 2 – evidence from individual studies with experimental design;
- Level 3 – evidence of quasi-experimental studies;
- Level 4 – evidence of descriptive studies (nonexperimental) or qualitative approach;
- Level 5 – evidence from case reports or experience;
- Level 6 – evidence based on expert opinions.

Even when employing other widely utilized classification, as the scientific levels of evidence according to the Oxford Centre for Evidence-based Medicine[11], these materials have evidence level D — Expert opinion without critical appraisal or based on basic subjects (physiological study or study with animals). However, this classification is inadequate because, in some approaches, due to ethical or safety reasons, only the laboratory experimental approach is possible.

RESULTS

We identified a total of 447 studies, distributed as follows: Pubmed (110), Embase (134), Scopus (111), Web of Science (87), and CINAHL (5). However, only seven studies met the inclusion criteria. The excluded studies showed the following limitations: covered only the blades; were duplicated on different bases; did not identify microbial or organic load contained in the cables; did not elaborate recommendations in relation to the proper type of reprocessing. To facilitate the presentation of results and discussion, each selected study received a code: E0 to E6. The studies included in this review are presented in Chart 1.

The variables of interest used in the analysis of the studies are shown in Charts 2 and 3.

DISCUSSION

The evidences reveal uncertainty in relation to the classification of risks of the laryngoscope handle to causing infection, proven

Chart 1. Description of authors, title, publication references, and search source. São Paulo, 2014.

Code	Authors	Title	References	Portal/database
E0	Howell et al.[12]	*Chlorhexidine to maintain cleanliness of laryngoscope handles: an audit and laboratory study*	Eur J Anaesthesiol. 2013;30(5):216-21	PubMed EMBASE
E1	Williams et al.[13]	*Contamination of laryngoscope handles*	J Hosp Infect. 2010;74(2):123-8	PubMed EMBASE SCOPUS Web of Science
E2	Call et al.[14]	*Nosocomial contamination of laryngoscope handles: challenging current guidelines*	Anesth Analg. 2009;109(2):479-83	PubMed EMBASE SCOPUS Web of Science
E3	Qureshi et al.[15]	*Laryngoscope handles in a medical intensive care unit: the level of bacterial and occult blood contamination*	J Hosp Infect. 2008;68(1):94-5	PubMed EMBASE SCOPUS Web of Science
E4	Simmons[16]	*Laryngoscope handles: a potential for infection*	AANA J. 2000;68(3):233-6	PubMed EMBASE SCOPUS Web of Science
E5	Phillips & Monaghan[17]	*Incidence of visible and occult blood on laryngoscope blades and handles*	AANA J. 1997;65(3):241-6	PubMed
E6	Morell et al.[18]	*A survey of laryngoscope contamination at a university and a community hospital*	Anesthesiology. 1994;80(4):960	PubMed

by the variety of reprocessing methods. It was observed that, in addition to the variation in reprocessing methods, subjective criteria such as the presence of visible organic residue (E1, E5-E6) were determining factors for the reprocessing type selection: none (E5 and E6), cleaning (E1-E3, E5-E6), low-level disinfection (E0 and E2), intermediate-level disinfection (E0, E1, E3), high-level disinfection (E4), and sterilization (E0 and E1).

Unlike the blades, the handles have not been directly associated with the transmission of infection[19]; however, this statement is contestable because the discrimination of a part of the set that carried microorganisms cannot be established in an investigation. The handle is manipulated and is attached to the blades, which come in contact with the mucosa; therefore, it is not possible to dissociate it from the set[7]. According to the

Chart 2. Description of the reprocessing in the research context, objectives and methods of the selected studies. São Paulo, 2014.

Code	Reprocessing in the research context	Objectives	Methods
E0	Autoclaving prior to the storage placed next to the beds. Before use, the handles were removed from the package for the insertion of batteries and were tested for functionality; then they were placed in the same package and classified as ready for use	To establish an effective decontamination routine for laryngoscope handles To compare the efficacy and quantify the residual effect of Sani-Cloth CHG 2% (chlorhexidine 2%/ isopropyl alcohol 70%) and Tuffie 5 wipes (Cocoalkyl dimethylbenzyl ammonium chloride) for the decontamination of the handles	Microbiological cultures using swabs in 55 cables considered ready for use and laboratory studies for microbial recovery after challenge infection with *Escherichia coli*, glycopeptide-resistant *Enterococcus faecium,* and methicillin-resistant *Staphylococcus aureus*
E1	Chlorhexidine spray or cleaning with detergent or alcohol and drying Sterilization, when the handles were considered "very dirty"	To identify the extent and nature of the contamination of laryngoscope handles considered clean and ready for use	Microbiological cultures by means of swab and test for occult blood in 64 laryngoscopes handles considered "ready for use" in a surgical center were performed.
E2	No specific guidelines. Cleaning of the handles using 3M HB Quat Disinfectant Cleaner (EPA registration for noncritical materials) or Caviwipes®. Both considered low-level disinfection	To evaluate institutional cleaning techniques and expand existing data by means of microbiological culture samples obtained from laryngoscope handles	Microbiological cultures were performed (for bacteria and viruses) by means of swabs in 60 laryngoscopes that were in operating rooms: 40 units for aerobic bacterial culture and 20 for viral contamination
E3	Cleaning and disinfection of the handles using Surfa'safe®	To determine the frequency of bacterial contamination and the presence of occult blood in laryngoscope handles	Microbiological cultures by means of swab and test for occult blood in 120 surfaces of laryngoscope handles from an intensive care unit (ICU) were performed
E4	High-level disinfection by means of Maxima Spray (germicidal detergent based on quaternary ammonium and chlorine)	To identify the incidence, type and sensitivity profile of bacteria isolated from laryngoscope handles	Microbiological cultures from 20* laryngoscope handles were performed (13 from operating rooms, 4 from facilities for same-day surgery suites, 1 from delivery room, and 1 from electrophysiology laboratory)
E5	The handles are washed after each use with an agent "approved by the institution". According to the authors, in fact, the handles are cleaned only when very dirty	To determine the incidence of visible and occult blood on laryngoscope blades and handles which were identified as ready for patient use	Test for occult and visible blood was performed (inspection) in 65 laryngoscopes from operating rooms in the morning and afternoon
E6	No protocols for cleaning the cable. When very dirty, cleaning was done with a cloth	To determine the presence of contamination by occult blood on laryngoscope blades and handles	Test for occult blood was performed on collected handles and blades from anesthetizing locations of 25 university hospitals and 13 community hospitals

*The autor describes only 19 laryngoscope handles in source article.

Chart 3. Description of the results, conclusions, and recommendations of the selected studies. São Paulo, 2014.

Code	Results	Isolated	Conclusions/recommendations
E0	Cultures: In 32 handles there was no growth In 23 handles one or more species were found It was observed higher residual effect in Sani-Cloth CHG 2% wipe	Coagulase-negative *Staphylococci* *Corynebacterium* spp *Bacillus* spp *Pseudomonas aeruginosa*	The authors recommend cleaning and decontamination using Sani-Cloth CHG 2% for 10 seconds In suspected cases of infection by *Clostridium difficile* and *Norovirus*, sterilization is recommended In the emergency and intensive care services, decontamination should occur before and after each use The monthly sterilization is suggested for decontamination of inaccessible areas for Sani-Cloth CHG 2% wipes
E1	*Culture: 9 handles presented no growth 19 handles presented growth of one species 18 handles presented growth of two species 11 handles presented growth of three species 5 handles presented growth of four species 2 handles presented growth of five species The occult blood was negative for all samples *No association with the amount and type of microorganism, anesthetizing location number, type of surgical procedure and hospital location.	*Bacillus* sp. Coagulase-negative *Staphylococci* *Enterococci* *Micrococcus* *Acinetobacter* *B. cereus* Leuconostoc Methicillin-Susceptible *Staphylococcus* *Klebsiella* *Streptococcus viridans*	The laryngoscope cable is a potential source of cross-infection There is a need for developing guidelines to standardize the laryngoscope handles cleaning methods To develop a design that prevents contact of the tip of the blade with the handle High-level disinfection is recommended
E2	Bacteria: 30 positive samples Viruses: all negative samples.	*Bacillus* spp. (not anthracis) Alpha-hemolytic *Streptococcus* spp. Vancomycin-susceptible *Enterococcus* spp. Methicillin-Susceptible *Staphylococcus* *Corynebacterium* spp.	It is necessary to adopt processing protocols with at least low-level disinfection
E3	*Culture: In 37 samples there was no growth In 58 samples there was growth of one species In 25 samples there was a growth of two or more species Average of 78CFU/200 uL Negative occult blood for all samples *Number of CFUs higher in handles unused for more than 3 days	Coagulase-negative *Staphylococci* *Bacillus* spp *Corynebacterium* *Micrococcus* Non-hemolytic *Streptococcus* *Staphylococcus aureus*	The laryngoscope handle is not considered a significant threat The authors consider that the risk of contamination can be minimized with proper disinfection

Continues...

Chart 3. Continuation.

Code	Results	Isolated	Conclusions/recommendations
E4	All samples showed microbial growth (range from 1 to 400 CFU) One sample underwent high-level disinfection according to the described procedure, and did not present growth	*Staphylococcus epidermidis* (multidrug resistant) *Staphylococcus aureus* *Citrobacter freundii* *Pseudomonas aeruginosa* *Enterococcus* *Streptococcus* *Bacillus* *Micrococcus*	Decontamination with water and detergent, followed by high-level disinfection or sterilization
E5	None of the samples presented visible blood 26 positive samples. The presence of occult blood was significantly higher in samples collected in the afternoon	The identification of microorganisms was not performed	The protocols used are ineffective Reclassification of laryngoscope handle as semicritical material
E6	University hospitals: 12 positive handles Community hospitals 7 positive handles	The identification of microorganisms was not performed	Both the handle and the blade are potential sources of infection The use of strict decontamination protocols, equipment or disposable blades and covers to the handles can prevent cross-contamination

CFU: Colony-forming units.

official recommendations, the laryngoscope handles should undergo high-level disinfection after cleaning[19-21].

The chemical disinfection requires immersion of the instrument; however, considering that they are heat-resistant materials, thermal disinfection can be recommended as the first option because it eliminates the inconvenient related to chemical processing, such as the dependence of complete immersion, the use of individual protection equipment, exposure of personnel to chemical agents, as well as the care with rinse procedure[20].

Failures in the reprocessing of this instrument resulted in two outbreaks of *Serratia marcescens* infection in intensive care units[22,23], in which the microorganism was isolated from the blades and in one of them dirt was visible. In addition to this literature, there is another outbreak of *Pseudomonas aeruginosa* that was also attributed to inappropriate reprocessing of the laringoscopes[4].

In relation to microbiological cultures, we observed in the reviewed literature the variety of microorganisms and colony-forming units in an order of 10^2, confirming that the laryngoscope handle is a potential source of contamination. Among the microorganisms identified, there are bacteria of epidemiological relevance[24], such as *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Acinetobacter,* and *Klebsiella*, common etiological agents in hospital pneumonias.

In relation to the methods employed, one limitation of the selected studies is the lack of identification of the microorganisms' origin: from the hands of professionals, from patients, or from the environment, considering that laryngoscopes generally are not packed in materials with biobarrier properties. Although there are no exclusive packages for semicritical materials, it is prudent to protect them from inadequate handling and dust. Thus, to protect the materials for the next use, it is recommended to use clean, nontoxic, sealable plastic bags, commonly used for food packaging or disinfected plastic containers with lid[25].

One aspect not reported in the studies that contributes to the diversity of reprocessing methods is the inconsistent recommendations at the manual of instructions of the laryngoscope manufacturers or distributors, which can lead to errors. This fact is illustrated in Chart 4, in which we reproduced the guidelines of three companies obtained on their respective web sites.

Company 1 confuses concepts when recommends cleaning the set with an intermediate level disinfectant, but does not describe compatible sterilization and disinfection procedures, emphasizing the disinfection of the blade. The E5 and E6 studies presented occult blood in the handles, demonstrating the need for a cleaning procedure that essentially involves water, detergent, and friction.

The manual of Company 2 contains typographical errors and determines the immersion time in the detergent solution (2 minutes); however, the detergent manufacturer should make this recommendation. Another significant aspect is the inappropriate time recommended for sterilization: 30 minutes at 134°C.

Company 3 makes mistakes in the sequence of steps "clean, disassemble, and sterilize". Cleaning a material requires it to be previously dismantled, when possible. Furthermore, it determines the disinfectant brand and the exposure time; again, the manufacturer of the solution should determine these items.

Inconsistent recommendations from the manufacturer such as to disinfect with "suitable germicide" or "appropriate solution" should not be approved at the time of registration of the product for marketing, as they do not allow the health-care institutions to develop secure protocols. Therefore, laryngoscope's manufacturers must provide germicidal options that meet high-level disinfectant category and clearly list compatible and incompatible formulations. The National Agency for Health Surveillance (ANVISA) must intervene so that decontamination instructions from any reusable material, including laryngoscopes, are accurate and secure.

The E0 and E1 studies showed the use of agents considered antiseptic (chlorhexidine) to date. Although the authors of the study E0 have demonstrated their effectiveness associated with residual effects, we observed that the authors emphasized the limitations of the product for inactivating *Norovirus* or *Clostridium difficile*. This limitation prevents the adoption of standard precautions for the reprocessing of laryngoscope handles. Furthermore, when suggesting the monthly sterilization to decontaminate inaccessible areas for Sani-Cloth CHG 2% wipes, the authors acknowledge that the adoption of this type of product, when routinely used, is unsafe.

Chart 4. Recommendations elaborated by different companies to the reprocessing of laryngoscopes. São Paulo, 2014.

Company	Raw material	Cleaning	Disinfection	Sterilization	Cautions/Warnings
1	AISI 304 stainless steel	"Alcohol" or "appropriate germicidal solution" and drying	Do not specify	Do not specify	Disassembly for cleaning Disinfection of the blade
2	"Stanless" steel, brass, plastic and electrically isolated handle	Rinse immediately after use Immersion in detergent for 2 minutes; Rubbing Drying	"Cold solutions" with exposure time and "power" according to the manufacturer. Immersion in 2.4% glutaraldehyde for 45 minutes at room temperature Rinsing and drying	Autoclave "Set the autoclave cycle in accordance to the following specifications: Temperature: 134ºC / 270ºF Cycle time: 30 minutes Drying time: 6 minutes"	Never clean the laryngoscope with ultrasound Do not use steel brushes "During the sterilization does not exceed the temperature of 134ºC / 270ºF and pressure of 28psi" "Autoclave at Flash cycle and by means of hot air are not recommended"
3	Chrome-plated brass / stainless steel	Immersion in water at 40-45°C for 10-20 minutes; Cleaning piece by piece with nylon brush and soap or mild detergent Rinsing and drying		Disassembly "Suitable germicidal solution" or ethylene oxide "Conditions of temperature 54°C (130°F)" Chemical sterilization "2% Glutaraldehy (Cidex®) for 12 hours" Rinse	"Clean, Disassemble and Sterilize"

Regarding the methods of physicochemical sterilization at low temperatures, it is not acceptable to recommend a single technology such as ethylene oxide (ETO), which in Brazil is applied by contractors. It is known that the adoption of this method implies considerable increase in the number of laryngoscope handles and blades in use. In the USA, there are also services that adopt plasma hydrogen peroxide; differently from ETO, this could be easily allocated in a health-care institution[21].

Although some authors do not accept the security of high-level disinfection because of the contamination of areas that are difficult to clean, and propose the use of condoms as blade covers[26], it is emphasized that there are no validations for this proposal and argument. If the cleaning is not possible, there is an equipment design error that should be notified to the manufacturer and to regulatory agencies. Besides the fact that the use of a cover may lead to the misconception that the reprocessing is unnecessary, there is the possibility of disruption of the cover and contamination of the instrument.

A controversial aspect related to the reprocessing of the instrument is the possible contamination by prions. Some authors advocate the use of disposable laryngoscope blades due to the possibility of contamination of the blade by lymphoid tissues during a laryngoscopy, constituting a possible source of prion diseases transmission[27]. The current scientific literature does not recommend the adoption of specific measures to handle prions in laryngoscope blades[21]. Generally, in suspected cases, health-care facilities should adopt specific guidelines for prions[28].

CONCLUSION

Laryngoscope cables cannot be considered independent from the blades and thus are semicritical materials. Taking into account the microbial and organic load identified in this review, which illustrates serious failures in the reprocessing routine, as well as the limitations of the identified publications, we considered that the main implication of these findings for nursing practice is the adoption of cleaning followed by high-level disinfection as a minimal reprocessing, contributing to the creation of standard operational procedures to ensure patient safety.

We reinforce that the controversy regarding the transmission of prion diseases by means of the laryngoscope needs to be further investigated. It is also important to emphasize the inconsistencies observed in the manufacturers' manuals, which are vague and lead to misinterpretations, requiring urgent review with the co-participation of ANVISA to support safe practices.

A small inventory of the equipment and the lack of access to technologies for reprocessing are not acceptable reasons for improvised recommendations, thus preventing the spread of certification and malpractice.

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SURGICAL WOUNDS INFECTIVE MICROBIOTA: NATIONAL AND INTERNATIONAL ANALYSIS OF SCIENTIFIC PRODUCTION

Microbiota infectante de feridas cirúrgicas: análise da produção científica nacional e internacional

Microbiota infeccioso de las heridas quirúrgicas: análisis de la producción científica nacional e internacional

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ABSTRACT: Objective: to identify the microbial flora of infected surgical wounds described in scientific literature. **Method:** integrative review conducted in the following databases: *Literatura Latino-Americana e do Caribe em Ciências da Saúde*, Medical Literature Analysis and Retrieval System Online, Scientific Electronic Library Online, Cochrane, and SciFinder Scholar. Five keywords from the Health Sciences Descriptors and boolean operators "OR" and "AND" were used for the selection of articles. A form with the information was completed: article identification, purpose, type of study, and results. **Results:** A total of 56 papers were selected, published between 1960 and 2013. The main infectious microorganisms were bacteria, followed by fungi. Infections were primarily caused by *Staphylococcus aureus* (39.3%), *Escherichia coli* (30.4%), *Pseudomonas aeruginosa* (19.6%), *Staphylococcus epidermidis* (17.8%), *Klesbsiella* spp (12.5%) and *Enterobacter* spp (10.7%). **Conclusion:** Gram-negative bacteria are the most common infectious microorganisms in surgical wounds. However, *Staphylococcus aureus* is the most frequent microorganism.

Keywords: Bacteria. Protozoan infections. Viruses. Fungi. Surgical wound infection.

RESUMO: Objetivo: Identificar a microbiota de feridas operatórias infectadas descritas em produções científicas. **Método:** Revisão integrativa realizada em bases de dados: Literatura Latino-Americana e do Caribe em Ciências da Saúde, *Medical Literature Analysis and Retrieval System Online*, *Scientific Electronic Library Online*, *Cochrane* e *SciFinder Scholar*. Para a seleção dos artigos foram utilizadas cinco palavras-chaves contempladas nos Descritores em Ciências da Saúde e os operadores booleanos OR e AND. Utilizou-se formulário com informações: identificação dos artigos, objetivo, tipo de estudo e resultados. **Resultados:** Foram selecionados 56 artigos, publicados entre 1960 e 2013. Os principais microrganismos infectantes foram as bactérias, seguidas pelos fungos. Infecções foram causadas principalmente por: *Staphylococcus aureus* (39,3%), *Escherichia coli* (30,4%), *Pseudomonas aeruginosa* (19,6%), *Staphylococcus epidermidis* (17,8%), *Klesbsiella* spp (12,5%) e *Enterobacter* spp (10,7%). **Conclusão:** Bactérias Gram-negativas são os mais frequentes microrganismos infectantes de feridas cirúrgicas. Contudo, *Staphylococcus aureus* é o microrganismo de maior frequência.

Palavras-chave: Bactérias. Infecções por protozoários. Vírus. Fungos. Infecção da ferida operatória.

RESUMEN: Objetivo: Identificar flora microbiana de heridas quirúrgicas infectadas descritas en producción científica. **Método:** Revisión integradora realizada en las bases de datos: Literatura Latino-Americana e do Caribe Ciências da Saúde, *Medical Literature Análise e Retrieval System on-line*, *Scientific Electronic Library Online*, Cochrane e *SciFinder Scholar*. La selección se utilizó cinco palabras clave que se contemplan en Ciencias de la Salud y operadores booleanos "OR" y "AND". Utilizó formulario con información: la identificación del papel, propósito, tipo de estudio y resultados. **Resultados:** 56 documentos fue seleccionado con la publicación entre 1960 y 2013. Principales microorganismos infecciosos era bacterias, seguidos por hongos. Infecciones fueron causadas principalmente por *Staphylococcus aureus* (39,3%), *Escherichia coli* (30,4%), *Pseudemonas aeruginosa* (19,6%), *Staphylococcus epidermidis* (17,8%), *Klesbsiella* spp (12,5%), *Enterobacter* spp (10,7%). **Conclusión:** bacterias Gram-negativas son microorganismos infecciosos más comunes de heridas quirúrgicas. Staphylococcus aureus es el microorganismo más frecuente.

Palabras clave: Bacterias. Infecciones por protozoos. Virus. Hongos. Infección de herida operatoria.

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INTRODUCTION

Hospital infection, according to Decree No. 2616/98 of the Brazilian Ministry of Health, is defined as an infection acquired after the patient's admission and manifested during hospitalization or after discharge, when related to hospitalization or hospital/outpatient procedures or manifested during the 72 hours before admission, but associated with diagnostic and/or therapeutic procedures performed during this period[1].

Currently, due to the high rate of morbidity and mortality, wound infection is a major concern in hospitals and can also cause physical and emotional harm, often keeping the client away from work and social life. This also increases the cost of treatment, which results in a longer hospital stay and in the increase of medical expenses[2].

Surgical site infection (SSI) can be understood as the entry, establishment, and growth of the pathogen in the surgical incision. The person presents decline in general condition, anorexia, fever, and purulent drainage, exposing the condition of infection by a microorganism. Despite its nonspecific nature, fever is the most common initial clinical sign of infection[3].

Generally, infection of the surgical wound can occur between 4 and 6 days after the procedure. However, according to the US Centers for Disease Control and Prevention (CDC), 98% of the SSIs can manifest up to 30 days after surgery, or even 1 year later, when prosthesis is implanted[4].

Some factors favor the establishment and the severity of infection, which may be intrinsic — when related to the patient's condition, such as: diabetes mellitus, obesity, malnutrition, chronic vascular disease, extremes of age, protein depletion, and smoking[5] — and extrinsic, which must be identified preoperatively and are related to surgery and hospital environment, such for example, the duration of the surgical washing, prolonged hospitalization, scraping, duration of surgery, skin antisepsis, prophylactic antibiotics, and sterilization[6].

The CDC classifies SSI as superficial or deep incisional SSI, or as organ/space SSI. In superficial infection, the skin and subcutaneous tissue are affected, and, in deep, deeper layers, such as the fascial and muscle layers are affected. On the other hand, organ/space SSI involves any part of the anatomy beyond the incision that has been manipulated or opened by the surgeon[4].

In Brazil, SSI ranks third among all infections present in health services and covers 14 to 16% of infections in hospitalized patients; 93% of these are severe, invading organs or spaces accessed during surgery, thus having an incidence rate of 11%[3]. Estimates of SSIs present an incidence of 2.3% and depend on the type of surveillance conducted, the characteristics of the hospital, the patient, and the surgical procedure[7].

It is evident that the SSI can be related to the presence of microorganisms, with bacteria being what most affect surgical incisions. Some of these pathogens are part of the skin flora itself in normal conditions; however, they become pathogenic under conditions favorable for their proliferation, thereby causing SSI[8].

As a strategy to prevent SSI, prophylactic antibiotic therapy is performed. However, many bacteria in the hospital environment have become resistant to most antibiotics used perioperatively due to exposure to these drugs, increasing hospital costs, as well as harming the recovery of the patient[9].

Given the above, this review has the following guiding question: what is the infectious microflora of surgical wounds described in scientific publications?

OBJECTIVE

This study aimed at identifying the microbiota present in surgical wound infections described by national and international scientific productions.

METHOD

This is an integrative review, which is an important tool for clinical practice, gathering results on a given topic and providing a deepening of the research theme.

The search was conducted in the following databases: *Literatura Latino-Americana e do Caribe em Ciências da Saúde* (LILACS), Medical Literature Analysis and Retrieval System Online (MEDLINE), Cochrane, and virtual libraries Scientific Electronic Library Online (SciELO) and SciFinder Scholar. The guiding question was the infecting microbiota in surgical wounds.

The study was conducted between September and December 2013, with no time frame. For the selection of the articles, the following Portuguese keywords were used: *bactérias; protozoários, vírus, fungos e infecção de ferida operatória*; in

English: bacteria, protozoan, viruses, fungi, surgical wound infection; and Spanish: *bacterias, protozoos, virus, hongos, infección de herida operatória*; all of which were included in DeCS (Health Sciences Descriptors).

Boolean operators OR and AND were used, and the crossing of descriptors in Portuguese, English, and Spanish was used as a research strategy, such as (*bactérias* OR *protozoários* OR *vírus* OR *fungos*) AND (*infecção de ferimento pós-operatório* OR *infecção da ferida operatória* OR *infecção de ferida pós-operatória*).

Inclusion criteria for selection were: articles published in Portuguese, English, or Spanish that portrayed in full the theme of the study. Items that do not relate to surgical wound infection and duplicates were excluded. Studies found in more than one database were considered only once.

For the analysis of the articles, the following variables were selected: title of the articles, authors, country, journal, database, publication year, qualification of the authors, language, professional area, approach, study type, classification of the surgeries, and types of surgeries infected.

The articles that met the inclusion criteria were analyzed using a form that included identification information for each article, in order to consolidate all the results presented in scientific production.

RESULTS

A total of 278 articles were found with the search in the databases, among which 56 articles met the search criteria. The bibliometric profile of the 56 studies included in the review was plotted and is shown in Table 1.

Most of the studies had a quantitative approach (94.6%), among which the exploratory descriptive studies were predominant (85.7%), and 71.4% were published in journals with international distribution.

Regarding the general theme, all articles dealt with different surgeries that presented SSI. Surgeries were classified and identified according to their site as shown in Table 2.

The microbiota responsible for the infection in these surgeries has also been identified and analyzed, and the main infectious microorganisms from surgical wounds described in the scientific productions were bacteria, followed by fungi (Tables 3 and 4).

The infections most cited in scientific publications were mainly caused by: *Staphylococcus aureus* (39.28%), *Escherichia coli* (30.35%), *Pseudomonas aeruginosa* (19.64%), *Staphylococcus epidermidis* (17.85%), *Klesbsiella* spp (12.50%), *Enterobacter* spp (10.71%), *Morganela morganii* (8.92%), and *Bacteroides* spp (7.14%). It is observed that the main microorganism in surgical wound infections were Gram-negative bacteria, which have a tendency to resist to the therapy used.

Table 1. Bibliometric profile of the studies analyzed.

Variable	n (%)
Database	
Cochrane	29 (51.8)
LILACS	25 (44.6)
SciELO	2 (3.6)
Continents	
North America	13 (23.21)
Central America	5 (8.92)
South America	20 (35.71)
Europe	11 (19.64)
Asia	7 (12.5)
Decades	
1960 – 1969	1 (1.80)
1970 – 1979	2 (3.60)
1980 – 1989	11 (19.6)
1990 – 1999	8 (14.3)
2000 – 2009	22 (39.3)
2010 – 2013	12 (21.43)
References	
International	40 (71.4)
National	16 (28.6)
Academic education	
Doctor	153 (62.4)
Nurse	8 (3.3)
Dentist	8 (3.3)
Chemist	3 (1.2)
Unspecified	73 (29.8)
Approach	
Quantitative	53 (94.6)
Qualitative	3 (5.4)
Study design	
Descriptive exploratory	48 (85.7)
Review study	4 (7.1)
Experimental	2 (3.6)
Experience report	1 (1.8)
Observational	1 (1.8)

Table 2. Classification and identification of the types of surgeries found in the studies analyzed.

Variable	n (%)
Classification of surgeries	
Deep	32 (37.6)
Superficial	32 (37.6)
Organ/space	21 (24.8)
Types of surgeries infected	
Digestive tract	27 (31.73)
Cardiothoracic	15 (17.64)
Orthopedic	15 (17.64)
Head and neck	9 (10.6)
Abdominal	9 (10.6)
Urologic	1 (1.17)
Unspecified	9 (10.58)

Table 3. Percentage of surgical site infection by Gram-positive bacteria identified in the scientific publications.

Microorganisms	%
Staphylococcus aureus	39.28
Staphylococcus epidermidis	17.85
Staphylococcus coagulase-negativa	10.71
Staphylococcus spp	12.50
Staphylococcus haemolyticus	3.57
Staphylococcus saprophyticus	1.78
Staphylococcus capitis	1.78
Streptococcus pyogenes	1.78
Staphylococcus hominis	1.78
Streptococcus viridans	3.57
Streptococos pneumoniae	1.78
Streptococcus pyogenes	1.78
Streptococos spp	5.35
Corynebacterium minutissimum	1.78
Corynebacterium bovis	1.78
Corinebactérias	1.78
Clostridium innocuum	1.78
Enterococcus spp	10.71
Enterococus faecalis	7.14
Peptococcus spp	3.57
Peptostreptococci	7.14
Propionibacterium spp	1.78
Propionibacterium acnes	3.57
Pneumococus spp	1.78
Eubacterium lentum	1.78

Table 4. Percentage of surgical site infection by Gram-positive bacteria, identified in the scientific publications.

Microorganisms	%
Acinetobacter baumanii complex	3.57
Acinetobacter baumannii	1.78
Acinetobacter spp	3.57
Acinetobacter calcoaceticus	5.35
Bacteroides fragilis	7.14
Bacteroides spp	7.14
Bacillus spp	1.78
Cedecea lapagei	1.78
Escherichia coli	30.35
Enterobacter spp	10.71
Enterobacter cloacae	7.14
Enterobacter aerogenes	1.78
Klebsiella spp	12.5
Klebsiella pneumoniae	5.35
Klebsiella ornithinolytica	1.78
Klebsiella oxytoca	1.78
Morganella morganii	8.92
Mycobacterium massiliense	1.78
Mycobacterium abscessus	1.78
Mycobacterium chelonae	1.78
Mycobacterium fortuitum	1.78
Melaninogenicus bacillus	1.78
Micrococcus luteus	1.78
Pseudomonas aeruginosa	19.64
Pseudomonas epiderme	1.78
Pseudomonas spp	5.35
Proteus spp	3.57
Proteus mirabilis	7.14
Proteus vulgaris	3.57
Serratia marcescens	3.57
Serratia spp	3.57
Sphingomonas paucimobilis	1.78
Salmonella spp	1.78
Veillonella	3.57
Haemophilus influenzae	3.57
Fusobacterium	1.78
Moraxella	1.78
Thetaiotaomicron bacteroides	1.78

DISCUSSION

Although there has been progress with the development of antibiotic therapy in the treatment of nosocomial infections, it is observed that surgical incision infections are still a concern, especially when the dehiscence of the wound occurs[10].

Infection with microorganisms at the surgical site is increasingly becoming a health problem, particularly infections caused by *E. coli*, *S. aureus,* and *P. aeruginosa*, which can cause complete surgical dehiscence without evisceration, abscess, retarding of the healing process, and death by septic shock and/or pneumonia[11].

Destitution and bacterial growth are the main prerequisite for the development of infection as well as the kind of microorganisms and toxins synthesized by them. Many pathogens have specific components that increase its virulence, such as *Klebsiella* spp and *Streptococcus pneumoniae* capsules, the endotoxins of gram-negative bacteria *Pseudomonas sp*, *Acinetobacter baumannii,* and *Bacillus* spp, exotoxins of streptococci, biofilms of *S. aureus* and *S. epidermidis*, contributing to antibiotic resistance[12].

Of the Gram-positive pathogens, *S. aureus* is responsible for many hospital infections that are usually transmitted by direct or indirect contact, from the patient's own normal skin flora, or by migration during the end of the procedures. In many cases, it can also have high resistance to antibiotics. Its severity and occurrence depend essentially on the triple relationship: host susceptibility, resistance, and quantity of microorganism[13].

Studies show that the pathogens of the SSI microbiology vary depending on the type of operation and the procedures performed. *S. aureus* was the most prevalent microorganism isolated in SSIs, followed by *K. pneumoniae*, *E. coli,* and *Klebsiella ozonae*[14].

Some authors have identified in their research a total of 343 bacterial colonies (average of 1.5 per patient), by 13 different resistant microorganisms, and the most common 5 accounted for more than 90% of cases (*A. baumannii*, 36.3%; *P. aeruginosa*, 21.9%; methicillin-resistant *S. aureus*, 14.7%; *Klebsiella pneumoniae*, 11%; and *E. coli*, 7.8%). However, this does not denote that the infections were caused by the resistant microorganisms isolated, only that the colonization were in many cases associated with the presence of these or other microorganisms in developed infections[15].

Other microorganisms that were not resistant became evident; however, they demonstrated their ability to be responsible for nosocomial infections, the most common being *Candida albicans* (18,5%), *E. coli* (15.1%), *P. aeruginosa* (8.9 %), *Enterobacter cloacae* (8.2%), and *Enterococcus faecalis* (8.2%). Among the more common resistant microorganisms that cause nosocomial infection are *A. baumannii* (35.1%), *P. aeruginosa* (21.6%), *K. pneumoniae,* and *E. coli* (10.8%)[15].

Although Gram-positive bacteria are the main causal agents, there are wide variations, and each service must know the microbiota related to health care. Other agents besides the germs are various contaminants from exogenous sources, such as instruments and prostheses[16].

With regarding to the determination of the specific site of the SSI, the sample showed that the superficial and deep categories showed the same quantity, followed by organ and space, both in-hospital and after discharge. Thus, during the hospitalization period, in the superficial and deep category, a total of 37.6% of infections was recorded, and, in the organ or space, 24.8%. These results do not support other studies, which have recorded 87.5% in superficial and 12.5% in deep SSI, with no SSI record of organ or space. The same study also shows that, in the postdischarge period, the total percentage of SSI diagnosed was 91.6% in the superficial category, 4.2% in deep and 4.2% for organ/space[17].

It is known that SSI is multifactorial; therefore, for the purpose of reducing the SSI rates, prophylactic measures should be provided, such as surgical antisepsis of the hands and forearms, justified by a rate of perforation of gloves by the end of surgery of 66.7%, as such perforations are not observed by the professionals at the end of the procedure. Other measures can also be taken, such as the appropriate time for the removal of hair, when needed; choice of antimicrobial prophylaxis related to the time of administration; nonuse of hand or forearm accessories by surgeon teams and the proper use of surgical mask, sterile coat/gown[18].

Investing in education in order to improve the assistance and the involvement of professionals in the implementation of preventive measures for SSI are essential to the full incorporation of the recommendations against SSI in the care of surgical patients[19].

CONCLUSION

In the face of the articles analyzed, it was found that surgeries with highest number of infections on the surgical site are those performed in the digestive tract, followed by cardiothoracic and orthopedic surgeries.

Gram-negative bacteria are the organisms most cited in the studied articles as responsible for infection of surgical incisions. However, *S. aureus* was the most present microorganism in infected surgical incisions that was mentioned in the scientific publications analyzed.

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SURGICAL POSITIONING: NURSING CARE IN THE TRANSOPERATIVE PERIOD

Posicionamento cirúrgico: cuidados de enfermagem no transoperatório

Posicionamiento quirúrgico: cuidados de la enfermería en el período transoperatorio

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ABSTRACT: During the operation room activities, it was observed that the nursing team did not actively perform patient positioning on the operating table, which encouraged us to investigate the issue. Objective: To identify the nursing care routine in patient positioning, reporting complications. **Methods:** This is an integrative literature review, with search in LILACS (*Literatura Latino-Americana e do Caribe em Ciências da Saúde*) and SciELO (Scientific Electronic Library Online) databases, from August to September 2014. **Results:** We found 20 articles and selected 10 according to the criteria. **Conclusion:** The positioning can cause complications, with pressure ulcers being the most frequent. Effective interventions are those that relief the pressure during the patient's stay at the table. The nurse is responsible for nursing care and, together with the team, for actively promoting actions that ensure patient safety, considering the circumstances and available resources.

Keywords: Patient positioning. Nursing care. Pressure ulcer.

RESUMO: Durante a atuação em centro cirúrgico observou-se que a enfermagem não atuava no posicionamento do paciente na mesa cirúrgica, o que nos incentivou a investigar sobre o tema. **Objetivo:** Identificar os cuidados de enfermagem no posicionamento, relatando as complicações. **Método:** Trata-se de revisão integrativa da literatura, com busca nos bancos de dados LILACS (Literatura Latino-Americana e do Caribe em Ciências da Saúde) e SciELO (*Scientific Electronic Library Online*), no período de agosto de 2004 a setembro de 2014. **Resultados:** Foram encontrados 20 artigos e selecionados 10 conforme critérios. **Conclusão:** O posicionamento pode ocasionar complicações, sendo a úlcera por pressão a mais frequentemente apontada. As intervenções eficazes são aquelas que aliviam as pressões durante a permanência na mesa. O enfermeiro é o responsável pelos cuidados de enfermagem e juntamente com a equipe deve promover ações que garantam a segurança do paciente, considerando as particularidades e os recursos disponíveis.

Palavras-chave: Posicionamento do paciente. Cuidados de enfermagem. Úlcera por pressão.

RESUMEN: Durante la actuación en el centro quirúrgico, se observó que la enfermería no trabajaba en el posicionamiento del paciente en la mesa quirúrgica, lo que alentó a investigar la cuestión. **Objetivo:** Identificar los cuidados de enfermería en el posicionamiento, haciendo un informe sobre las complicaciones. **Método:** Se trata de una revisión integradora de la literatura, utilizándose la búsqueda en las bases de datos LILACS (*Literatura Latino-Americana e do Caribe em Ciências da Saúde*) y SciELO (*Scientific Electronic Library Online*), en el período comprendido entre agosto de 2004 hasta septiembre de 2014. **Resultados:** Se encontraron 20 artículos y se seleccionaron 10 de ellos, basándose en criterios. C**onclusión:** El posicionamiento puede causar complicaciones, y las ulceras por presión son las más frecuentes reportadas. Las intervenciones eficaces se relacionan con el alivio de las presiones en la mesa quirúrgica. El enfermero es responsable por los cuidados de enfermería y debe promover acciones juntamente con su equipo que garanticen la seguridad del paciente, teniendo en cuenta las particularidades y los recursos disponibles.

Palabras clave: Posicionamiento del paciente. Cuidados de enfermería. Úlcera por presión.

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INTRODUCTION

Perioperative nursing is a concept that has been consolidating in Brazil. Its sense is broad, covering the preoperative, intraoperative, and postoperative periods[1]. In this context, perioperative nursing is based on six principles: integrity, individuality, participation, continuity, documentation, and evaluation[2].

The nurse is responsible for planning and implementing nursing interventions to prevent complications from anesthesia and surgery, assisting the patient together with the multidisciplinary team, that is, with the surgeon, the anesthesiologist, and nursing technicians. They decide the best positioning for the patient, thus facilitating the activities during the anesthetic and surgical procedures. Thus, the nurse identifies the anatomical and physiological changes of the patient associated with the type of anesthesia, surgical time, and procedure to be carried out, to avoid complications in the postoperative period[3].

Patients may spend a long time on the operating table, undergoing the effects of analgesics and muscle relaxants, which, although necessary, submit the patient to a condition of frailty and physical dependence[4]. There is still the need to put and keep the patient in different positions that meet the requirements of the operative technique and expose the surgical site. Therefore, carefully planned actions must be carried out by the nursing staff, in order to obtain success in the anesthetic-surgical procedure[1,3,5].

The surgical patient positioning is an act that requires competence and must be precise and judged as a major factor in the safe surgical procedure[5], which is a key factor for the promotion of welfare and security, preventing adverse events[6]. In this context, care planning, teamwork, and the use of devices and positioning equipment specific for each patient are essential to perform the positioning with quality[3,4]. Therefore, records and documentation of all care delivered, mobilization, protection features used, sites and clinical condition of the patient are crucial[2].

It is especially incumbent upon nurses to implement the care that best suits the patient and to recognize the risk factors related to surgical positioning, so that they can take effective measures to contribute to the recovery[4].

The interest in conducting this study was due to observations in the operating room, as a surgical instrumentation technician, of occasional failures of the circulating nurses to participate in this procedure, perhaps for lack of scientific evidence on the positioning and the complications it can cause if not performed properly. This fueled the desire to investigate the literature in order to provide more support for the nursing staff in the operating rooms.

Given the above, the objective of this study is to identify the literature on nursing care related to surgical positioning of adult patients during the transoperative period.

METHODS

The method adopted in this study was the integrative literature review, a resource of evidence-based practice, which allows the synthesis and analysis of scientific knowledge produced on the subject investigated[8]. It is a method that calls for the use of research results for the nurse's decision-making process in their daily practice[8]. For the development of the integrative review, six stages were covered, which will be discussed further.

The first stage is the formulation of the guiding question: What are the care activities performed by the nursing team regarding adult patient positioning in the transoperative period?

In the second stage, surveys were conducted in the LILACS (*Literatura Latino-Americana e do Caribe em Ciências da Saúde*) and SciELO (Scientific Electronic Library Online) databases, from August 18 to September 30, 2014, using the keywords: "posicionamento do paciente" (patient positioning) and "enfermagem" (nursing). Inclusion criteria were articles published in Portuguese, with text available in full and which were published from 2004 on. Exclusion criteria were articles that were not compatible with the purpose of this integrative review and duplicates.

In the third stage, the information was extracted from articles to be included in the integrative review and a database containing the relevant information was developed.

In the fourth and fifth stages, we evaluated the articles, and the topics that emerged from the reading were discussed.

Finally, the sixth stage included the analysis of the selected articles. It is noteworthy that both the analysis and synthesis of information extracted from articles were made in a descriptive manner, which allowed observing, describing, and classifying the information, in order to gather knowledge on the topic selected for this review[9].

RESULTS

With regard to the descriptor "posicionamento do paciente", 161 articles were found, 112 in the LILACS database and 46 in the SciELO database. Combining with the descriptor "enfermagem", 20 articles were found, 15 in the LILACS database and 2 in the SciELO database. Moreover, three articles were found that were published in a specific magazine about nursing in the operating room, which were used in this review, as shown in Table 1. Of the 20 studies found, 10 were used for the integrative review, after application of preestablished criteria, as shown in Table 2.

Of the 10 (100%) studies included in the review, 5 (50%) were field researches with a quantitative approach, 3 (30%) were integrative literature reviews, and 2 (20%) were systematic literature reviews. Regarding the types of journals these articles were published in, the nursing journals stand out with the largest number of publications, 9 (90%). Regarding the authors of the study, all are nurses (100% of the sample). Among the places of origin of the publications, São Paulo was the predominant location, with 8 (80%) articles. The year of 2011 was the one with most publications, with 4 (40%) studies.

Chart 1. Results of searches in databases by descriptor – São Paulo, 2014.

Descriptors	Database			
	LILACS	SciELO	Others	Total
Patient Positioning	112	46	3	161
Patient Positioning and Nursing	15	2	3	20

Chart 2. Presentation of the summary of selected articles – São Paulo, 2014.

Authors (year)	Journal/ location	Type of study	Article summary
Matos FGO, Picoli M (2004)	Ciência, Cuidado e Saúde/ Maringá (PR)	Quantitative	The sample consisted of 30 surgical patients of both sexes, aged between 20 and 60 years. During follow-up of patients in the perioperative period, the nursing diagnosis of Risk for Perioperative Positioning Injury was identified in 100% of the sample. The main recommendations are: each operating room must have an individual temperature control to adapt it to the needs of the patient, keeping the patient covered to avoid unnecessary heat loss and making use of heated solutions.
Ursi ES, Galvão CM (2006)	Rev. Latino-Am. Enfermagem/ Ribeirão Preto (SP)	Integrative literature review	The sample consisted of 14 articles selected in CINAHL and MEDLINE databases. In the review, the results of the articles indicated that the devices considered most effective in preventing skin lesions were micropulsating air mattress, the dry viscoelastic polymer mattress cover, and gel pads.
Lopes CMM, Galvão CM (2010)	Rev. Latino-Am. Enfermagem/ Ribeirão Preto (SP)	Integrative literature review	The sample consisted of 20 articles selected in the PubMed, CINAHL, and LILACS databases. All articles reviewed showed that the surgical patient positioning causes some negative impacts on bodily systems and can cause complications such as musculoskeletal pain, dislocation of joints, damage to peripheral nerves, skin lesions, cardiovascular and lung involvement, and even compartment syndrome.
Scarlatti KC, Michel LM, Gambas MA, Gutierrez MGR (2011)	Rev. Esc. Enferm. USP/São Paulo (SP)	Quantitative	The sample consisted of 199 patients. Of these 199, 20.6% showed pressure ulcers (PUs), 98.6% in stages I and II, with the front torso being the predominant location (35.1%). The variables, position, duration of surgery, general anesthesia, and use of devices showed a statistically significant association.
Grigoleto ARL, Avelar MCQ, Lacerda RA, Mendonça SHF (2011)	Esc. Anna Nery/São Paulo (SP)	Systematic literature review	The sample consists of seven studies selected in the PubMed/MEDLINE, Ovid, CINAHL, Cochrane, and LILACS databases. It can be inferred that the responsibility of the nurse with the other team members in the operating room is first to evaluate the client as a whole, as well as to observe the conditions of the support brackets, the time of use during the procedure, and any changes that might be related to the positioning on the operating table.

Continue...

Chart 2. Continuation.

Authors (year)	Journal/ location	Type of study	Article summary
Barbosa MH, Oliva AMB, Sousa Neto ALS (2011)	Revista Cubana de Enfermería/ Uberlândia (MG)	Quantitative	The sample consisted of 50 adult patients who underwent surgeries in different specialties. It was observed that 37 (74.00%) patients had skin lesions at the end of the surgical procedure, all classified as Grade I. The perioperative nursing care to the surgical patient is a responsibility of the nurse, and the positioning is one of the key factors for obtaining a safe and effective procedure.
Carneiro GA, Leite RCBO (2011)	Rev. Esc. Enferm. USP/São Paulo (SP)	Quantitative	The sample consisted of 182 patients. The incidence of patients undergoing cardiac surgery who developed skin lesions owing to the intraoperative period was of 20.9%. A total of 19.2% of the lesions were presented as PUs in stage I; 1.1% of the lesions were characterized as abrasion; 1.1%, incised wounds; 0.5%, lacerations; 0.5%, superficial electrical burn; and 0.5%, stage II PUs. This work reveals the incidence of skin lesions in the intraoperative period on a small number of patients but urges nurses to think more carefully about the type of assistance they will provide to the patient.
Rodrigues RTF, Lacerda RA, Leite RB, Graziano KU, Padilha KG (2012)	Rev. Esc. Enferm. USP/São Paulo (SP)	Integrative literature review	The sample consists of 12 articles selected in electronic databases. The analysis of the articles led to the conclusion on the relevance of studies to primarily evaluate the impact and resoluteness of resources in meeting the needs, as well as improvement or generation of other innovative resources.
Bentlin AC, Grigoleto ARL, Avelar MCQ, Sundfeld MCK (2012)	Rev. SOBECC/São Paulo (SP)	Quantitative	The sample consisted of 14 elderly individuals of both sexes. Of these, 6 showed skin alterations, which were not present in the first stage of the study (hyperemia, abrasions, and bruises). These elderly individuals remained at the operating table for about 50–130 minutes without the proper protection features.
Sergio FR, Cameron LE, Vital ICO (2012)	Rev. SOBECC/São Paulo (SP)	Systematic literature review	The article presents the importance of the nurse's role in the early recognition of complications arising from surgical positioning, contributing to disease prevention. Among the risk factors for the development of compartment syndrome are: obesity, peripheral vascular disease, prolonged surgery (longer than 3 hours), and the lithotomy position.

DISCUSSION

Three main topics were found during the assessment of the articles, namely:

1. risk factors for the development of complications;
2. complications arising from surgical positioning; and
3. nursing care related to the surgical positioning of the patient.

This integrative review provides health-care professionals with detailed information about the aforementioned topics.

Risk factors for the development of complications

Preexisting conditions should be considered when planning nursing care to surgical patients, especially those affecting the vascular, respiratory, circulatory, neurological, and immune systems[5]. All risk factors should be identified in the preoperative evaluation and documented, contributing to the care plan[3].

Surgical patients are the first candidates to developing skin lesions intraoperatively, owing to decreased capillary blood flow, prolonged immobility, and pressure[2]. One of the most common complications is the development of pressure ulcers (PUs). There are several risk factors related to the pathogenesis of PUs that develop during surgical procedures and can be grouped into intrinsic and extrinsic factors. Among the intrinsic factors are: age (very young and elderly individuals may have more sensitive skin), body weight (overweight and underweight may lead to an increase in the incidence of lesions), nutritional status (malnutrition and dehydration), and chronic diseases such as diabetes mellitus, vasculopathy, neuropathy, hypertension, and anemia.

Among the extrinsic factors are, type and duration of surgery (procedures lasting longer than 2 hours can impair the oxygenation of compressed tissues), anesthesia (loss of compensatory physiological protection), problems in controlling body temperature (hypothermia causes body structures to depend more on oxygen, and the lack of necessary supply may favor the appearance of lesions), surgical positions, and immobilization owing to positioning.

Some positions associated with patient characteristics may increase the risk of complications, such as the lithotomy position on an obese patient, which may compromise their respiratory function and may even cause compartment syndrome. Thus, all surgical patients should be considered at high risk for developing PUs[3,7,10].

Complications resulting from surgical positioning

The volume of the pulmonary capillary blood flow decreases with prolonged immobility. Lung expansion is limited by the position's pressure on the ribs or the by ability of the diaphragm to force the abdominal contents down. Anesthesia causes peripheral vasodilation, resulting in hypotension and decreasing venous return. It also reduces the ability of the normal defenses to protect against excessive manipulation[2].

Undoubtedly, the skin as a natural barrier is the organ more prone to injuries arising from surgical positioning, with erythema, bruising, risk of PUs, electrical burns, injuries from chemical substances, and focal alopecial[4]. The tissue and skin may be injured owing to excessive pressure or bruising owing to contact with a hard surface. The external pressure of 32 mmHg is considered the threshold. Besides this, the small vessels collapse, causing thrombosis, which results in the occlusion of tissue blood flow and deprivation of enough oxygen and nutrients. Therefore, the production of toxic metabolites occurs at the cellular level, leading to tissue acidosis, increased capillary permeability, edema, cell death, and formation of PUs[3]. PUs, as any lesion caused by unrelieved pressure resulting in damage to the tissues, usually occur in areas of bony prominences and are graded in stages I, II, III, and IV. In addition to the PUs, other aggressive events are present in the operating environment that could affect the patient, such as electrical burns owing to the use of electrocautery[8].

The analyzed studies showed that surgical patient positioning can cause some negative impact on body systems, causing various complications, such as musculoskeletal pain, dislocation of joints, damage to peripheral nerves, skin lesions, cardiovascular and lung involvement, and even compartment syndrome[3].

Compartment syndrome, although being most often associated with trauma, has been reported as a consequence of surgical placement during prolonged surgeries. It is characterized by an increase in pressure within a body compartment, which reduces capillary perfusion below a level necessary for the tissues viability, leading to ischemia. This may cause a permanent neuromuscular deficit if there is a delay in diagnosis and treatment, consisting in performing decompressive fasciotomy[7].

The presence or installation of pathological processes may result in changes that cause impairment of its functional structure, and, consequently, increased hospital stay for treatment[5].

Nursing care related to surgical positioning of the patient

Patient positioning for surgery is essential to perform a safe and efficient procedure, so all team members should protect patients from any harmful effects resulting from improper positioning. Nurses, along with other members of the team, are responsible for first evaluating the patient as a whole, observing the conditions of the support brackets and any situation that could compromise patient positioning on the operating table and cause complications[5,7].

Effective interventions in the prevention of skin lesions are related to the relief of pressure during and immediately after the patient's stay on the operating table, on the standard mattress[5]. The most effective devices in preventing skin lesions, in descending order, are: micropulsing air mattress, dry viscoelastic polymer mattress cover and gel pads[8].

The use of protective features in patient positioning during surgery ensures the maintenance of the integrity of skin and osteoarticular and neuromuscular pressures, aiming to avoid friction, thus preventing skin lesions such as PUs, neuromuscular compression, or stretches, and contact with the desk metal, which can cause burns (due to the use of electrocautery) and other damages[6].

The studies that were analyzed presented nursing care in the surgical positioning of the patient and the recommendations according to the positions on the operating table, listed further.

Dorsal decubitus or supine position: padding the calcaneus, the sacrum and coccyx, the olecranon, the scapula, the ischial tuberosity, and the occiput. Keeping arms at the sides of the body with palms facing down (pronation) or forming a "cross" with an arm supported by a splint in an angle lower than 80° relative to the body, in order not to cause stretching of the muscles and nerves in this region, as well as compression of the subclavian and axillary arteries under the choroid process of the scapula or compression between the clavicle and the first two ribs. No tourniquetting the extremities to secure hands. The sheet of the surgical table can be used to secure the arms in their entire length and prevent that they are, if it that is the case, pending to the sides of the table. The head should be aligned with the spine and the hip. A small cushion under the head allows the relaxation of the trapezius muscle and prevents stretching of the neck; bending and twisting can cause contractures and interfere with the airway patency. The lower limbs (LL) must remain extended and feet slightly apart[3,6].

Ventral decubitus or prone position: protecting the hips and thighs with big pillows. Protecting the breasts. Accommodating male genitalia in a lateral position. Protecting the back of the feet, the shoulder girdle, the olecranon, the iliac spine, and the patella[3].

SIMS (lateral) position: maintaining spinal alignment, observing the ears, placing a support under the head, the armpit region, and between the legs, keeping the leg in contact with the table flexed at the hip and the upper one stretched. Using an adhesive tape of 10 cm width fixed to one side of the table, over the iliac crest, to the other side[2,3].

Lithotomy: using padding on the stirrups. Having two people slowly lift the legs with a slight rotation of the hips, positioning knees with a slight flexion. Covering the legs with cotton boots. Placing arms on the splints or relaxed over the abdomen, supported by a sheet. Slowly reversing the positioning to favor the physiological adaptation of the organism to a new position since the abrupt change can cause severe hypotension owing to sudden change of the circulatory flow. Coating the metallic leg protectors with soft cushions, with height adjusted to the length of the patient's lower limbs, positioning the two legs at the same time, that is, two professionals must be performing the procedure, also caring for a safe and slow positioning, flexing knees and supporting one hand on the foot plant region[3,6].

Each operating room must have an individual temperature control to adapt it to the needs of the patient, and body temperature should be maintained above 35.5°C[1].

It is worth mentioning that there are limitations to this study owing to the absence of specific and current articles on the subject. It is important to conduct further studies using protective devices to prove their effectiveness in preventing complications from patient positioning on the operating table.

CONCLUSION

We can conclude that nursing care during surgery is vitally important, given that the evaluation of the patient is carried out considering the risk factors for developing complications that can compromise their physical integrity. Several factors may contribute to the occurrence of adverse events, including some characteristics of the patient, such as age, weight, nutritional status, and preexisting conditions. The nurse, as a professional responsible for the patient in the operating room, must ensure their safety and protection, making use of the SAEP (Systematization of Perioperative Nursing Care), which is an available, indispensable and highly important tool. This tool allows a better assessment, as well as a full assistance according to the needs of the patient, consisting of different phases, which, if well developed, constitute an individualized and quality nursing care. These phases are: anamnesis and physical examination, nursing diagnosis, care plan, nursing prescription and, hence, the evolution of nursing based on a correct assistance.

It is important for nurses to be prepared to prevent complications that may occur, from burns and skin injuries to the impairment of nerves and tissues owing to improper positioning on the operating table or even a severe hypotension caused by the physiological response to the position, because if they occur and are not diagnosed quickly, they may cause serious damage to the patient.

Nurses should promote actions to prevent complications from the anesthetic-surgical procedure, monitor the patient at all stages of their treatment, provide all the necessary resources for a successful procedure, and oversee all nursing team's actions. For this, it is necessary to keep constantly updated and promote continuing education to its employees.

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NURSING CLINICAL PRACTICE IN MECHANICAL CIRCULATORY SUPPORT: SEARCH FOR EVIDENCE

Prática clínica do enfermeiro em assistência circulatória mecânica: busca de evidências

La práctica clínica de enfermería en soporte circulatorio mecánico: búsqueda de pruebas

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ABSTRACT: Objective: To analyze the scientific literature regarding the clinical practice of nurses in patients using mechanical circulatory support. **Method:** Integrative literature review was conducted from the databases of SciELO, Cochrane Library, PubMed, and LILACS, from April to August 2014. **Results:** Although there is a progress in the research on this topic, there are only few studies, of which eight articles were selected. Three articles point out the need of the nurses to detain knowledge about mechanical circulatory support for an effective and good service. Two articles approached the nursing care in patients using device. Three studies reported complications because of the use of intra-aortic balloon pump and showed that complications can be minimized through training and periodic clinical assessment of the nurse. **Conclusion:** There are only few articles that focused on nursing care; therefore, there is a need to further explore this theme to subsidize the practice based on scientific evidence.

Keywords: Nursing. Heart failure. Heart-assist devices. Assisted circulation.

RESUMO: Objetivo: Analisar na literatura científica a prática clínica do enfermeiro ao paciente em uso de assistência circulatória mecânica. **Método:** Revisão integrativa da literatura realizada nas bases de dados SciELO, Cochrane Library, PubMed e LILACS, de abril a agosto de 2014. **Resultados:** Embora haja avanço em pesquisas sobre o tema, ainda há poucos estudos, haja vista oito artigos selecionados. Três artigos apontam para a necessidade do enfermeiro deter o conhecimento sobre assistência circulatória mecânica, para uma assistência eficiente e com qualidade. Dois artigos trouxeram a assistência de enfermagem a pacientes em uso de dispositivos. Três relataram complicações devido ao uso do balão intra-aórtico e mostraram que as complicações podem ser minimizadas a partir da capacitação e da avaliação clínica periódica do enfermeiro. **Conclusão:** Há poucos estudos direcionados à assistência de enfermagem, havendo a necessidade de maior exploração do tema para subsidiar a prática baseada em evidências cientificas.

Palavras-chave: Enfermagem. Insuficiência cardíaca. Coração auxiliar. Circulação assistida.

RESUMEN: Objetivo: Analizar en la literatura científica la práctica clínica de las enfermeras a los pacientes utilizándose del soporte circulatorio mecánico. **Método:** Revisión integradora de la literatura conducida en las bases de datos SciELO, *Cochrane Library*, PubMed y LILACS, desde abril hasta agosto de 2014. **Resultados:** Aunque hay avances en la investigación sobre el tema, hay pocos estudios, con solo ocho artículos seleccionados. Tres artículos apuntan a la necesidad de las enfermeras detener los conocimientos sobre soporte circulatorio mecánico para el servicio eficiente y de calidad. Dos artículos presentaron la atención de la enfermería a los pacientes que utilizan dispositivos. Tres estudios informaron complicaciones por la utilización de balón intra-aórtico y mostraron que las complicaciones pueden reducirse al mínimo basándose en la formación y la evaluación clínica periódica de la enfermera. **Conclusión:** Hay pocos estudios con foco en la atención de la enfermería, y una necesidad de una mayor exploración del tema, para subsidiar la práctica basada en evidencias científicas.

Palabras clave: Enfermería. Insuficiencia cardíaca. Corazón auxiliar. Circulación asistida.

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INTRODUCTION

Recognized by its high rate of morbidity and mortality, heart failure (HF) is a clinical syndrome in which there is a functional or structural change of the heart that results in a dysfunction in the ejection or accommodation of blood within physiological pressure values[1].

This syndrome has a high incidence and prevalence worldwide, thus resulting in two million cases every year with decrease in quality of life[2]. It has been estimated that 1 to 2% of the population presents HF in developed countries; and in Europe, in about ten million people, this diagnosis is associated with ventricle dysfunction[1,2].

In Brazil, around 6.4 million subjects have an HF condition, which was the main cause of hospitalization in patients aged above 60 years and the third cause of hospitalizations in the Brazilian Unified Health System (SUS, acronym in Portuguese) in the year of 2007[3]. Hospitalization costs because of HF result in 60% of the total cost of treatment for this syndrome[3].

Ventricle remodeling (structural, biochemical, molecular, and cellular changes)[4-6] happens throughout the years, which can be made reversible by using devices of mechanical circulatory support (MCS) that provide a reverse remodeling[7].

The use of such devices was proven to be efficient, when compared with the clinical treatment, in a prospective and randomized study named Rematch[8]. This investigation was carried out in 129 patients, who were submitted to the left ventricle support device, and who presented HF without indication for heart transplantation or refused to undergo the procedure. As a result, a better evolution in the patients using the device, that is, destination therapy, was observed, compared with those patients who underwent a clinical treatment exclusively.

When this circulatory support is used as a temporary support in a myocardium considered viable, it is referred as "bridge to recovery." However, if the myocardium is unrecoverable and heart transplantation is crucial, circulatory support is referred as "bridge to transplantation", and if heart transplantation is not indicated or the patient refuses to undergo the procedure, it is referred as "destination therapy"[9].

This kind of treatment aims at reestablishing hemodynamics, improving symptoms by means of the increase of organ perfusion, preventing myocardial lesion, and improving patients' functional capacity[10,11].

Thus, the devices for HF treatment associated with ventricle dysfunction have been increasingly used as a bridge to heart transplantation in patients with myocardial failure, besides being used in the myocardial readaptation, restoration of cardiac output, acute myocardiopathy, acute myocardial infarction, postcardiotomy cardiogenic shock, infectious myocarditis, and transplantation rejection[9]. In most of the times, the patient who has undergone a heart surgery (myocardial revascularization, valve repair, corrective surgery, heart transplant) needs cardiopulmonary deviation using the extracorporeal circulation (CEC) machine. However, one of its complications is the difficulty in weaning off the CEC, the patient presents low cardiac output, intraoperative HF, and thus he or she needs to insert a MCS inside the operating room to improve the cardiac output[9].

Therefore, perioperative nurses should seek technical and scientific improvement to guide their actions regarding the use of these devices, to provide more safety to the critical patient, and to improve the quality of the provided service, because implementation and removal of devices can be done inside the operating room.

The MCS devices can be classified in several ways, as seen in Chart 1[8,9,11].

HF is a public health issue and because of its clinical and epidemiological aspects, as well as the tendency of searching for alternatives to treat HF and preserve life, this study is necessary to subsidize a safe nursing care in the operating room, in the postanesthetic recovery, and in the intensive care unit, and, as a consequence, to reduce the probability of adverse effects.

OBJECTIVE

To analyze the scientific literature for nursing clinical practice while using the MCS in the patients.

Chart 1. Classification of devices of the mechanical circulatory support.

Classification according to	Device
Flow type: Counterpulsation Continuous Pulsatile	 Intra-aortic balloon pump Roller, centrifuge, and axial Pneumatic and electric
Position in relation to the heart	Series or parallel
Assisted ventricle	Right, left, or biventricular
Grade of ventricle replacement	Total or partial
Position in relation to the patient	Para-corporeal or implantable
Period of permanence	<30 days – short duration 30 days to 1 year – medium duration >1 year – long duration

METHOD

This is an integrative review that followed the folowing steps: elaboration of the guiding question and objective for the integrative review; establishment of criteria to include and exclude studies (sampling); definition of information to be removed from the selected studies (study categorization); evaluation of the studies included in the integrative review; interpretation of results; and presentation of the results (knowledge synthesis)[12].

The guiding question used as basis for this integrative review was: What is the scientific production regarding the nursing clinical practice in patients using the MCS?

In the literature review, the Scientific Electronic Library Online (SciELO), Cochrane Library, *Literatura Latino-Americana e do Caribe em Ciências da Saúde* (LILACS) through the Health Virtual Library (BVS), and PubMed databases were consulted from the period of April 2014 to August 2014.

Based on the Medical Subject Headings (MeSH), the keywords used were nursing, heart failure, heart-assist device, ventricle assist device, and based on the Descritores em Ciências da Saúde (DeCS): *insuficiência cardíaca*, *coração auxiliar*, *circulação assistida* (in Portuguese). The PubMed and Cochrane Library databases used the keywords according to MeSH. On the other hand, SciELO used them according to MeSH and DeCS. In both the cases, the Boolean operator "AND" was used, thus applying all the possible combinations among the keywords.

The inclusion criteria were original articles in Portuguese, English, and Spanish languages published in the period from 2005 to 2014; studies in humans, adults (older than 19 years old), and elderly; both genders; systematic reviews; controlled randomized studies, quasi-experimental outline studies; and studies that portrayed interventions, guidelines, or procedures of nursing interventions in MCS.

The exclusion criteria included articles that were not available for full reading, and dissertations and theses.

In the first step, a search was done in the databases and the studies that met the objectives of this study were chosen, based on reading the titles and abstracts.

A total of 1,413 studies were found: 900 from PubMed, 391 from Cochrane, 114 from LILACS, and 8 from SciELO. Of these, 742 were not available electronically and 62 were repeated. In addition, only few articles met the all inclusion criteria; therefore, only 13 of them were included: 5 from LILACS, 7 from PubMed, and 1 from SciELO. Of these, five were repeated, so only eight articles were included in this study.

After choosing and reading the articles, an adapted instrument[13] of collection was used to gather the collected data comprising the following items: identification data of the original article (title, country, language, year of publication, study institution, journal), study methodological characteristics (type, objective), evaluation of methodology, measured interventions, and results obtained.

Two independent reviewers analyzed the studies. When both reviewers disagreed about the inclusion of a study, a third nurse reviewer was requested to intervene. The reviewers were not blind.

A scientific evidence level by kind of study was used from the Oxford Center for Evidence-based Medicine (CEBM) to classify the articles[14].

RESULTS

Eight articles were selected: two were published in 2013, two in 2012, one in 2011, two in 2009, and one in 2006. With regard to the publication location, two were from Brazil and six were from the United States. One study was published in the AORN Journal, one in the AACN Advanced Critical Care, one in the Heart Lung, three in the Progress in Transplantation, one in the *Revista Latino-Americana de Enfermagem*, and one in the *Acta Paulista de Enfermagem*.

All investigations had evidence level 5, which is a score for low scientific evidence.

To obtain a clearer analysis of the articles[10,15-19] that met the inclusion criteria, Table 1 shows the chosen articles with their titles, name of authors, studied interventions, results, and conclusions.

DISCUSSION

Although there have been advances in the investigations regarding MCS, there are only few studies related to nursing, given the number of articles chosen for this integrative review.

Oppositely, studies[10,15-19] point out the growing participation of nurses in the MCS care. A study[16] emphasized the increasing presence of nurses in the MCS programs in the United States, which is in agreement with another study[18] that pointed out the responsibilities, functions, and procedures performed by these professionals.

Among the eight selected studies, three studies (37.5%)[15,17] point out the need of knowledge by the nurses on the used MCS to achieve good and faster results for both the patients and the multiprofessional team. It is worth mentioning that in one of the

Table 1. Synthesis of the selected articles for this integrative review.

Article title	Authors	Studied Interventions	Results	Conclusions
Gastrointestinal bleeding in patients with assist devices: what every cardiac nurse should know[10]	Ballew CC, Surrat JF, Collins TL, Shah N	Possible causes, the group of diagnosis procedures, and treatments for gastrointestinal bleeding	Incidence of 13 to 44% of patients using ventricle support devices. Bleeding is present when using the continuous-flow device compared with the pulsatile one. Risk factor: advanced age. Treatment: cauterization, epinephrine injection, metal clips, bandages, or plasma use	The ventricle support devices are successful treatments at long term; however, there are some limitations for caregivers, patients, and family, as these patients, many times, have risk factors for bleeding.
Monitoring patients with continuous-flow ventricular assist devices outside of the intensive care unit: novel challenges to bedside nursing[15]	O'Shea G, Teuteberg JJ, Severyn DA	Describe the function of continuous-flow devices and how they affect the function of monitoring options, and how to clinically assess to quickly identify those whose condition might deteriorate	Despite all the technological advances, the most important monitoring device is still the "bedstead nurse."	The condition of each patient should be assessed according to their clinical records, and data follow-up is an additional piece of information to analyze
Practice pattern and professional nurse practitioners in mechanical circulatory support programs in the United States: a survey report[16]	Casida JM, Pastor J	Practice pattern and professional issues faced by nursing in the development of mechanical circulatory support programs in the United States	Most of the nurses were experts in heart surgery or intensive care, but not in transplant; 90% of the nurses were authorized to prescribe medications and procedures and 64% were authorized to provide hospital discharge; 96% of the nurses characterized it as a stressful work. Many of them pointed out lack of knowledge of evidence-based practice or guidelines. Only 2 of the 48 interviewed subjects mentioned being satisfied with such work.	Although the results are preliminary, data extended the existing information of this important group of nursing professionals, thus providing a script for future investigations and development of relevant policies for MCS programs in the United States
Complicações do balão intra-aórtico em uma coorte de pacientes hospitalizados: implicações para a assistência de enfermagem[17]	Assis RBS, Azzolin K, Boaz M, Rabelo ER	Complications because of IAB use by relating them to permanence time, to the presence of risk factors/ comorbidity, and nursing records	The mean of permanence with the IAB was 28 hours; 25% of the patients presented vascular complications. The male gender presented more complications. The higher the number of hours with the IAB, the higher the number of complications. Only 68.3% of the medical records reported using catheters. Only 28.8% of them presented an evolution, thus describing the presence of device, and 26.9% reported patient's conditions after their discharge.	The most frequent complications were vascular-related ones. Patients with more than 37 hours using the device presented more complications. The occurrence of complications might be minimized through periodical clinical evaluation and lab monitoring.
A survey of nurses in the mechanical circulatory support programs in the United States[18]	Casida JM, Ilacqua J	Role of nurses in mechanical circulatory support programs in the United States	A total of 63% of the registered nurses were not trained. More than 62% of their jobs were destined to direct care to the patients and their caregivers. Less than half of the participants needed to complete the basic or advance life support. A total of 71% of the nurses obtained their knowledge through informal means. The most common function in the job was care coordination. Both APN and RN work as educators in the entire health service; 96% of the RN sees an improvement in the patient's quality of life, whereas only 90% of the APN referred it.	Regardless of the nurses' level of autonomy in the clinical practice, they are consultants, educators, investigators, and leaders, besides coordinating patient care.

Continue...

Table 1. Continuation.

Article title	Authors	Studied Interventions	Results	Conclusions
Validação de protocolo para assistência a pacientes com balão intra-aórtico[19]	Machado RC, Guerra GM, Branco JNR	Develop a care protocol for patients with IAB and to validate the content of this protocol	Thirty-six items were assessed, which were focused on the care of the patients using the IAB. In the end, a protocol with 22 items was developed approaching since the patient and family's education to the performance of the procedure and care until his/her discharge.	A protocol with 22 items was prepared with regard to care for the patients using IAB
Intra-aortic balloon pump therapy: a primer for perioperative nurses[20]	Tremper RS	Use of an intra-aortic balloon pump in the perioperative period	Shows indications, contraindications, and complications, perioperative use, manipulation and console setting, and physiology	Having knowledge about IAB allows nurses to anticipate the surgical staff needs and improve patients' results
Ventricular assist devices: what intensive care unit nurses need to know about postoperative management[21]	O'Shea G	Strategies of nursing management in the postoperative period and the most important complications that critical care nurses need to know	Nurses should pay attention to monitoring, hemorrhage, right ventricle dysfunction, heart tamponing, cannula obstruction, dysrhythmias, secondary organic dysfunction, hemolysis, respiratory and neurological dysfunction, infection, mechanical failures, and thrombosis.	Indicates the need of knowledge by the nurses, and this device improves quality of life compared with drug therapy; however, it presents risks and complications

IAB: intra-aortic balloon; NAP: nurses of advanced practices; RN: registered nurses; MCS: mechanical circulatory support.

investigations[18], 75% of the nurses working with the MCS program in the United States had been trained on device handling; however, most of the nurses learned about it through informal means (out of job). Studies showed that nurses should be trained regarding indications, benefits, risks, and possible complications associated with these therapeutics; thus, emphasizing as the care strategy the accurate physical examination[16,17,19].

Two articles (25%) analyzed the nursing care in the patients using the ventricle support device[10,15] and showed the challenges faced by nurses, especially when the continuous flow equipment is used, as it is not possible to measure the hemodynamic parameters through the traditional invasive methods. Thus, the professionals must be qualified to identify the complications of these devices — such as, gastrointestinal bleeding, which have not been found a cause yet. Therefore, the institution should provide resources, for example, the use of a Doppler ultrasound to check the blood pressure.

Three studies (37.5%)[10,17,19] analyzed the use of an intra-aortic balloon pump (IAB) and showed that complications can be minimized with nurse's qualification and periodic clinical evaluation. A study[19] pointed out that only 28.8% of the 104 medical records showed an evolution describing the use of IAB, and 26.9% reported, after device removal, the patient's conditions; thus, this lack of information in the records might be associated with the technical and administrative attributions, as well as with the number of patients to be cared. This is in agreement with one of the studies chosen for this integrative review[16], which explored the excessive attributions and responsibilities in this group of professionals. In addition, 96% of the nurses characterized the job as stressful and mentioned the lack of institutional support and lack of professional acknowledgment, as only 2 (4.16%) of the 48 interviewed nurses reported being satisfied with their occupation.

One of these studies emphasized the importance of the operating room nurses having basic knowledge about IAB, because they were in charge of solving problems of the device. It also described in details the activities conducted by the nurses in all stages of the procedure (preparation of material/equipment, implementation of device, and removal), as well as indications, contraindications, and complications of this complex therapy. Such complications might be a result from infections, limb ischemia, balloon rupture, bleedings, paraplegia, or abdominal pain caused by the occlusion of the mesenteric artery[19].

Most of the complications seen in the studies presented in this review[10,14,15,17] could be minimized or avoided using protocols, as they guide clinical procedures, flows, and conducts, thus increasing the probability of good results[17,18].

A study[19] developed a care protocol for the patient using IAB, which is indicated for supporting or rehabilitating the coronary flow. This protocol aimed at decreasing the risk factors of the therapeutics and providing evidence for the nurse's clinical practice. A total of 22 items can be highlighted related to IAB patient's care, such as fulfillment of

the system transductor with heparin, skin antisepsis in the area where the device is inserted with chlorhexidine at 2%, patient in horizontal supine position after inserting the device with the limb restricted to avoid flexion and prevent flow obstruction and hematomas, periodical evaluation of the limb, manual compression of the place after device removal, and compressive dressing[19]. Thus, it provides subsidies so that the nurse can offer interventions aiming at a quality care to the critical patient.

The growing presence of critical patients in the operation center shows the need of nurses with technology skills to take care of these complex therapies, besides the magnitude of the responsibility of these professionals.

Thus, to obtain professional training, quality care, and, consequently, better results in the patients using MCS devices, we should focus our view on the nursing process systematization that allows developing methodologies for interdisciplinary care, thus guiding the nursing work process[22].

CONCLUSION

There are only few studies that focused on nursing care; therefore, more exploration of this theme is necessary to subsidize scientific evidence-based practice. Only two studies provided notes on the nurse's clinical practice in MCS. The others emphasized the need of knowledge and the importance of updating it by the nurses to provide a quality care. Thus, most of the nurses who are involved in the MCS practice acquire their knowledge during their professional routine.

In addition, the article emphasizes that institutions need to work with care methodologies and protocols, because they are the most important achievements in the nursing care with the aim of obtaining more professional training, better quality care, optimization of work time, and institutional planning to provide resources for the professionals.

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