STRESS AND BURNOUT AMONG PERIOPERATIVE NURSES

DOI: 10.5327/Z1414-4425201800020001

The Burnout Syndrome has been studied for more than three decades and results from emotional exhaustion mainly associated to the characteristics of work environments. This syndrome was first associated with helping professions, such as lawyers, teachers, social workers and health related ones, and it is currently present in several areas, with a high prevalence among health care professionals.

Professionals who are directly exposed to and are required to deal with conflict situations, leadership positions, quick decision-making and intense bureaucracy are more likely to develop it.

Thus, nurses responsible for providing perioperative care in their daily routine usually deal with a greater sort of conflicts regarding the conduct of clinical cases and illnesses which require them to be extremely involved with the patient, the multiprofessional team and themselves, in order to meet the best possible outcome in patient care. A study carried out in a reference hospital in the city of São Paulo, São Paulo, with 188 nurses who assisted patients in the perioperative period identified that 10% of these professionals had burnout syndrome and over 50% had a propensity to develop it[1].

The effects of the burnout syndrome may be devastating, as they lead to emotional exhaustion, with symptoms ranging from loss of energy and enthusiasm to changes in vital signs, depersonalization related to frustration and detachment, and careless attention to patient care, in addition to low professional achievement, leading to conflicts with staff members, absenteeism, decreased quality of services and, in more extreme cases, chronic stress and suicide[2,3].

The burnout process is individual and its evolution may take years or even decades, with a gradual and cumulative onset and a progressive increase in severity, often not noticed by the individual, who usually refuses to believe that there is "something wrong with him/her". Therefore, as the condition progresses, it is considered a major occupational and social issue, with a rather costly treatment for the organization[4].

This is a theme of great importance in the hospital context, specifically when associated to nursing, which is considered the third most stressful profession in the health area. This is due to the nursing professional's activities being overwhelmed by excessive workload, limiting contact situations, high levels of tension, and interpersonal problems of those who provide direct assistance. In addition, there are the high bureaucratic and institutional demands and the pressure exerted by patients and their families, as well as oscillations between the feeling of impotence before death and the recovery of patients.

In Brazil, the exact number of nurses or workers affected by the burnout syndrome is unknown, though the issue has been gaining importance in several studies, with the factors associated to the activity working as fundamental predictors.

In this sense, not only institutions, but also professionals themselves, should early recognize the relevant symptoms and factors related to the onset of the syndrome, in order to stop its evolution from reaching extreme proportions and all damages related to it.

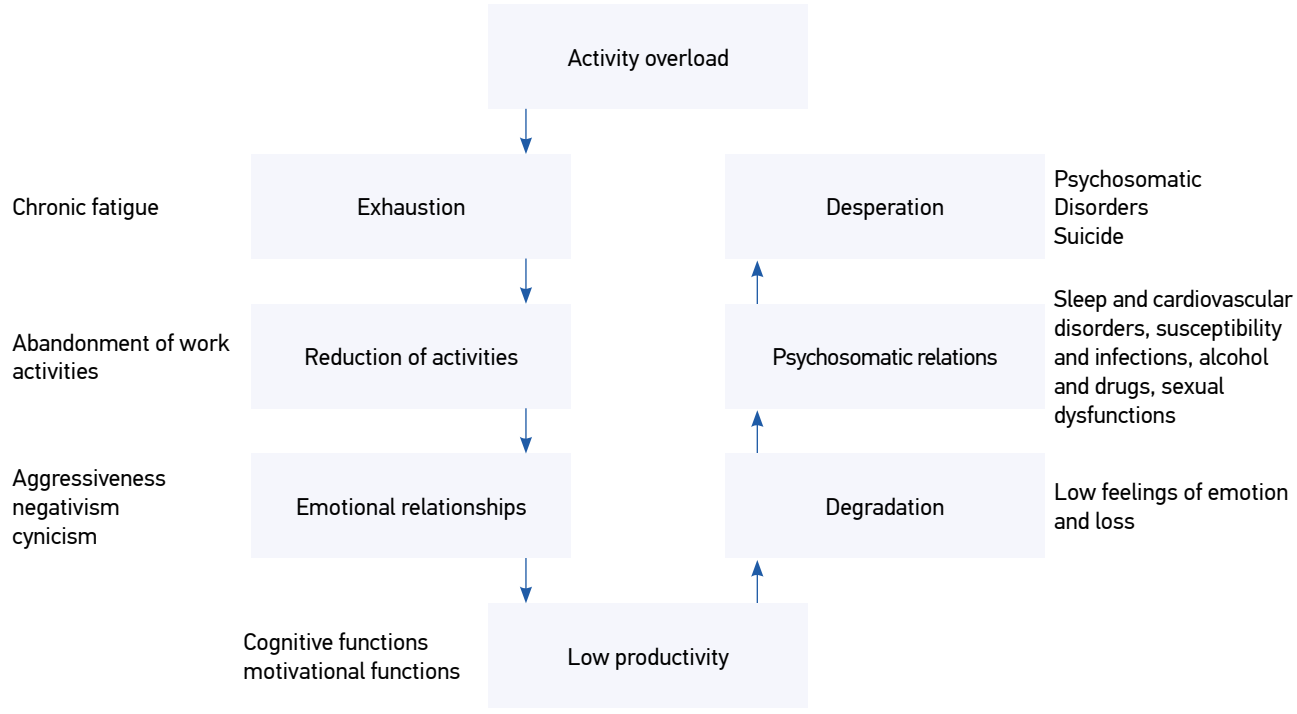
Symptoms are manifested as a cascade (burnout cascade) as shown in Figure 1[5].

The adversities involved in this complex work activity should not represent obstacles in the implementation of preventive diagnosis and treatment measures. Initially, the development of focus groups is recommended for the understanding of critical points, as well as the involvement of sectors' leaderships and hospitals' high management boards throughout the process.

After surveying the problems, professionals should suggest improvement measures and be closely monitored by trained individuals, such as psychologists, psychotherapists and psychiatrists, since drug treatments or other therapies, in some cases, should not be ruled out.

Preventive measures, such as daily physical activities, dedication to leisure and family, cultural programs and other pleasure-related activities should be encouraged by managers.

The creation of a positive work environment where opinions are respected and taken seriously, in addition to the right of workers subjected to the Federal Constitution, must be considered.



Source: adapted from Weber and Jaekel-Reinhart[5].

Figure 1. Burnout Cascade.

The early identification of the burnout syndrome not only assists the choice for the best treatment, which allows the individual to be early valued, recovered and reintegrated into his/her work environment, but also reduces the losses that have a direct impact on the quality of care provided to patients.

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STERILIZATION PROCESS FROM THE PERSPECTIVE OF THE PROFESSIONALS OF THE MATERIAL AND STERILIZATION CENTER

Processo de esterilização sob a ótica dos profissionais do centro de material e esterilização

Procedimiento de esterilización bajo la óptica de los profesionales del centro de material y esterilización

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ABSTRACT: Objective: To analyze the work process of nursing professionals working in the material and sterilization center (MSC) on the sterilization of surgical material. **Method:** A descriptive study, anchored by qualitative approach and carried out with 11 nursing professionals from MSC, through a semi-structured interview. In order to evaluate the data, content analysis was chosen, with transversal thematic modality. **Results:** The interviews presented the description of the steps involved in the sterilization process, the relationship with patient safety, difficulties in the work process, and permanent health education as a possible mean of overcoming difficulties. **Conclusion:** Workers have incipient knowledge of the steps of the sterilization process with a direct influence on patient safety. Management actions and permanent education in health are necessary to guarantee the quality of work and to enable the reduction of failures in the work process. The daily difficulties encountered by MSC nursing staff were also related.

Keywords: Nosocomial infection. Sterilization. Patient safety. Professional practice. Continuing education.

RESUMO: Objetivo: Analisar o processo de trabalho dos profissionais de enfermagem atuantes no centro de material e esterilização (CME) acerca da esterilização de material cirúrgico. **Método:** Estudo descritivo, ancorado pela abordagem qualitativa e realizado com 11 profissionais de enfermagem do CME por meio de entrevista semiestruturada. Para avaliação dos dados, optou-se pela análise de conteúdo, modalidade temática transversal. **Resultados:** Os depoimentos apresentaram a descrição das etapas envolvidas no processo de esterilização, a relação com a segurança do paciente, as dificuldades no processo de trabalho e a educação permanente em saúde como meio possível de superar as dificuldades. **Conclusão:** Os trabalhadores têm conhecimento incipiente das etapas do processo de esterilização, com influência direta na segurança do paciente. Ações de gestão e de educação permanente em saúde são necessárias para garantir a qualidade do trabalho e possibilitar a redução de falhas nesse processo. Foram citadas, ainda, as dificuldades diárias encontradas pelo pessoal de enfermagem do CME.

Palavras-chave: Infecção hospitalar. Esterilização. Segurança do paciente. Prática profissional. Educação continuada.

RESUMEN: Objetivo: Analizar el proceso de trabajo de los profesionales de enfermería actuantes en el CME sobre la esterilización de material quirúrgico. **Método:** Estudio descriptivo, anclado por el abordaje cualitativo y realizado con 11 profesionales de enfermería del CME, por medio de entrevista semiestructurada. Para la evaluación de los datos, se optó por el análisis de contenido, modalidad temática transversal. **Resultados:** Los testimonios presentaron la descripción de las etapas involucradas en el proceso de esterilización, la relación con la seguridad del paciente, las dificultades en el proceso de trabajo y la educación permanente en salud como medio posible de superar las dificultades. **Conclusión:** Los trabajadores tienen conocimiento incipiente de las etapas del proceso de esterilización con influencia directa en la seguridad del paciente. Las acciones de gestión y de educación permanente en salud son necesarias para garantizar la calidad del mismo y posibilitar la reducción de fallas en el proceso de trabajo. Aún se relacionó las dificultades diarias encontradas por el personal de enfermería del CME.

Palabras clave: Infección hospitalaria. Esterilización. Seguridad del paciente. Práctica profesional. Educación continua.

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Received: 06/16/2017 – Approved: 04/07/2018
DOI: 10.5327/Z1414-4425201800020002

INTRODUCTION

The material and sterilization center (MSC) is a technical support unit for the provision of appropriately processed health products (HPs) for the provision of health care to individuals. This process includes: cleaning, preparation, sterilization, storage, and distribution of materials to other hospital areas[1,2].

Direct patient care is related to indirect care provided by MSC professionals, who must provide support for care, since the efficiency of sterilization makes it possible to reduce exogenous infections and to improve the quality of care provided to the patient[3,4].

The understanding on the influence of cleaning, disinfection and sterilization procedures of materials in the prevention and control of hospital infections highlights the importance and the responsibility of the MSC in health institutions, as the existence of flaws in these processes determines the emergence of complications in patients[5].

Historically, the activities developed in the MSC were carried out by people without specific qualification to exercise the complexities of the processing of health materials. The lack of training programs and ongoing updating for professionals, both for those who directly perform actions and those who use the sterilized materials, jeopardizes the security of health care due to the lack of knowledge of the processing steps[4].

This reality can be modified by associating the qualification of the professionals to the development of their attributions with excellence[6].

OBJECTIVE

To identify the perception of nursing professionals working in the MSC on the process of the sterilization of surgical material.

METHOD

The study was based on a qualitative, descriptive and exploratory approach that emphasizes the uniqueness and the significance understood by the nursing professionals regarding the work process in the MSC pertinent to the studied phenomenon[7].

Therefore, the study was carried out at the MSC of a public hospital in Recife, Pernambuco, Brazil, which is a reference in the fields of trauma-orthopedic surgeries and general surgeries, with nurses, technicians and nursing assistants working in this unit. The inclusion criterion was related to the exercise of the functions, for at least one year in the referred department. Professionals who were on health leave, maternity leave or vacation were not included.

The saturation criteria were obeyed, in which there were no new ideas in the testimonies, to totalize the sample of 11 individuals. The data were collected from October 2016 to February 2017 through a semi-structured interview in a reserved environment, to ensure the confidentiality of the information obtained.

An instrument was elaborated by the researchers consisting of sociodemographic information from the participants, such as: age, sex, working hours, length of service and schooling, to characterize the sample, as well as the following questions:

1. What do you understand by the process of sterilization of critical articles?
2. How do you relate material processing in the MSC to patient safety during your practice?
3. What difficulties do you encounter in your daily work?
4. Do you get any kind of training to do your job? How is this process done?

The interviews were recorded in a digital device and then transcribed in full and lasted, on average, 7 minutes. To ensure the anonymity of the subjects, they were identified by the letter I (interviewed), followed by the interview's ordinal number (1, 2, 3, etc.), and their functional category (N: nurse; NT: nursing technician; NA: nursing assistant).

The evaluation of the analytical material was carried out by content analysis with transversal thematic modality, which consists of pre-analysis, material exploration and treatment of results[8]. In the pre-analysis, the ordering of the initial ideas was organized according to the research objective and the literature[8].

In the exploration of the material, the coding system was defined by the identification of the recording units or nuclei of the senses, and by the determination of the categories. Then, there was the treatment of the results, with inference and interpretation to condense and highlight the information collected, as well as to compare them with the pertinent literature[8].

The project was approved by the Research Ethics Committee of the Hospital Otávio de Freitas, under Certificate of Presentation

for Ethical Appreciation (CAEE) no. 58035316.0.0000.5200. All participants signed the informed consent.

RESULTS

Of the 11 participants, ten are female. They were: two nurses, seven technicians and two nursing assistants, with average age of 50 years, mean time of service in the department equal to nine years and average of 22.6 years of professional training. Their workday is a 12-hour shift per 60 hours off, and only one of the interviewees was a 6-hour daytime worker. The two upper-level participants have an industry-specific postgraduate degree.

Of the total, four had another employment relationship. No possible losses were identified in their work process, because they did not mention any complaints of problems related to the double journey, such as fatigue or delays, among others.

The codification of the testimonies resulted in the emergence of four categories, which will be described next.

Knowledge of the professionals on health product processing

The professionals' knowledge on the procedures performed for HPs sterilization was described succinctly, being restricted to the process of cleaning and preparation of the material:

> We take the material, put it in the enzyme solution; we wait until we can take the material off of it; we put it under the tap, brush the material, remove the dirt and take it to the preparation room. Place it in the drying machine (I10, NT).

> The material goes through the washing cycle, then goes to the dryer, then to the sorting table, and from there it goes to be packed (I8, NT).

> It is washed, then goes on the table, then the drying process, then to be packed (I6, NA).

As for the cleaning step, only one of the participants mentioned the time of immersion of the products in solutions, but in a dubious and incorrect way:

> Washing is performed with suitable solutions. In this step, the staff prepares and immerses the materials. It then has to stay submerged for a while. I do not remember very well if it's 10 or 15 minutes (I5, NA).

Careful investigation of the cleaning process is one of the critical points for a product to be reused. Regarding the preparation of the materials, most of the testimonies described the process, although none mentioned its inspection:

> In the sorting table, the product is placed in the dryer. It is separated by the type of piece, and then it goes to packing table (I4, NT).

> It goes through the dryer, and when the material arrives on the table, it is already good and dry. So, we just have to sort them, and put them in boxes (I7, NT).

Importance of material processing in patient safety

The activities developed in the MSC show strong interference in the final product during care activities. The unanimity in the answers showed the relevance of the processing being performed correctly, to avoid possible complications, as shown in the following section:

> If we have a flaw in one of these processes, we are putting the patient at risk for contamination and infection (I11, N).

> You have to deliver the material completely sterile so as not to harm the patient's health. And it has to be free of any infection (I2, NT).

> To avoid infection. Because the material needs to be sterilized, as it will be in direct contact with the patient (I3, NT).

One of the participants emphasized the importance of evaluating the effectiveness of the sterilization process through indicators:

> For patient safety, depending on the material, it has to have a tape, a chemical indicator that goes inside the material indicating every process that it

> goes through in sterilization. Failure in this indicator means that the material is not well sterilized. So, the goal is to give better surgery conditions to the patient, thus avoiding infection, whatever it is (I6, NA).

Difficulties encountered in the work process in the material and sterilization center

The interviewees exposed the difficulties encountered in the work routine, pointing out the lack of fundamental materials and personal protective equipment (PPE) as the aspects responsible for the department's poor functioning:

> There are days when there is no surgical grade; there are days when there are no bands, of various sizes, that's when I see the need for materials [to be restocked] (I8, NT).

> With regard to the quantity of material, we would need to have more instruments to replace them from time to time (I11, N).

> The lack of material is due to this being a public hospital, which is in crisis and depends on public tenders. So, that is a problem (I1, N).

> The difficulty is [the lack of] protective material for us, for example. In my case, there is a lack of glasses, a visor, you see? A lack of appropriate gloves to handle the hot material (I6, NA).

> The stuff [material] that is lacking here is gloves; gloves are the main thing (I10, NT).

On the other hand, there was a perceived resistance from the professionals regarding the use of the PPEs, as emphasized in one of the interviews about daily work difficulties:

> It is the protection of the employee and the use of PPE. They have a lot of resistance in using it (I1, N).

Another factor that interferes with the quality of sterilization services is the insufficient number of existing workers, as well as the great number of nursing professionals with physical or psychological problems, which, according to the interviews, is frequent and inadequate for the department's demands:

> Deficit of personnel, we actually need a larger staff so that we can improve the quality of service (I11, N).

> We don't have enough people, it's too much work for too little staff; there is a shortage in workforce (I2, NT).

> Most of the time, the MSC has a bad reputation, because it is the department where the older people, sick people, and those deemed useless go to work at (I3, NT).

> When you have a health problem, their [managers'] view is that this is your place, but it is not, because we know that we do a lot here, and it depends a lot on physical strength, we deal with a lot of heavy things (I1, N).

Permanent education of professionals as a strategy for service improvement

In the praxis of the MSC professionals, the lack of training is a limitation in overcoming daily difficulties:

> They told me to train with my colleagues on the job. Those who have more time started teaching me, that's how I learned (N8, NT).

> So, as there is a lot of very specific things, it is a very vast area, I feel this difficulty, because I had to learn on the job. Every day you learn something different, and I think I need to go through a recycling process with the professionals (N3, NT).

According to the narratives, when permanent education courses were offered, associated with extra remuneration, employees felt stimulated to participate, and considered it as a positive aspect of the institution:

> The goal of the hospital is to train the professional as a whole, even considering positions and careers,

> which has an increase in productivity over every eight hours of the semester course that we take. So, it's a way to encourage employees to seek qualification (N3, NT).

> Also, productivity is a thing. Without this productivity, we do so much when we take the course, if we don't take it, it will be worse. So, you have to seek it (N2, NT).

Likewise, despite the importance of the nurse as a manager of these activities, only one of the respondents highlighted the role of the nurse as an educator:

> The nurse who teaches us does it through the information that we have in literature, in those books that show the images and names of the instruments (N9, NT).

DISCUSSION

The MSC is the department responsible for concentrating the HPs, sterilized or not, preserving them and keeping them in good condition. For the proper development of its operating dynamics and the effective processing of the material, it is ideal that it is submitted to the following steps, sequentially: reception, cleaning/disinfection, preparation, sterilization, storage and distribution[1].

Research conducted in a public hospital in Porto Alegre, Rio Grande do Sul, Brazil, with nursing professionals working in the MSC showed that most professionals describe the process of cleaning and preparation of the materials in a concise way, which can be justified by doing isolated practical activities, without theoretical articulation, making the employees mere executors of tasks, mechanized[3,9].

The greater the difficulty in the cleaning step, the greater the difficulty in sterilization, considering that cleaning is the central to the processing of the items. Therefore, when it is not possible to guarantee safety during preparation, sterilization of the material should not be carried out. Doubts, lack of knowledge, and inadequate washing techniques can lead to failures in the reprocessing of instruments[3].

Upon receipt of the material, it should be thoroughly submerged in a solution containing enzymatic detergent at warm temperature for at least 3 minutes or as directed by the manufacturer[3,10]. Despite the importance of immersion time, only one participant mentioned this aspect, but in a dubious and incomplete way. This fact could be related to the non-use of protocols in the service, in the training of the team and/or in the supervision of the nurse during the procedures.

There was a significant difference between the participant's statement about the exposure to detergent and what is recommended by the standards, which may imply inefficient processing in terms of wasted time and the probable wear of the item, having a direct effect on the efficiency of the process[11].

After the washing, the materials are completely dried, manually or through an automated process, using a soft and light-colored material that does not release fibers, to facilitate the identification of possible dirt, or by means of a compressed air jet on materials with lumens, recesses, valves, among others[11]. Most of the interviewees reported the drying stage without concern for the inspection.

Careful investigation of cleaning is one of the critical points for a product to be reused, as residues can prevent the contact of the sterilizing agent and cause adverse immunological events to patients. In addition, articles that are not intact or functional should be replaced to avoid harm to the patient, lengthen of the surgery's duration, or dissatisfaction of the user team[11].

A descriptive multi-case study conducted in four hospitals in Salvador, Bahia, Brazil, observed that employees did not systematically carry out the necessary visual inspection or the integrity and functionality tests to prevent risks related to cleaning failures and possible changes in the characteristics of products submitted to multiple reprocessing cycles[12]. This fact resembled the findings of this series, in which only two professionals pointed out the inspection of materials as a primordial step in the quality of the cleaning performed.

Most of the subjects mentioned sterilization succinctly, citing it as part of the process. In contrast, only three interviewees discussed their types and their specificities, such as hydrogen peroxide plasma gas and saturated steam under pressure.

Some interviewees showed little knowledge about the stages of material processing, despite having nine years of experience, on average. This point can be considered as an alert for strategies to transform realities, such as the development of educational actions and the encouragement of participation in events and discussions, among others, aimed at improving the knowledge of these professionals.

Qualitative research with MSC professionals demonstrated that the participants did not know how to describe the stage nor to inform the types of sterilization. It was clarified that, in addition to knowing each step of the processing, it is essential to know the whole process, to guarantee the absence of contamination of the hospital materials and consequent complications to the patient[3].

Storage is the final part of the process, in which sterilized products must be stored in a clean and dry place, protected from direct sunlight, and subjected to minimal manipulation, ensuring their physical integrity and avoiding contamination[3,11]. In this sense, one of the participants attributed importance to the control of the material in that place.

MSC plays an important role in the prevention and control of infections. Therefore, it needs to function with adequacy, efficacy, and safety in the work process, in order to provide the necessary quality of the sterilized articles, contributing to patient care and with the surgical team[3].

The activities developed in the MSC show strong interference in the final product during the assistance. Any failure in reprocessing implies a possible compromise of the sterility of the products and allows an increase in the risk of infections in all the procedures that are performed in patients, such as surgeries, dressings, and venous punctures[13]. The unanimity in the answers showed the importance of the processing being done correctly to avoid possible complications.

In a study conducted in Teresina, Piauí, Brazil, it was observed that the nursing team valued their work in the MSC and attributed it to indirect patient care, stressing the need to follow technological advances and the improvement of these activities so that patient safety was maintained[14]. One of the participants emphasized the importance of evaluating the effectiveness of the sterilization process through indicators.

The practice of sterilization should be based on pre-established criteria, anchored by relevant scientific references and standards, ensuring that reprocessed products do not cause infection[3]. In this sense, the professionals working in the MSC must have an active responsibility in the prevention and control of hospital infections, adopt measures with the purpose of causing microbial death and guaranteeing the safety of the processing[11].

During the research, the interviewees exposed the difficulties encountered in their work routine, pointing out the lack of fundamental materials to the department as the cause for its malfunction.

The management of materials is a segment in which the quantity of inputs is planned, executed and controlled through effective and economic strategies. However, it has been a concern in health institutions, especially in the public sector, due to tight budgets, which require more control of consumption and expenditure so that staff and patients are not deprived of the necessary materials, and there is no interference with the quality of processing[15].

One study sought to assess occupational hazards in the MSC environment and demonstrated that most professionals stated that PPEs should be used and cared for to avoid basic accidents[16]. In this series, similar concern was found, even though the lack of such equipment in the department was highlighted due to the importance that the professionals attribute to them in the prevention of work accidents, constituting a positive factor of this research.

During the development of their work activities, workers must be aware of the occupational hazards to which they are exposed. The most common is the biological risk, since employees continually are exposed to blood and other body fluids upon receiving the contaminated product. In order to protect the employee from the risks likely to threaten their safety and health, it is recommended and mandatory to use PPE, which are all personal devices used by the individual in the exercise of their function[17].

PPE, such as a cap, goggles, mask, thick rubber gloves, waterproof apron and closed and rubberized shoes, are work tools designed to protect the health of workers and reduce the risks to which they are exposed. Therefore, companies are responsible for the correct delivery, testing and training regarding its use, as well as for listening to suggestions and criticisms[17]. On the other hand, some resistance was noticed from the professionals regarding the use of PPEs.

Authors have hypothesized that more senior workers, with more experience, could feel safer and end up neglecting certain precautions, relying too heavily on their skills, thus occasionally causing accidents[18]. The study population had, on average, 22.6 years of professional experience, which can be an alert to the other services.

In a survey carried out in six hospitals in Londrina, Paraná, Brazil, on the use of PPE in MSCs, negative feelings regarding their use were identified, such as discomfort, difficulty in use, heat, among others, but the professionals revealed that they used the equipment because it was a requirement from the institution. However, if they could choose, they would not use them[17]. These opinions converge with the workers' statements regarding adherence to PPE.

Another factor that interferes with the quality of sterilization services is the number of existing workers, which is often insufficient for the industry's demand. It may be due to the failure in sizing the nursing staff, thus affecting the operational functioning of their daily practice[1,19].

Often, the MSC becomes a space forgotten by managers, considering that nursing professionals with physical or psychological problems, those with advanced ages, readapted, in pre-retirement or due to inadequacy in relationships in different areas of care are referred to this department and, therefore, deemed unable to carry out direct care activities[19].

Designating professionals with health or relationship problems, and/or knowledge gaps, for a sector of such high technical complexity as the MSC is a mistake, as workers need to have a satisfactory profile and theoretical and practical training to ensure the quality of services and care provided in health facilities[1].

The nurse responsible for the MSC must establish allies with continuing education services and develop coping strategies before a shortage of human resources, such as managing the activities to be developed, anticipating and organizing the priorities without jeopardizing the processing's safety or quality[19].

The need for actions in education and health regarding the procedures performed in the processing of products was evidenced, since the professionals affirmed that the lack of training is a limiting factor in overcoming daily difficulties.

Taking into account it is a department with diverse peculiarities to keep the team in sync, the development of continuous worker training and improvement programs for permanent education could be useful for preventing these situations[20]. In view of these aspects, linking theory to practice will provide employees with better assimilation and critical thinking about the need for and importance of meticulous care with the materials[9].

People, when motivated, carry out their work in a balanced and productive way[9]. According to the narratives, when there were permanent education courses associated with extra remuneration, workers felt encouraged to participate, and this aspect of the institution was considered positive.

In a study carried out in São Paulo, São Paulo, Brazil, most of the nurses gathered their employees to guide them, usually when new equipment was acquired by the institution[9], which converged with the findings in the respondents' statements when explaining the routine with the arrival of a new chemical or machine. Despite the importance of the nurse as manager of these activities, only one of the respondents highlighted the role of this professional as an educator.

Thus, it is important to consider that, in order for nurses to achieve their professional recognition, they must transform their workspace into a pleasant environment in which all the staff can feel welcomed, with their aim focused on the value of care and humanization, besides being based on scientific research and effective actions regarding permanent education in health[3].

FINAL CONSIDERATIONS

The MSC is a sector of vital importance in the prevention and control of infections related to health care when functioning in compatibility with its guidelines, so that all steps are carried out effectively and safely, as its service influences the quality of the indirect care provided to the patient.

Thus, it is necessary to implement health education programs that cover all professionals in the area, so that changes in the work method can be sought through awareness-raising, involvement, sharing, and application of scientific knowledge in daily practices.

Regarding the sterilization process of the surgical material, it was noticed that some professionals showed little knowledge of the steps involved in reprocessing. It was noticed that doubts and insecurities arise during practice, as well as lack of necessary materials, among other difficulties, which seriously compromises the effectiveness of sterilization.

Professionals who carry out their activities in the MSC must be able to follow the technological development that perfects the service. Therefore, the participation of nurses in the professional qualification of the material sterilization process and in the identification of the needs of its staff is fundamental to guarantee the efficiency of the processes and to contribute to the prevention of infections. Thus, the identification of the difficulties proposes the mobilization of subjects to implement changes in their work process, in order to overcome such frailties, as well as the need to carry out future researches that complement the data obtained here.

During the study, there were some limitations, such as data collection during employee working hours. This may have partially compromised the participants' statements, as the MSC is an environment of constant activity, and the professionals may have answered some questions briefly to resume their activities quickly.

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IMPLICATIONS FOR THE QUALITY OF SURGICAL CARE THROUGH THE NON-MAINTENANCE OF HOSPITAL EQUIPMENT

Implicações na qualidade do atendimento cirúrgico diante da não manutenção dos equipamentos hospitalares

Implicaciones para la calidad de la atención quirúrgica por medio del no mantenimiento de los equipos hospitalarios

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ABSTRACT: Objective: To identify the implications of non-maintenance of hospital equipment for the quality of surgical care. **Method:** This is a quantitative, exploratory, descriptive, observational study carried out at a philanthropic hospital in the countryside of Minas Gerais. The technique of direct observation was applied, as well as the evaluation of records related to preventive and corrective maintenance of surgical equipment. **Results:** During the observation period, the equipment presenting most failures during surgical procedures were: electric scalpel, intensifier, and surgical focus. Equipment functionality and maintenance data were compared with manufacturers' recommendations and the scientific literature. **Conclusion:** Failure in surgical equipment maintenance can prolong patients' postoperative recovery, increase morbidity and mortality, and lead to unnecessary financial impact for the institution. It is hoped that the results of this study motivate the multiprofessional team to perform preventive maintenance of equipment before surgeries.
Keywords: Surgical centers. Surgical equipment. Equipment maintenance.

RESUMO: Objetivo: Identificar as implicações da não manutenção dos equipamentos hospitalares na qualidade do atendimento cirúrgico. **Método:** Trata-se de uma pesquisa quantitativa, exploratória, descritiva, observacional, realizada em um hospital filantrópico do interior de Minas Gerais. Aplicou-se a técnica de observação direta e a avaliação de registros de manutenção preventiva e corretiva dos equipamentos cirúrgicos. **Resultados:** Durante o período de observação, verificou-se que os equipamentos que mais apresentaram falhas durante a cirurgia foram: bisturi elétrico, intensificador e foco cirúrgico. Os dados de funcionalidade e manutenção dos equipamentos foram comparados com recomendações do fabricante e com a literatura científica. **Conclusão:** A não manutenção dos equipamentos cirúrgicos pode prolongar a recuperação pós-operatória, aumentar a morbidade e a mortalidade e levar a um impacto financeiro desnecessário para a instituição. Espera-se que os resultados deste estudo possam motivar a equipe multiprofissional à realização da manutenção preventiva dos equipamentos antes das cirurgias.
Palavras-chave: Centros cirúrgicos. Equipamentos cirúrgicos. Manutenção de equipamento.

RESUMEN: Objetivo: Identificar las implicaciones del no mantenimiento de los equipos hospitalarios en la calidad de la atención quirúrgica. **Método:** Se trata de un estudio observacional, descriptivo, exploratorio y cuantitativo realizado en un hospital filantrópico del interior de Minas Gerais. Se aplicó la técnica de observación directa y la evaluación de registros de mantenimiento preventivo y correctivo de los equipos quirúrgicos. **Resultados:** Durante el período de observación, se verificó que los equipos que presentaron el mayor número de fallas durante la cirugía fueron: bisturí eléctrico, intensificador y foco quirúrgico. La funcionalidad del equipo y los datos de mantenimiento se compararon con las recomendaciones del fabricante y la literatura científica. **Conclusión:** La falta de mantenimiento del equipo quirúrgico puede prolongar la recuperación postoperatoria, aumentar la morbilidad y la mortalidad y generar un impacto financiero innecesario para la institución. Se espera que los resultados de este estudio motiven al equipo multiprofesional a realizar el mantenimiento preventivo del equipo antes de las cirugías.
Palabras clave: Centros quirúrgicos. Equipo quirúrgico. Mantenimiento de equipo.

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Received: 28/11/2017 – Approved: 13/03/2018
DOI: 10.5327/Z1414-4425201800020003

INTRODUCTION

One of the World Health Organization's (WHO) world challenges for surgical patients' safety includes evaluating minimum standards for surgical center (SC) equipment, in addition to the most significant items for patient's safety risk[1,2]. In 2009 and 2014, WHO published guidelines for safe surgeries in order to reduce the occurrence of adverse events and to define safety standards that could be applied to all countries[1,2].

In this context, some countries in Europe, for example, still cannot improve adverse event rates in hospitals' SC, which confirms that the challenge implemented by WHO is a persistent problem not only in Brazil, but also at a global level[3].

In Brazil, it is estimated that about 3 to 16% of all hospitalized patients suffer adverse events and more than half of these events can be avoided[4]. The rate of perioperative adverse events is 3%[1]. Besides that, among the surgeries considered to be highly complex, about 16% are performed in hospitalized patients, with significant death rates[5].

Surveillance of adverse events is one of the gold standard practices that improve patient care during surgeries[2,3]. Evaluation of equipment quality and safety has been critically indicated as a key point for the patient's safe care. Despite the emergent need, few studies have given attention to the importance of this practice, especially in a SCs[3-6].

A recent study indicates that, according to the International Organization for Standardization (ISO), a laryngoscope, for example, must have the minimum acceptable measure of brightness and luminosity for intubation in case of elective surgeries[6]. In this study, performed at a hospital in Norfolk, Virginia, USA, only 29% of 283 laryngoscopes evaluated matched the standards[6]. However, no adverse events were reported with the use of such equipment.

The SC is one of the most complex units of a hospital; thus, it is more susceptible to adverse events[5] due to surgical interventions and evident transition of different employees. Operating rooms (OR) are structured with equipment that must be functioning properly to ensure patient's safety, reducing the number of recurring incidents in surgical environment.

ORs hold hospital equipment such as scalpels and anesthesia machines, which, despite allowing long maintenance time interval, must be daily inspected for the simple detection of cable oxidation and gas adjustment, for example. According to the Association Française de Normalization (AFNOR), maintenance is a set of actions that aim at ensuring the proper functioning of equipment, using controls to measure its performance, increase its lifespan and provide safety to patients[7]. Preventive maintenance is essential to extend equipment lifespan, reduce costs and improve safety and performance, but financial resources have been restricting the development of programs for this purpose.

To ensure that the inspection is adequate and done periodically, the institution should have a maintenance schedule, which ensures a minimum level of quality. The frequency of preventive maintenance varies according to the manufacturer's recommendation. When the equipment fails, however, it is necessary to activate corrective maintenance, which consists in repairing the defect that made it stop working.

It is important to highlight that most adversities can be prevented when there is correct management and proper use of equipment by the team. The possibility of an event from occurring during surgery may decrease, but the best way to avoid it is properly planning preventive maintenance.

Bearing in mind the lack of scientific knowledge and the adverse events caused by equipment in SCs, this article looks for a critical discussion about maintenance and adequate conditions of these items. Furthermore, the present work tries to contribute with the improvement of surgical patients' safety, protecting the community from avoidable damages and reducing adverse events in hospitals.

OBJECTIVE

To identify the implications of non-maintenance of hospital equipment for surgical care quality.

METHOD

This is a quantitative, exploratory and descriptive study conducted in the surgical center of a philanthropic hospital in the countryside of Minas Gerais, Brazil.

Hospitals provide emergency and hospitalization services. Small, medium and large surgeries are conducted, as well as laboratory and imaging diagnoses. The unit in question performs, on average, 150 to 200 surgeries a month. The technique of equipment direct observation at the surgical center, and the team was trained according to the WHO Observer Manual, made available in Portuguese by The National Health Surveillance Agency (in Portuguese, Agência Nacional de Vigilância Sanitária, ANVISA) and Pan American Health Organization (PAHO)[1,2]. The observation sessions were distributed in morning, afternoon and evening shifts. Observation took 40 to 60 minutes over a period of 7 months, from September 2016 to March 2017.

Data collection was performed by previously trained undergraduate and masters' students. Their training was based on the reading of the following materials: Guidelines for Recalls, Corrections and Removals (Devices) by the Food and Drug Administration (FDA), Second Global Challenge for Patient Safety: Safe Surgery Saves Lives (orientations on safe surgery by WHO), and the reference document for the National Patient Safety Program by the Ministry of Health (MH).

Students were allowed to collect data after achieving at least 85% of agreement with the lead investigator. Students watched surgeries on observation day to check for any adverse events caused by equipment malfunction. The records of preventive and corrective maintenance of the institution's surgical equipment were evaluated.

For observation of surgeries and surgical equipment, a form with the following information related to items' maintenance was used: malfunction, calibration, and occurrence of adverse events due to equipment during surgery. Equipment functionality and deterioration data were compared to manufacturers' recommendations and the scientific literature. Data were analyzed and compared using the Microsoft Excel® program.

RESULTS

According to data collected during observations, the surgical center has four OR, a post-operative room with three adult beds and one pediatric bed, a wash basin unit with three pedal taps, a room for surgical material storages, and a purge. The operating rooms contain five surgical foci, four of which are fixed on the ceiling and one is portable. The focus fixed on OR-1 ceiling was not functioning for more than six months. The center also has eight multiparameter monitors, four of which are inside operating rooms and four in the postoperative room.

based on observation sessions, the equipment that presented more failures during surgeries were: focus, intensifier, and electric scalpel. Electric scalpel failed ten times, the enhancer failed seven times, and surgical foci failed three times during surgeries (Figure 1). However, no adverse events were reported due to equipment inadequacy.

Chart 1 shows the equipment assessed and the comparison between maintenance dates, as recommended by both the manufacturer and ANVISA.

DISCUSSION

In the present study, equipment without maintenance records, as well as an intensifier and an inoperative surgical focus were found in the SC. In hospital practice, surgery delays and cancellations are results of defective intensifiers and the absence of others to replace them. The only intensifier that was working flawed during surgery (Figure 1), and procedures that required this equipment had to be performed at another institution, leading to the nessecity of displacing both patients and hospital staff.

In addition to the manufacturer's recommendation to perform maintenance of intensifiers every six months, simple daily procedures could have avoided these situations, namely, battery performance, ventilation, and electrical performance check, as shown in Chart 1.

The creation of guidelines for Standard Operational Procedures (SOP) is essential to guide maintenance, especially because of manufacturers' recommendations and the fragility of surgical equipment, which can flaw during surgery[6,7].

Multiprofessional team's awareness is highly necessary so the staff can understand manufacturers' recommendations of equipment use in daily practice, such as cable oxidation check, manometer suitable pressure and lamp operation, thus preventing adverse events from occurring.

The aim of equipment maintenance is to ensure its proper functioning and improve its lifespan, in a way that it is adequate for tasks to be performed[3].

In the present study, equipment such as electric scalpel, portable aspirator, cardioverter and multiparameter monitors were found to have their maintenance dates overdue.

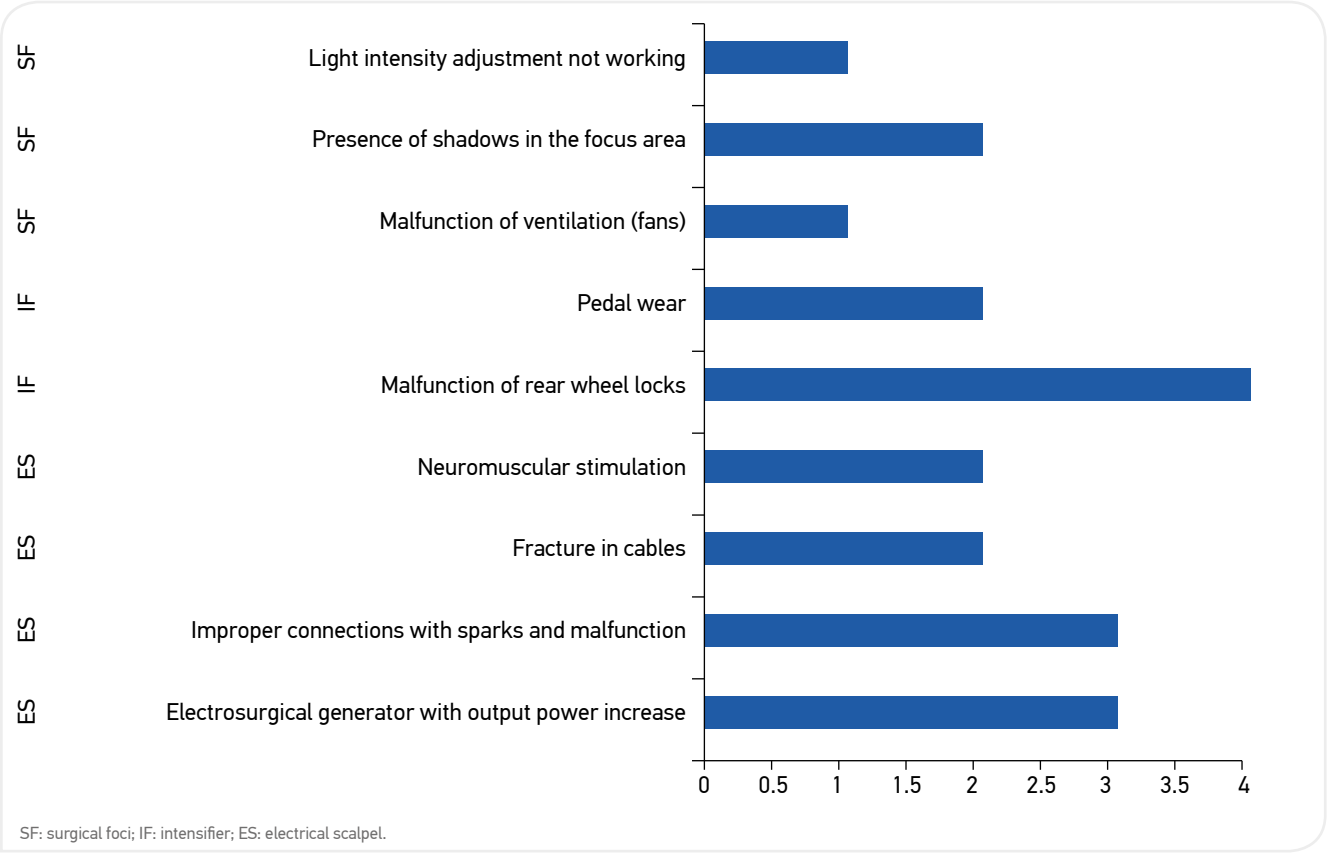

Figure 1. Distribution of failures observed by type of equipment. Diamantina, Minas Gerais, 2017.

Chart. Maintenance of hospital equipment, according to the recommendations of the manufacturer and the National Sanitary Surveillance Agency. Diamantina, Minas Gerais, 2017.

Equipment	Specification	Quantity	Last maintenance date	Suggested by the manufacturer and Anvisa
Anesthesia machines	Origami plus k Takaoka®. Asia, Latin America DrägerFabius® Plus, Lübeck, Alemanha	1 3	29/09/2015 No registry date	Preventive maintenance: every 12 months. At each surgery, evaluate: - equipment connections; - exhaust system's operation; - adjustment of gas flow; - aspirator; - hoses; - gas pressure.
Surgical Aspirator	Dia-Pump® Fanem, 089/ R2D2. São Paulo, Brazil	1	18/12/2013	Preventive maintenance: every six months. Every three months: - change the microfilter; - clean the micro ventilator. Check daily: display, circuit board, pressure gauge, pressurizing pump control and hygiene.
Electric scalpel	Wem®, SS-501s. Brussels, European Union Wem®, SS-501s. Brussels, European Union Deltronix®. Ribeirão Preto, São Paulo, Brazil	2 1 1	No registry date 11/12/2015 16/05/2013	Preventive maintenance: at least once a year. Check daily: oxidation in the power cables and physical damage to the equipment housing. Weekly: check power source conditions.

Continue...

Chart 1. Continuação.

Equipment	Specification	Quantity	Last maintenance date	Suggested by the manufacturer and Anvisa
Cardioversor	Medtronic Lifepak®20, Tolochenaz, Switzerland	1	21/03/2013	Preventive maintenance: at least once a year. Check daily: Battery charge and discharge applied to a defibrillator analyzer. Every six months: - check DEA; - check defibrillation's standard blades; - check the pacemaker; - check the synchronized cardioversion conditions of the therapy cable.
Surgical Foci	Hanaulux® Blue 80, North Rhine-Westphalia, Germany Hanaulux® Blue 80, North Rhine-Westphalia, Germany Baumer® SA Mogi Mirim, São Paulo, Brazil	1 3 1	No registry date (not working) No registry date 18/07/2013	Preventive maintenance: should not exceed two years. Weekly: - functional and visual inspection of the surgical focus; - check the shelf-life of the carcass; - check the shock absorber of the outbreaks; - check whether the domes are in proper position; - inspect if the lamps are centered and fixed; - check the electrical safety of the lighting system.
Multiparameter monitors	Dixtal Biomédica Ind e Com. Ltda, dx 2023. Manaus, Amazonas, Brazil Dixtal Biomédica Ind. e Com. Ltda, dx 2023. Manaus, Amazonas, Brazil	1 7	30/11/2012 No registry date	Preventive maintenance: yearly. Check: - calibration; - measurement of electrical insulation of the apparatus; - electrical controls, screws and indicators audible and visual. Every three months check: - presence of dry rubbers and connections; - cracking of plastic parts and connectors; - oxidation of metal parts; - cable breakage; - Audible or visual alarm failures.
Intensifiers	OEC Fluorostar 7900. General Electric Company®. Buc, France Opescope Activo Shimadzu Corporation Ltda. Kyoto, Japan	1 1	No registry date (not working) 14/12/2016	Preventive maintenance: every six months. Check: - manual movement of latches and mechanical components; - electromechanical performance; - safety lock performance; - electric performance, - battery operation and electrostatic discharge; - ventilation operation; - operation of image generation and resolution.
Optical Fiber Laryngoscope	M/S SNAA Industries, Paquistan	4	No registry date	Preventive maintenance: before every use. Check: - battery integrity; - correct operation of the lamp; - Damaged items should be replaced whenever necessary.
Surgical Tables	Mercedes IMEC®. São Paulo, Brazil	4	No registry date	Preventive maintenance: at least once a year. Check: - electrical parts; - alignment; - lubrication; - wear; - cleaning.

Anvisa: National Health Surveillance Agency; DEA: Automatic external defibrillator.

This may suggest that hospital managers or the multiprofessional team often wait for a defect to perform corrective maintenance, which can lead to surgery delays, inoperative devices and adverse events in patients, who are often on the operating table.

The Brazilian Technical Standards Association defines maintenance as "the combination of all technical and administrative actions intended to maintain or replace an item in a state in which it can perform a required function"[3].

A study carried out at a teaching hospital in the South-Center region of the State of São Paulo showed that, among adverse events reported, 31.9% were directly related to surgical equipment[4].

Another study, carried out at a teaching hospital in the Midwest region of Brazil, reported 42 episodes of adverse events, of which 26.2% were associated with OR structure problems, such as equipment maintenance and materials[5]. Most of these events (73.8%) were caused by problems with the anesthesia machine and burns caused by electric scalpel[5].

To avoid adverse events, it is necessary to check for oxidation in the electric scalpels' power cables, physical damage at their casing, and their power source's condition. This demonstrates how equipment checks prior to surgery can prevent damages to patients who are undergoing surgery. This procedure should be performed by surgeons and technologists, mainly because they wear sterile mitts.

The surgical foci assessed in this study presented shadows, which weakens luminosity upon surgery. A visual inspection should be performed daily, as foci's minimum requirements must be met so surgeries can be safe.

Three anesthesia devices had no maintenance records. Complications with this equipment are known to be an important cause of death in SCs worldwide[8,9]. This data can be reversed once the multiprofessional team is aware of the importance of daily evaluation.

As for laryngoscopes, daily check is essential so patients in need of tracheal intubation and anesthesia can be safely assisted. The maintenance of laryngoscopes involves, above all, quality and acceptable levels of light. A study carried out in Norfolk (Virginia, USA) assessed 691 laryngoscopes, of which 28% were below recommended standards (between 500 and 867 lux)[6]. In addition, light-measurement tests had never been performed on any of them. Instead, only qualitative visual inspections had been made, which does not guarantee efficiency[6].

Although visual inspection can identify wear, deterioration and oxidation in equipment, not performing physical and mechanical tests should not be acceptable in healthcare institutions, as these places aim at the best care.

The gas cylinders and supports presented rust all over them, making it difficult to read standard information on it. There was also equipment without seal. Aiming to prevent incidents and adverse events, the institution should create and publish SOPs, routines, guidelines, manuals and other material to standardize techniques, procedures and behaviors.

It is known that more than half of all adverse events caused by surgical equipment can be avoided when maintenance is up to date and when the multiprofessional team itself checks devices before each surgery[6-11]. Although adverse events during surgical interventions are recognized as a public health issue, they are still not acknowledged as such by health institutions[6-11]. Deficiencies in organizational, economic and financial management are the main causes, especially in developing countries.

In 2017, FDA raised questions to a hospital in Michigan (USA), where surgical equipment presented defects during surgeries due to inadequate maintenance, putting the lives of patients at risk[8]. An observational study in England and Wales pointed 6% (n = 754) of patients undergoing surgeries facing adverse events due to the absence of or inadequate maintenance of hospital equipment[8]. The same study found that 12% (n = 116) of patients who had adverse events due to equipment were seriously injured or died[7]. Most health institutions, however, do not disclose quantitative data about these events.

Health institutions should be encouraged to create the habit of recording surgical incidents caused by equipment, which would contribute to the creation of an adverse events' database. This would demand commitment from hospital management and multiprofessional team on daily vigilance. On the other hand, that would lead to potential safety solutions for surgeries, as recorded and validated data could be used in hospital practice.

The terms "device failure" or "medical equipment" are used by the FDA to regulate and keep track of equipment quality maintenance[8]. Such terms describe the failure of a given material to perform its function, including any deviation or abnormality in its functionality or intended use[10,11]. Therefore, one can understand the importance of producing consistent data aimed at reaching minimum quality requirements and increasing surgical equipment lifespan.

However, despite the challenging proposal of preventive and corrective maintenance, whether for institutional, economic or legal reasons, many hospitals do not dedicate to creating protocols that meet these equipment's minimum quality parameters.

The results of the present study demonstrate the absence of prevention and prolonged time to perform corrective maintenance in hospital equipment. They are only repaired when there are no conditions of use, which then require more time for correction, besides influencing directly on the quality of the assistance provided. The failure to perform experimental tests on defective equipment was a limitation for this study. These tests validate and attest wear and malfunction, especially in electrosurgical generators of electric scalpels, which, therefore, can lead to adverse events such as burns in surgical sites and tissues.

Our findings, however, should motivate the multiprofessional team to perform preventive maintenance of hospital equipment, as well as surveillance prior to surgeries. Finally, inadequate preventive and corrective maintenance of equipment can prolong postoperative recovery, increase morbidity and mortality, besides the financial impact[10,11]. In addition, safety standards and quality care are part of a set of requirements necessary for surgery safety programs in hospitals.

FINAL CONSIDERATIONS

The present work concludes that the maintenance of hospital equipment is essential, either to provide safe mechanisms for surgical patients or to start a safety program for surgeries aiming at adverse events' prevention.

Due to the complexity of this sector, the surgical center should promote a daily evaluation prior to all surgeries. Equipment should be tested for its status and functionality to avoid incidents during procedures. Thereby, further studies should be carried out to clarify an ideal schedule for corrective and preventive maintenance of surgical equipment.

The lack of records and the bad equipment maintenance in the institution chosen for this study indicate that it is still a challenge for health institutions to adequately keep their devices' maintenance and therefore prevent adverse events with surgical patients. Thus, beyond meeting the objectives of a research that aims to expand and contribute to existing knowledge, fostering social transformations that can lead to reflection, this study proposes quality indicators that enable the implementation and validation of protocols and control.

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SERIOUS ADVERSE EVENTS IN SURGICAL PATIENTS: OCCURRENCES AND OUTCOMES

Eventos adversos graves em pacientes cirúrgicos: ocorrência e desfecho

Eventos adversos graves en pacientes quirúrgicos: ocurrencia y desenlace

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ABSTRACT: Objective: To identify the occurrence of serious adverse events (SAE) in surgical patients and their possible outcomes. **Method:** Retrospective quantitative study, performed by the analysis of records and data of perioperative patients, who suffered SAE in 2016 at a private hospital in São Paulo. **Results:** There were 19 SAEs, mostly in female patients aged 40 to 49 years, hospitalized by gastroenterological pathologies. The most frequent occurrences were damage in digestive organs, hemorrhagic shock and vascular lesion. Regarding outcomes, patients were referred to the intensive therapy unit, medical-surgical clinic and hemodynamics; two patients died. **Conclusion:** The nursing staff should be aware of factors that may lead to SAE and receive guidance on notification, so they can improve surgical patients' safety and care.

Keywords: Perioperative nursing. Patient safety. Medical errors.

RESUMO: Objetivo: Identificar a ocorrência de eventos adversos graves (EAG) em pacientes cirúrgicos e seus possíveis desfechos. **Método:** Estudo retrospectivo, quantitativo, realizado pela análise de prontuários e banco de dados de pacientes no perioperatório, que sofreram EAG em 2016, em um hospital privado de São Paulo. **Resultados:** Ocorreram 19 EAG, com predominância de pacientes do sexo feminino, entre 40 e 49 anos, internados por patologias do sistema gastroenterológico. As ocorrências mais incidentes foram: lesão de órgãos digestórios, choque hemorrágico e lesão vascular. Quanto aos desfechos, os pacientes foram encaminhados à unidade de terapia intensiva, clínica médico-cirúrgica e hemodinâmica; dois pacientes evoluíram a óbito. **Conclusão:** Os profissionais da equipe de enfermagem devem estar atentos aos fatores que podem contribuir para a ocorrência de EAG e orientados em relação à notificação, a fim de aperfeiçoar a segurança e a qualidade da assistência prestada aos pacientes cirúrgicos.

Palavras-chave: Enfermagem perioperatória. Segurança do paciente. Erros médicos.

RESUMEN: Objetivo: Identificar la ocurrencia de eventos adversos graves (EAG) en pacientes quirúrgicos y sus posibles desenlaces. **Método:** Estudio retrospectivo, cuantitativo, realizado por el análisis de prontuarios y banco de datos de pacientes en el perioperatorio, que sufrieron EAG en 2016, en un hospital privado de São Paulo. **Resultados:** Ocurrieron 19 EAG, con predominancia de pacientes del sexo femenino, entre 40 y 49 años, internados por patologías del sistema gastroenterológico. Las ocurrencias más incidentes fueron: lesión de órganos digestivos, choque hemorrágico y lesión vascular. Cuanto a los desenlaces, los pacientes fueron encaminados a la unidad de terapia intensiva, clínica médico-quirúrgica y hemodinámica; dos pacientes evolucionaron a óbito. **Conclusión:** Los profesionales del equipo de enfermería deben estar atentos a los factores que pueden contribuir para la ocurrencia de EAG y orientados con relación a la notificación, a fin de perfeccionar la seguridad y la calidad de la asistencia prestada a los pacientes quirúrgicos.

Palabras clave: Enfermería perioperatoria. Seguridad del paciente. Errores médicos.

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Received: 12/19/2017 – Approved: 03/03/2018
DOI: 10.5327/Z1414-4425201800020004

INTRODUCTION

Around 234 million highly complex surgical procedures are performed per year. As the traumatic injuries, the occurrence of cancers and cardiovascular diseases continues to grow, and surgical interventions tend to grow[1].

In 2004, the World Health Organization (WHO) launched the World Alliance for Patient Safety, aiming at the improvement of patient care and quality of health services[1].

Surgical procedure is the only treatment that aims at relieving the disabilities and reducing the risk of death caused by diseases. Despite saving countless lives, the lack of access to quality surgery is a problem worldwide[1].

Seven million surgical complications are registered every year, covering at least one million patients who died immediately after or during surgery[1].

Lately, patient safety has become a constant concern for the health sector, for it is a major principle in patient care. Safety failure during medical care can cause considerable damages to the patient. This issue has been debated due to the impact that adverse events bring to health systems[2].

Serious adverse events (SAE) are defined as incidents that take place in patient care during hospitalization, which may result in surgical site infections, inadequate surgical positioning, procedures in the wrong side of the body, incorrect medicine administration and anesthetic-surgical problems. Such events make hospitalization longer, more expensive, and, in more serious cases, increase the risk of death[3].

Adverse events related to surgical procedures require special attention, as the Surgical Center (SC) is the place where they most frequently occur. Due to the intense transit of professionals and the diversity of anesthetic-surgical and diagnostic procedures, it is one of the hospital's most complex units. Around 50% of SAEs are related to surgical assistance and could be prevented[1,3].

When adverse events take place, they must be informed. Notification has become an important instrument to improve the quality of the health system. The notification system is a set of interconnected actions to check and verify SAEs aiming at improving patient safety during hospitalization[4].

However, some of these events are not notified by the nursing staff. These under-reports are related to the lack of understanding about the importance of notification and the required procedures to do it. Besides, some professionals do not want to have their identity revealed, because they are afraid of receiving oral or written retaliation. Thus, under-reports can mask the total number of adverse events[5].

For a surgical treatment to be successful, it is necessary to fully implement individual assistance throughout the complete perioperative period. Its purpose is to provide the possibility for the patient to experience faster and more efficient recovery, which is, in other words, high-quality care. Patient safety is an obligation for all health professionals, including the nursing staff, which plays a major role in SAE prevention[3].

The nursing staff is responsible for preparing the patients, setting specific and individual care for each type of surgery. This type of care includes adequate orientation as to the upcoming procedure, patient's physical and emotional preparation, administration of preanesthetic, when required, referment to she SC, and many other attributions[6].

In this scenario, it is extremely important to recognize SAEs and verify their outcomes for the patients, who are the victims of such events.

OBJECTIVE

To identify the occurrence of serious adverse events in the perioperative period and their outcomes to the patients.

METHOD

This is a documental, descriptive, exploratory, retrospective research, with qualitative analysis, performed by primary documents, in records and surgery data of patients who had been hospitalized in a large private hospital, located in the south of São Paulo. The hospital has 728 beds and performs around three thousand anesthetic surgical procedures per month.

This study's sample was composed of record and data of 19 patients who have suffered SAE in 2016, during the perioperative period. Considering an average of 3 thousand surgeries per month, the SAE occurrence in this study's host institution was of 0,053% during this one-year period.

The collection of information in the data of patients' records was performed in the first semester of 2017, using a form specially designed for this study, which contains 14 items, divided in 3 parts:

- Part I: characterization of the sample (gender, age, main pathology);
- Part II: information on the anesthetic surgical procedure (type and duration of anesthesia, performed surgery, surgery's classification related to the risk of contamination, duration of surgery and hospitalization period);
- Part III: information on SAE (place of occurrence/notification, type of SAE, conclusion after its occurrence and interventions towards it).

The data was only collected after the approval of the Institution's Ethics Committee (CEP) via Plataforma Brasil (CAAE 62113016.9.0000.0071). Because of the sample composition, we asked and received the permission of the institution's CEP coordinator to not use the Informed Consent Form (TCLE). The researchers committed to keep the obtained information in secrecy and use the data exclusively for this study.

Results were analyzed by quantitative descriptive statistics according to mean and percentages, demonstrated through charts and graphics in absolute numbers in order to facilitate and organize the data.

To obtain the results of patients' characterization, each sample linear was divided as described and, therefore, it allowed the calculation of each item's average: gender, subdivided into female and male; age, subdivided in 10-year intervals; and main pathology, subdivided into cardiovascular, aesthetic, gastroenterological, gynecological, musculoskeletal, neoplasia, pulmonary and respiratory conditions.

The following events were delimited to obtain the results: unnecessary surgical approach, anesthetic block in wrong limb, inadequate catheter, hemorrhagic shock, oropharyngeal foreign body, digestive organ damage, urinary organ injury, vascular injury, cardiorespiratory arrest (CRP), burn by electric scalpel, bleeding after myocardial revascularization (MR), and compartment syndrome.

To obtain the results of SAE outcomes, the subsequent areas were defined: medical-surgical clinic, pediatric clinic, hemodynamics, death, infectious disease and intensive care unit (ICU).

Other data were registered, such as: performed anesthesia and its duration, classification of surgery (elective, urgency and emergency), classification of surgery regarding the contamination potential (clean, potentially contaminated, contaminated and infected), performed surgery and its duration and hospitalization time.

RESULTS

Sample Characterization

Table 1 presents the sample's characterization data, composed of 19 patients who suffered SAE in 2016 at the host institution.

Eleven (57,89%) of these patients were female, mostly aged between 40 and 49 years (n=05; 26,32%) and 50 to 59 years (n=04; 21,05%). Seven patients (36,84%) were hospitalized with a gastroenterological system's main pathology, which are: acute cholecystitis, intestinal sub occlusion, intestinal endometriosis, enteric fistula, inguinal hernia, and gastroesophageal reflux disease (Table 1).

Table 1. Patients who suffered SAE – sample characteristics.

Variable/Category	n	%
Gender		
Female	11	57.89
Male	08	42.11
Age Group (years)		
0 to 9	01	5.26
10 to 19	01	5.26
20 to 29	-	-
30 to 39	02	10.53
40 to 49	05	26.32
50 to 59	04	21.05
60 to 69	02	10.53
70 to 79	03	15.79
80 to 89	01	5.26
Main pathology		
Gastroenterological	07	36.84
Cardiovascular	04	21.05
Skeletal muscle	02	10.53
Neoplasm	02	10.53
Esthetics	01	5.26
Gynecological	01	5.26
Pulmonary	01	5.26
Respiratory	01	5.26
Total	19	100.00

Information on anesthetic surgical procedure

Table 2 presents the data on the anesthetic surgical procedures of 19 patients who underwent surgery and suffered SAE.

Sixteen (84,21%) of these 19 patients performed the surgical procedure under general anesthesia, 10 (52.63%) of which were urgency surgeries and 11 (57.89%) were classified as clean, according to contamination potential (Table 2).

Occurrence and outcome after serious adverse event

To verify the occurrence and outcome of the SAE's with the patients in the sample, the type of SAE was also verified (Table 3).

The most frequent adverse events in these patients were: four (21.05%) lesions in digestive organs, 2 patients (10.53%) had hemorrhagic shock and 2 (10.53%) suffered vascular lesions (Table 3).

The main outcomes after SAE are presented in a graph (Figure 1), considering that eight of them (42.11%) were transferred to the ICU, 5 (26.32%) were hospitalized in the medical-surgical clinic, 2 (5.26%) were referred to hemodynamics and 2 (5.26%) died.

DISCUSSION

In any of the operative stages, nursing care for the surgical patient causes a series of actions which require the team's attention to maintain his/her safety[7].

Table 2. Information on anesthetic-surgical procedure.

Variable/Category	n	%
Performed Anesthesia		
General	16	84.21
Local	01	5.26
Spinal anesthesia	01	5.26
Spinal anesthesia + sedation	01	5.26
Surgery classification		
Urgency	10	52.63
Elective	06	31.58
Emergency	03	15.79
Surgery classification regarding contamination potential		
Clean	11	57.89
Potentially contaminated	06	31.58
Contaminated	01	5.26
Infected	01	5.26
Total	19	100.00

SC is the place where most of the adverse events occur. Many factors contribute with their causes, due to the high complexity of the procedures[8].

In the present study, 4 SAEs (21.05%) related to digestive organ lesions were observed during video laparoscopic

Table 3. Serious Adverse Events Characteristics.

Serious Adverse Events	n	%
Digestive organ injuries	04	21.05
Vascular lesion	02	10.53
Hemorrhagic shock	02	10.53
Catheter allocated in inappropriate location	01	5.26
Anesthetic block performed on the wrong limb	01	5.26
Foreign body in oropharynx	01	5.26
Unnecessary surgical approach	01	5.26
Urinary organs injury	01	5.26
Cardiorespiratory arrest	01	5.26
Burn by electric scalpel	01	5.26
Bleeding after myocardial revascularization	01	5.26
Compartment syndrome	01	5.26
Use of non-sterile material during surgery	01	5.26
Divergence in the counting of compresses	01	5.26
Total	19	100.00

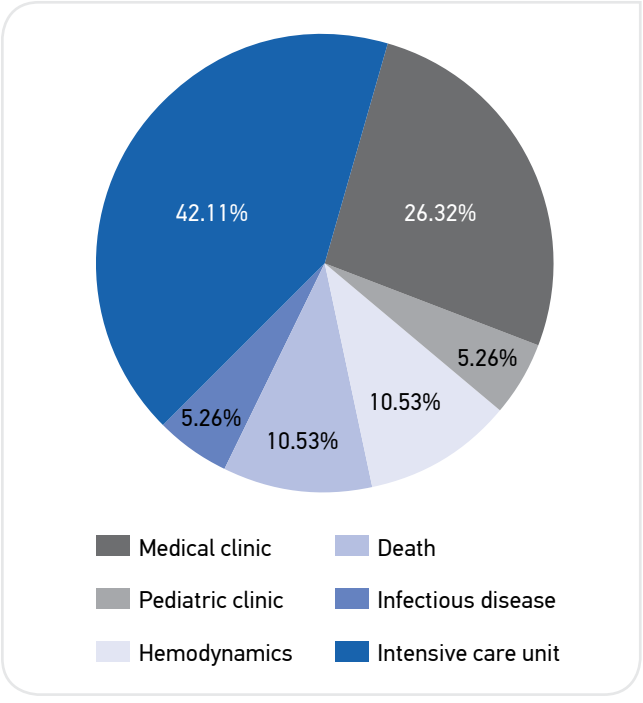

Figure 1. Outcomes after the occurrence of SAE.

surgeries, such as jejunum, liver and stomach. The jejunal lesion had an important impact on the patient's life, leading to an increase in hospitalization time and the necessity of ileostomy. The use of different instruments to perform abdominal cavity laparoscopic surgeries may cause perforation of some organs. Most of the complications resulting from the access to this cavity occur through maneuvers without direct visualization by the surgeon.[9].

Two other SAEs (10.53%) were related to the abdominal aortic aneurysm repair surgery, and both patients died due to injuries in the iliac arteries and mesenteric ischemia. Endovascular surgery for the correction of abdominal aortic aneurysm is not free of complications, which may occur during or after the procedure. The increasing morbidity and mortality of patients who have undergone this type of surgery is undefined; and it is not yet known whether it is related to the surgical technique or not[10].

There were two SAEs (10.53%) related to hemorrhagic shock in this study. One of them occurred during the MRI surgical procedure, when there was an accidental disconnection of the extracorporeal circulation circuit (ECC), with significant blood loss. Some complications may occur during or after surgery, such as hemorrhage, which presents the rupture of some ligations or inefficiently performed hemostasis as etiologic factors. The clinical consequence depends on the size of the vessel, type of bleeding, and the amount of blood lost in a fraction of the time. Hypovolemia puts the life of patients at risk, and requires early diagnosis and definitive hemostasis, often performed in a new surgical intervention (reoperation)[11].

There was an event referring to the present research, in which the patient underwent an elective esthetic surgery and suffered a second-degree burn caused by the electric scalpel (ES). A study with the purpose of evaluating ES incidents in the SC, carried out in a public school in Ceará, involving 40 health professionals, observed the lack of familiarity with the equipment or its maintenance, which was performed only in a situation of defect.[12].

A SAE occurred with a patient who was referred to the SC for central venous catheter passage (CVC) and, after that, presented with somnolence and loss of left motor strength. Some tests, as the X-ray and the angiotomography, showed the catheter was misplaced. Central venous access is often used for monitoring and infusing fluids and vasoactive drugs. Despite its benefits, it involves risks, such as arrhythmia, collection of mediastinal fluid, hemothorax, perforation of cardiac chambers and cardiac tamponade[13,14].

In the present study, a case was reported in which the counting of compresses was not effective, leading to a new surgical approach in which a compress was found in the patient's abdominal cavity. To certify the prevention of object retention or intracavitary foreign bodies during the intraoperative period, the surgical counting process must be performed in all surgeries. It is a manual process and a responsibility of the attending nurse and the nursing technician circulating with the technicians[15].

In this study, there was a cardiorespiratory arrest (CRA) during a surgical procedure, in which the team approached a brain tumor. In this case, the patient, a child, was reestablished hemodynamically and referred to the pediatric ICU. The Brazilian Journal of Anesthesiology published a survey showing that the incidence of intraoperative CRP varied from 2.56 to 44 cases per 10,000 procedures. CRP is the most serious, although potentially reversible, adverse event that may take place during surgery[16].

This study showed that in the postoperative period of pulmonary segmentectomy and adrenalectomy, with duration of 10 hours, the patient evolved with compartment syndrome (CS), requiring surgical reassembly to perform fasciotomy. Despite being more frequently associated with trauma, CS has been reported as a consequence of the positioning of operating tables during prolonged surgeries, as in the reported case. Intraoperative CS caused by prolonged positioning has a subtle beginning; and the absence of symptomatic findings while the patient is anesthetized leads it to becoming a complication that can easily go unnoticed both intra and postoperatively[17]. However, a study reported the occurrence of this complication after medium-length surgeries, between 3 and 4 hours [18].

In the current study, after the first postoperative day, a patient who underwent MRI had to return to the SC (reoperation) due to major bleeding. In a study performed in a general hospital in the city of Cascavel, Paraná, with 119 patients who underwent MRI surgery, 28 (23.5%) had complications in the postoperative period.[19].

In one event, the patient underwent hysterectomy and salpingectomy; on the second postoperative day, the drainage flow increased, and a creatinine sample was collected from the material, with positive result. She returned to the SC (reoperation) to undergo exploratory laparotomy and bladder raffia / suture. Bladder injury is the most common complication of vaginal hysterectomy, with an estimated incidence of 0.4 to 1.86%. The posterior wall of

the bladder is usually the most damaged, either by devascularization or laceration.[20].

Other events occurred during surgeries, including anesthetic block in the wrong limb, gauze in the oropharynx, unnecessary surgical approach and use of non-sterile material. Even though these events were considered as SAEs, they did not bring major damages or increased time of hospitalization.

After the occurrence of SAE, the patients were referred to different sectors, according to their clinical status. Of the 19 patients who composed the sample, 8 (42.11%) were transferred to the ICU due to hemodynamic instability; 5 (26.32%) were led to the medical-surgical clinic to continue treatment; 2 (5.26%) were referred to hemodynamics, where a rapid diagnosis was conducted and in which the initiation of treatment is often a factor for patient's survival; and 2 (5.26%) patients died, 1 by mesenteric ischemia and 1 by lack of bilateral iliac artery flow.

Regarding the information about the anesthetic surgical procedure, 16 (84.21%) patients underwent the procedure under general anesthesia. Its average duration was 3 hours and 48 minutes, the longest being 8 hours and 45 minutes, and the shortest being 50 minutes.

According to their urgency, surgical procedures are classified as: urgency, emergency and elective[21]. In this work, 10 (52.63%) were urgency surgeries; 6 (31.58%) were elective; and 3 (15.79%) emergency. Their average duration was 3 hours and 57 minutes, the longest being 8 hours and 15 minutes, and the shortest, 30 minutes.

According to their contamination potential, surgeries are classified as: clean, potentially contaminated, contaminated and infected. Of the 19 patients in the sample, 11 (57.89%) surgeries were classified as clean, 6 (31.58%) as potentially contaminated, 1 (5.26%) as contaminated and 1 (5.26%) as infected.

Patients' hospitalization time was, on average, 10.6 days, with the longest being 43 days, and the shortest, 1 day. According to the National Supplementary Health Agency (ANS), the ideal length of hospitalization time for large hospitals varies from 4 to 5 days[22].

CONCLUSION

This study shows us that in the 19-patient sample, there was a predominance of female patients, aged between 40 and 49 years, and presenting gastroenterological pathology as the main hospitalization cause.

The most prevalent SAEs were digestive organ lesions followed by hemorrhagic shock and vascular injury. Regarding outcomes, patients were referred to the intensive care unit, medical-surgical clinic and hemodynamics; two patients died.

Because it is a high complexity environment with intense flow of people, the whole team must be aware of the factors that can harm safety, individualizing each surgical patient care.

The number of events found during the survey was low (0.053%) compared to the high demand and the movement in the SC (about 3 thousand procedures per month). Nevertheless, the host institution of this research looks for implementing constant improvements and notification strategies, so that SAEs become increasingly scarce.

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LEARNING NEEDS ABOUT CARDIAC SURGERY FROM THE PERSPECTIVE OF PATIENTS AND NURSES

Necessidades de aprendizagem acerca da cirurgia cardíaca na perspectiva de pacientes e enfermeiros

Necesidades de aprendizaje acerca de la cirugía cardíaca en la perspectiva de pacientes y enfermeros

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ABSTRACT: Objective: To verify the agreement between nurses' perceptions about learning needs of patients in the preoperative period of cardiac surgery, and the topics that patients show to have less knowledge about. **Method:** Descriptive-exploratory study carried out in two steps, at two university hospitals in the city of Recife, Pernambuco, Brazil. In the first step, researchers questioned 30 nurses on which topics they believed patients had more questions or less knowledge about. In the second step, 50 patients were interviewed so as to check their knowledge about the 18 topics that the nurses had judged. **Results:** The mean of correct answers was 5.92. In 16 of the 18 topics assessed, patients had less knowledge in nurses' perspective than their correct answers represented. **Conclusion:** The topics patients had more queries about should become the focus of attention in nurses' formation, as these professionals should be acquainted with the population they're caring for in order to better plan their actions.
Keywords: Health education. Preoperative period. Thoracic surgery. Nursing care.

RESUMO: Objetivo: Verificar a concordância entre a percepção dos enfermeiros sobre a necessidade de aprendizagem dos pacientes em período pré-operatório acerca da cirurgia cardíaca e os tópicos sobre os quais os pacientes mostram menor conhecimento. **Método:** Trata-se de um estudo descritivo-exploratório, realizado em duas etapas, em dois hospitais universitários na cidade do Recife, Pernambuco, Brasil. Em uma primeira etapa, os pesquisadores questionaram 30 enfermeiros sobre quais tópicos eles acreditavam que os pacientes tivessem mais dúvidas ou menor conhecimento. Na segunda etapa, 50 pacientes foram entrevistados para verificar seu conhecimento acerca dos 18 tópicos que os enfermeiros haviam julgado. **Resultados:** A média de acertos dos pacientes foi igual a 5,92. Em 16 dos 18 tópicos avaliados, o conhecimento dos pacientes era menor na perspectiva dos enfermeiros do que nos valores representados pelos acertos dos próprios pacientes. **Conclusão:** Os tópicos que os pacientes tiveram mais dúvidas devem se tornar focos de atenção no processo educativo do enfermeiro, que necessita conhecer a população sob seus cuidados para melhor planejar suas ações.
Palavras-chave: Educação em saúde. Período pré-operatório. Cirurgia cardíaca. Cuidados de enfermagem.

RESUMEN: Objetivo: Verificar la concordancia entre la percepción de los enfermeros sobre la necesidad de aprendizaje de los pacientes en período preoperatorio acerca de la cirugía cardiaca y los tópicos sobre los cuales los pacientes muestran menor conocimiento. **Método:** Se trata de un estudio descriptivo-exploratorio, realizado en dos etapas, en dos hospitales universitarios en la ciudad de Recife, Pernambuco, Brasil. En una primera etapa, los investigadores cuestionaron a 30 enfermeros sobre qué tópicos creían que los pacientes tenían más dudas o menor conocimiento. En la segunda etapa, 50 pacientes fueron entrevistados para verificar su conocimiento acerca de los 18 tópicos que los enfermeros habían juzgado. **Resultados:** El promedio de aciertos de los pacientes fue igual a 5,92. En 16 de los 18 tópicos evaluados, el conocimiento de los pacientes era menor en la perspectiva de los enfermeros que en los valores representados por los aciertos de los propios pacientes. **Conclusión:** Los tópicos que los pacientes tuvieron más dudas deben convertirse en focos de atención en el proceso educativo del enfermero, que necesita conocer a la población bajo sus cuidados para mejor planificar sus acciones.
Palabras clave: Educación en salud. Periodo preoperatorio. Cirugía torácica. Atención de enfermería.

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Received: 11/30/2017 – Approved: 03/04/2018
DOI: 10.5327/Z1414-4425201800020005

INTRODUCTION

The preoperative period is intended to the preparation of a patient in all aspects, and is also the moment to clear issues and doubts about the procedures, how they should get prepared and how the postoperative period will likely be[1,2]. Waiting for surgery is often a moment permeated with the fear of disability, death, or the possibility of changes in body image, which causes distress and anxiety[3].

Anxiety and stress bring both psychological and physiological repercussions that can lead to decreased tissue recovery capacity and slow immune response, thus contributing to a greater predisposition to infections[4].

In order to enforce health education, nurses should seek to understand the patients' learning needs and be familiar with scientific evidence necessary to plan care and guide this process[5]. Health education promotes reflection and critical awareness, with emphasis to a dialogic process that orients the work with people, therefore not being just a merely instructional act[6]. Thus, nursing professional must know how to communicate with people, understand patients' demands and, in a more popular sense, speak their language.

In order to make health education practice more effective and efficient in the preoperative period of cardiac surgeries, it is important to think of strategies that encompass language accessible to the target public and propose educational and interactive actions between the professional and the patient. Preoperative orientation and visits are extremely relevant, as they reduce anxiety and increase adherence to therapeutic proposals[2,5,7].

OBJECTIVE

To check the agreement between nurses' perception about the learning needs of patients in the preoperative period of cardiac surgery and the topics that patients show to have less knowledge about.

METHOD

This is an exploratory, descriptive study with quantitative approach.

The research had two steps and was carried out at two university hospitals in the city of Recife, Pernambuco, Brazil: a reference specialized cardiology center, and a center for cardiac surgery and other surgical specialties.

In the first step, the researchers made questions to 30 nurses on which topics they believed patients had more queries or less knowledge about. To collect these replies, the questioning was based upon the content taught in the health education strategy of the hospital, the most common queries of patients and the authors' experience with the theme. The content used in guidelines to patients at the hospital was conceived after an extensive review of the literature, and also drawn on the experience of professionals involved and on the hospital's protocols.

In this stage, an instrument with 18 topics was created and allowed nurses to evaluate, on a 1-to-5 Likert scale, the level of queries or lack of knowledge about each topic by patients they deal with on a daily basis. Score 1 was attributed to lowest level of queries, and each topic the patients had more questioning about was scored as 5.

For data analysis, topics with scores 3, 4 and 5 were considered relevant from the perspective of nurses, since these portray the greater needs of patients from the professionals' point of view.

In the second step, 50 patients were assessed as to the same topics. Their responses were classified as follows:

- the patient *does not know* anything about the topic addressed (when no or a completely wrong answer was given);
- the patient *knows partially* about the topic addressed (when the patients could not use terms correctly or did not know details, but had an idea about the subject addressed);
- the patient *knows* about the topic addressed (when a correct answer, in their own layman words, was given).

The authors were cautious not to interview patients who had already undergone any educational intervention, in order to seek the most primary doubts, that is, never before addressed to them by any professional[8].

Data were analyzed using the SPSS 20.0 software. Afterwards, the χ^2 test was applied to compare the differences between the percentage of answers by patients who did not know anything about the subject and the percentage of importance attributed by nurses to each item, considering the level of statistical significance at $p<0.05$.

The research was conceived on the basis and ethical precepts of Resolution no. 466/2012 by the National Health Council (CNS), and was initiated after approval by the Research Ethics Committee of the Hospital Complex of University of Pernambuco, via Plataforma Brasil, under CAAE number 12600113.4.0000.5192.

RESULTS

Thirty nurses were invited to participate, mostly women (24/80.0%), with mean time since graduation of 5.5 years (±10.43) and professional experience time similar to that of graduation completion (5.0±10.78). The background time varied between 4 and 28 years and all of them were from the field of welfare care.

As for academic qualification, 18 professionals (60.0%) had a Masters' degree in Nursing and 27 (90.0%) had specialization in Cardiology, Surgical Clinics or related areas aimed at adult health; only 2 (6.77%) had a doctoral degree. Twenty (66.7%) had articles published in journals of the field of Cardiology Nursing; 17 (56.7%) had participated or were taking part in research in the area; and 23 (76.7%) had experience with welfare in the field of cardiology; the others (7/23.3%) were experienced in Surgical Clinics, including assistance in pre- and postoperative periods.

The sample of 50 patients was predominantly composed of women (27/54.0%), aged 65 years or more (37/74.0%), coming from the countryside (25/50.0%), with partners regardless of marital status bond (26/52,0%). The most common religion of patients was Catholic (25/50.0%) and 22 patients (44.0%) were retired. Most of them had normal body mass index (BMI) (32/64.0%). The leading comorbidity in the sample was hypertension (25/50.0%), followed by diabetes (13/26.0%); high rates of smoking (23/56.0%) and alcoholism (23/56.0%) were also pointed out. A portion of 32.0% (16) of the sample had previously undergone cardiac surgery already. Table 1 shows descriptive statistics of correct answers given by patients interviewed.

Table 1. Descriptive statistics of number of correct answers by patients interviewed. Recife, Pernambuco, Brazil, 2017.

	Median	Mean	Standard deviation	Min.	Max.	25 percentile	75 percentile
Correct answers	5.0	5.92	4.35	1.0	15.0	4.0	8.0

Table 2. Comparison between patients who could not answer and nurses' perspectives about their queries and level of knowledge per topic. Recife, Pernambuco, Brazil, 2017.

Question	Patient could not answer (n/%)	Nurse's perspective (n/%)	p-value
1. Which surgery was performed?	18/36.0	26/86.7	<0.001
2. What was the reason for surgery?	16/32.0	29/96.7	<0.001
3. How is this type of surgery performed?	35/70.0	17/56.7	0.238
4. What is fasting?	02/4.0	19/63.3	<0.001
5. For how long should one fast before surgery?	32/64.0	30/100.0	<0.001
6. What the reason for fasting?	40/80.0	24/84.0	1
7. Which trichotomy is needed?	15/30.0	23/76.7	<0.001
8. After surgery, can one cough?	40/80.0	29/96.7	0.046
9. What is the right position for sleeping at the hospital after surgery?	11/22.0	27/90.0	<0.001
10. Where will you be when you wake up from surgery?	17/34.0	28/93.3	<0.001
11. How is your diet after surgery?	25/50.0	30/100.0	<0.001
12. Is it possible to resume daily living activities that used to be performed before surgery?	17/34.0	28/93.3	<0.001
13. Is it possible to do physical activities again?	20/40.0	27/90.0	<0.001
14. Will you be allowed to make physical effort, such as picking up heavy objects, after hospital discharge?	05/10.0	26/86.7	<0.001
15. Is it possible to have a normal sexual life after surgery?	24/48	30/100.0	<0.001
16. How is the care of post-surgical wound?	36/72	30/100.0	<0.001
17. Which are the signs of surgical wound infection?	34/68	30/100.0	<0.001
18. Will you be allowed to smoke again after surgery?	0/0	30/100.0	<0.001

Comparing the topics proposed, the number of patients who could not answer properly and the view of nurses about their queries and lack of knowledge, one notices that the percentage of patients who actually did not know the answers was lower than nurses estimated, considering 16 out of 18 topics (Table 2). This means that, for nurses, the level of knowledge of patients is lower than what they actually portrayed. Item 6 alone, which addressed the reasons for fasting before surgery and same percentage (80.0%), and item 3, on the means of surgery performance, the nurses had estimated that they would know the answer less often than they did (p=0.238).

DISCUSSION

It is extremely important to create and validate scales and instruments to evaluate subjective aspects related to health care and, in particular, to patients' knowledge[9-11]. Such instruments allow a more accurate evaluation and a more focused, optimized proposition of intervention measures for a better-quality care to patients[11,12].

Educational actions conducted by the nurse with patients and relatives increase adherence to self-care in addition to reducing anxiety, which is necessary in both pre- and postoperative periods[13]. Studies have shown that adherence to the rehabilitation process is associated with the patient's being aware of the procedures they will be submitted to and the recovery process they will be facing[14]. Nursing interventions in preoperative period are fundamental to empower patients with the knowledge necessary to become responsible, along with the medical team, for their recovery process and self-care[15].

From the results, one can infer that nurses considered that the knowledge of patients would be lower than actually portrayed by them when answering — even partially — the questions. However, the fact that nurses underestimate patients' knowledge does not directly affect the education process, since only the opposite would be a reason for concern.

Wrong answers relating to aspects that may be considered basic, such as type and reason of surgery (40; 80.0%) and fasting time (32; 64.0%), represent low levels of knowledge that can be overcome in the preoperative visit, to be performed by nurses of the sector or even by Surgical Center's professional. However, nurses providing preoperative care may have other strategies for health education, such as booklets, videos and lectures. Important to underline that questions about the postoperative period should also be emphasized, once there is evidence that it can contribute to lower preoperative anxiety and to improve recovery and patient adaptation, affecting the length of stay in intensive care and the incidence of postoperative complications[16-18]. In this sample, questions about self-care in the postoperative period did not have satisfactory answers.

Overall, the mean score of 5.92 (±4.35) was considered low, as 75.0% of patients answered up to eight questions correctly out of 18, that is, less than half (Table 1). Considering that the distribution of correct answers was 1 to 15 topics answered correctly, we must continue to investigate factors that could improve results, including access to the Internet, the media, and presence of companions.

A national survey on the clinical validation of the Nursing Diagnosis "Poor knowledge" indicated that more than 75.0% of patients were framed in this category, similarly to findings of other studies[19-21]. This percentage is close to the view of nurses taking part in the present study about patients' lack of knowledge about cardiac surgery.

Another study with 80 patients, which used a specific questionnaire on coronary disease and revascularization, reported more than 50.0% of patients in the sample as not able to answer the questions about name of disease, signs and symptoms of complications, objectives and type of surgery, and anesthesia[22]. Brazil still lacks a questionnaire addressing patients' knowledge about the preoperative period of cardiac surgeries.

One limitation of this research project was not investigating whether the patients had sought previous information about the procedures that could significantly impact on their knowledge, that is, accessed the Internet, learned from acquaintances' or relatives' experience, or even from other patients in the nursing ward who had been previously submitted to the surgery.

CONCLUSION

Nurses were shown to consider patients' levels of knowledge lower than they actually were as far as answering the questions, even partially, is concerned. Out of 18 topics evaluated, patients knew less than nurses thought they did in 16 of them, considering the number of correct answers by patients themselves.

The topics patients had more queries about should become the focus of greater attention in nurses' academic formation.

To press ahead with this study, the authors will continue to work on the elaboration and validation of a scale to evaluate the knowledge of patients in the preoperative period about cardiac surgery. With this scale, nursing professionals will be able to investigate the topics that raise more queries in the population under their care, as well as to evaluate the impact of educational strategies used.

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THE IMPACT OF NURSE TRAINING IN CARDIAC SURGERY POSTOPERATIVE CARE

Impacto de uma capacitação para enfermeiros acerca da assistência no pós-operatório de cirurgia cardíaca

Impacto de una capacitación para enfermeros acerca de la asistencia en el postoperatorio de cirugía cardíaca

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ABSTRACT: Objective: To evaluate the impact of a theoretical training program for nurses in care for postoperative cardiac surgery patients. **Method:** Descriptive, quantitative study, conducted at a philanthropic hospital in the countryside of the state of São Paulo, and divided into three stages: application of a pre-test, training with active participation, and application of a post-test. **Results:** A total of 47 nurses participated in the study, most of them females, with 1 to 3 years of experience in nursing, and only 4 of them had experience in cardiac surgery. We observed a significant increase in the number of right answers on the test after the training program, in comparison with the pre-test. **Conclusion:** The study demonstrated the need for continuing education for nurses working in postoperative of cardiac surgeries. The theoretical training program for nurses proved to be significant but limited in terms of teaching-learning process.
Keywords: Postoperative period. Nursing care. Thoracic Surgery. Postoperative complications.

RESUMO: Objetivo: Avaliar o impacto de um programa de capacitação teórica para enfermeiros acerca dos cuidados ao paciente no pós-operatório de cirurgia cardíaca. **Método:** Estudo descritivo, quantitativo, realizado em um hospital filantrópico do interior do estado de São Paulo, dividido em três etapas: aplicação do instrumento de pré-teste, capacitação expositiva dialogada e aplicação do instrumento de pós-teste. **Resultados:** Participaram da pesquisa 47 enfermeiros, a maioria do sexo feminino, com experiência de 1 a 3 anos na enfermagem, e somente 4 enfermeiros com experiência em cirurgia cardíaca. Verificou-se aumento significativo no número de acertos na avaliação após a capacitação, no pós-teste em relação ao pré-teste. **Conclusão:** Foi evidenciada a necessidade de formação continuada para os enfermeiros atuantes no pós-operatório de cirurgias cardíacas. O programa de capacitação teórica para os enfermeiros se mostrou significante, porém limitado, no que tange ao processo ensino-aprendizagem.
Palavras-chave: Período pós-operatório. Cuidados de enfermagem. Cirurgia torácica. Complicações pós-operatórias.

RESUMEN: Objetivo: Evaluar el impacto de un programa de capacitación teórica para enfermeros acerca de los cuidados al paciente en el postoperatorio de cirugía cardiaca. **Método:** Estudio descriptivo, cuantitativo, cumplido en un hospital filantrópico del interior del estado de São Paulo, dividido en tres etapas: aplicación del instrumento de pre-prueba, capacitación expositiva dialogada y aplicación del instrumento de post-prueba. **Resultados:** Participaron de la investigación 47 enfermeros, la mayoría del sexo femenino, con experiencia de 1 a 3 años en la enfermería, y solamente 4 enfermeros con experiencia en cirugía cardiaca. Se encontró un aumento significativo en el número de aciertos en la evaluación después de la capacitación, en el post-prueba en relación a la pre-prueba. **Conclusión:** Se ha evidenciado la necesidad de formación continuada para los enfermeros actuante en el postoperatorio de cirugías cardíacas. El programa de capacitación teórica para los enfermeros se mostró significante, pero limitado, en lo que se refiere al proceso enseñanza-aprendizaje.
Palabras clave: Periodo posoperatorio. Atención de enfermería. Cirugía torácica. Complicaciones posoperatorias.

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Received: 09/21/2017 – Approved: 03/03/2018
DOI: 10.5327/Z1414-4425201800020006

INTRODUCTION

The health team is responsible for planning and discussing actions that provide quality care, in order to guarantee the quick recovery and early discharge for patients who undergo cardiac surgery. In the postoperative period, the nurse, aided by his or her team, is in charge of monitoring the anesthetic recovery (AR) and of paying attention to possible surgery complications, during the patient's stay at the Intensive Care Unit (ICU)[1].

To promote full, singular, and qualified care, nurses must integrate the nursing process into their daily routine, to systematize the assistance and adopt an evidence-based clinical practice[2]. In this regard, one of the phases of the nursing process that stands out is care prescription. Nurses must implement it according to their scientific knowledge and the individual needs of each patient, analyzed through data collection, preparation of nursing diagnoses, and care planning[1].

In this context, it is important that these professionals be often trained to develop their skills and abilities to identify the real needs of patients and effectively plan their care. Training in different areas has the purpose of updating and complementing the knowledge of the professional and allowing better performance of the participant. It is also a necessity in the health field, which experiences constant changes and requires permanent professional qualification of the nurse [3].

Consequently, the training of nurses working in cardiac surgery is extremely important, as this is one of the therapeutic possibilities adopted for cardiovascular diseases (CVD), known as the main cause of death in the world, with 17.5 million cases each year. A situation of great concern to health managers[4-6].

However, some cases require surgical treatment — a procedure that has been going through remarkable technological advances, in a quick and steadfast manner — to increase not only the survival, but also the quality of life of these patients after surgery.

Among the classes of cardiac surgeries, there is reconstructive, corrective, and replacement. Myocardial revascularization (MV) is the most common reconstructive surgery. Its purpose is to preserve myocardial function, and it may be performed with or without a cardiopulmonary bypass (CPB)[1].

CPB is a procedure used in most cardiac surgeries. It consists of the total cardiopulmonary bypass, temporarily replacing the pumping function of the heart and the ventilatory function of the lungs. The risk of complications, such as arrhythmias, ischemia, and changes in blood pressure levels, in the postoperative period is directly related to the time during which the patient is exposed to the CPB. The greater the time of exposure to the CPB, the greater the probability of patients presenting with prolonged neurological deficits, such as changes in cognitive and intellectual functions, and lethargy[2].

Therefore, patients who undergo cardiovascular surgery, especially those that use CPB, require systematic care in the postoperative period. They stay in the ICU for four days, on average, and the most frequent complications they suffer are the pulmonary ones[1,7].

The expansion of the Cardiovascular Surgery Service of a hospital institution in the countryside of the state of São Paulo prompted the idea of implementing this training program so as to meet the need to prepare nurses to satisfy the recent demand.

Accordingly, this research is important to evaluate a training method for nurses who assist the postoperative cardiac surgery patient, given that adequate support contributes to improving the quality of care after surgery.

OBJECTIVES

To evaluate the impact of a theoretical training program for nurses on care for postoperative cardiac surgery patients;

To assess the performance of the nurses before and after the application of the method.

METHOD

This is a descriptive and quantitative study of a theoretical training program for nurses from a hospital institution in the countryside of the state of São Paulo, regarding care for postoperative cardiac surgery patients. We divided the research into three stages:

1. application of the pre-test instrument;
2. theoretical training;
3. application of the post-test instrument.

We developed the data collection instrument (pre and post-test) based on the literature[2,8-13]. The first part

consisted of the sociodemographic characteristics of the participants. The second part included 14 questions related to the variables relevant to the theme of study: care in the pre, trans, and postoperative period of cardiac surgery. The topics discussed were mechanical ventilation, hemodynamic monitoring, drain care, dressing care, body temperature, drugs, pacemaker electrodes, the performance of laboratory tests and of electrocardiograms, precautions when performing a chest x-ray, and prevention of possible complications. After preparing the instrument, we submitted it to face validity.

Face validity has the purpose of evaluating if the data collection instrument agrees with what it intends to measure[14]. Five nurses — with Master's or Ph.D. degrees, and with experience in postoperative cardiovascular surgery — participated in this process. We selected the judges through "snowball or network sampling," and they received a formal invitation by e-mail[14].

The suggestions regarding the clarity of the wording and presentation of the alternatives were pertinent, and we followed the orientation of the judges. Relevant variables in questions regarding cardiac tamponade and care for a patient with intra-aortic balloon were included in the instrument[15,16].

We prepared the study protocol following the legal and ethical standards for research involving human beings, in compliance with Resolution no. 466/2012 of the National Health Council of the Ministry of Health and submitted it for consideration by the Research Ethics Committee of Universidade Federal de São Carlos (UFSCar), CAAE 46154915.0.0000.5504.

The participants authorized the use of the findings of this research by signing the Informed Consent Form (ICF), and the authors guaranteed the anonymity of the subjects.

After elaborating the project, the researchers organized a timeline and uploaded it to the system of the participating institution (Intranet) to ensure that all nurses had access to it.

There were four dates available, always in the afternoon, for completion of the training, and the professionals participated according to their preference. Each group had 12 nurses, on average.

We carried out this study in February, 2016, and counted on the participation of 47 nurses of the 63 who worked at the hospital institution. The inclusion criteria were: being a nurse, having a contract of employment with the institution head of research, accepting to participate in the study by signing the ICF, and completing all stages of training.

Stage 1 consisted of clarifying the research objectives to participants and of delivering the signed ICF, followed by the pre-test, which aimed at assessing their knowledge on the theme.

Stage 2 covered the theoretical training: a two-hour class with active participation and the assistance of texts, images, and videos. It was held in the auditorium of the institution using material resources present at the site, such as data projector, projection screen, and sound system. The two nurses who taught the classes were researchers from the study with experience in postoperative cardiovascular surgery.

Stage 3 was the application of the post-test, with the objective of identifying changes in the answers after the theoretical training and evaluating its effectiveness. In stages 1 and 3, which consisted of the application of the data collection instruments, participants had 45 minutes to answer the questions, both in the pre- and post-tests.

For the statistical evaluation, we conducted a descriptive and exploratory analysis, with the purpose of providing an overview of the general behavior of the data set, using the software R. We applied the Wilcoxon test to analyze the possible existence of a difference in the ratio of correct answers in the pre- and post-tests. With this information, we could evaluate if the performance of the professionals improved after the training process and measure this difference. The confidence level adopted was 5% ($p<0.05$).

RESULTS

A total of 47 nurses participated in this study. They were evaluated according to sociodemographic characteristics (Table 1).

The female gender was predominant in the study, and the age of 21 (44.6%) nurses was between 30 and 39 years. The length of professional experience for 22 (46.8%) subjects was between 1 to 3 years. Only 4 nurses (8.5%) reported having some training in cardiac surgery.

Table 2 shows the average of correct answers from the participants in the pre- and post-tests, in relation to the time of experience and the mean improvement after training. We observed that, in the pre-test, participants with 6 months of experience, on average, answered 8 questions correctly; the average for those with 1 to 3 years of experience was 6.68; 3 to 5 years, 5.7; 5

to 10 years, 5.12; and more than 10 years, 8.16. We can conclude that even among participants with more than 10 years in the profession — the highest average —, the time of experience did not influence the average number of correct answers. There was no gradual mean growth with the increasing time of experience.

After the training program, all the averages of correct answers increased in relation to the time of experience in Nursing (Table 2). The highest growth was among participants with 5 to 10 years in the profession (2.75), and the lowest among participants with more than 10 years of experience (0.167). The category of participants with six months of experience is not conclusive, since it has only one observation.

In Table 3, it is possible to notice that the variable related to severe complications in the postoperative period showed the highest number of correct answers among the participants in the pre and post-tests. The question with less correct answers corresponded to the recognition of the cardiac tamponade (question 14), with only four right answers in the pre-test and none in the post-test.

There was an increasing number of correct answers in most questions in the post-test in relation to the pre-test. The exceptions were question 9, about preload, which had 14 correct answers, and question 14, about the recognition of the cardiac tamponade, which had no right answers in the post-test. Question 1, regarding educational interventions, had one less correct answer in the post-test when compared to the pre-test. Question 13, on severe complications in the postoperative period, had the highest number of right answers after training (41). Questions 4, 6, 8, and 10 had an increase of more than 20% in the number of correct answers after the nursing training (Table 3).

In general, the number of right answers grew after the training program and had significance level ($p = 0.0037$). After the statistical analysis, we can conclude that the performance of the professionals improved after the theoretical training, as the results of the post-test demonstrated.

Table 1. Sociodemographic characteristics of the study participants. São Carlos, 2017.

Variable	n	%
Age Group (years old)		
20 to 29	18	38.2
30 to 39	21	44.6
40 to 49	05	10.6
50 to 59	03	6.3
Gender		
Female	40	85.1
Male	07	14.8
Length of professional experience		
6 months	01	2.1
From over 1 to 3 years	22	46.8
From over 3 to 5 years	10	21.2
From over 5 to 10 years	08	17.0
Over 10 years	06	12.7
Professional experience in cardiac surgery		
Yes	04	8.5
No	43	91.5
Total	47	100.0

DISCUSSION

The nursing professionals must constantly update their knowledge, since the health field experiences progressive transformations due to new scientific and technological findings. Faced with this situation, it is essential for the professionals to seek permanent improvement, so that they can provide qualified care, focusing on systematization and comprehensiveness[3].

Table 2. Average number of right answers from the participants in the pre and post-test in relation to the length of professional experience. São Carlos, 2017.

Length of professional experience	Quantity	Average pre-test	Average post-test	Increase after the test
6 months	01	8.0	9.0	1.0
1 to 3 years	22	6.681	7.27	0.589
3 to 5 years	10	5.7	7.2	1.5
5 to 10 years	08	5.125	7.875	2.75
Over 10 years	06	8.166	8.333	0.167

According to this logic, it is important for nurses to be one of the main agents of transformation in health work. They must develop skills in care, management, and leadership, as well as in education, prioritizing their continuous training and that of their team[3].

The study evaluated a theoretical training program for 47 nurses on care for postoperative cardiac surgery patients. It was conducted in a philanthropic hospital institution that performs a large number of cardiovascular surgeries in adult patients, such as tumor resection, aneurysm repair, aortic dissection, myocardial revascularization, and valve replacement.

However, the results of this study demonstrated that only 4 (8.5%) nurses had experience postoperative cardiac surgery care, corroborating other studies in which the professionals involved in the assistance of critically-ill patients had recent professional training, had no experience, or were looking for theoretical improvement. Nevertheless, these aspects are necessary for those who work in a complex area that requires the development of skills[17,18].

These nurses are usually more responsible professionals who take the initiative, so that they can fit in the critical care profile. They are always seeking to update and improve their knowledge by taking specialization courses, so they can become more competent when working in the care of critical patients[17,18].

Thus, as a preparation strategy, some institutions carry out training programs during the integration period of the Nursing professional, with the purpose of improving the care of the patients assisted. However, this is not a standard practice for all institutions. In addition, employees without prior experience are often transferred to more complex areas. Consequently, it is essential to stimulate these professionals to update themselves periodically, so that they can strengthen the knowledge acquired[3].

The nurses showed better performance after the theoretical explanation. The questions with the greatest variation were those related to intra-aortic balloon, myocardial revascularization, and administration of epinephrine. The reduced time for the application of the second test may have influenced this result, since the participants took the theoretical class on the same day of the test.

One of the most common methods for nurse training is active participation. In this method, the facilitator presents the theme and, concomitantly, allows the professionals to share prior experiences, in order to improve their knowledge and, consequently, the quality of patient care[19].

Nevertheless, this type of method, when applied alone, has some restrictions, such as reduced time frame to deepen the reflections; vertifcal transmission of ideas (teacher/student); and an evaluation process focused on

Table 3. Number of right answers from the nurses on care for postoperative cardiac surgery patients in the pre and post-test. São Carlos, 2017.

Variable	Pre-test		Post-test	
	n	%	n	%
1. Educational interventions in the preoperative period	38	80.8	37	78.7
2. Preoperative care	30	63.8	32	68.0
3. Mitral valve replacement	16	34.0	18	38.2
4. Myocardial revascularization	06	12.7	21	44.6
5. Equipment and materials in the postoperative period	31	65.9	35	74.4
6. Postoperative examinations	25	53.1	39	82.9
7. Priority interventions in the postoperative period	36	76.5	37	78.7
8. Cardiac output	21	44.6	31	65.9
9. Preload	24	51.0	14	29.7
10. Administration of noradrenaline	05	10.6	17	36.1
11. Intra-aortic balloon	05	10.6	11	23.4
12. Consequences of the increase in cardiac output	21	44.6	25	53.1
13. Severe complications in the postoperative period	40	85.1	41	87.2
14. Recognition of cardiac tamponade	04	8.5	0	0

the reproduction of the content offered[18]. Despite these limitations, the significance test was positive (p=0.0037) in the current study.

Although the results show satisfactory level of significance, the repercussions of this research involve new challenges for the development of knowledge and skills in the health work process. Thus, it questions if teaching-learning strategies with active methodologies can achieve better results when it comes to the process of continuous education in postoperative care for cardiac surgery patients, in contrast with the expository method to meet this demand.

Question 14, about the "recognition of cardiac tamponade", which is related to one of the postoperative complications of cardiovascular surgery, demonstrated a reduction in the rate of correct answers, even after training. The theoretical method offered may explain this result, once it does not favor reflection.

Based on this consideration, it is imperative to highlight the active methodology as a major trend in educational processes. Its popularity is owed to characteristics that include the individual's autonomy, learning with meaning, and questioning in search of solutions, resulting in a situation of action-reflection-action, capable of generating continuity or rupture processes. In the continuity process, the subject confronts the concepts learned with the knowledge acquired previously, whereas in the rupture process the student transcends his or her experiences through opportunities for new challenges[20].

In this context, we highlight questions 9 — about "preload" — and 14 — regarding "cardiac tamponade" — as limitations of the study, as both showed a decrease in the number of right answers in the post-test. This result indicates that there was a hindrance in the method applied to the training in regard to these issues, which are directly related to postoperative complications of cardiovascular surgery. Above all, we emphasize the need to implement active strategies that provide a better understanding of the theme.

CONCLUSION

The study demonstrated the need for continuing education for nurses working in postoperative care of cardiac surgeries. The theoretical training program for nurses proved to be significant. The number of right answers in the post-test had a substantial increase in relation to the pre-test (p =0.0037), despite the limitation of this value in terms of teaching-learning process.

We suggest further studies to evaluate training strategies for health professionals, highlighting the difficulty to find studies in the literature on training associated with care for postoperative cardiovascular surgery patients.

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QUALITY MANAGEMENT TOOLS AS STRATEGIES FOR REDUCING SURGERY CANCELLATIONS AND DELAYS

Ferramentas de gestão de qualidade como estratégias para redução do cancelamento e atrasos de cirurgias

Herramientas de gestión de calidad como estrategias para reducción de la cancelación y retrasos de cirugía

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ABSTRACT: Objective: Case study on the reduction of surgery cancellations leveraging quality management tools to solve the problem of lack of surgical materials. **Method:** For mapping the problem, the team listed related factors that were categorized and presented using an Ishikawa diagram and, after that, the GUT Prioritization Matrix. **Results:** Through the optimization of the "Surgical Data Map", the active participation of its members and the adoption of management tools (Ishikawa diagram and GUT), actions were taken and led to the solution of weaknesses related to the surgical dynamics. **Conclusion:** The use of management tools to detail the problem and to make better use of the surgical mapping made it possible to solve several issues related to suspension, delay and transfer of procedures, thus mitigating future problems.
Keywords: Quality management. Problem solving. Nursing. Sterilization.

RESUMO: Objetivo: Relatar a experiência de redução de cancelamentos de cirurgias que utilizou ferramentas da gestão de qualidade para solucionar a problemática de falta de materiais para as cirurgias. **Método:** Para o mapeamento da problemática, a equipe listou uma série de fatores relacionados que foram categorizados e apresentados na forma de diagrama de Ishikawa; posteriormente, utilizou-se a matriz de priorização de gravidade, urgência e tendência (GUT). **Resultados:** Por meio da otimização do "bate-mapa", da participação ativa dos seus integrantes e da adoção de ferramentas de gestão (diagrama de Ishikawa e matriz GUT), ações foram tomadas, levando à solução de fragilidades relacionadas à dinâmica cirúrgica. **Conclusão:** O uso de ferramentas gerenciais para detalhamento do problema e melhor utilização do "bate-mapa" cirúrgico possibilitou solucionar problemas relacionados à suspensão, ao atraso e/ou à transferência de procedimentos, mitigando problemas futuros.
Palavras-chave: Gestão da qualidade. Resolução de problemas. Enfermagem. Esterilização.

RESUMEN: Objetivo: Informe de caso para la reducción de cancelaciones de cirugías que utilizó herramientas de gestión de calidad para solucionar la problemática de falta de materiales para las cirugías. **Método:** Para el mapeo de la problemática, el equipo enumeró una serie de factores relacionados que fueron categorizados y presentados en la forma de Diagrama de Ishikawa, posteriormente se utilizó la Matriz de Priorización GUT. **Resultados:** Por medio de la optimización del "bate-mapa", de la participación activa de sus integrantes y de la adopción de herramientas de gestión (Diagrama de Ishikawa y GUT), se tomaron acciones que llevaron a la solución de fragilidades relacionadas con la dinámica quirúrgica. **Conclusión:** El uso de herramientas gerenciales para detallar el problema y la mejor utilización del "bate-mapa" quirúrgico posibilitó solucionar diversos problemas relacionados con la suspensión, el retraso o la transferencia de procedimientos, mitigando los problemas futuros.
Palabras clave: Gestión de la calidad. Solución de problemas. Enfermería. Esterilización.

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Received: 08/24/2017 – Approved: 01/28/2018
DOI: 10.5327/Z1414-4425201800020007

INTRODUCTION

The Sterile Processing Departament (SPD) is a functional unit with the goal of reprocessing reusable medical devices (RRMD) within healthcare services. The SPD units are rated as Class I or II, acoording to a Resolution by the Collegiate Board of the Brazilian Health Regulatory Agency (ANVISA), Resolution No. 15, from March 15, 2012[1]. Class I SPD is the one that does the reprocessing of non-critical, semi-critical and critical medical devices, with non-complex design, which are subject to processing. Class II SPD does the reprocessing of non-critical, semi-critical and critical medical devices, with complex and non-complex design, which are subject to processing.

The technical manager (TM) is a undergraduate and legally licensed professional who takes technical responsibility for the healthcare service or for the processing company in compliance with the health regulatory agency, as defined by the current legislation. [1]The nurse, who integrates the healthcare team, gathers the indispensable conditions to be responsible for the SPD. The nurse is the professional who, throughout academic education both in undergraduate and graduate degrees, studies specific themes regarding good practices for RRMD processing[2].

The SPD unit has connections with most sectors in a hospital because it supplies medical devices not only to the Surgery Center (SC), but also to in-patients units, ambulatory, emergency and intensive care units, among others[3].

SPD focuses on processing the RRMD in order to assure patient safety and avoid the ocurrence of adverse events related to the use of these medical devices. RRMD processing includes sequential and unidirectional steps, and any undetected flaw in any of those steps may affect the expected results, meaning that the patients might not receive medical devices that are safe to protect them from healthcare-associated infections (HAI).

The hospital environment is constantly evolving in search of always-improving healthcare safety and excellence. Therefore, new technologies are incorporated into the daily routine of the institution and new goals are set throughout the hospital's strategic planning.

With the technological advances and the development of new surgical techniques and minimally-invasive procedures, the medical devices used in aggressive medical interventions have become more complex, requiring the improvement of cleaning, preparation, sterilizing and storage routines.

The SPD main connection inside the hospital is the SC, which supplies material for the conduction of several anesthetic and surgical procedures. Therefore, the actions carried out in the SPD have direct repercussion over the SC dynamics, so, if there's a flaw in any of the unit's routines, it might compromise patient safety as well as result in the delay or even cancellation of surgeries.

The cancellation of surgeries ocurrs, among other reasons, due to lack of planning. Surgery is an important event that requires the attention of the entire team involved in the anesthetic/surgical procedure, especially when the reasons for cancellation are potentially preventable[5].

Such situations require quality management actions to guarantee the observance and the fulfillment of good practices of healthcare attention, towards the effectiveness and the efficiency of hospital care. The tools used in quality management for event analysis and decision-making processes allow professionals to define, measure, analyze and offer solutions for problems that have direct or indirect interference in patient care.

This report was motivated by a successful experience to deal with the lack of medical supplies in operating rooms (OR), as well as correlated problems, which led to a reduction in the number of surgeries cancelled not due to patient-related reasons, but with close relation to the SPD.

OBJECTIVE

To report a case that took place at a SPD that used quality management tools to solve the problem of lack of medical supplies for surgeries. The proposed strategy to solve the problem was the reformulation of the department's daily meeting, called "Surgical Data Map".

METHOD

Study type

This is a ase case report that describes the performance of SPD nurses to overcome the challenge of surgery cancellations due to the lack of specific medical supplies for surgical procedures.

Context of the studied field

The scenario is part of a large, private tertiary care health institution founded in 1906 and located in São Paulo city (Brazil). The work carried out at the hospital is acknowledged by the *Joint Commission International* (JCI) and *QMentum*, organizations that guide and monitor high-performance standards in

quality. The health institution is nationally accredited by the National Accreditation Organization (ONA) with degree of excellence, the highest level of certification granted by this organization. These entities utilize an evaluation system that, after analyzing the work routines, formally acknowledges and certifies the quality of the services provided by the hospital. In order to ensure the quality levels, the evaluations are revalidated every year by a specialized external team.

The hospital in question is a high-complexity facility that currently works with 294 operational beds and 73 intensive care beds. This hospital offers several clinical and surgical services, including: craniomaxillofacial, oral and maxillofacial, cardiology, head and neck, digestive tract, general, pediatrics, plastic, thoracic, vascular, coloproctology, orthopedic, oncology and urology, as well as general and specialized neurosurgeries, among others. The SC is available to outside surgeons, though a previous registration is required.

The SPD is a Class II centralized kind with a physical space of 295 m² (3,175 sq. ft.), equipped with modern technology to process the RRMD and to allow the traceability of cleaning, preparation, disinfection and sterilization routines. This system allows the hospital to perform an average of 1,200 surgeries per month.

Ishikawa diagram development

In 2014, the SPD was experiencing some difficulties with its daily workflow, and the worst of them was the lack of medical supplies to meet the demands of elective, urgent and emergency surgeries which led to the delay or cancellation of procedures. In order to outline the problem, the team listed a series of related factors that were categorized and presented in the form of an Ishikawa diagram, also known as cause and effect diagram (Figure 1).

The Ishikawa diagram was used to show the existing relationship between the phenomenon, the cause and the effect, elements that, for technical reasons, may affect the result. The process ultimately consisted of a problem to be solved and then used to sum up and define the possible causes, working as a guide to identify and determine the corrective measures to be adopted[6].

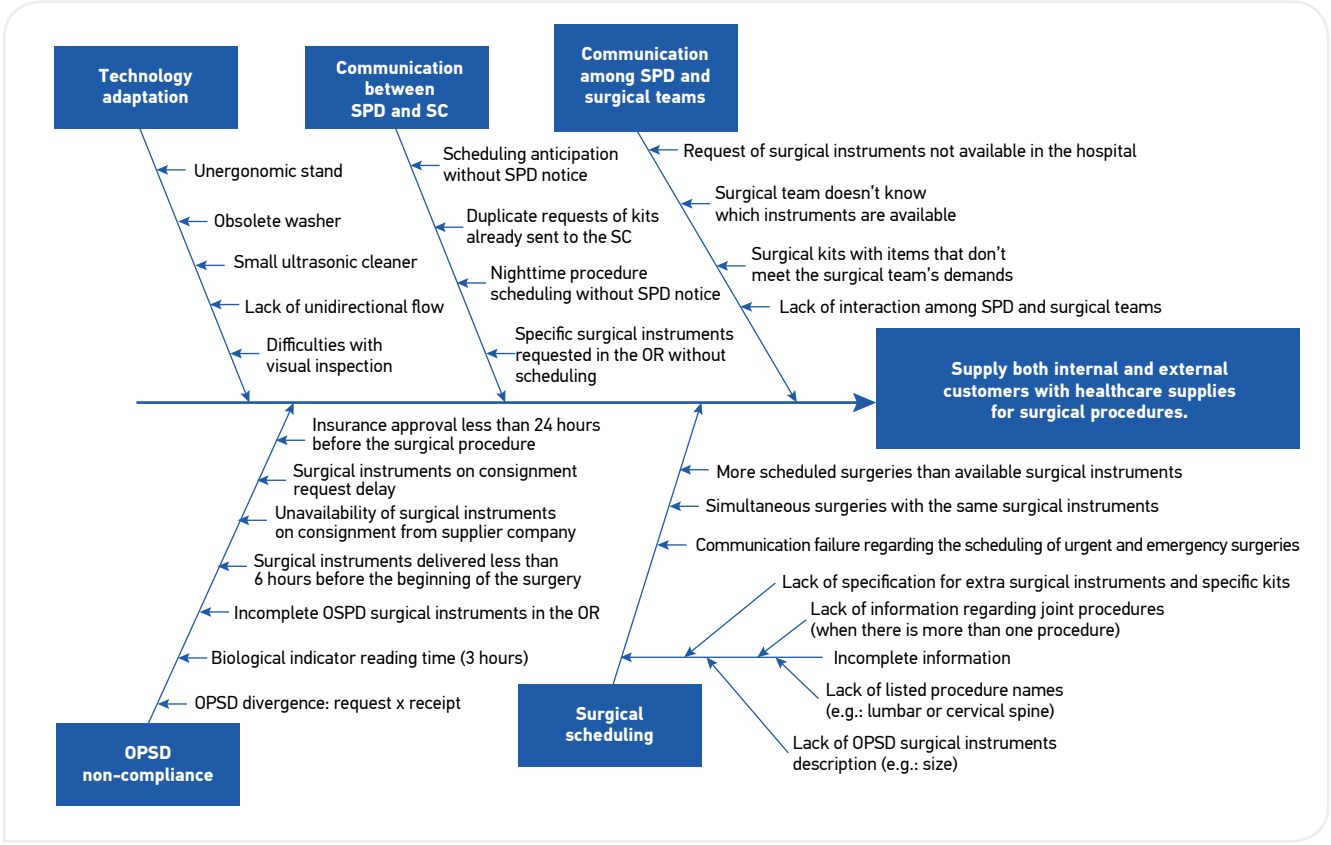

Figure 1. Cause and effect diagram: mapping of weaknesses.

Defining action priorities

After the problems and their inter-relations got listed with the cause and effect diagram, it was possible to identify improvement opportunities. To solve the problem, the team decided to use a prioritization matrix tool (gravity, urgency and tendencies – GUT) as a way to prioritize the actions that would be taken (Chart 1).

The step-by-step for the construction of the matrix included:

- step 1: formulation of the list of problems;
- step 2: categorization of problems according to each of the three GUT variables. Each problem was analyzed according to a score ranking from 1 to 5, to each one of the variables: 1 for cases with no gravity or urgency, but with a tendency to get worse, and 5 for extremely severe and urgent cases that will get worse immediately if not dealt with;
- step 3: establishment of a ranking of the main problems (by multiplying the three scores);
- step 4: analysis to define the weak points (ranking of the main problems);
- step 5: elaboration of action plans to solve or reduce the problems[6].

Proposed solutions

After the analysis of the problems, other correlated causes that required short and mid-term solutions were detected.

Chart 1. Prioritization matrix.

Problem description	G	U	T	SCORE	*
Incomplete OPSD** material in the room	5	5	5	125	1º
Lack of description on OPSD equipment (e.g.: size)	5	5	5	125	2º
Specific surgical instruments requests without scheduling	4	5	5	100	3º
Simultaneous surgeries with the same surgical instruments	5	4	4	80	4º
Obsolete washer	5	4	4	80	5º
OPSD divergences: request x receipt	4	4	4	64	6º
Missing unidirectional flow	4	4	4	64	7º
Scheduled surgeries overcoming available surgical instruments	4	3	3	36	8º
Lack of information regarding joint surgeries	4	3	3	36	9º
Communication failure regarding the scheduling of urgent and emergency surgeries	3	4	3	36	10º
Surgical instruments on consignment unavailable from supplier company	4	3	3	36	11º
Request of surgical instruments unavailable in the hospital	3	4	3	36	12º
Equipment being delivered with less than 6 hours advance regarding the start of the surgery	3	4	3	36	13º
Surgery anticipation without the SPD being informed	3	3	3	27	14º
Nighttime surgery scheduling without notice to the SPD	3	3	3	27	15º
Surgical instruments on consignment request delay	3	3	3	27	16º
Lack of listed surgery procedure names (e.g.: lumbar or cervical spine)	3	3	3	27	17º
Difficulties to carry out visual inspection	4	3	2	24	18º
Surgical kit with items that don't meet the team's demands	3	2	3	18	19º
Lack of specification for extra surgical instruments and specific kits	3	2	3	18	20º
Small ultrasonic cleaner	2	3	3	18	21º
Lack of communication among SPD and medical teams	2	3	2	12	22º
Biological indicator reading time (3 hours)	2	2	2	8	23º
Surgery approved by insurance less than 24 hours before the procedure	2	2	2	8	24º
Surgical team unaware of the available surgical instruments	2	2	2	8	25º
Unergonomic equipment stand	2	2	2	8	26º
Duplicate requests (kits that have been previously sent to the SC)	2	2	2	8	27º

*Prioritization; OPSD: Orthosis, Prosthesis and Special Devices.

However, those problems involved different sectors of the hospital, other than the SPD, and the interaction between them would allow the solution of most of the listed issues. Three lines of action were identified to solve the problems:

1. "Surgical Data Map";
2. financial support for the following items: infrastructure adequacy, acquisition of new technologies, surgical instruments and increase of human resources of the hospital.
3. inter-professional communication.

RESULTS

"Surgical Data Map"

The nurses of the SPD began to participate, systematically, of a meeting called "Surgical Data Map", which happened every day in order to verify the authorizations by the private health insurance for surgical procedures. The group of professionals who attended the meeting consisted of SPD, SC and surgical scheduling nurses, as well as the nurse technician who was responsible for ordering the products on consignment. The daily meetings allowed the identification of other issues and their effective solving solution.

After the reformulation of the "Surgical Data Map" daily meeting, other professionals spontaneously joined the group, such as the SC pharmacists, the Hemodynamics nurses and, in some specific meetings, the leaders of the sector responsible for products on consignment. Currently, the newcomers of the aforementioned sectors, the staff in training and the trainee nurses also take part in the "Surgical Data Map" meeting. With the optimization of the "Surgical Data Map", the active participation of the group members and the adoption of management tools, several actions were taken and led to the solution of deficiencies, as shown in Chart 2.

The involvement of the hospital's financial department was necessary for some of the actions, as described in Chart 3.

Important inter-professional communication components were also outlined, as listed in Chart 4.

The implemented actions resulted in solutions that contributed with the improvement of the surgery cancellation indicator. The data were selected according to the SPD criterion of lack of reusable medical devices. When this indicator was analyzed, the team concluded that over the last 5

Chart 2. Actions taken after "Surgical Data Map" assessment.

Rescheduling of simultaneous surgeries with the same surgical instruments.
Surgical instruments requests are met according to previous scheduling and availability.
OPSD requests are ordered soon after approval.
During urgent or emergency situations, other supplier companies are contacted when the first-choice company has no availability of the surgical instruments on consignment, according to pre-established criteria.
Surgical instruments on consignment inspection on delivery according to medical request and insurance authorization.
Surgical instruments on consignment orders are made by the respective sector by phone or e-mail to the supplier company. If there's a delay, the SPD nurse will place a new phone call in order to get a delivery forecast.

OPSD: Orthosis, Prosthesis and Special Devices; SPD: Sterile Processing Department.

Chart 3. Financial support to the following items: infrastructure adequacy, acquisition of new technologies, surgical instruments and increase of the human resources of the hospital.

New surgical instruments acquisitions according to the type of scheduled surgery.
Acquisition of a 1-hour biological indicator reader.
Acquisition of six equipment stands and hydraulic chairs according to professional's height.
Acquisition of three thermodesinfectant equipment.
Acquisition of a higher capacity ultrasonic cleaner.
Physical space rearrangement in order to maintain unidirectional flow.
Acquisition of inspection microscope and light system replacement.
Hiring of a coordinator for the SPD and two night shift exclusive nurses.

SPD: Sterile Processing Department.

Chart 4. Interprofessional communication.

The surgery scheduling sector notifies the SPD about urgent and emergency procedures by phone or e-mail.
The nurse in charge of the sector will review the scheduling information whenever necessary.
Surgery scheduling can only be anticipated upon instruments and equipment on consignment availability check by an SPD nurse.
Medical kits sent to the SC are registered under a document called "Surgical Notice" which describes all the supplies and equipment to be utilized during the surgery. This information is also uploaded to a traceable computer system.
Surgical teams are invited to the SPD to see which surgical instruments regarding their specialties are available at the department, thus allowing a better management of said equipment.
Content rearrangement on the existing kits according to suggestions by surgeons and surgical technicians.
Acquisition of new medical kits after SPD nurses and surgical teams conjoint decision.
SPD nurses are present in the OR during perioperative period, when needed, with direct contact with the multidisciplinary team in order to clarify doubts and to give immediate responses to problems regarding instruments.
When there are doubts upon the receipt of surgical instruments on consignment the surgical team is contacted to provide answers.

SPD: Sterile Processing Department. SC: Surgery Center; OR: operating room.

years, the surgery cancellation rate peaked in 2012 (3.8%), which was the worst result motivated by this problem, and kept on decreasing throughout the following years, reaching its best performance in 2016, with under 0.5% cancellations of scheduled anesthetic/surgical procedures.

DISCUSSION

In order to assess the quality of healthcare services, the selection of a method that will allow guidelines or standards that can help the institution to reach the highest levels of excellence is key. Hospital institutions choose accreditation programs which are voluntary and developed under a periodic basis, according to order No. 538, issued by the Health Ministry (HM) on April 17, 2001. This ministerial order acknowledges ONA as the competent and authorized institution to be responsible for carrying out the development of the Hospital Accreditation Program[7].

This program allows healthcare services to be managed with quality, according to what is recommended by the Accreditation Guide for Hospitals[7,8]. It is an evaluation program, therefore, the healthcare institutions are expected to adopt the indicators. Those are objective measures that provide, through its results, a clear view of the hospital's real conditions. Therefore, it is also possible to outline new practices. During the evaluation period, the team could verify the importance of not only monitoring the indicator, but also intervening when necessary. For that to happen, the adoption of tools that can help with the decision-making process is essential, such as the ones used in this experience report, including the Ishikawa diagram and the GUT prioritization matrix tool.

The management of the surgery cancellation indicator allowed the SPD and the multidisciplinary teams to find solutions for several issues. A study has demonstrated that the cancellation of surgeries has repercussions on the entire chain of services of the anesthetic/surgical routine. The lack of medical supplies is reported as one of the main causes leading to this scenario[9].

CONCLUSION

This report showed that better interaction among the several sectors of a large hospital is possible with the implementation of a daily meeting called "Surgical Data Map". This routine facilitated the solution of problems such as the lack of reprocessing of reusable medical devices for surgeries, thus avoiding the suspension, the delay or the postponement of procedures and the mitigation of several forthcoming problems.

It demonstrated that the adoption of quality management tools helped with decision-making processes, leading to the increase of managerial and care quality and the humanization of the hospital-patient relationship. The study made all the professionals involved, with no exception, aware that they are co-responsible both for the positive results of a successful procedure and for the waste and loss of resources and the work redone. It was also stablished that the nurse, in the context of the multidisciplinary team, is the most committed and knowledgeable professional to coordinate a work group with the goal of improving patient care and safety.

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CHANGE ASSESSMENT PROTOCOL FOR STEAM STERILIZATION PROCESS*

Protocolo de avaliação de mudança para o processo de esterilização a vapor

Protocolo de evaluación para el proceso de esterilización a vapor

Natalia Barbosa Ferreira de Moura do Santos[1], Andrea Alfaya Acuna[2], Cristina Silva Sousa[2]

ABSTRACT: Objective: To report on the experience of creating a protocol, which evaluates changes in the steam sterilization process. **Method**: Experience report, based on the theoretical basis and validation of new equipment at the Central Sterile Supply Department. The validation occurred between May and July of 2016, and tested the suitability of the process and the material, using ISO 17665-1. The protocol includes main points that influence the decision of whether to maintain or re-evaluate the equipment. The protocol validation was carried out by five nurses from the Central Sterile Supply Deparment. **Results:** The protocol was composed of six actions, which required verification of the equipment, and three actions that did not impact any critical points in the process. The most critical point observed was with wet materials. The protocol was validated by the nurses from the Central Sterile Supply Department, and presented as a flowchart. **Conclusion:** The protocol promotes the idea of nurses acting critically in corrective and preventive maintenance of steam sterilization equipment.
Keywords: Sterilization. Steam. Equipment and supplies, Hospital. Perioperative nursing.

RESUMO: Objetivo: Relatar a experiência da criação de um protocolo de avaliação de mudança do processo de esterilização a vapor. **Método:** Relato de experiência, com base no fundamento teórico e na validação de novos equipamentos do Centro de Material e Esterilização. A validação ocorreu entre maio e julho de 2016, e testou a adequação ao processo e ao material, utilizando a NBR ISO 17665-1. O protocolo contempla os principais pontos para influenciar a decisão de manter ou reavaliar o equipamento. A validação do protocolo ocorreu por cinco enfermeiros atuantes no Centro de Material e Esterilização. **Resultados:** O protocolo foi composto por seis ações, que exigem requalificação do equipamento, e três ações que não impactaram em nenhum ponto crítico do processo. O ponto mais crítico observado ocorreu com materiais úmidos. O protocolo foi validado pelos enfermeiros do Centro de Material e Esterilização e apresentado na forma de fluxograma. **Conclusão:** O protocolo favorece que enfermeiros atuem de forma crítica na manutenção corretiva e preventiva do equipamento de esterilização a vapor.
Palavras-chave: Esterilização. Vapor. Equipamentos e provisões hospitalares. Enfermagem perioperatória.

RESUMEN: Objetivo: Informar la experiencia de la creación de un protocolo de evaluación del proceso de esterilización a vapor. **Método:** Relato de experiencia, basado en el fundamento teórico y en la validación de nuevos equipos del Centro de Material y Esterilización. La validación ocurrió entre mayo y julio de 2016, y probó la adecuación al proceso y al material, utilizando la NBR ISO 17665-1. El protocolo contempla los principales puntos para influir en la decisión de mantener o reevaluar el equipo. La validación del protocolo fue realizado por cinco enfermeros actuantes en el Departamento Central de Abastecimiento de Esterilización. **Resultados:** El protocolo fue compuesto por seis acciones, que exigen recalificación del equipo, y tres acciones que no impactan en ningún punto crítico del proceso. El punto más crítico observado ocurrió con materiales húmedos. El protocolo fue validado por los enfermeros del Departamento Central de Abastecimiento de Esterilización y presentado en forma de diagrama de flujo. **Conclusión:** El protocolo favorece que los enfermeros actúen de forma crítica en el mantenimiento correctivo y preventivo del equipo de esterilización a vapor.
Palabras clave: Esterilización. Vapor. Equipos y suministros de hospitales. Enfermería perioperatoria.

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Received: 10/23/2017 – Approved: 03/09/2018
DOI: 10.5327/Z1414-4425201800020008

INTRODUCTION

According to the Resolution from the the Collegiate Board of Directors of the Brazilian Agency for Sanitary Surveillance (*Agência Nacional de Vigilância Sanitária* - ANVISA) no. 15, of March 15, 2012, it is mandatory to standardize the various processes that occur within a Central Sterile Supply Department (CSSD). The centers are classified as CSSD class I and CSSD class II, and are intended to establish good practices for the processing of health products (PHP)[1]. Article 37 of this regulation describes the need to verify the installation, the operation, and the performance of the equipment used in the automated cleaning and in the sterilization of PHP, with minimum annual periodicity. These components make up the equipment validation process[2].

The validation of the sterilization depends on a set of steps called verification, which certifies the adequacy of the evaluated parameters. Among them, the validation of the sterilizing equipment's performance, which is carried out by physical, chemical and biological controls, aims to ensure that the probability of microorganism survival is less than 1:1,000,000 (10^{-6})[3,4]. Thus, verification is defined as the set of actions taken to attest and document the proper installation and function of all facilities, systems and equipment, leading to the expected results. The verification is part of the validation, but the isolated stages of the verification do not constitute the validation of the process[5].

Sterilization is the process of destroying microorganisms to such an extent that it is no longer possible to detect them in the standard culture medium in which they had previously proliferated[3,6]. It can be performed by physical, chemical and physicochemical means. Among the physical processes exists high-pressure saturated steam sterilization.

This monitoring of the sterilization processes should incorporate a physical, chemical and biological evaluation. The physical control includes monitoring the critical parameters of each process, by means of manual recording or through a printer that is interconnected to the sterilizer. For the chemical control, indicators and integrators with different market presentations are used. Biological indicators are characterized by a standardized preparation of bacterial spores designed to produce suspensions with 105 to 106 spores per filter paper units[7].

Theoretically, a standard moist heat sterilization cycle is divided into three phases or stages[1]: conditioning, in which the air is withdrawn from the sterilizer's inner chamber, and the load is preheated; exposure or sterilization, in which contact of the vapor with the material occurs under controlled pressure and temperature conditions to promote the death or inactivation of viable microorganisms; and drying, which is responsible for the removal of steam and vapor condensate from the interior of the load.

Validation is documented evidence that the equipment sterilization process is effective and reproducible. Reproducibility issues are fundamental to a well-defined validation process, therefore, it is important that a hospital has defined and approved its working protocols. Furthermore it is ideal that there is an operative quality system set in place to ensure the verification of the procedures and their reproducibility[5].

The validation process consists of the following steps[5]:

1. project verification: before purchasing the equipment, the manufacturer's installation requirements must be known;
2. facility verification: documented evidence, provided by the manufacturer or distributor, that the equipment has been delivered and installed in accordance with the specifications;
3. operation verification: documented evidence, provided by the manufacturer or distributor, that the equipment operates within the original manufacturing parameters, after the facility has been verified;
4. performance verification: documented evidence that the equipment, after verifying its installation and operation, performs consistently for at least three successive cycles of the process, with identical parameters, and using the most challenging load determined by the health service.

Regardless of the sterilization method, the equipment must be approved by ANVISA, validated by the manufacturer at the time of installation, re-verified at least annually, and monitored, before being routinely used. Furthermore, the equipment must undergo preventive and repair maintenance from hospital engineers or from the equipment manufacturer[5].

OBJECTIVE

To report on the experience of creating a change assessment protocol for the steam sterilization process.

METHOD

This is an experience report of creating a change assessment protocol for the steam sterilization process at a large philanthropic hospital located in the city of São Paulo. The protocol was built based on theoretical bases[8], norms and resolutions, and the monitoring of the validation process of the CSSD's new equipment.

Equipment of great productive capacity and low operating costs were acquired for the new CSSD, which opened in August of 2016. They were obtained with the objective of improving logistics in relation to refilling supplies and improving the work structure, with a focus on health, and on patient and employee safety[9].

In March of 2016, in conjunction with the CSSD's coordinator nurse, the need to develop this study was observed. Nurses should not only be part of the processing of the material, but also when the equipment undergoes modifications and when it presents problems. Hence arose the question that guides the present work: When is it necessary to verify the equipment? Do the nurses know this? Based on these questions, the nurses sought information about the validation process of the equipment and observed the performance verification of the autoclaves three times, since the operational verification was already in process.

The implementation of a new CSSD, with the installation of new steam sterilization equipment (Century v120 and Evolution HC1000), requires that its processes be validated and verified before the unit begins to operate.

The validation process of the steam sterilization equipment must be carried out by the manufacturer — the company *Steris*, which is responsible for the installation and thermal verification. The thermal calibration of the equipment is performed by the company *Escala* and the performance verification is carried out by the company *Orion*, both of which are contracted by the hospital unit. These steps are essential for the equipment to operate properly and be cleared for use.

The professionals involved in the autoclave verification processes were listed. The company *Steris* was represented by the following professionals: service supervisor, technical officer and clinical specialist. The company *Escala*, which was responsible for the calibration, was represented by the operational technicians. And the company *Orion*, which carried out the equipment's performance verification, was represented by the field technicians and their managing partner. The hospital's maintenance and clinical engineering teams, and the CSSD's nursing team — comprised of the coordinator, the lead nurse, the resident nurse, and nursing technicians — were also involved throughout the process.

The verification process requires norms that govern that the work be conducted in an appropriate way. To this end, the manufacturer's standards, national regulations and also international regulations — translated and used in the country — such as RDC n. 15[2] and NBR ISO n. 17.665-1[10]. This process should be developed within the hospital unit's CSSD.

Thus, in the period from May to July of 2016, the validation process occurred. For performance verification to be effective, the following tests should be performed: leak test, three empty sterilization cycles, Bowie Dick, and three unloaded sterilization cycles. All of the cycles were monitored with thermometers placed at specific points in the equipment, which evaluated the process points.

At the end of this process, the authors began to construct the protocol, with the objective of following the main points that guide the decision to maintain or re-evaluate the equipment.

Subsequently, the CSSD nurses validated the protocol through reading the constructed material. They were then asked about the flowchart's understandability, clarity, and readability.

The creation process of the change assessment protocol was finalized and presented to the CSSD nursing team, printed on A3 bond paper, and made available in the unit's preparation area.

RESULTS

On May 25, 2016, the equipment's performance verifications began, with technicians from Orion, representatives from Steris, the CSSD nursing technicians and the unit's lead nurse. At the time of the first tests, there were problems with the wet load, which made it impossible to perform the tests, so the activities had to be halted. The possible reasons for the wet load were: piping, equipment, vacuum and heating curve.

The performance verification was resumed on June 15, 2016, starting with equipment number 02, which has a cycle for prions. The tests described above were carried out both for the normal cycle and for the prion cycle, that

is, six tests with no load and six tests with a load were performed. This performance verification process took three days to complete.

On June 22, 2016, autoclaves number 02 and 03 were approved, and the lead nurse supervised the second day of tests in autoclave number 04. Orion's technicians installed thermometers in the equipment, and monitored its heating curve using a laptop. First, the tests without a load were carried out, then the tests with a load. The materials used were prepared and packed by the CSSD technicians.

Equipment number 01 was submitted to the tests on June 23, 2016. The express cycle was excluded in this process because the institution does not use it, and the other cycles were approved without intercurrences.

After the performance verification phase, the equipment validation was completed and the autoclaves were cleared for use. The established sterilization time was 4 minutes, at 134ºC, and 40 minutes of drying time for non-woven fabric (NWF) or surgical grade paper. For the container cycle, 20 minutes of drying time was established. In cases of materials that correspond to a special cycle, 90 minutes of drying time was required.

In October 2016, the validation documents were analyzed, dates and phases of the validation were registered, NBR ISO 17.665-1[10] was acquired and, from that moment, the protocol was constructed. At the end of that month, the protocol was finalized and presented to the unit coordinator to be validated for layout and content.

After the coordinator validated it, changes in the flowchart format were necessary to make it more understandable, and to add on points that would lead to re-verification. Additionally changes were made to identify which points would not cause an impact, and may require only corrective or preventive maintenance.

In November of 2016, a new version of the flowchart was presented to the unit coordinator, and a redesign was deemed necessary. At this time, a change to the flowchart's color was requested, in order to to make it more understandable, as well as changes to some sentences, in order to improve their clarity.

At the end of November, the reformulated version of the flowchart (Figure 1) was presented to the CSSD nurses to validate understandability and to assess clarity and applicability. This was carried out through informal conversation.

There were no changes after this phase, and the flowchart was printed and made available on colored A3 bond paper in the preparation area, near the autoclave and close to the location of the CSSD nurses. It is to be used as a guiding instrument in the autoclave's change assessment process.

DISCUSSION

The results of this work demonstrate that the change assessment process is complex and requires the involvement of the nursing team in all of its phases.

Among the difficulties experienced during this period, understanding the equipment process, the possible failures in the validation process, and the parameterization of the sterilization processes were challenges faced when finishing the construction of the flowchart.

The validation process, including the verification of sterilization equipment performed by companies that provide validation services, has evolved in recent years. The process of sterilization by autoclaving has basically stayed the same since its inception in 1880 by researcher Charles Chamberland. It can be affirmed that the equipment's evolution focused on the control of the sterilization cycle phases, made possible by safety and registration devices. Also, requirements about the sterilization quality management system were put in place in documents[11].

Nowadays, it is imperative that CSSDs at health care institutions validate their sterilization processes, including the verification of their sterilizing equipment. To that end, it is necessary to choose a technical standard that can be used as a reference for the creation and execution of validation protocols. Other standards may be adopted in conjunction with the main one, such as the use of references for acceptance criteria, procedures and indicators, as well as technical recommendations from class associations and the manufacturer[11].

The validation protocols should inform all of the procedures to be performed, and the expected results of each step of the PHP processing, including the justification for each acceptance criterion adopted. Evidence should be provided demonstrating that the achievement of these criteria will ensure that the materials processed in the equipment will be sterilized. This evidence, considered an outcome indicator, should be obtained through sterility tests, which correspond to the biological indicators[11].

The choice of the technical standard to be followed should be based on the date of publication, since it is imperative

to use the most recent standard as possible and, preferably, one that is already officially translated into the Portuguese language. For steam autoclave, the standard applied is NBR ISO 17.665-1[10] by the Brazilian Association of Technical Standards (*Associação Brasileira de Normas Técnicas* -ABNT), which came into effect on February 22, 2010. This standard includes the full translation of the international standard ISO 17.665-1:2006, which cancels/replaces ABNT NBR ISO 11.134:2001[11].

Because the sterilization process validation has several stages, the norm allows them to be concluded in a random order, as there is no need for one step to be satisfactorily completed before the next is initiated. The key point is that all of the steps are completed satisfactorily[11].

In NBR ISO 17.665-1[10], item 12.5 says that any change should be evaluated as to its impact on the effectiveness of the sterilization process. Changes to be considered — if applicable — should include:

1. replacement of a part that could cause a process parameter to change;
2. replacement of a part that could cause increased leakage into the sterilization chamber;
3. variation of the homogeneity in the sterilization chamber;
4. modified program and/or driver;
5. any changes to the process parameter;
6. any changes to the services and to a service's maintenance results;

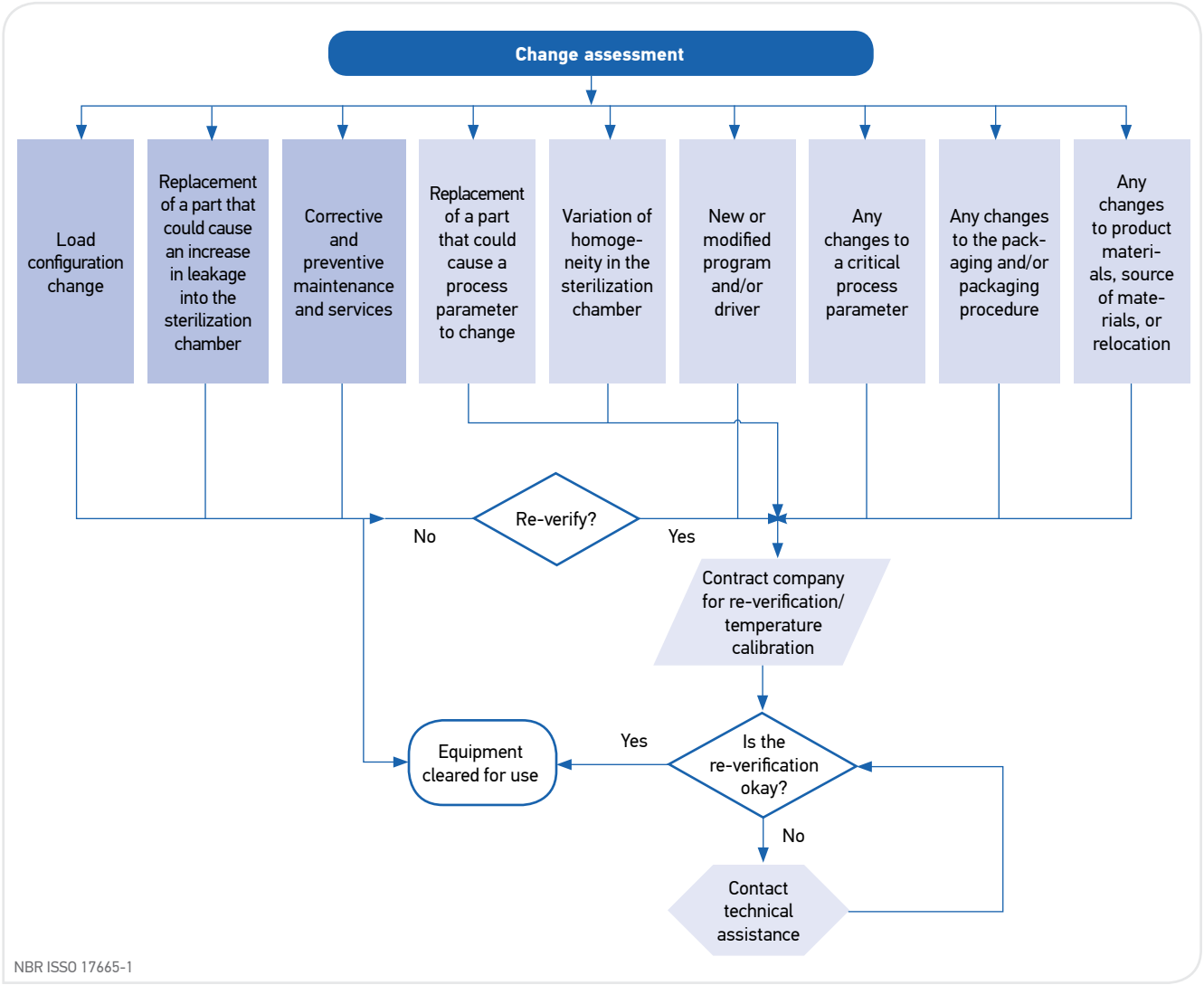

Figure 1. Flowchart for the Steam Sterilization Change Assessment Protocol.

7. any changes to the packaging and/or packaging procedure;
8. any changes to load configuration;
9. any changes to product materials, source of materials, or design.

The outcome of this evaluation should be documented, including the justification for the decisions made and the extent of changes made to the sterilization process, product or re-verification required (if applicable)[10].

It is recommended that a validation group be created, composed of the CSSD's nursing team, engineering and maintenance teams, and suppliers and service providers, who must have a proven professional qualifications to carry out their activities, elaborate and execute the verification, and change control and equipment monitoring protocols[1].

FINAL CONSIDERATIONS

This study confirmed the importance of the validation process and its application in the nurses' work routine. Producing the protocol comes in the interest of encouraging the nursing team to be more active in all processes within the CSSD. As a key part of the process of receiving and delivering sterile materials, nurses must seek theoretical bases and have an active voice in the verification process of the steam sterilization equipment.

Despite the pertinence of this topic in the current context, it is necessary to consider that the nursing team is not involved in the equipment re-verification process, leaving the matter to the maintenance and/or hospital engineering teams. Therefore, in addition to the necessity of encouraging nurses to look more critically at the process, it is essential to develop an indicator that evaluates this protocol's applicability in the day-to-day work of nursing teams.

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ABRASIVE INJURY AFTER CARDIAC CATHETERISM: CASE REPORT

Lesão por abrasão após cateterismo cardíaco: relato de caso

Lesión por abrasión después del cateterismo cardíaco: relato de caso

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ABSTRACT: Objective: To report a case of skin abrasion related to dressing removal after cardiac catheterization via the femoral artery. **Method:** Report of a case registered in a university hospital in Northeastern Brazil, occurred in September 2017. **Results:** The patient was submitted to cardiac catheterization, which indicated myocardial revascularization surgery. In the preoperative period, the skin lesion was identified, extending transversely in the abdomen, infraumbilical region and the inner side of the right thigh, corresponding to the region where the post-catheterization compressive dressing was performed. **Conclusion:** The post-catheterization compressive dressing should be performed and nursing should pay special attention to its removal, due to the risk of abrasion, which can affect a large area, causing direct damage to the patient and increasing the risk of infection.

Keywords: Postoperative complications. Wounds and injuries. Cardiac catheterization. Thoracic surgery. Nursing care.

RESUMO: Objetivo: Relatar um caso de lesão de pele por abrasão relacionada à retirada de curativo pós-cateterismo cardíaco via artéria femoral. **Método:** Relato de um caso registrado em um hospital universitário do Nordeste do Brasil, ocorrido em setembro de 2017. **Resultados:** A paciente foi submetida a um cateterismo cardíaco, que indicou cirurgia de revascularização miocárdica. No período pré-operatório, identificou-se a lesão de pele, que se estendia transversalmente no abdome, na região infraumbilical e na face interna da coxa direita, correspondendo à região em que foi realizado o curativo compressivo pós-cateterismo. **Conclusão:** O curativo compressivo pós-cateterismo deve ser realizado e a enfermagem deve dar atenção especial à sua retirada, em virtude do risco de lesão por abrasão, que pode acometer uma grande área, ocasionando dano direto ao paciente e aumentando o risco de infecção.

Palavras-chave: Complicações pós-operatórias. Ferimentos e lesões. Cateterismo cardíaco. Cirurgia torácica. Cuidados de enfermagem.

RESUMEN: Objetivo: Informar un caso de lesión de la piel relacionada con la extracción del apósito después del cateterismo cardíaco a través de la arteria femoral. **Método:** El informe de un caso registrado en un hospital universitario en el noreste de Brasil que ocurrió en septiembre de 2017. **Resultados:** El paciente fue sometido a cateterismo cardíaco, lo que indicó cirugía de revascularización miocárdica. En el período preoperatorio, se identificó la lesión de la piel, que se extiende transversalmente en el abdomen, la región infraumbilical y el lado interno del muslo derecho, correspondiente a la región donde se realizó el apósito compresivo post-cateterismo. **Conclusión:** El apósito compresivo post-cateterización debe realizarse y la enfermería debe prestar especial atención a su extracción, debido al riesgo de abrasión, que puede afectar a un área grande, causando daño directo al paciente y aumentando el riesgo de infección.

Palabras clave: Complicaciones postoperatorias. Heridas y lesiones. Cateterismo cardíaco. Cirugía torácica. Atención de enfermería.

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Received: 11/07/2017 - Approved: 03/11/2018
DOI: 10.5327/Z1414-4425201800020009

INTRODUCTION

In addition to risks inherent to an invasive procedure and the use of contrast, cardiac catheterization via femoral artery causes discomfort to the patient, who needs to stay motionless while the compression dressing is in place[1].

Nursing care provided to patients who undergo this procedure must be integral and attentive to complications[2]. To prevent bleeding, bruising, and ecchymosis at the puncture site, a compression dressing of large extension, that can serve as a tourniquet on the thigh, is applied. After catheterization, patients — at most services in the country — remain motionless and restricted to bed, while this dressing is kept in place for up to six hours, even when there is evidence that this time can be safely reduced to up to three hours[3,4].

Complications arising out of this procedure are already well documented. However, we could not find any reference to abrasion injury during removal of compression dressing in the literature searched. Possibly because it rarely occurs, or for being an adverse event that is not specific to catheterization[3-6], which justifies the present study.

OBJECTIVE

To report a case of skin abrasion injury related to removal of post-cardiac catheterization dressing via femoral artery.

METHOD

Report of a case registered in a university hospital in the Northeast of Brazil, which occurred in September 2017. Case of skin abrasion injury related to removal of post-catheterization dressing via femoral artery, with description of how the adverse event occurred, its relevance and implications in the perioperative period of cardiac surgery.

The patient was evaluated in two moments: first, on the day before surgery, 12 days after diagnostic catheterization, and in the intraoperative period, that is, when the heart surgery happened.

For data collection, medical records were referred to, in addition to preoperative and intraoperative assessments by the researchers. In the preoperative period, on the day before surgery, an enterostomal therapist visited the patient, described the lesion state, and registered the risk of the patient if submitted to heart surgery.

This case report is part of a research project on surgical positioning and skin injuries in perioperative period, approved by the Committee for Ethics in Research of the institution where the study was conducted (CAAE: 66142117.0.0000.5208, Report: 2.045.355). Important to mention that the patient agreed with the execution of this study and publication of images. The authors undertook to use the information to conduct this study only and to keep the research subject's identity anonymous.

RESULTS

An elderly female patient, 67 years old, obese (body mass index – BMI=36.3 kg/m^2), hypertensive, non-insulin-dependent diabetic, non-smoker, non-drinker, stated suffering from paroxysmal nocturnal dyspnea and edema in lower limbs for approximately three years, without investigating the cause.

She had acute chest pain and was sent to the reference cardiology emergency, after being treated in an emergency care unit. During pre-hospital care, she remained hemodynamically stable, but complained of tight retrosternal pain, which lasted more than 12 hours, accompanied by dyspnea, with partial oxygen saturation (Sat O_2>94%). Electrocardiograms showed a new right bundle branch block and changes indicative of acute myocardial infarction (AMI), with corresponding elevation in markers of myocardial necrosis. The staff implemented a compensation strategy and referred the patient to cardiac catheterization.

The procedure was performed without urgency, via femoral artery, with a 6-French introducer sheath, following the routine for coronary artery evaluation and ventriculography. There was no entry in medical record regarding removal of introducer or dressing made by the nurses after the procedure.

On the day following the catheterization, an echocardiogram confirmed the indication for myocardial revascularization (MR) surgery. The surgery was scheduled for ten days later, that is, 12 days after catheterization.

On the day before surgery, the patient received a routine preoperative visit, in which a nurse evaluates the patient, gives them instructions about the perioperative period, and answers their questions. Upon the visit, the surgery center (SC) nurse identified the injuries and required evaluation by an enterostomal therapist.

The lesion had characteristics of skin abrasion in the area of compression dressing, commonly applied after hemodynamic procedures. It stretched across the infraumbilical area (Figure 1) and reached the anterior and inner side of the right thigh (Figure 2), without signs of infection, with receding edges, and signs of reepithelization. The enterostomal therapist registered her findings in the medical records, communicated them to the nurse of that area, and contacted the physician responsible for the heart surgery. The latter confirmed being aware of the situation, but stated that the patient should still undergo surgery because of the risks of delaying this second procedure.

On the day of the surgery, the patient was taken to the SC after being prepared with preoperative bath, shaving – including lower limbs –, and peripheral venous access. After entering the operating room (OR), the patient was placed in the appropriate table, answered questions made by the nurse from the surgical safety checklist, and received anesthetic induction. She was then submitted to orotracheal intubation, central venipuncture and left radial artery puncture for invasive monitoring of blood pressure.

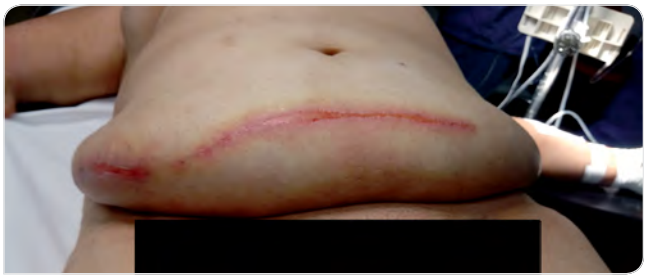

Figure 1. Abrasion injury in infra-umbilical area after removal of post-cardiac catheterization compression dressing with surgical tape.

Figure 2. Abrasion injury on inner right thigh after removal of post-cardiac catheterization compression dressing with surgical tape.

After the procedures carried out by the anesthesia team, including prophylactic antibiotic therapy, the nurse uncovered the patient to perform urinary catheterization and prepare the skin. At this point, he came across the extensive lesion. The team discussed the situation and decided to proceed due to the risk-benefit ratio, as assessed by the surgeon. In the instrument for registration of Systematization of Perioperative Nursing Care, the nurse found the entries about the preoperative visit and recorded the condition of the injury at admission in the room.

During positioning for cardiac surgery, the patients are usually wrapped in a strip of surgical tape, secured on the surgical table's ends. In other surgeries, Velcro straps and buckles can be used, but cardiac surgeries require asepsis of the entire torso and the surgical tape allows continuous application of the solution, unlike Velcro straps.

The skin was prepared with chlorhexidine antiseptic solution, followed by an alcohol solution. The nurse took care not to let the alcohol solution get in contact with the injured area, but applied the antiseptic solution on it, since there was no aqueous solution available. Between the first asepsis, performed by the nurse, and the second, done by the scrub nurse, the abdominal area received a layer of cross-sectional compress. Surgical tape was applied over the compress for safety in surgical positioning, ensuring no contact between it and the skin to prevent worsening of abrasions or the appearance of new ones.

The surgery lasted approximately four hours, with extubation in the OR. The patient was transferred to the cardiac surgery recovery unit with monitoring and without vasoactive drugs. Upon removal of surgical tape, new lesions were not found. At the end of the surgery, the injury edges and peri-incisional skin were hyperemic, probably due to the time they were kept in contact with the chlorhexidine solution.

After surgery, the adverse event was recorded. The patient had no surgical site infection (SSI) or other infectious complications during 11 days of hospital stay, until discharge.

DISCUSSION

The patient had risk factors for skin and positioning injuries – such as diabetes, advanced age, and obesity – which should have be given greater attention[7]. These factors must serve as a warning for strategies to prevent such injuries, including careful initial inspection of dermis condition and risks.

A strategy used by some nurses to protect the skin as much as possible is to first place a layer of micropore tape over the post-catheterization or angioplasty compression site and only then cover it with the surgical tape. This prevents epidermal contact and facilitates the removal. Important to note that we did not find studies in the literature that validate this resource.

One cannot affirm that the hemodynamic staff failed upon checkout, that is, the evaluation of the patient before leaving the procedure room, because she was discharged from the service to the emergency, where the dressing was removed[8,9]. We also did not find reports of abrasion lesion after this procedure in the literature.

An integrative review verified the prevalence of 27 nursing diagnoses in hemodynamic services. However, it did not show diagnoses of "risk for impaired skin integrity" or "risk for impaired tissue integrity", both applicable in complications. The former is useful to describe skin abrasion injury and the latter to refer to complications such as hematomas[10]. Despite the nursing diagnosis of "risk for impaired skin integrity" in post-catheterization patients, another study points out that the exam was mentioned because it can be used for any dermal invasion, without considering abrasion risk[11].

A publication reported the experience of a service with the use of a checklist designed for diagnostic and therapeutic cardiac catheterization procedures as a strategy for nursing care management. It showed to be an improvement in assistance quality, suggesting that it is possible to use this tool until dressing removal, when the staff assesses the possibility of complications at the puncture site that would hardly be noticed before[12].

Timeout, or patient safety checking immediately before skin incision, is still a challenge for nurses in SC. It should include an overall assessment of the patient, with records of previous skin injuries and review of strategies to prevent new and surgical-positioning lesions[7,8,13]. Demands such as room preparation, surgery delays, and team collaboration hinder this step[8,14]. In the case presented, only after intubation and invasive procedures did the nurse identify the lesions.

An integrative review aimed at addressing nursing care in surgical positioning and reporting complications did not describe non-use of surgical tape as care strategy, although it is still used in some surgeries, mainly to ensure patient safety while moving the table for lateral tilt, head or lower-limbs elevation during surgery, or when the patient is accommodated in such positions[7]. The SC where the event occurred has Velcro straps and buckles available for this purpose; however, some teams prefer surgical tapes.

At the end of the surgery, the occurrence was registered in the hospital's computerized surveillance of adverse events. Healthcare professionals should incorporate this procedure into their routine, given that, in spite of the large number of adverse events reported in some studies, results may be underestimated when there is no organizational culture to promote adherence to records[15].

FINAL CONSIDERATIONS

Post-catheterization compression dressing is necessary, and the nursing staff must give special attention to its removal due to the risk of abrasion injury. This lesion can affect a large area, causing direct damage to the patient and increasing risks of infection, as described in the patient this study focused on.

We suggest the establishment of protocols to prevent skin injuries for both hemodynamic services and surgical centers. Lastly, emphasis is given to the importance of recording adverse events for further analysis of failures, proposal of interventions, and constant reflection about protocols and institutional routines.

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