POSTOPERATIVE CARE FOR COVID-19 PATIENTS: CHALLENGES FOR PERIOPERATIVE NURSING PRACTICES

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The COVID-19 pandemic brought several obstacles to health care, with a great impact on surgical patient care. In addition to the suspension of elective surgeries, which led to the increase of waiting lists for surgical interventions and the reduction of revenues in health institutions, surgeons faced ethical issues and uncertainties regarding decision making for elective surgical procedures and clinical outcomes in the postoperative period.

Among the possibilities of action in the pandemic scenario, patient classification levels were proposed to define surgical intervention priorities, along with the elaboration of strategic planning for the adequate sizing of human resources that could meet the demand of critical patients in the different health services[1].

Surgical procedures, including cardiovascular and oncological interventions, had several implications with the rescission of elective surgeries. The reason is that surgeons experienced the difficult choice to perform surfical procedures in patients considering the situation`s risks of infection and postoperative complications due to COVID-19, besides systemic deterioration and aggravation of the disease with the increase in the waiting time for surgical interventions.

The study pointed out that patients undergoing cardiac surgery had a low incidence of COVID-19 in the postoperative period (8.1%), indicating the possibility of intervention with adequate planning of care and testing of patients that would have improved quality of life in the postoperative period and the prevention of clinical complications associated with previous comorbidities.[2].

In contrast, research indicated that patients with COVID-19 during the preoperative period or acquired in the postoperative period had an increased risk of mortality in the 30 days after surgical intervention and postoperative pulmonary complications associated with high levels of physical condition-ASA (III to V); age over 70 years old; execution of emergency procedures and diagnosis of cancer.[3]

In addition to the issues related to decision-making for the execution of the surgical procedure, the challenges of health teams also include the need to organize an adequate management of human resources in the surgery center (SC) and physical structure to assist patients infected with SARS-CoV-2 in the intra- and postoperative periods.

During the intraoperative period, the institutions needed to develop care protocols that allowed the execution of the surgery without exposing professionals to contamination, with the adequate supply of personal protective equipment (PPE), as well as an air-conditioning system structure with negative pressure in order to avoid environmental contamination by aerosols. In the postoperative period, surveillance of patients was intensified both in the prevention of SARS-CoV-2 infection and in the adequate control of the respiratory pattern of patients with a positive diagnosis, aiming to reduce postoperative complications.

The monitoring of possible complications, such as pneumonia and pulmonary thromboembolism[1] was added to the need for planning and assertive decision by the anesthesiologist and surgeons team, regarding the urgency of referring patients in the immediate postoperative period to the intensive care units (ICUs).

The perioperative nursing teams had to adapt to the needs of ICU care, contributing significantly to the workforce of this sector in the face of the growing demand for critical care in the postoperative period, besides the execution of anesthesia recovery of patients who were not referred to the ICU in the operating room. Thus, a new work routine scenario for these professionals was designed, modifying the flow of care in the SC, and developing or updating skills and knowledge to meet the new profile of patients in the postoperative period.

Through numerous challenges imposed by the COVID-19 pandemic for postoperative care, the perioperative nursing team had the opportunity to strengthen its practices and obtain scientific knowledge with a focus on critical patient care, aiming at carrying out actions in the health team for

assertive surgical interventions and effective control of postoperative complications.

Thus, consistent actions of permanent education services that promote the improvement of professionals to act with scientific basis and skills according to the real needs of patients assisted in this new scenario of surgical care is of utmost importance.

Cassiane de Santana Lemos

Post-Doctoral at the School of Nursing of Universidade de São Paulo (USP). Professor at the School of Nursing of USP, professor of the undergraduate course in Nursing of the Faculty of Medical Sciences of Santa Casa de São Paulo, and guest professor of the undergraduate and graduate courses of Faculdade Israelita de Ciências da Saúde Albert Einstein.

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LEVEL OF STRESS IN NURSING PROFESSIONALS OF A SURGICAL CENTER

Nível de estresse entre profissionais de enfermagem em um centro cirúrgico

Nivel de estrés en los profesionales de enfermería en un centro quirúrgico

Tamires Leal da Silva[1], Jacqueline Ramos de Andrade Antunes Gomes[2], Marcelo Moreira Corgozinho[3]*

ABSTRACT: Objective: To assess the level of stress of nursing professionals in a surgical center. **Method**: This is a descriptive, exploratory study with a quantitative approach, based on the Bianchi Stress Scale to assess a sample of 50 participants. **Results**: Females were predominant among nurses (100%) and nursing technicians (90.7%), aged between 31 and 50 years (76%), with more than 16 years of training (64%) and working time in the operating room above 16 years (34%). Nurses had an medium stress score in all domains, with emphasis on activities related to personnel administration (score 4.47), while among nursing technicians, a low level of stress was more common, except for the medium level in activities related to the functioning of the unit (score 3.1). **Conclusion**: Nurses had a medium level of stress, while technicians had a low level of stress. It is important to seek strategies for coping with administrative management problems in the case of nurses, and the operation of the surgical center for nursing technicians.
Keywords: Nursing, team. Stress, psychological. Surgicenters.

RESUMO: Objetivo: Avaliar o nível de estresse entre profissionais de enfermagem em centro cirúrgico. **Método:** Trata-se de estudo descritivo, exploratório, com abordagem quantitativa, que utilizou a Escala Bianchi de Stress para avaliar uma amostra de 50 participantes. **Resultados:** Houve predomínio do sexo feminino entre enfermeiros (100%) e técnicos de enfermagem (90,7%), da faixa etária entre 31 e 50 anos (76%), do tempo de formação superior a 16 anos (64%) e do tempo de atuação no centro cirúrgico acima de 16 anos (34%). Os enfermeiros apresentaram escore médio de estresse em todos os domínios, com destaque para atividades relacionadas à administração de pessoal (escore 4,47), enquanto entre os técnicos de enfermagem predominou o baixo nível de estresse, com exceção do médio nível nas atividades de funcionamento adequado da unidade (escore 3,1). **Conclusão:** Os enfermeiros destacaram-se pelo médio nível de estresse, enquanto os técnicos pelo baixo nível de estresse. Destaca-se a necessidade de buscar estratégias de enfrentamento dos problemas de gestão administrativa, no caso dos enfermeiros, e de funcionamento do centro cirúrgico, para os técnicos de enfermagem.
Palavras-chave: Equipe de enfermagem. Estresse psicológico. Centros cirúrgicos.

RESUMEN: Objetivo: Evaluar el nivel del estrese entre los profesionales de enfermería en centro quirúrgico. **Método:** Es un estudio descriptivo, exploratorio, con enfoque cuantitativo, que utilizó la Escala Bianchi de Stress para evaluar una muestra de 50 participantes. **Resultados:** Predominó el sexo femenino entre enfermeras (100%) y técnicos de enfermería (90,7%) con edades comprendidas entre 31 y 50 años (76%), tiempo de formación mayor de 16 años (64%) y tiempo en el centro quirúrgico mayor de 16 años (34%). Las enfermeras habían presentado el puntaje medio del estrese en todos los dominios, con la prominencia para las actividades relacionadas con la administración de personal (puntaje 4.47), mientras que, entre los técnicos de enfermería, predominó el nivel bajo del estrese, con la excepción del nivel medio del estrese en las actividades del funcionamiento adecuado de la unidad (puntaje 3.1). **Conclusión:** Las enfermeras se destacaron por su nivel medio de estrés, mientras que los técnicos, por su bajo nivel de estrés. Se destaca la necesidad de buscar estrategias para la confrontación de los problemas de la gerencia administrativa, en el caso de las enfermeras, y del funcionamiento del centro quirúrgico, para los técnicos de enfermería.
Palabras clave: Grupo de enfermería. Estrés psicológico. Centros quirúrgicos.

[1]Nurse specializing in surgical center by the Uniprofessional Residency Program in Nursing, Surgical Center of the School of Health Sciences (ESCS/Fepecs) – Brasília (DF), Brazil.
[2]PhD in Science from Universidade de Brasília. Coordinator of the Uniprofessional Residency Program in Nursing, Surgical Center of ESCS/Fepecs – Brasília (DF), Brazil.
[3]PhD in Bioethics from the Health School of Universidade de Brasília. Preceptor and tutor of the Uniprofissonal Residency Program in Nursing, Surgical Center of ESCS/Fepecs – Brasília (DF), Brazil.
*Corresponding author: mmcorgozinho@gmail.com
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INTRODUCTION

Currently, in the labor world, given the challenges of industrial progress, globalization, technological development and virtual communication, health professionals are exposed to situations that go beyond skills and capacities developed. As a result, stress can cause biopsychosocial changes in human beings, harming their health, productivity and relationships with relatives and the social circle[1].

Stress can be defined as a general wear of the body caused by pressure or accumulation of psychophysiological pressures, motivated by a stressor, which leads the individual to an imbalance in homeostasis and exposes them to situations that irritate, excite or frighten them[2-5].

Nursing is the profession of caring, and professionals are directly close to patients and their relatives, so they deal with suffering, pain and death daily[3]. In addition to that, these professionals are exposed to chemical, physical and biological agentes in their work environment, which causes tension, anxiety and fear. Occupational stress is also related to high work demands, which result in reduced productivity and quality of work, increased rates of absenteeism and work accidents, and higher turnover of professionals[5-7].

Nursing professionals working in the surgical center are highly predisposed to the incidence of stress because they perform their activities in a closed environment, with many risks, different routines, high level of technical demand and productivity. In the perioperative period, these professionals must always be attentive while monitoring the patient's health status and prepared to deal with possible complications. In addition, they forecast and provide all resources to be used during the procedures and support the other professionals in the team[3].

However, the relevance of this study stems from the need to recognize the domains of professional practice that generate a greater load of stress on the nursing staff of a surgical center, providing an opportunity to intervene with measures to cope with stressful situations[8].

OBJECTIVES

- To assess the level of stress of nursing professionals who work in the surgical center of a public hospital in the Federal District (DF);
- To identify the most stressful activities among nursing professionals who work in the surgical center of a public hospital in the Federal District (DF).

METHOD

This is a descriptive, exploratory study with a quantitative approach, carried out with the nursing team of the surgical center of a public hospital in Brasília (FD), whose specialties are the following: ophthalmology, otolaryngology, urology, gynecology, mastology, plastic surgery, vascular, orthopedics and urgency.

The study sample consisted of 7 nurses and 43 nursing technicians from the surgical center of the respective hospital, workers of the morning, afternoon and evening shifts. Nursing residents and professionals who were on vacation or on other legal leaves were excluded from this study.

Data were collected in December 2019 and the Bianchi Stress Scale[8] was used as instrument, as it aims to measure the level of stress that professionals attribute to each activity performed in their work environment. It is a self-applicable, validated scale composed of two parts:

- sample characterization: biological sex, age, position, work unit, time of work at the unit, work shift, time since graduation, postgraduate courses;
- stressors in the performance of nursing professionals, with 51 items on a Likert scale grouped into six domains. Domain A: relationship with other units and supervisors (nine situations); domain B: proper functioning of the unit (six situations); domain C: nursing staff administration (six situations); domain D: nursing care provided to the patient (fifteen situations); domain E: coordination of activities (eight situations); and domain F: working conditions (seven situations).

The instrument was tested for internal reliability by the Cronbach's Alpha test in the Statistical Package for Social Sciences (SPSS) and obtained, in the total scale, 0.96 (almost perfect reliability) and, in the domains, above 0.70 (substantial reliability), which shows its consistency. As in other studies[9,10], the scale was applied to nursing technicians and nurses because it lists activities performed by both categories and because there is the option "does not apply or I do not do it: 0".

For the analysis, data were input to a Microsoft Office Excel spreadsheet and, later on, presented in tables for descriptive analysis of absolute frequencies. The scoring was performed for each domain in the two professional categories (nurses and nursing technicians). By summing the scores of the component items of each domain and dividing the result by the number of items, the average score for each domain

studied was obtained. The range of scores for each domain is 1 to 7, with the standardized stress level scored as 3 or below being considered as low level of stress, between 3.1 and 5.9 as medium level of stress, and 6.0 or above as high level of stress. The zero value is reserved for cases in which the professional does not perform the activity or when it does not apply.

This study was assessed and approved by the Research Ethics Committee of the Health Sciences Education and Research Foundation (CEP/Fepecs), under Opinion No. 3.685.587 and Certificate of Presentation for Ethical Appreciation (CAAE) No. 21152619.9.0000.5553, in compliance with the terms of Resolution No. 466/2012 of the National Health Council[11].

RESULTS

Of the total number of participants (n=50) from the surgical center, females (female biological sex) were predominant among both nurse (100%) and nursing technicians (90.7%). The age group between 31 and 50 years old prevailed (76%), followed by those over 50 years old (20.0%), as shown in Table 1.

As for time since their graduation, most had mor than 16 years (64%). Regarding the time of experience in a surgical center, most had more than 16 years (56%), followed by 6 to 10 years (24%). As for the time of work in the surgical center of the study institution, 34% had more than 16 years in the house, followed by one year (20%).

Table 1. Profile of nursing professionals from the surgical center who made up the sample.

Variable	Professional category		Total (n=50)
	Nurse (n=7)	Nursing Technician (n=43)	
Age (years)			
20-30	0	2 (4.65%)	2 (4%)
31-40	2 (28.6%)	13 (30.23%)	15 (30%)
41-50	3 (42.8%)	20 (46.51%)	23 (46%)
50+	2 (28.6%)	8 (18.6%)	10 (20%)
Biological sex			
Female	7 (100%)	39 (90.7%)	46 (92%)
Male	0	4 (9.3%)	4 (8%)
Time since graduation (years)			
2-5	0	3 (6.97%)	3 (6%)
6-10	2 (28.6%)	6 (13.95%)	8 (16%)
11-15	0	7 (16.28%)	7 (14%)
>16	5 (71.4%)	27 (62.8%)	32 (64%)
Time of experience in the field (years)			
2-5	0	2 (4.65%)	2 (4%)
6-10	2 (28.6%)	10 (23.25%)	12 (24%)
11-15	0	7 (16.28%)	7 (14%)
>16	5 (71.4%)	23 (53.5%)	28 (56%)
Did not reply	0	1 (2.32%)	1 (2%)
Time in the current job (years)			
<1	1 (14.3%)	9 (20.93%)	10 (20%)
2-5	2 (28.6%)	7 (16.28%)	9 (18%)
6-10	0	6 (13.95%)	6 (12%)
11-15	0	7 (16.28%)	7 (14%)
>16	4 (57.1%)	13 (30.23%)	17 (34%)
Did not reply	0	1 (2.32%)	1 (2%)

Table 2 shows data regarding the level of stress detected in the nursing staff of the surgical center, measured through the Bianchi Stress Scale. In the category of nurses, scores between 3.1 and 5.9 were obtained, characterizing a medium level of stress in all domains studied in the scale. The domain with the highest level of stress detected was "activities related to personnel administration" (C. 4.47), followed by the domains "activities related to the proper functioning of the unit" (B. 4.14), "coordination of activities in the unit" (E. 3.76), "working conditions" (F. 3.54), "relationship with other units and supervisors" (A. 3.39) and "nursing care provided to the patient" (D. 3.17).

The predominant level of stress detected in the professional category of nursing technicians was low in the following domains: "relationship with other units and supervisors" (A. 2.42), "nursing care provided to the patient" (D 2.31), "working conditions" (F. 2.27), "coordination of activities in the unit (E. 0.92) and "activities related to personnel administration" (C 0.48). A medium level of stress was detected among nursing technicians in the domain "activities related to the proper functioning of the unit" (B. 3.1).

Table 3 shows the activities with the highest stress load in each domain of the Bianchi scale. Nurses had a medium level of stress in all domains, with emphasis on "activities related to personnel administration" (C), with the main activities chosen as the greatest cause of stress: "supervising the team's activities" (5,28) and "preparing the monthly staff scale" (5.2). In the domain "control of material used" (B), the most stressful items were: "material control" (4.57), "equipment control" (4.42) and "material replacement" (4.33).

For the nursing technicians, the items generating the highest levels of stress in the domain "proper unit functioning" (B) were: "request for revision and repair of equipment" (5.44), "control of equipment" (4.66) and "survey of amount of material in the unit" (4.31).

DISCUSSION

Data in this study show the predominance of female participation (female biological sex) in the nursing category, just like in other studies[2,3,6,7,9,12-16]. This is consistent with data from the Federal Council of Nursing (Cofen), which states that, in 2015[17], nursing professionals are predominantly female (84.6%), and highlights the growth of the male population in recent years.

Table 2. Level of stress among nursing professionals from the surgical center, according to professional category.

Domains	Bianchi Stress Scale*	
	Nurse	Nursing Technician
Relationship with other units and supervisors (A)	3.39	2.42
Activities related to the proper functioning of the unit (B)	4.14	3.1
Activities related to personnel management (C)	4.47	0.48
Nursing care provided to the patient (D)	3.17	2.31
Coordination of activities in the unit (E)	3.76	0.92
Work conditions (F)	3.54	2.27

*Bianchi Stress Scale: equal to or below 3.0 (low stress level); between 3.1 and 5.9 (medium level of stress) and equal to or above 6.0 (high level of stress).

Tabela 3. Atividades mais estressoras nos domínios da Escala Bianchi de Stress, segundo categoria profissional.

Category	Domain	Situation	Mean*
Nurse	C - Personnel management	Supervising team activities	5.28
		Developing monthly staff schedule	5.20
	B - Proper functioning of the unit	Controlling material used	4.57
		Controlling equipment used	4.42
		Material replacement	4.33
Nurse technician	B - Proper functioning of the unit	Request for equipment maintenance and repair	5.44
		Equipment control	4.66
		Survey of material in the unit	4.31

*Bianchi Stress Scale: equal to or below 3.0 (low stress level); between 3.1 and 5.9 (medium level of stress) and equal to or above 6.0 (high level of stress).

Nursing professionals perform their functions at work in addition to their role as a mother and a wife at home, becoming overloaded with the accumulation of tasks and attributions that contribute to the emergence of stress[16]. In parallel, professional ethics signals for a nurse performing an affective work in constant polishing of moral values, promoting empathy with the experiences of the patient[18].

The age group 41-50 years old prevailed among the nursing categories. Studies[7,15] state that older professionals have greater self-confidence and security to perform their functions and face the stressors of daily work. However, a research[3] indicated the opposite: aging, physiological wear and the emergence of non-communicable chronic diseases would be associated with the inadequacy of these professionals to the sector's routines, making them more vulnerable to stress.

Regarding the time since graduation and the length of experience in the area, most reported having more than 16 years of background and more than six years acting in a surgical center. Therefore, it is a very experienced team of surgical nursing. It is noteworthy that the length of experience in the area influences coping with stress, contributing to the improvement of professionals and preparing them to face situations that require specialized scientific knowledge, skill and safety in the work environment[9,12].

Among nurses, the domains with the highest levels of stress were domain C, "activities related to personnel management", and domain B, "activities related to the proper functioning of the unit", which is in line with the results of similar studies[9,12]. Regarding domain C, among the most stressful activities and items, "supervising the team's activities" and "preparing the monthly staff scale" stood out. This domain is related to administrative nursing activities that require responsibility, empathy, and dedication on a daily work schedule, monthly work schedule, vacation schedule, surgery map, and management of material resources and equipment in the sector.

Interpersonal relationships are considered a complex aspect that contributes to the emergence of stress among professionals[3,9]. A study[19] carried out with professional nurses who worked in a surgical center reported a low professional satisfaction index; "professional interaction" was the most relevant component and "professional status" the least relevant. It is noteworthy that, to minimize the problems inherent to interpersonal relationships, one must encourage teamwork and move away from individualization and competitiveness for a pleasant interaction, which contributes to the prevention of stress and to an increase in the quality of life at work[9].

Nursing technicians had a medium level of stress only in domain B, related to the "adequate functioning of the unit", and a low level of stress in the others. However, another similar study[3] did not show stress in most nursing professionals, despite the surgical center being a sector that contributes to its emergence.

As for activities related to "proper functioning of the unit " (domain B), there was a medium level of stress for both categories, the most stressful situations being: "control of material used", "control of equipment", "replacement of material", "request for equipment maintenance and repairs" and "survey of existing material". The scarcity of materials and the inadequate functioning of equipment cause physical and psychological wear to the nursing team and, consequently, cause stress because they are concerned with the quality of care provided to surgical patients[15].

The exposure of professionals to potentially stressful situations can trigger states of stress, interfering with the performance of activities and the quality of care provided[2,15]. Nursing professionals must work aligned and as a team in order to ensure the proper functioning of the unit, patient safety, and less exposure to stressors[9].

The lack of comparison between stress levels in different care profiles in the surgical center is a limitation of this study. However, even in the presence of stressful factors, the nursing team, in its management and care role, contributes decisively to safe care practices in the surgical center.

CONCLUSIONS

The analysis of the results allowed us to conclude that the nurses participating in the study had a medium level of stress in all the studied domains, while among the nursing technicians, a low level of stress predominated, with the exception of the medium level of stress related to the domain "adequate functioning of the unit". The most stressful domain among nurses is related to personnel management and the proper functioning of the unit, such as team management activities and bureaucratic activities related to the surgical environment. Regarding the operation of the unit, forecasting, providing and monitoring materials and equipment are the most exhausting and stressful tasks, probably because professionals routinely deal with the scarcity of resources and low-quality equipment.

The results presented in this study are expected to make professionals and the management team aware of the factors that cause stress and pave the way for strategies to cope with situations that generate stress among nursing professionals in surgical centers.

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SUSPENSION OF ORTHOPEDIC SURGERIES FOR EXTRINSIC REASONS IN OLDER PATIENTS

Suspensões de cirurgias ortopédicas por motivos extrínsecos em pacientes idosos

Suspensiones para cirugía ortopédica por razones extrínsecas en pacientes ancianos

Milena Bizo[1], Maria Clara Vioto Gragnani[2], Thainá Oliveira Laluce[3]*, Jaqueline Lopes Gouveia[4], Priscila Buck de Oliveira Ruiz[5], Rita Cássia Helú Mendonça Ribeiro[6]

ABSTRACT: Objective: To identify the rates and extrinsic reasons for the suspension of elective orthopedic surgeries in older adults and the course until their performance, according to sex, age group, origin, and type of surgery. **Method:** This is a retrospective descriptive study with a quantitative analytical approach and variable correlation, carried out in a teaching hospital from January to June 2018. The sample consisted of orthopedic surgery patients aged 60 years and older. **Results:** Out of the 543 orthopedic surgeries scheduled for older adults, 93 (17.41%) were suspended. The main reason for suspension was the previous surgery lasting longer than expected (35.48%); the surgery was canceled once and performed 1–2 days after the suspension (91.87%), with statistical significance (p=0.00). **Conclusion:** We found that the rate of surgical suspension for extrinsic reasons in orthopedic older patients was 17.41%. Surgical suspension remains a great challenge for professionals and health facilities, showing the significant involvement of nurses in detecting and solving surgical delays in order to decrease their incidence.

Keywords: Aged. Orthopedics. Elective surgical procedures. Health management. Perioperative nursing.

RESUMO: Objetivo: Verificar taxa e motivos extrínsecos de suspensões de cirurgias ortopédicas eletivas em idosos e o percurso até sua realização, reconhecendo sexo biológico, faixa etária, procedência e tipo de cirurgia. **Método:** Estudo retrospectivo, com delineamento descritivo, abordagem quantitativa do tipo analítica, com correlação entre variáveis, realizado em um hospital de ensino no período de janeiro a junho do ano de 2018 com idosos de 60 anos e acima, pacientes de cirurgias ortopédicas. **Resultados:** Das 543 cirurgias ortopédicas de idosos agendadas, 93 (17,41%) foram suspensas. O maior motivo para a suspensão foi extrapolação do tempo da cirurgia anterior (35,48%); a cirurgia foi cancelada uma vez e realizada entre um e dois dias após a suspensão (91,87%), com significância estatística (p=0,00). **Conclusão:** Constatou-se que a taxa de suspensão cirúrgica nos idosos ortopédicos, por motivos extrínsecos, foi de 17,41%. A suspensão cirúrgica ainda é um grande desafio aos profissionais e às instituições de saúde, demonstrando grande envolvimento do enfermeiro em detectar e solucionar o atraso cirúrgico, de modo a diminuir sua incidência.

Palavras-chave: Idoso. Ortopedia. Procedimentos cirúrgicos eletivos. Gestão em saúde. Enfermagem perioperatória.

RESUMEN: Objetivo: Verificar la tasa y motivos extrínsecos de las suspensiones electivas de cirugía ortopédica en ancianos y la vía para su realización, reconociendo el sexo biológico, grupo de edad, origen y tipo de cirugía. **Método:** estudio retrospectivo, con diseño descriptivo, abordaje analítico cuantitativo, con correlación entre variables, realizado en un hospital de enseñanza, de enero a junio del año 2018, con ancianos de 60 años y más, sometidos a cirugía ortopédica. **Resultados:** De las 543 cirugías ortopédicas programadas para ancianos, 93 (17,41%) fueron suspendidas. El mayor motivo de suspensión fue la extrapolación del momento de la cirugía anterior (35,48%); la cirugía se canceló una vez y se realizó entre uno y dos días después de la

[1]Nurse, graduate student of the Multidisciplinary Residency Program in Adult and Older Adult Health, Faculdade de Medicina de Botucatu, Universidade Estadual Paulista "Júlio de Mesquita Filho" (UNESP) – Botucatu, (SP), Brazil.
[2]Bachelor's degree in Nursing from the Faculdade de Medicina de São José do Rio Preto (FAMERP). Nurse in the Emergency Department of the Hospital de Caridade São Vicente de Paulo – Jundiaí (SP), Brazil.
[3]Nurse, graduate student of the Unidisciplinary Residency Program in Surgical Center and Sterile Processing Department, Hospital Sírio-Libanês – São Paulo (SP), Brazil.
[4]Specialist in Surgical Center, Anesthesia Recovery, and Sterile Processing Department from FAMERP. Nurse in the Surgical Center of the Hospital de Base de São José do Rio Preto – São José do Rio Preto (SP), Brazil.
[5]Nurse, master's degree from the Nursing Graduate Program of FAMERP – São José do Rio Preto (SP), Brazil.
[6]Ph.D in Sciences and Health from FAMERP. Professor at FAMERP – São José do Rio Preto (SP), Brazil.
*Corresponding author: thainalaluce@gmail.com
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suspensión (91,87%), con significación estadística (p=0,00). **Conclusión:** Se encontró que la tasa de suspensión quirúrgica, en el anciano ortopédico por razones extrínsecas, fue del 17,41%. La suspensión quirúrgica sigue siendo un gran desafío para los profesionales y las instituciones de salud, demostrando la gran implicación del enfermero en la detección y resolución del retraso quirúrgico, con el fin de reducir su incidencia.

Palablas clave: Anciano. Ortopedia. Procedimientos quirúrgicos electivos. Gestión en salud. Enfermería perioperatoria.

INTRODUCTION

In recent decades, the fertility rate of the world's population has decreased while life expectancy has increased. This change in the population pyramid brings greater public health problems since it affects a vulnerable group — older adults[1]. According to the World Health Organization (WHO), in developing countries, such as Brazil, older adults are individuals aged 60 years or over; in developed countries, this age increases to 65 years[1].

With advancing age, hospitalizations also increase, and several functional and structural changes occur, including reduced body mass, natural loss of bone density, degenerative diseases, and hearing and visual impairment[2,3]. Fall is one of the main reasons for hospitalization among older adults. It is characterized by an involuntary event that results in a change from the initial position to the same or a lower level, causing one or more lesions[2]. Older adults are the group most affected by this accident, which has a high recurrence and represents an important factor for the development of chronic complications[2].

Some age-related changes directly interfere with the surgical process, including the decrease in lean mass and total water, which are predisposing factors for higher drug toxicity and greater risk of hypothermia[3]. Natural physiological changes, associated with comorbidities, predispose individuals to falls, which are the leading causes of bone fractures and sometimes require surgical treatment[4]. Given the vulnerability of this group, the surgical procedure is a source of great concern for the multidisciplinary team and demands more caution in the perioperative period[3].

Surgical procedures involve several factors, which can be intrinsic — related to the patient — or extrinsic — related to the environment and the team[4]. Issues in these factors may lead to surgical suspension and postponement. This scenario has consequences for the patient, who will not be free from this invasive act but will remain hospitalized and exposed to infectious agents, often restricted to their bed and subjected to muscle atrophy, pressure ulcers, osteopenia, pneumonia, pulmonary embolism, and fat embolism[5,6]. In addition, this situation results in losses to the facility due to the increase in costs with hospitalization, medication, food (patient and companion), materials, and professionals[4].

According to a study carried out in a public teaching hospital in the state of Minas Gerais, the rate of surgical suspension was 14.14%, and most of them (63.78%) had no records of the reason. Among the justified suspensions, 8.82% corresponded to the patient not being admitted, 8.30% to the lack of appropriate clinical conditions, and 8.14% to administrative issues. Out of 15 specialties, urology and orthopedics had the highest number of suspended surgeries[7].

Considering these findings, the present study is justified, as it focuses on the suspension of orthopedic surgeries in the older population.

OBJECTIVE

To identify the rates and extrinsic reasons for the suspension of elective orthopedic surgeries in older adults and the course until their performance, according to sex, age group, origin, and type of surgery.

METHOD

This is a retrospective descriptive study with a quantitative analytical approach and variable correlation, carried out between January and June 2018.

The study site was a large teaching hospital with extra capacity (708 beds), located in the Southeastern region of Brazil. The facility provides care to 2 million inhabitants, patients of the public and private health systems, from 102 municipalities in the Rio Preto Regional Health Division (DRS 15). It serves users of the public health system (*Sistema Único de Saúde* — SUS) and beneficiaries of the private health system (*Sistema de Saúde Suplementar* — SSS), composed of several health providers and insurance companies accredited by the hospital, in addition to self-pay patients.

The study was conducted in the surgical center (SC), which consists of 28 operating rooms (OR), with an average of 31,714 surgeries/year, mostly performed by SUS.

In order to meet the objectives of this study, we analyzed the electronic medical records of patients aged 60 years or older submitted to elective orthopedic surgeries. Patients who had their surgery canceled for intrinsic reasons were excluded. We collected information from 93 records.

After tabulation of the collected data, two statistical analysis functions were performed: descriptive and inferential. The descriptive part involved building up the profile of the studied sample, considering the variables analyzed and their repercussions. Data were fully and relatively replicated in this first stage.

In the inferential domain, the statistical objective was to analyze independence and prediction among the variables proposed in the work scope. To that end, we used the Mann-Whitney U test within the expected standards. Results related to the dependence between the proposed variables were obtained by analyzing the p-values. A p-value lower than 0.05 was considered statistically significant.

All analyses were performed with the software Statistical Package for the Social Sciences (SPSS Statistics), version 23, coupled with tools from Excel®, version 2016.

We calculated the surgical suspension rate using the commitment to hospital quality (*compromisso com a qualidade hospitalar* — CQH) formula, which comprises the number of surgeries suspended for extrinsic factors multiplied by 100 and divided by the total number of surgeries scheduled[8,9].

This study complied with the ethical procedures that govern the research with human beings, established by Resolution no. 466/2012 of the National Health Council. It was submitted to the Research Ethics Committee (REC) of the Faculdade de Medicina de São José do Rio Preto (FAMERP) and approved as an amendment, opinion no. 2,748,090, on March 2, 2018, as part of the parent project *"Estudo da Qualidade de Vida de Idosos"* (Study on the Quality of Life of Older Adults), REC-FAMERP, opinion no. 1,508,014.

RESULTS

In the period analyzed (January to June 2018), the SC had 11,511 surgeries scheduled, considering all surgical specialties of the hospital. Among them, 1,117 (9.70%) were orthopedic surgeries, of which 543 (48.61%) were performed in older patients. During the study interval, 1,185 procedures were canceled — 394 (33.24%) were orthopedic surgeries, 125 (31.72%) in older patients. However, when considering extrinsic and intrinsic reasons for cancellation, 93 (74.4%) older adults had their surgery canceled for extrinsic reasons, that is, for reasons related to the SC of the hospital. Applying the CQH formula to the data collected, we found a surgical suspension rate of 17.41%.

According to the descriptive sample analysis, out of the 93 surgeries suspended for older patients, 22 (23.66%) occurred in March, 67 (72.04%) in women, 63 (67.74%) in patients from other cities, 38 (40.86%) in those aged 60 to 69 years, 55 (59.14%) occurred once, 24 (25.80%) had a waiting time of 1 to 2 days, and 33 (35.48%) were caused by the previous surgery lasting longer than expected. Also, 29 (31.18%) surgeries were performed due to femoral fracture and 11 (11.83%) to tibial fracture.

The study found a statistically significant correlation in the inferential statistical analysis when comparing age group × waiting time for surgery (p=0.004); number of suspensions × waiting time for surgery (p=0.000); number of suspensions × reason for suspension (p=0.015); month × reason for suspension (p=0.014); and month × type of surgery (p=0.027). We performed hypothesis tests using the Mann-Whitney U test and analyzing the behavior of the correlations among the variables studied and the level of explanation of the dependent variable in relation to the independent variables of the sample.

When comparing month × type of surgery, we found 19 types of surgeries, with the most frequent being femoral fracture (29/31.18%), followed by tibial fracture (11/11.83%); others had a rate lower than 10% (p=0.027).

The correlation between age group and waiting time for surgery showed statistical evidence; most older adults aged 60–69 years waited 1–2 days to have surgery, but a high number of them waited more than 30 days (87.50%), followed by those aged 80–89 years who waited 21–30 days (66.67%) when compared to other age groups (p=0.004), as shown in Table 1.

Another significant factor was the waiting time and the number of suspensions (p=0.00). A total of 91.67% of surgeries were suspended once and performed 1–2 days later, while 88.24% occurred 3–5 days later; the others waited up to more than 30 days to be performed (Table 2).

Among the main reasons for surgical suspension, we have the previous surgery lasting longer than expected (35.48%), which was correlated with the months studied (p=0.014), such as January, with 69.23% of suspensions (Table 3). A significant percentage of surgeries (50%) was canceled twice, showing a correlation with the reason for cancellation (p=0.014), as presented in Table 4.

Table 1. Waiting time for surgeries according to the patients' age group.

Age group (years)	Not performed		1 to 2 days		3 to 5 days		6 to 8 days		9 to 10 days		11 to 20 days		21 to 30 days		>30 days		Total	
p=0.004*	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
60 to 69	3	21.43	10	41.67	8	47.06	7	36.84	1	50	2	33.33	-	-	7	87.50	38	40.86
70 to 79	4	28.57	10	41.67	6	35.29	5	26.32	-	-	2	33.33	1	33.33	1	12.50	29	31.18
80 to 89	5	35.71	3	12.50	2	11.76	7	36.84	1	50	2	33.33	2	66.67	-	-	22	23.66
>90	2	14.29	1	4.17	1	5.88	-	-	-	-	-	-	-	-	-	-	4	4.30
Total	14	100	24	100	17	100	19	100	2	100	6	100	3	100	8	100	93	100

*Significant value; Mann-Whitney U test.

Table 2. Waiting time for surgery according to how many times the procedure was suspended.

Number of suspensions	Not performed		1 to 2 days		3 to 5 days		6 to 8 days		9 to 10 days		11 to 20 days		21 to 30 days		>30 days		Total	
p=0.000*	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Not performed	14	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	15.05
1	-	-	22	91.67	15	88.24	7	36.84	1	50	4	66.67	2	66.67	4	50	55	59.14
2	-	-	2	8.33	1	5.88	9	47.37	1	50	1	16.67	-	-	4	50	18	19.35
3	-	-	-	-	1	5.88	3	15.79	-	-	1	16.67	1	33.33	-	-	6	6.45
TOTAL	14	100	24	100	17	100	19	100	2	100	6	100	3	100	8	100	93	100

*Significant value; Mann-Whitney U test.

Table 3. Reasons for surgery suspension according to month.

Reason for suspension	January		February		March		April		May		June		Total	
p=0.014*	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Previous surgery lasted longer than expected	9	69.23	3	42.86	8	36.36	4	28.57	5	29.41	4	20	33	35.48
The team chose to operate another emergency/urgent patient	-	-	1	14.29	2	9.09	5	35.71	4	23.53	1	5	13	13.98
The team chose to perform another surgical procedure	-	-	2	28.57	3	13.64	-	-	2	11.76	9	45	16	17.20
Death	-	-	-	-	-	-	-	7.14	-	-	1	5	2	2.15
TOTAL	13	100	7	100	22	100	14	100	17	100	20	100	93	100

*Significant value; Mann-Whitney U test. Reasons for suspension with a percentage lower than 10% were excluded. The total values correspond to all reasons for suspension.

Table 4. Reasons for surgical suspension according to how many times the procedure was suspended.

Reason for suspension	Not performed		1 time		2 times		3 times		Total	
p=0.015	n	%	n	%	n	%	n	%	n	%
Previous surgery lasted longer than expected	-	0	22	40	9	50	2	33.33	33	35.48
Emergency surgery took precedence	-	0	12	21.82	1	5.56	-	-	13	13.98
Another surgical procedure took precedence	2	14.29	7	12.73	5	27.78	2	33.33	16	17.20
Total	14	100	55	100	18	100	6	100	93	100

*Significant value; Mann-Whitney U test. Reasons for suspension with a percentage lower than 10% were excluded. The total values correspond to all reasons for suspension.

DISCUSSION

Studies have indicated that the suspension rate of elective surgeries in university hospitals ranges from 17 to 33%[10,11]. An international investigation[11] found a cancellation rate varying between 1 and 23%, corroborating our results — 10.29% of the total number of surgeries suspended. In the East African country of Malawi, a study found differences between the surgical suspension rates of underdeveloped countries, such as South Africa (44.5%) and Malawi (44.2%), and developed countries, such as the United Kingdom (0.7–1.1%) and Australia (7.2%). This finding reveals that the staff size, surgical volume, available resources, and demand are predisposing factors for the increase in suspensions[12].

In a document analysis of 1,449 canceled surgeries, the surgical specialty with the highest frequency of cancellation was orthopedics, and the main extrinsic reasons for suspension included the change in approach of the surgical team and the elective surgery lasting longer than expected[13]. The study also identified that the main causes for surgical suspension involved decisions made by the surgeon, the anesthesiologist, and the nurse, considering both intrinsic and extrinsic reasons[13].

In another investigation carried out in the state of Paraná[14], cancellations of general surgery and orthopedic surgery stood out; orthopedics had a rate of 23.57%, a value close to that of our research.

A study in a teaching hospital in Paraná reported a suspension rate of 26.2% for orthopedic surgeries, which was the specialty with the second-highest suspension rate, following only thoracic surgery[15]. In this study, the reasons were divided into extrinsic and intrinsic to the patient. Only 22% of suspensions occurred for intrinsic reasons, while the remainder (78%) was attributed to extrinsic factors, showing that the main causes for suspensions were actually related to the SC[15].

In a hospital in Belo Horizonte, capital of Minas Gerais,[16] researchers assessed the surgical suspension rate from July to December 2013, including intrinsic and extrinsic reasons. The suspension rate of orthopedic surgeries was 22.1%, corresponding to second place. This information confirms the finding of the current research, evidencing the high suspension rate of orthopedic surgeries. Among the extrinsic reasons for suspension, those authors identified a high incidence of non-authorization from the patient's insurance provider (31.5%)[16], contrary to the results obtained in the present study, whose highest suspension rate was the previous surgery lasting longer than expected (35.48%). In our research, the rate of surgical suspension for extrinsic reasons in older patients was 17.12% after applying the CQH formula, while a study conducted in a hospital in Belo Horizonte, with patients of all age groups and that included intrinsic and extrinsic reasons, detected a rate of 5.2% in a 6-month period[16].

An investigation carried out in a Chinese university hospital revealed that the female sex presented significant differences compared to the male sex, which might be justified by women's higher demand for health services[11]. This result corroborates our research since the highest percentage of surgical suspensions was detected among female patients (72.04%).

Research conducted in a hospital in São Paulo demonstrated that older patients are the most affected, reporting that suspensions for clinical and non-clinical reasons held the second place[17]. This finding agrees with our study, which evidenced that 31.72% of suspensions occurred among older adults due to intrinsic and extrinsic reasons.

As to the types of orthopedic surgery with the most suspensions, femoral fracture had the highest incidence (31.18%) and was predominant throughout the period studied. This kind of fracture is more frequent among older adults due to falls. A study evaluating femoral fractures from 2008 to 2012 confirmed that, in line with other countries, Brazil presents a high number of cases — approximately 36,200/year —, which results from the significant number of surgeries scheduled for this specialty[18].

In agreement with our results regarding the previous surgery lasting longer than expected (35.48%), a study conducted in the university hospital of the Universidade Federal de Santa Catarina (UFSC) identified the lack of enough time for the procedure (24%) as one of the main reasons for surgical suspensions, followed by the lack of beds in the intensive care unit (ICU) (12%) [19]. A study performed in São Paulo showed that the main extrinsic reasons for suspension were the delay in the previous surgery and the lack of ICU beds, equipment, and materials, such as orthotics, prosthetics, and special materials (OPSM)[17]. Time delay may result from complications or changes in techniques and approaches during the surgical procedure, the presence or absence of resident physicians in the OR, as well as the surgical complexity of the following operation[11].

Another cause for surgery delay is the failure in planning and checking the surgery schedule board — directly linked to the nurse's team management skills —, as well as the assertive communication among those involved and the previous knowledge of hospital materials and equipment.

The surgical cancellation rate evidences the need for its reduction. To that end, we must continuously monitor this indicator and implement strategies aimed at decreasing it. Good process management and strategies are necessary for nurses to detect and solve surgery delays, which demands a proactive attitude and the empowerment of this professional so as to benefit as many patients as possible[20,21].

The use of management tools, such as the gravity, urgency, and tendency (GUT) matrix and the Ishikawa diagram, can be a strong contributor to solving challenges in the SC, since ineffective planning is among 21% of causes for suspension[21].

According to a study carried out in a public referral hospital in the state of Pernambuco from February 2015 to February 2016, the specialties most prone to suspension were general surgery, orthopedics, and urology, in this order. Among the extrinsic reasons, the ones that stood out were the delay in the previous surgery (16.8%), the addition of an emergency surgery (14.1%), and the delay of the surgical team (8.4%), with the female sex being the most frequent (56%)[22], corroborating the findings of the present study. We emphasize that this scenario affects patients and their families, generating stress, distress, and dissatisfaction with the situation and the facility, as well as the facility itself, with increased expenses and stress for the team[22,23].

The nurse is responsible for planning and managing the SC routine, having to adapt every day to the constant changes in the surgical schedule. A study evaluating the implications of surgical cancellation from the perspective of nurses showed that this professional feels responsible and concerned with the waste it causes and with its consequences. Despite the differences between the main reasons for suspension, we found common data and issues when comparing our results to those of studies conducted in other facilities and that users experience great emotional, financial, and health loss[22,23].

An integrative review reported that the main stress-generating factor for patients after the suspension of their surgery was the failure in communication between the professional and the patient. The patient's lack of clinical conditions was the main reason for cancellation, and orthopedic surgery was the specialty with the most procedures suspended[24]. The nurse has an important role in this process because, in addition to providing care to the individual who will undergo the surgical procedure, they must guide and address the doubts that arise so the patient can feel safe[24]. In this scenario, the Perioperative Nursing Care Systematization (*Sistematização da Assistência de Enfermagem Perioperatória* — SAEP) is a support tool used to evaluate the patient and the communication within the nursing team, ensuring the continuity of care[24].

The limitations of the study included the poor completeness and correctness in the filling of all procedure data and of the justifications for cancellation in the patient's electronic medical record, in addition to the excessive scheduling and changes that occur and that hinder the research performance and validation.

CONCLUSION

This study identified that the suspension rate of orthopedic surgeries among older patients due to extrinsic reasons was 17.41%, which corroborates data from studies conducted in university hospitals. Most surgeries occurred in March, among females, in patients from other cities, and in those aged 60–69 years; the main surgery category was femoral fracture. The majority of the surgical procedures were suspended only once and performed 1–2 days later, with the main reason being the previous surgery lasting longer than expected and thus exceeding the SC working hours.

Surgical suspension remains a great challenge for professionals and health facilities. We noted the great involvement of nurses in managing and minimizing the suspension; however, this is not their exclusive role. Involvement in the preoperative organization is essential, including from surgical team members.

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COST MANAGEMENT AT THE OPERATING ROOM: FINANCIAL IMPACT AND LOSS OF REVENUE

Gestão de custos no centro cirúrgico: impacto financeiro e perda de receita

Gestión de costos en el quirófano: impacto financiero y pérdida de ingresos

Mayara Martins de Sousa[1], Rachel de Carvalho[2]*

ABSTRACT: Objective: To list the materials of greatest financial impact in the operating room and to estimate the loss of revenue they represented for the institution. **Method:** Retrospective and quantitative research, with collection in the database and spreadsheets of the surgical center and revenue guarantee for the years 2015 and 2018 of a private and large institution in São Paulo. **Results:** The materials that had the greatest financial impact were: Sevorane®, Plasma Lyte®, thermal blanket, bispectral monitor sensor, anesthesia mask, eletric scalpel pen, Sequel® leg protector, and electrosurgical plate. They represented a financial loss of BRL 342,473.00 in 2015, when there was still no on-site audit practice, compared with the amount of BRL 114,157.00, in 2018, after implementing checking initiatives in the operating room. **Conclusion:** There was a financial benefit achieved with the practice of on-site audit, with a 66.6% decline in the amount of materials and medicines excluded by the audit due to the enhancement in the quality of the notes found in medical records.

Keywords: Operating room nursing. Hospital records. Costs and cost analysis. Organization and administration.

RESUMO: Objetivo: Elencar os materiais de maior impacto financeiro no centro cirúrgico e estimar a perda de receita que representaram para a instituição. **Método:** Pesquisa retrospectiva e quantitativa, com coleta em banco de dados e planilhas do centro cirúrgico e garantia da receita dos anos de 2015 e 2018 de uma instituição privada de extra porte de São Paulo. **Resultados:** Os materiais que causaram maior impacto financeiro foram: Sevorane®, Plasma Lyte®, manta térmica, sensor de monitor bispectral, máscara de anestesia, caneta para bisturi, perneira Sequel® e placa para bisturi. Representaram perda financeira de R$ 342.473,00 em 2015, quando ainda não havia a prática de auditoria *in loco*, comparada ao valor de R$ 114.157,00, em 2018, após ação de conferências em sala operatória. **Conclusão:** Houve benefício financeiro alcançado com a prática da auditoria *in loco*, com declínio de 66,6% na quantidade de materiais e medicamentos excluídos pela auditoria em razão da elevação da qualidade das anotações em prontuário.

Palavras-chave: Enfermagem de centro cirúrgico. Registros hospitalares. Custos e análise de custo. Organização e administração.

RESUMEN: Objetivo: Enumerar los materiales con mayor impacto financiero en el Centro Quirúrgico y estimar la pérdida de ingresos que representaron para la institución. **Método:** Investigación retrospectiva y cuantitativa, con recolección en la base de datos y hojas de cálculo del Centro Quirúrgico y garantía de los ingresos para los años 2015 y 2018, de una institución privada extra grande de São Paulo. **Resultados:** Los materiales que causaron mayor impacto económico fueron: Sevorane®, Plasma Lyte®, Manta térmica, Sensor monitor biespectral, Máscara de anestesia, Pluma para bisturí, Perneira Sequel® y Placa para bisturí. Representaron una pérdida económica de R$ 342.473,00 en 2015, cuando aún no existía la práctica de auditoría *in situ*, frente al valor de R$ 114.157, en 2018, tras la acción de conferencias en el quirófano. **Conclusión:** Se logró un beneficio económico con la práctica de la auditoría *in situ*, con una disminución del 66,6% en la cantidad de materiales y medicamentos excluidos por la auditoría, debido al aumento en la calidad de las notas en las historias clínicas.

Palabras clave: Enfermería de quirófano. Registros de hospitales. Costos y análisis de costo. Organización y administración.

[1]Nurse degree from Faculdade Israelita de Ciências da Saúde Albert Einstein (FICSAE) – São Paulo (SP), Brazil.
[2]PhD in Nursing from the School of Nursing, Universidade Federal de Goiás. Professor of undergraduate and graduate courses at FICSAE – São Paulo (SP), Brazil.
*Corresponding author: prof.rachelcarvalho@gmail.com
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INTRODUCTION

In the midst of a business scenario in which health economy has been gaining an extremely relevant role, it is evident that the increase in costs has been calling the attention of hospital managers and the sources of payment of care practices. Hospital institutions invest in the auditing of accounts aiming at adequate remuneration of the provided care and at the invoicing of accounts in a reliable way according to what has been used by the patient[1].

In the context of hospital institutions, the surgical center (SC) is one of the sectors that most uses material resources, which generates high consumption and, therefore, makes this space a great producer of waste. Hence, this sector represents a major challenge for the management of excessive spending[2,3]. This waste can also result in ineffective production of processes, procedures, and/or services aimed at providing care[4].

The accounting audit processes at the SC are intended to check the performed procedures, materials used in anesthesia and surgeries, administered medications and exams, in comparison with the hospital bill, to be sent to sources of payment[4].

Following a worldwide trend to reduce hospital costs through new cost management models[5], the central hospital of this study performs an on-site and prior analysis of intraoperative hospital records inside the operating rooms (OR). This practice occurs during the surgical procedure and at its completion. Subsequently, the nurse auditors check all items in the hospital bills related to the patient, in addition to the respective clinical record, in order to make corrections with a much broader perspective, as they were present at the time of the anesthetic-surgical act. These practices also enable to develop a constant educational activity with the entire team that provides direct care to the patient and is responsible for filling out the institutional forms.

Such corrections, positive (inclusions of materials/equipment) or negative (exclusions of materials/equipment) adjustments, justify the collection of procedures and prevent the occurrence of disallowances. "Disallowances" are defined as the cancellation or partial or total refusal of the budget, bill, account, for being considered illegal or improper, concerning items that the auditors of health insurance plans do not consider suitable for payment[6].

Healthcare processes generate revenue through the records of the actions taken. It is noteworthy that a significant part of the payment for materials, medicines, and procedures is linked to the records of healthcare professionals, which are generally inconsistent, illegible, and subjective, causing disallowance of invoicing items, errors in collections and, consequently, loss of revenue[7]. A study carried out in the state of Rio Grande do Sul, Brazil, pointed out that 90% of disallowances occur due to inadequate and/or incomplete fulfillment of medical record data: clinical and nursing evolution, medical prescription, nursing report, surgical description, and anesthesia record. Among the 218 records analyzed by the authors, 77% were not properly filled in[8].

Thus, inadequate completion affects the economic support and the controllership of the hospital, as it results in undue payments related to the hospital bill[9]. In the accounting and financial perspective of the institution, the audit contributes to mitigate the generation of unnecessary expenses, as it is a tool that allows identifying focuses of cost generation and proposes intervention measures with future evaluation criteria[10].

In order to measure the magnitude of the financial loss that can be generated by the lack of information in medical records, in addition to the inexistence of the on-site checking practices, the authors listed the materials that, due to the absence of medical records, may represent an offense to the invoicing of accounts and the financial sustainability of the institution.

OBJECTIVES

To list which materials have the greatest financial impact on the SC of a private hospital in the state of São Paulo, Brazil;

To estimate the annual loss of revenue of the SC due to the absence of records of the actions taken by the healthcare team.

METHOD

This is a retrospective study, based on primary documentation, with quantitative data analysis. The study was carried out in a general hospital of the private network, of large size, with about 720 active beds, located in the South Region of the city of São Paulo, which has two SCs. One of them has 14 OR and 10 beds for Post-Anesthetic Recovery (PAR), and the other has 21 OR and 36 beds for PAR, where about 3 thousand anesthetic-surgical procedures are performed per month.

Results from the SC database and sectorial spreadsheets were used, which have been recorded for the purpose of revenue guarantee, based on the records for the years 2015 and 2018. In 2015, at the central institution of the research, data analysis on financial losses resulting from the lack of evidence in medical records started being analyzed. The results of such analyses gave rise to an educational project for promoting changes in the culture of collections for the team providing direct care to patients. In 2018, there was already a sector in the institution responsible for on-site checking practices and for the survey of financial data. For these reasons, the years 2015 and 2018 were chosen for the survey of this study.

The data collection instrument was used in the form of a spreadsheet, in which information on the materials with the highest dispensing volume by the pharmacy and the highest percentage of exclusion by the internal audit of the hospital were inserted for each of the months of 2015 and 2018, i.e., from January 1st to December 31, 2015 and from January 1st to December 31, 2018. It is noteworthy that the spreadsheet was created by a statistical professional, master in mathematics and statistics.

Data were collected between the months of May and August 2019, after approval of the research project by the Scientific Committee, and after authorization by the SC management and the manager of the Revenue Guarantee sector of the central institution of the study. Considering that this is a cost-related research, which does not involve human beings, the project did not need approval from the Research Ethics Committee.

The collected data were transferred to an Excel spreadsheet, in which they underwent quantitative treatment, according to statistical guidance, and are presented in absolute numbers and percentages in the form of tables and graphs/figures. Databases of materials and medicines dispensed by the pharmacy were analyzed and subtracted from those invoiced by the audit, thus representing the amount of financial loss for each item. The percentage variation of the items dispensed, used, and excluded by the audit was considered for lack of evidence, as well as the financial values based on the cost of each item, preestablished by the institution.

RESULTS

Results are presented in line with the study purposes, i.e., the financial benefit that the on-site audit has brought to the SC since the beginning of this activity, in 2015. For data analysis, materials with a higher volume of dispensation by the pharmacy and a higher percentage of exclusion by the internal audit of the hospital were considered, due to lack of evidence in the medical records (Table 1 and Figure 1).

As for the impact generated by the waste of medical devices on the financial health of the institution, the calculation was done through the cost of the materials dispensed by the pharmacy and used in surgical procedures. The Brazilian currency (*real*, BRL) was used for the calculation.

In 2015, when there was still no on-site auditing activity, 54,441 excluded units were identified due to lack of medical and nursing evidence in the medical records. Three years after implementing the activities, the evaluation of the same database showed a decline of 66.6%, represented by the 18,147 units excluded in 2018. The sum of the materials represented an effective financial cost for the institution of BRL 342,473.00 in 2015, compared with BRL 114,157.00 in 2018.

Table 1. Materials and medicines dispensed by the pharmacy, used and excluded by the internal audit due to lack of evidence of use in the medical records, 2018.

Materials/medicines	Dispensed	Excluded due to lack of evidence	%
Sevorane® 250-mL bottle	55,673	10,528	18.9
Plasma Lyte® 500 mL	7,518	1,157	15.3
Upper-body thermal blanket	8,181	623	7.6
Bispectral monitor sensor	10,887	619	5.6
Adult-size anesthesia mask	23,199	1,069	4.6
Electric scalpel pen	21,195	744	3.5
Medium Sequel® Leg protector	5,591	137	2.4
Electrosurgical plate	23,395	565	2.4

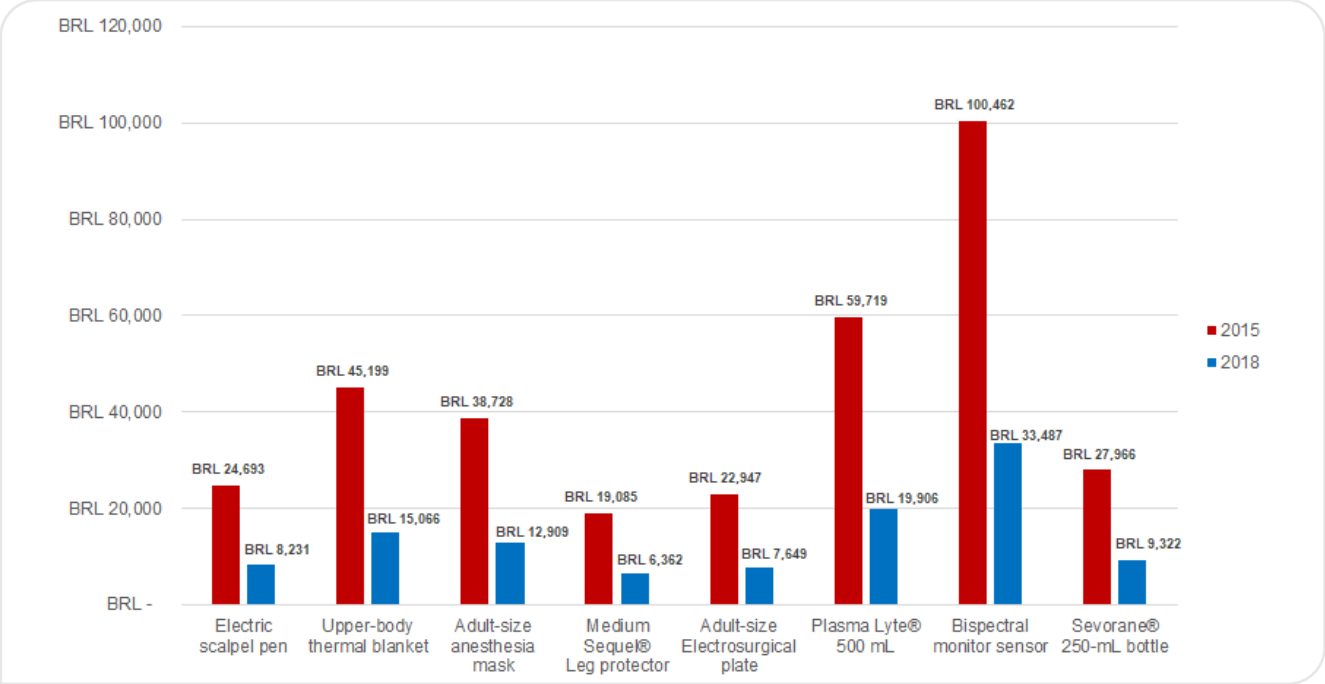

Figure 1. Annual loss of revenue, per material, after internal audit, due to lack of evidence in medical records. Comparative between 2015 and 2018. Amounts expressed in Brazilian currency (real, BRL).

When there was no local initiative, the financial loss ranged from BRL 100,462.00 to BRL 19,085.00 over the year, compared with a much lower amount, ranging from BRL 33,487.00 to BRL 6,362.00 after implementing the actions in the OR.

The month that represented the highest cost due to lack of evidence was January 2015, when the evaluated items totaled BRL 47,779.00. In April 2015, there was a fall in the values due to the implementation of local actions aimed at educating and changing the culture of waste of materials by the medical and assistance team. Months of lowest financial loss were registered as of April 2018, when the institution had already consolidated the action and, mainly, the interaction of the assistance team with the on-site audit team. The percentage of improvement in the notes from medical records reached 86.1% when compared with the worst month, without on-site audit, and with the best month, with the presence of competing actions in the OR.

From the implementation of the on-site auditing practice to the current period, there was a decrease in the lack of evidence in the nursing and medical notes in patients' records, which also provided a reduction in the time interval between hospital discharge and forwarding the invoice to the source of payment, especially to health insurance plans.

DISCUSSION

The practice of nurse auditors is part of an educational process, and although knowledge of this activity can still be considered recent, it is able to significantly contribute to the profession by creating circumstances for the management of a quality nursing care[11]. The audit function must go beyond purely financial issues, as there is also great potential for changing the culture of waste of materials and flawed notes.

The bispectral monitor sensor was the item representing the greatest financial impact in 2015. The bispectral index is a multifactorial parameter derived from the electroencephalogram, which allows monitoring of the hypnotic component of anesthesia[12]. Some studies demonstrate that adequate monitoring of anesthesia depth could reduce the excessive administration of anesthetic agents, decrease the time for recovery from anesthesia, nausea and vomiting, headache and cognitive dysfunctions[13], factors that also benefit the cost management of the SC. The high value of the sensor, in addition to the lack of evidence of its use, culminated in an annual loss value of BRL 100,462.00. This item, which exclusively depends on medical notes for correct invoicing, dropped to BRL 33,487.00 after actions taken to raise awareness of its correct use,

note of parameters in the anesthesia record, and training for proper positioning, avoiding waste and indication for surgeries with duration longer than two hours.

Another item with a high percentage value of exclusion was Sevorane®, in a 250-mL bottle. It is a general inhalational anesthetic, for hospital use, whose administration has been associated with induction of anesthesia with rapid and mild loss of consciousness and rapid recovery after suspension of anesthesia. It is widely used, as it covers adult and pediatric patients and is only restricted to cases of malignant hyperthermia or known sensitivity[14]. Considering that it is an inhalation agent, the extent of its use in each surgical procedure has become a process difficult to control, causing an annual loss of BRL 27,966.00. The improvement action for this indicator was to enter into a commercial agreement with the sources of payment according to which, for each hour of Sevorane® use in the OR, an amount equivalent to 30 mL of the drug would be charged. Guidance was also given to the entire medical staff of anesthesiologists on the new way for charging the medicine. The improvement process reduced the cost to BRL 9,322.00, achieving savings of more than BRL 18,000.00 per year.

Among the materials listed by the study, the upper-body thermal blanket also represented a great financial impact. It is used due to decrease in body temperature that occurs immediately after induction of general or local anesthesia, due to the redistribution of heat from the central compartment to the peripheral compartment of the body. In surgical interventions in which body cavities are exposed, heat loss is even greater, making its use with heated air flow even more necessary[15]. Its percentage loss value reduced from 12.9 to 1.1% after taking educational initiatives aiming at the quality of the records of nurses and technicians who work as circulators.

The role of nurse auditors is unknown to most nursing professionals. Research shows that the nursing audit is basically related to hospital costs, checking practices, and the control of medical records[6]. However, as this professional approaches nursing assistants and the medical team, they become aware of their roles and perceive them as a source of educational influences and improvement in the quality of care provided to the patient[16].

This statement is confirmed with data shown in Figure 2, which demonstrates high values of financial

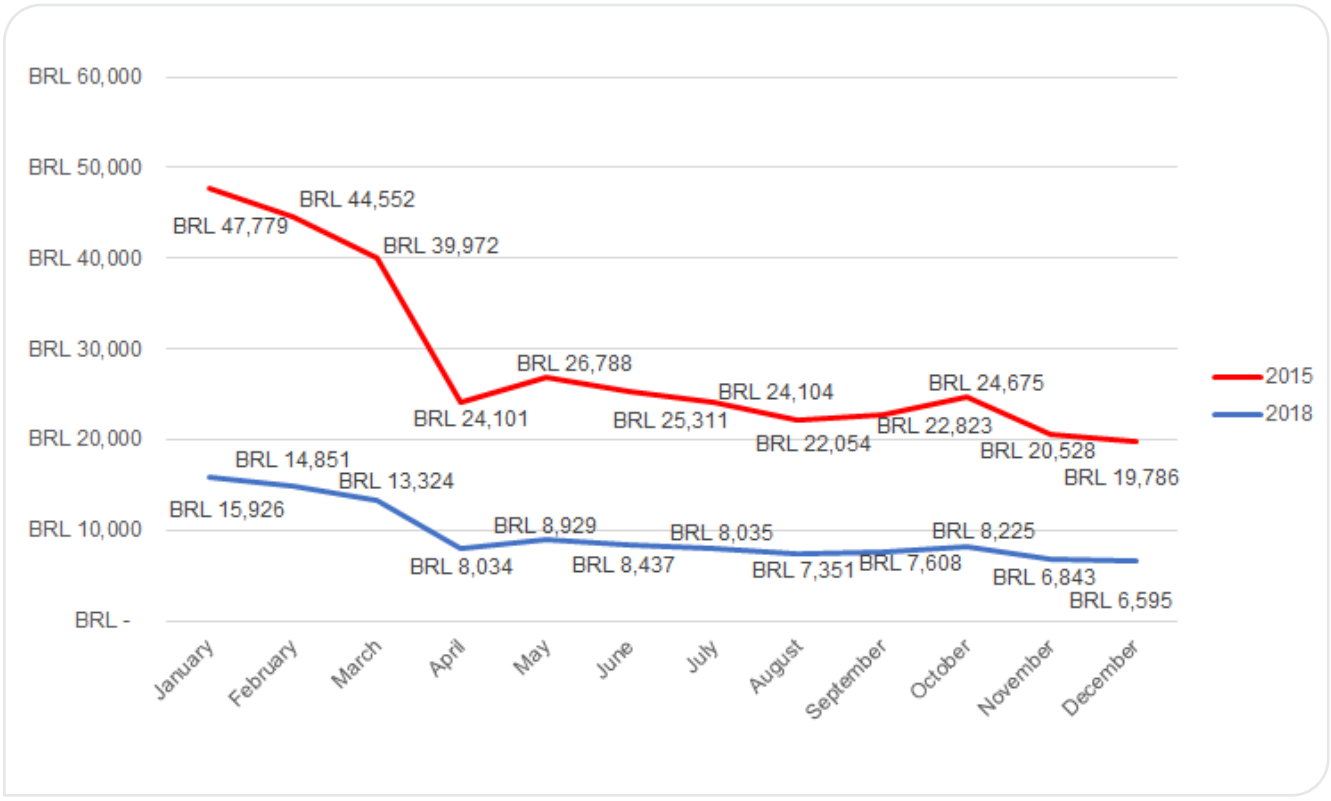

Figure 2. Monthly cost of the lack of evidence in medical records. Change in the quality of notes between the years 2015 and 2018. Amounts expressed in Brazilian currency (*real*, BRL).

loss when there was no on-site audit (BRL 100,462.00 to BRL 19,085.00) and much lower values after implementing the action and merging both teams (BRL 33,487.00 to BRL 6,362.00), when everyone could understand the actual role of the audit, the importance of the action for the financial profitability of the institution, and the impact that the culture of waste could bring in the long-term. Bearing these points in mind, the awareness of professionals becomes essential aiming at a reformulation in the way of carrying out the audit process.

Another aspect to be observed concerns the sustainability of healthcare institutions, which must economically develop through the efficient management of their numerous processes. In Brazil, there are still few scientific investigations on the costs of nursing care, although the team's role in controlling hospital costs contributes to the efficiency of the institutions. The lack of knowledge of the relationship between the cost of procedures and the productivity of services favors waste and hinders the emergence of numerous possibilities for improving management in nursing[17].

The lack of managerial control has been identified as a cause of inefficiency of healthcare services, both public and private, and it is essential to adopt strategies that assist in the faster discovery of waste and failures that increase spending in organizations[1]. Such failures portray a high cost for the institution, represented, in this study, by the amount of BRL 342,473.00 per year. If the opportunity for improvement had not been identified and this amount had persisted until 2018, this period would have represented an estimated financial loss of BRL 1,027,419.00 for the institution.

In this sense, the implementation of on-site audit can contribute and support quality parameters, thus being perceived as an effective form of cost management not only by notes in the patients' records, but also by daily observing the practice and supporting the actions taken by the team.

The incorporation of several professionals seeking to reduce costs has transformed the financial goal into a commitment for all involved employees[18].

The evaluation of the effectiveness and economy of healthcare-related initiatives finds in the audit an effective management tool, and this, in turn, is able to contribute to the complex planning of healthcare services. It can instrumentalize the nursing team and reinforce the importance of the nurse auditor in this process through actions and guidelines, in addition to the creation of instruments that facilitate healthcare records[19].

CONCLUSION

The performance of this study, through the quantitative analysis of database, sectorial spreadsheets of the SC, and revenue guarantee for the years 2015 and 2018, allowed the authors to conclude that the materials that caused the greatest financial impact for the institution were Sevorane®, 250-mL bottle (18.9%), Plasma Lyte® 500 mL (15.3%), upper-body thermal blanket (7.6%), bispectral monitor sensor (5.6%), adult-size anesthesia mask (4.6%), electric scalpel pen (3.5%), medium Sequel® leg protector (2.4%), and adult-size electrosurgical plate (2.4%). The materials represented a financial loss of BRL 342,473.00 in 2015, when there was no on-site audit practice, compared with the amount of BRL 114,157.00 in 2018, after implementing checking practices at the OR.

The experience of the evolution of the retrospective audit model to the on-site model proved to be positive, as it was possible to perceive the financial benefits obtained in just three years of operation, in addition to an intangible gain as for culture-related change in the attitude of healthcare professionals with regard to the quality of medical records.

Benefits for the nursing field

By adopting a critical and reflective thinking, it is possible to implement new ways of thinking about nursing auditing in the hospital context, assuming the role of daily educator in the SC, interacting with healthcare professionals, and enabling them to make the necessary improvements.

The on-site work of nurses strengthens the relationship with the other professionals, even assisting in their view of the audit not as a supervisory exercise, but rather as an advisory and educational exercise aimed at good nursing practices.

Study limitations

This research was carried out based on materials and equipment only dispensed in the OR. The authors intend to carry out a new study that encompasses the entire surgical ward, including items dispensed in anesthetic recovery and in the material and sterilization center.

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PATIENT SAFETY CLIMATE IN SURGICAL CENTERS: ASSESSMENT BY THE MULTIDISCIPLINARY TEAM

Clima de segurança do paciente em centro cirúrgico: avaliação pela equipe multidisciplinar

Clima de seguridad del paciente del centro quirúrgico: evaluación del equipo multidisciplinario

Fernanda Cristina Fernanda Cristina Mucelini[1]*, Fabiana Gonçalves de Oliveira Azevedo Matos[2], Eduardo Beserra da Silva[3], Débora Cristina Ignácio Alves[4], Juliana Aparecida Peixoto Nishiyama[5], João Lucas Campos de Oliveira[6]

ABSTRACT: Objective: To assess the patient safety climate in the surgical center of a public teaching hospital, from the perspective of the multidisciplinary team. **Method:** This is a cross-sectional, descriptive study developed in the surgical center of a teaching hospital located in the state of Paraná, Brazil. The Brazilian and validated version of the *Safety Attitudes Questionnaire/Operating Room Version* was applied to a sample of 36 multidisciplinary professionals. In the descriptive statistical analysis, scores higher than 75 points were considered positive. **Results:** The average perception of the multidisciplinary safety climate was 61.8±38.8 points. Only Factor 8 – Job satisfaction (82.6±23.4) and Factor 12 – Surgeon as team leader (77.1±27.2) achieved positive scores in the study. The worst domain evaluated was "Stress recognition" (34.2±34.1). The category "nursing assistants" was the one that best evaluated the patient's safety climate, even without reaching the cutoff point. **Conclusion:** Patient safety climate in the surgical center was negatively assessed by the multidisciplinary team, which indicates the need for reviewing processes to achieve greater safety in care.

Keywords: Patient safety. Organizational culture. Surgicenters. Patient care team. Perioperative nursing.

RESUMO: Objetivo: Avaliar o clima de segurança do paciente no centro cirúrgico de um hospital público de ensino, sob a ótica da equipe multidisciplinar. **Método:** Estudo transversal, descritivo, desenvolvido no centro cirúrgico de um hospital universitário do Paraná, Brasil. Aplicou-se a versão brasileira validada do *Safety Attitudes Questionnaire/ Operating Room Version* a uma amostra de 36 trabalhadores multidisciplinares. Na análise estatística descritiva, os escores acima de 75 pontos foram considerados positivos. **Resultados:** A média da percepção do clima de segurança multiprofissional foi de 61,8±38,8 pontos. Apenas o Fator 8 - Satisfação no trabalho (82,6±23,4) e o Fator 12 - Cirurgião como coordenador da equipe (77,1±27,2) alcançaram escores positivos no estudo. O pior domínio avaliado foi "percepção de estresse" (34,2±34,1). A categoria "enfermeiro assistencial" foi a que melhor avaliou o clima de segurança do paciente, mesmo sem atingir o ponto de corte. **Conclusão:** O clima de segurança do paciente no centro cirúrgico obteve avaliação negativa pela equipe multidisciplinar, o que indica a necessidade de revisão de processos para possível maior segurança no cuidado.

Palavras-chave: Segurança do paciente. Cultura organizacional. Centros cirúrgicos. Equipe de assistência ao paciente. Enfermagem perioperatória.

RESUMEN: Objetivo: Evaluar el clima de seguridad del paciente en el Centro Quirúrgico de un hospital público docente, desde la perspectiva del equipo multidisciplinario. **Método:** Estudio descriptivo transversal, desarrollado en el Centro Quirúrgico de un hospital universitario de Paraná, Brasil. Se aplicó la versión brasileña validada del *Safety Attitudes Questionnaire / Operating Room Version* a una muestra de 36 trabajadores multidisciplinarios. En el análisis estadístico descriptivo, los puntajes superiores a 75 puntos fueron considerados positivos. **Resultados:** La percepción media del clima de seguridad multiprofesional fue de 61,8±38,8 puntos. Solo el Factor 8- Satisfacción laboral (82,6±23,4) y el Factor 12- Cirujano como coordinador del equipo (77,1±27,2) obtuvieron puntuaciones positivas en el estudio. El peor dominio evaluado fue la "Percepción de estrés" (34,2±34,1). La categoría "Enfermero asistencial"

[1]Nurse. Undergraduate degree in Nursing from Universidade Estadual do Oeste do Paraná – Cascavel (PR), Brazil.
[2]Nurse. PhD in Science at Escola de Enfermagem da Universidade de São Paulo (EEUSP). Adjunct Professor of the Nursing School at Universidade Estadual do Oeste do Paraná – Cascavel (PR), Brazil.
[3]Technologist in Systems Analysis and Development. Undergraduate degree from Centro Universitário Univel Cascavel – Cascavel (PR), Brazil.
[4]Nurse. PhD in Health Sciences at EEUSP. Adjunct Professor of the Nursing School at Universidade Estadual do Oeste do Paraná – Cascavel (PR), Brazil.
[5]Nurse. Master's Student of the Graduate Program in Nursing, Nursing School, Universidade Federal de Mato Grosso – Cuiabá (MT), Brazil.
[6]Nurse. PhD in Nursing at Universidade Estadual de Maringá. Adjunct Professor of the Nursing School at Universidade Federal do Rio Grande do Sul – Porto Alegre (RS), Brazil.
Corresponding author: fernanda11mucelini@hotmail.com.br
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fue la que mejor evaluó el clima de seguridad del paciente, incluso sin alcanzar el punto de corte. **Conclusión:** El clima de seguridad del paciente en el Centro Quirúrgico fue evaluado negativamente por el equipo multidisciplinario, lo que indica la necesidad de revisar los procesos para una posible mayor seguridad en la atención.

Palabras clave: Seguridad del paciente. Cultura organizacional. Centros quirúrgicos. Grupo de atenciónal paciente. Enfermería perioperatoria.

INTRODUCTION

Patient safety is inseparable from the quality of health care, and must be a constant commitment of policies, institutions, and professionals working in the area. Hence, actions that favor the safe provision of care must be constantly (re)planned, even due to the high occurrence of adverse events (AE) in the provision of care.[1]

Identifying risks and managing them, as well as notifying, analyzing, and preventing AE, are some activities associated with safe practices.[1,2] In Brazil, the notification of errors and AE is an important passive way of mapping the reality of incidents that affect patient safety[1] and is recurrently deficient, as demonstrated by studies carried out in the states of Paraná[3] and Minas Gerais.[4] Research carried out in a hospital in the state of São Paulo showed that professionals are afraid of reporting errors and being punished.[5] This scenario tends to indicate that punitive culture can be present in many healthcare institutions, especially translated into the fear and/or apprehension of notifying incidents related to safety in the provided care.[3-5]

Punitive culture is not in line with the development of the patient safety culture. This is because a positive safety culture requires a set of individual and collective factors that include aspects such as:

- a culture in which all professionals involved in the provision of care take responsibility for their own safety, for the safety of their colleagues, patients, and family members;
- a culture that prioritizes safety over financial and operational goals;
- a culture that encourages and rewards the identification, notification, and resolution of safety-related issues;
- a culture that, based on the occurrence of incidents, promotes organizational learning; and
- a culture that provides resources, structure, and accountability for the effective maintenance of safety.[6]

The assessment of patient safety culture provides elements of interest for developing strategies for concrete improvements in the provision of care, as it is based on the principle of systematic appreciation of a set of institutional and professional values that can be developed/improved and, therefore, impact on practices aimed at healthcare safety.[7] According to some theoretical perspectives, safety climate is understood as the measurable sphere of the patient safety culture, whose objective is based on metrics, through specific instruments for this purpose.[8]

It is known that some care environments favor risks to patient safety, such as the surgical center (SC), where the evident complexity of care provision tends to expose patients and the healthcare team to the potential incidence of harms. In this context, a systematic literature review[9] carried out by English researchers, which aimed to quantify the potentially preventable harms to the surgical patient by evaluating the frequency, severity, and preventability of the causes and consequences of surgical AE, demonstrated that, according to the analysis of 14 primary studies (totaling 16,424 surgical patients), 14.4% of the evaluated patients experienced some type of AE, and 5.2% of AE were potentially preventable. Among the consequences of these events, 3.6% were fatal; 10.4% were classified as severe; 34.2%, as moderate; and 52.5%, as mild.[9]

Taking this into consideration, the social and scientific relevance of investigating patient safety climate in the surgical context is evidenced, in such a way to promote improvements in patient safety. Therefore, the following study question was raised: what is the assessment of the patient safety climate among professionals from the multidisciplinary team of the SC of a public teaching hospital in the state of Paraná?

OBJECTIVE

To assess the patient safety climate in the SC of a public teaching hospital, from the perspective of the multidisciplinary team.

METHOD

This is a cross-sectional, descriptive research with a quantitative approach. It was carried out in the SC of a public teaching hospital in the state of Paraná, Brazil, which exclusively serves patients from the Brazilian Unified Health System (SUS). The institution has 210 beds, including inpatient beds in medical and surgical units, adult intensive care unit (ICU),

pediatric ICU, neonatal ICU, intermediate care unit (IMCU), emergency room (ER), surgical centers (SC), obstetric center (OC), and specialty outpatient clinics.

The SC under study has five operating rooms and a post-anesthesia care unit (PACU) and performs about 400 surgeries/month.[10] The sector has a nurse responsible for coordinating the SC, who works eight hours a day. The nursing care team is composed of one nurse in each work shift (morning, afternoon, and three night shifts), five nursing technicians in the morning shift, five in the afternoon shift, and three in each night shift. In addition to the nursing team, the sector has a multidisciplinary team composed of surgeons, anesthesiologists, residents in medicine, nursing, pharmacy, and dentistry (maxillofacial surgery), and support professionals (pharmacy, laboratory, cleaning and technical administrative professionals).

The study population consisted of the multidisciplinary team working in the SC, as previously described. The convenience sampling consisted of the following inclusion criteria: professionals working in the SC for at least one year. All participants signed an informed consent form. Professionals absent from work for any reason during the field research and those who did not respond to three attempts/reminders for data collection were excluded. After verifying the eligibility criteria, 78 data collection questionnaires were handed out, of which, after due attempts, 36 professionals from the multidisciplinary team returned the completed questionnaires.

Data collection was carried out from January to June 2019, using the translated, adapted, and validated Brazilian version of the *Safety Attitudes Questionnaire/Operating Room Version*, which in Portuguese is called *Questionário de Atitudes de Segurança/Centro Cirúrgico* (SAQ/CC) [SAQ/Surgical Center].[11] This instrument was developed based on the Safety Attitudes Questionnaire (SAQ) developed by researchers at the University of Texas, United States of America (USA), in 2006.[12]

The SAQ/CC is an instrument composed of three parts: the first part contains 15 items aimed at describing the quality of communication and collaboration experienced between professionals working in the SC. The second part contains 40 items on the perception of safety that permeates patient care; and the third part contains questions for the characterization of the respondents (professional category, length of experience in the specialty, length of experience in the study hospital, work arrangement, work shift, ethnicity, age, sex, and country of origin). The open-ended question about the three main recommendations to improve the patient safety climate in the SC was not evaluated in the present study due to insufficient responses from the participants.[11]

The 40 items of the SAQ/CC[11] are grouped into six domains and six factors, namely: safety climate (seven items), management perception (five items), stress recognition (four items), work conditions (six items), communication in the surgical environment (four items), and perception of professional performance (four items).[11] The questionnaire factors do not have specific nomenclature, and they were named as follows:

- Factor 7 (three items);
- Factor 8 (one item);
- Factor 9 (two items);
- Factor 10 (two items);
- Factor 11 (one item); and
- Factor 12 (one item).

Finally, there is a question about having already answered the referred instrument.[11]

Each item in the questionnaire is arranged for responses on a Likert-type scale, which ranges from "strongly disagree – option A" (0 points) to "strongly agree – option E" (100 points); a score of zero corresponds to the worst perception of safety culture; and a score of 100, to the best perception of safety in the SC. Option B is equivalent to 25 points (partially disagree); option C, to 50 points (neutral); and option D, to 75 (partially agree). Option X, "not applicable," does not score.[11] To obtain the final scores for each domain and factor, the answers to the questions for each domain/factor must be added together and divided by the number of questions for each domain/factor.

For data analysis, positive patient safety attitudes were considered as those with scores ≥75 points on the Likert scale (equivalent to partially agree or totally agree), per SAQ/CC domain and in the general evaluation.[11]

Data manually collected were entered into electronic spreadsheets of Microsoft Office Excel® software. Next, they were imported into the *Comma-separated values* (CSV) program and a code was created to compile and export data to perform descriptive statistical analysis, in which categorical variables were analyzed by absolute and relative (%) frequencies and 95% confidence interval for proportions; and the ordinal variables, which were transformed into quantitative variables (scale score), by measures of central tendency (mean and median) and dispersion (standard deviation).

The study was submitted to the Research Ethics Committee of Universidade Estadual do Oeste do Paraná (UNIOESTE), with Opinion No. 3062301/2018 and Certificate of Presentation for Ethical Consideration (CAAE) 50066815.8.0000.0107.

RESULTS

The study included 36 (46.1% of the population) professionals from the multidisciplinary team who worked in the SC unit. Characterization data of the professionals are presented in Table 1. Most workers were women (55.6%); aged between 31 and 40 years (30.6%); self-reported to be white (80.6%); and were part of the team of surgical technicians/circulating nurses (25.0%) and of the support teams (25.0%).

The descriptive analysis of the first part of the SAQ/CC instrument is presented in Table 2, concerning the quality of communication and collaboration experienced with the other professionals of the multidisciplinary team during the work

Table 1. Characterization of professionals of the multidisciplinary team who worked in the surgical center and who composed the study sample (n=36).

Variables	n	%	95%CI*
Sex			
Women	20	55.6	[38.1–72.1]
Men	16	44.4	[27.9–61.9]
Time working in the sector			
Up to 11 months	04	11.1	[3.1–26.1]
1 to 2 years	05	13.9	[4.7–29.5]
3 to 4 years	02	5.6	[0.7–18.7]
5 to 10 years	08	22.2	[10.1–39.2]
11 to 20 years	12	33.3	[18.6–51.0]
21 to 39 years	05	13.9	[4.7–29.5]
Age group			
Up to 30 years old	08	22.2	[10.1–39.2]
31 to 40 years old	11	30.6	[16.3–48.1]
41 to 50 years old	06	16.7	[6.4–32.8]
51 to 60 years old	10	27.7	[14.2–45.2]
Over 60 years old	01	2.8	[0.1–14.5]
Ethnicity			
White	29	80.6	[64.0–91.8]
Black	03	8.3	[1.8–22.5]
Mixed-race	03	8.3	[1.8–22.5]
Asian	01	2.8	[0.1–14.5]
Work shifts			
Full time	01	2.8	[0.1–14.5]
Part time	17	47.2	[37.4–64.5]
Night	07	19.4	[8.2–36.0]
Variable shifts	11	30.6	[16.3–48.1]
Professional category			
Surgical technicians/Circulating nurses	09	25.0	[12.1–42.2]
Support team	09	25.0	[12.1–42.2]
Anesthesiologist	05	13.9	[4.7–29.5]
Nursing assistants	05	13.9	[4.7–29.5]
Surgeon	04	11.1	[0.1–14.5]
Surgical resident/Internist	03	8.3	[1.8–22.5]
Coordinating nurse	01	2.8	[0.1–14.5]
Total	36	100.0	[90.3–100]

*95% confidence interval for proportions.

routine, showing that only the surgical technicians/circulating nurses category achieved the minimum score (≥75).

The descriptive analysis according to domains/factors resulting from the application of the SAQ/CC in the SC under study is presented in Table 3, showing that only Factor 8 and Factor 12 obtained the minimum established score.

The scores of each professional category per domains/factors of the SAQ/CC are presented in Table 4, showing

Table 2. Scores for each professional category and the overall score related to the quality of communication and collaboration experienced with the multidisciplinary team (n=36).

Professional Category	Mean	Median	Standard Deviation
Surgical technicians/Circulating nurses	80.0	75	18.7
Support team	71.5	75	21.5
Anesthesiologist	71.2	75	22
Surgeon	70.3	75	23.8
Coordinating nurse	70.1	75	27.5
Nursing assistants	67.3	75	28.9
Surgical resident/Internist	66.9	75	26.2
Total	70.05	75	25.75

Table 3. Descriptive analysis according to domains/factors resulting from the application of the Safety Attitudes Questionnaire/Surgical Center (SAQ/CC) in a public teaching hospital (n=36).

Domain/factors	Mean	Median	Standard Deviation
Safety climate	68.0	75	28
Management perception	55.6	50	32.9
Stress recognition	34.2	25	34.1
Work condition	61.4	75	33.6
Communication in the surgical environment	72.4	75	32.2
Perception of professional performance	71.5	75	33.8
Factor 7	58.7	75	31.2
Factor 8	82.6	100	23.4
Factor 9	56.9	75	34.7
Factor 10	66.7	75	26.4
Factor 11	58.3	50	33.3
Factor 12	77.1	75	27.2
Overall	61.8	75	38.8

Table 4. Mean scores and standard deviation per factor/domain and overall, according to professional category.

Professional Category	8	12	CSE	PPP	SC	10	WC	7	11	9	MP	SR	OM	SD
Surgeon	93.8	68.8	73.4	64.1	69.6	62.5	53.1	62.5	87.5	53.1	53.6	18.8	58.6	38.3
Surgical resident/Internist	83.3	83.3	77.1	83.3	64.3	79.2	58.8	79.2	50.0	62.5	48.3	56.3	65.7	26.8
Surgical technicians/ Circulating nurses	69.4	86.1	59.0	64.4	63.1	69.4	58.8	48.6	47.2	54.2	48.3	36.1	57.5	35.7
Anesthesiologist	85.0	75.0	76.2	56.3	72.7	60.0	53.3	40.0	70.0	57.5	47.0	25.0	57.6	36.4
Nursing assistants	90.0	80.0	72.5	83.8	70.7	67.5	71.7	60.0	55.0	60.0	61.0	38.8	66.6	31.2
Coordinating nurse	75.0	100.0	81.3	68.8	57.1	75.0	45.8	37.5	25.0	87.5	75.0	62.5	62.8	27.1
Support team	86.1	66.7	80.6	75.0	70.2	63.9	69.0	72.2	58.3	54.2	65.6	31.3	65.7	31.4
Total	82.6	77.1	72.4	71.5	68.0	66.7	61.4	58.7	58.3	56.9	55.6	34.2	61.8	38.8

SC: safety climate; MP: management perception; SR: stress recognition; WC: work condition; CSE: communication in the surgical environment; PPP: perception of professional performance; OM: overall mean; SD: standard deviation; 7: Factor 7; 8: Factor 8; 9: Factor 9; 10: Factor 10; 11: Factor 11; 12: Factor 12.

that no professional category obtained the minimum score determined as the cutoff point.

Regarding the last item on the scale (open-ended question), all participants indicated that they had not previously answered the aforementioned instrument.

DISCUSSION

The authors observed a prevalence of women (55.6%), with an average age of 31 to 40 years (30.6%), which corroborates the literature.[13] Professionals who most adhered to the survey were the surgical technicians/circulating nurses (25.0%) and the support team (25.0%). There was a predominance of professionals who have worked between 11 and 20 years (33.3%) in the sector and with part-time work schedule (47.2%). Stability in a certain sector for a long period may be related to the working arrangement of the institution,[14] which, in this case, is mostly statutory.

Regarding the quality of communication and collaboration experienced with other professionals of the multidisciplinary team in their work routine, the mean scores ranged from 66.9 to 80.0 points. Only surgical technicians/circulating nurses obtained positive scores in this regard, which denotes weakness in the interprofessional communication process in the investigated SC.

Communication is among the ten primary goals for safe surgery,[15] enabling quality care and prevention of adverse events.[16] However, research carried out on patient safety culture states that effective communication still faces major barriers.[3,5] This leads to the reflection that some safe care strategies do not require financial investment, but rather behavioral and relational changes.

Surgical technicians/circulating nurses are the professionals who account for the greater number of employees in the aforementioned SC. In addition, they spend most of the time in contact with the medical team and with the patient, and they are responsible for the operationalization of the surgical procedure. The present study demonstrates that communication is positive among these professionals. Conversely, it is deficient in the perception of other team members.

Factor 8 corresponds to the worker's perspective on job satisfaction. This is considered an important factor to improve the quality of the provided care, reducing the possibility of illness at the service location.[17] Therefore, job satisfaction is a quality indicator in human resource management, as it reflects the organization models of professional activity, interfering with the worker's perception of their occupation, which in turn affects the quality of care – especially in the case of nursing, which directly deals with human care.[18]

Working in a closed environment as the SC, which requires intense action from different professional teams, can result in interpersonal conflicts that must be well managed for the surgical procedure to be successful.[5,19] This allusion can be verified in the low scores among most professional categories regarding collaboration at work.

Factor 12 questions whether "the surgeon should be formally coordinating the operating room team during the surgical procedure." According to the literature, surgeons are responsible for planning, executing, and coordinating the team within the operating room, and the nurse is responsible for ensuring that the procedure is performed in the best possible way, through the prediction and provision of material and human nursing-related resources.[19]

It was possible to verify that the safety climate of the multidisciplinary team working in the SC had an overall mean of 61.8±38.8 points, indicating weakness in the institutional safety climate. Thus, it is worth noting that professional healthcare practice is permeated by numerous risk situations, which requires organizations to implement strategies that change the institutional culture and values over time, reflecting in safe care and mitigation of care-related risks.[1,6]

The domains "safety climate," "stress recognition," and "work condition" had negative scores in all isolated professional categories. Regarding the domain "safety climate," it was verified, considering the participants' responses, great difficulty in dealing with the responsibilities concerning safety in the work environment, which indicates local institutional weakness in supporting safe practices as for the specificity, complexity, and hazards of the research site. The safety climate characterizes the perception of workers about the safety of the work environment, associated with behaviors of better adherence to concrete and safe practices for the patient.[7]

Regarding the domain "stress recognition," it was possible to verify that occupational stress is negatively evaluated among professionals working in the SC. It can lead to psychological, physiological, or even behavioral problems, culminating in work-related suffering.[20] In this context, (re)thinking about occupational stress seems to benefit the quality of life at work, but also the safety of the surgical patient.

The burden of professionals and the accumulation of work arrangements is a problem frequently experienced by the healthcare team. Furthermore, in the context of the nursing team, a recent study also carried out in a teaching hospital in the state of Paraná identified a deficit of nurses working in the SC and an abundance of the technical team, which can compromise the planning of qualified and safe care.[21]

One of the great challenges of the nurse as a manager is the constant readjustment of work schedules according to requirements of the unit.[22] Inadequate work conditions can generate occupational burnout, favoring absenteeism and turnover, which, in turn, increase the risks to patient safety.[22]

The professional category "nursing assistants" (67.3±28.9), even without reaching the cutoff point, obtained the best assessment of the patient safety climate. Although the scores among nurses also indicate the need for improvements, this finding reinforces the position of this professional as a promoter of patient safety strategies,[19] as their work has been historically associated with direct assistance articulated with the management of care and also of the healthcare team and/or services.[18]

Regarding the domain "work condition," all professional categories mentioned the conditions in which they perform their work as negative. It is assumed that this finding, considering its predominance, may have had an impact on the evaluation of other items and domains regarding patient safety climate. That is, negatively evaluating their work conditions, SC professionals may perceive, in a distorted way, some aspects (perhaps positive) that influence the provision of safe care.

Overall, the evaluation of professionals regarding safety climate in the study site was negative. A research carried out in northern Paraná on 437 nursing workers showed similar results and suggests that the impact of this assessment can result in financial, social, and psychological damages, both for professionals and patients.[23] The authors emphasize that identifying local weaknesses concerning institutional safety favors the planning of strategies to obtain more promising results.[23]

In the scenario of surgical specificity, it is noteworthy that patient safety indicators are relevant for the SC manager to guide the planning and implementation of interventions that provide safety for both the patient and the professionals.[24] Thus, monitoring the performed and implemented actions must be a management commitment toward better quality and safety[3], also in the surgical center.

The authors verified great difficulty, on the part of professionals who worked in the studied SC, in accepting to participate in the study. Those who answered the questionnaire pointed out that its length may have prevented volunteers from participating in the present research.

The exclusively descriptive content, the geographic restriction, and the small sample of professionals were the main limitations of this study. However, the authors believe that the research brings important contributions to the context of surgical patient safety, as it emphasizes that the assessment of safety climate in the SC is possibly the first step toward the development of improvement actions for a safer surgical care. The study also indicates that the reduction of stress in the team, the articulation of nurses in increasing the safety of surgical patients, and better interprofessional communication can be effective strategies.

CONCLUSION

It is concluded that the assessment of patient safety climate by the multidisciplinary team of the SC under study was negative. The mean of the total scores of the domains/factors of the SAQ/CC was 61.8 points (SD=38.8), ranging from 34.2 to 82.6 points. "Stress recognition" was the worst domain assessed by the team. Only two domains/factors (Factor 8 – Job satisfaction and Factor 12 – Surgeon as team leader) achieved positive scores in the research, which was insufficient to change the negative overall assessment verified in the study. The professional category with the best evaluation, even with a score lower than the cutoff point, was "nursing assistants."

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APPLICATION OF THE RISK ASSESSMENT SCALE FOR THE DEVELOPMENT OF INJURIES DUE TO SURGICAL POSITIONING

Aplicação da escala em avaliação de risco para o desenvolvimento de lesões decorrentes do posicionamento cirúrgico do paciente

Aplicación de la escala en la evaluación de riesgos para el desarrollo de lesiones derivadas del posicionamiento quirúrgico del paciente

Maria José Dias Gonzaga[1]*, Diógenes Farias Gomes[2], Larissa Cunha Alves[3], Mikaelle Fernandes Marques[4], Raila Souto Pinto Menezes[5]

ABSTRACT: Objective: To identify whether there are consecutive risks of surgical positioning through the application of the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning (ELPO). **Method:** Observational, descriptive, cross-sectional study with a quantitative approach, carried out in a teaching hospital located in the north of the state of Ceará, Brazil. Two instruments were used, a clinical-epidemiological profile based on a structured interview and the ELPO scale, applied in the perioperative period to 31 surgical patients. **Results:** Most patients were men, mixed-race, and aged between 18 and 39 years. The most frequent procedures were debridement and fracture reduction, in accordance with hospitalizations due to motorcycle accidents. When evaluating the patients as for the risk of injuries due to surgical positioning, all subjects had ELPO score≤19, that is, they presented a lower risk for the development of injuries. **Conclusion:** The study allows for the profile of patients undergoing surgical procedures in the institution to be known, as well as the characterization of the participants regarding the risk of developing injuries due to surgical positioning, which was classified as low.

Keywords: Patient positioning. Pressure ulcer. Nursing care.

RESUMO: Objetivo: Identificar se há riscos consecutivos do posicionamento cirúrgico, por meio da aplicação da Escala de Avaliação de Risco para o Desenvolvimento de Lesões Decorrentes do Posicionamento Cirúrgico (ELPO). **Método:** Estudo observacional, descritivo, transversal, com abordagem quantitativa, executado em um hospital de ensino do norte do estado do Ceará. Foram utilizados dois intrumentos, um de perfil clínico-epidemiológico com base em entrevista estruturada e a ELPO, aplicada no período perioperatório a 31 pacientes cirúrgicos. **Resultados:** A maioria dos pacientes era do sexo biológico masculino, parda, na faixa etária entre 18 e 39 anos. Os procedimentos mais frequentes foram debridamentos e reduções de fraturas, em conformidade com as internações por acidentes motociclísticos. Quando avaliados quanto ao risco de lesões decorrentes do posicionamento cirúrgico, todos os pacientes apresentaram escore ELPO≤19, isto é, em menor risco para o desenvolvimento de lesões. **Conclusão:** O estudo oportunizou conhecer o perfil dos pacientes submetidos a procedimentos cirúrgicos na instituição, assim como a caracterização dos participantes quanto ao risco de desenvolver lesões decorrentes da posição cirúrgica, que foi classificado como baixo.

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

[1]Master's Student in Adult Health Nursing at Universidade de São Paulo – São Paulo (SP), Brazil. Specialist and Residency Training in Urgency and Emergency at Centro Universitário INTA (UNINTA) – Sobral (CE), Brazil.
[2]PhD student in Public Health at Universidade Estadual do Ceará (UECE) – Fortaleza (CE), Brazil.
[3]Specialist in Medical-Surgical Nursing, with major on Surgical Center, Post-anesthesia Care Unit, and Sterile Processing Department. Professor at UNINTA – Sobral (CE), Brazil.
[4]Master's student in Family Health from the Graduate Program in Family Health at Universidade Federal do Ceará (UFC) – Fortaleza (CE), Brazil.
[5]Master's degree in Family Health from Universidade Estadual Vale do Acaraú (UVA). Tutor of the Program of Residency Training in Urgency and Emergency at UNINTA. Professor of the Nursing Program at UNINTA – Sobral (CE), Brazil.
*Corresponding author: maiserdias@hotmail.com
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RESUMEN: Objetivo: Identificar el riesgo, mediante la aplicación de la Escala de Evaluación de Riesgos para el Desarrollo de Lesiones Derivadas del Posicionamiento Quirúrgico (ELPO). **Método:** Estudio observacional, descriptivo, transversal con abordaje cuantitativo, realizado en un hospital universitario del norte del estado de Ceará. Se utilizaron dos instrumentos, uno con perfil clínico-epidemiológico basado en entrevista estructurada y el ELPO, aplicado en el período perioperatorio a 31 pacientes quirúrgicos. **Resultados:** La mayoría de los pacientes eran hombres biológicos, *pardos*, con edades entre 18 y 39 años. La mayor frecuencia de procedimientos fue el desbridamiento y reducción de fracturas, en consenso con las hospitalizaciones por accidentes de motocicleta. Cuando se evaluó el riesgo de lesiones por posicionamiento quirúrgico, todos los pacientes tuvieron un puntaje ELPO≤19, es decir, un menor riesgo de desarrollar lesiones. **Conclusión:** El estudio permitió conocer el perfil de los pacientes sometidos a procedimientos quirúrgicos en la institución, así como la caracterización de los participantes en cuanto al riesgo de desarrollar lesiones derivadas de la posición quirúrgica, el cual fue clasificado como bajo.

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

INTRODUCTION

Nowadays, patient safety is one of the great challenges in healthcare, which has been widely discussed in recent times, promoting debates worldwide. However, there are still many goals to be achieved in order to improve the quality of care[1].

In this sense, quality of care is directly linked to patient safety. The later involves preventing errors in the care provided to patients and eliminating the harm that can result from such errors. Adverse events caused to the patient in the hospital environment can result in serious damages, generating morbidity or mortality[2]. Based on international patient safety goals, the safe surgery protocol was created.

The Surgical Center (SC) is considered a critical area in the hospital environment, in which surgical procedures of varied complexities are performed, and it is one of the sectors that pose risk and generate several cases of adverse events (AE) during hospitalization[3].

During hospitalization in the SC, patients undergo the following periods that compose the phases of surgical care: immediate preoperative, intraoperative, and immediate postoperative (which includes anesthetic recovery)[4].

In the perioperative period, there are several factors that can trigger an AE, such as procedures that take more than two hours and can compromise tissue oxygenation; hypothermia, which can damage the perfusion of the whole body, impairing oxygenation and favoring the emergence of injuries; patient positioning and lack of pressure relief[5].

Nurses, in their professional practice in the SC, can identify patients at risk of injuries due to surgical positioning in the intraoperative period. It is the "risk of involuntary anatomical and physical changes resulting from posture or equipment used during an invasive/surgical procedure" and that has the following risk factors: disorientation, edema, emaciation, immobilization, muscle weakness, obesity, and sensory and perceptual alterations due to anesthesia[6].

When positioning the patient on the operating table, there is an instrument to detect the risk of developing a postoperative complication, the pressure ulcer, which is the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning (*Escala de Avaliação de Risco para o Desenvolvimento de Lesões Decorrentes do Posicionamento Cirúrgico do Paciente* – ELPO). This instrument was validated and developed in Brazil in 2013 by Camila Mendonça de Moraes Lopes, PhD in Nursing, aiming at guiding the clinical practice of perioperative nurses. It was developed in the doctoral dissertation titled *Risk Assessment Scale for the Development of Injuries due to Surgical Positioning: construction and validation*[7].

The purpose of ELPO is to guide clinical practice, helping nurses to make decisions about the care provided to surgical patients, especially in the prevention of possible complications related to surgical positioning. This becomes essential in the nursing work process, as this instrument has a practical application and must be used when positioning the patient on the operating table[7,8].

The ELPO scale considers risk factors based on the best available evidence, namely: type of surgical positioning, type of anesthesia, surgical time, type of support surface, limb position, and patient-related factors such as age and comorbidities, aiming at obtaining adequate accommodation, lack of risks, and performing a safe and effective surgical procedure[7].

The advent of the ELPO scale contributes by adding information and indicates special attention to patients who may be at higher risk and who require special care, considering that the score ranges from 7 to 35 points. The higher the score, the greater the risk of the patient developing injuries due to surgical positioning[7,8].

The basic types of surgical positioning are the supine position, the prone position, and the lateral position. They can be

modified according to the type of surgery, the anesthetic-surgical team, or the patient's specificity. Among the best-known modifications are the following positions: Trendelenburg, reverse Trendelenburg, lithotomy position, sitting or modified Fowler's position, Kraske or Jackknife position, and others[9,10].

The nurse, as the professional responsible for the patient in the SC, provides direct care, ensuring their protection and safety by using the Perioperative Nursing Care Systematization (PNCS), an available, indispensable, and vitally important tool that allows better assessment as well as integral health care according to the needs of each patient[5].

Taking this into consideration, the following question was raised: are patients undergoing the surgical procedure at risk of developing injuries due to surgical positioning?

The guiding question arose from the author's experience as a resident nurse in the surgical center at a teaching hospital, as it would be necessary to apply the assessment instrument to the patient during the intraoperative period, identifying whether there are consecutive risks of surgical positioning. Therefore, this study is focused on surgical patients concerning the risk of developing pressure ulcer, to whom nurses working in the surgical center can stratify the care with greater need for prevention in all care-related processes.

This study is relevant because the hospital where the research was conducted is the reference in urgent and emergency care (with provision of immediate healthcare services) and has high rates of surgical procedures, requiring the application of the ELPO scale, which enables to identify the risks of developing pressure ulcers. In addition, it is worth mentioning that the research intends to contribute and guide healthcare practices, to promote patient safety and the development of continuing education in the service to improve the quality of nursing care and encourage the development of care protocols aimed at patients' surgical positioning.

OBJECTIVE

To identify the risk of pressure ulcer in surgical patients through the application of the ELPO scale.

METHODS

This is an observational, descriptive, cross-sectional study with a quantitative approach. The research was developed in accordance with the ethical precepts of Resolution No. 466 of the National Health Council, of December 2012, and the project was approved by the Scientific Committee and by the Research Ethics Committee, under opinion No. 3,554,625.

The study location was the teaching hospital Santa Casa de Misericórdia, located in the northern region of the state of Ceará, Brazil. This institution is considered a reference hospital in urgency and emergency care in the city of Sobral. This institution does not work with the ELPO scale in the PNCS process; it is characterized as a tertiary, high complexity hospital that operates as a teaching hospital, focused on the development of teaching, research, extension activities, and health care. The SC has 10 operating rooms (OR) that operate 24 hours a day, with emergency, urgent, and elective surgeries afforded by health insurance plans or by the Brazilian Unified Health System (SUS).

The research was carried out with patients treated at the Surgical Center Unit of Hospital Santa Casa de Misericórdia de Sobral. The study population consisted of people of both sexes admitted to the SC requiring surgical approach, whether emergency, urgent, or elective. The study inclusion criteria were:

- patient undergoing musculoskeletal trauma surgery;
- patients requiring surgical re-approach due to trauma;
- aging 18 years or older;
- conscious patients;
- unconscious patients with a family member who authorized the participation in the research.

Data were collected between October and November 2019, and the sample consisted of 31 patients. The study considered two instruments: clinical-epidemiological profile and the ELPO scale.

The clinical-epidemiological profile instrument was used to conduct a semi-structured interview with each patient to identify social and epidemiological characteristics, which helps to identify risk factors and the possibilities of guidelines for interventions. Conversely, the ELPO scale was applied as an instrument to investigate the clinical situation regarding surgical positioning in the OR. The applications of both instruments were necessary for the best design of this research.

In the data collection process, there was the first contact with the patient or family member to provide explanations about the study. After signing the informed consent form, a structured interview was conducted, with the completion of the clinical-epidemiological profile instrument; then, the patients were followed up in the OR, where the ELPO scale was applied in the intraoperative period. The scale was applied after the patient was positioned on the operating table for surgery.

The analysis was performed with the results obtained from the descriptive statistical instruments. The clinical-epidemiological profile and the ELPO data were analyzed using the Statistical Package for the Social Sciences (SPSS) software. The results are presented in graphs and tables, which provide quick visualization and understanding.

RESULTS

The analyses and discussions regarding the application of the ELPO scale to 31 surgical patients, in the preoperative and intraoperative periods, are described in topics and organized according to the clinical-epidemiological profile (sex, ethnicity, age group, causes of hospitalization) and also to the evaluation of the risk score, according to ELPO.

Most patients (27/87.1%) were men and self-reported to be mixed-race (28/90.3%); 17 (54.8%) aged between 18 and 39 years, and 11 (35.4%) aged between 40 and 59 years (Graph 1).

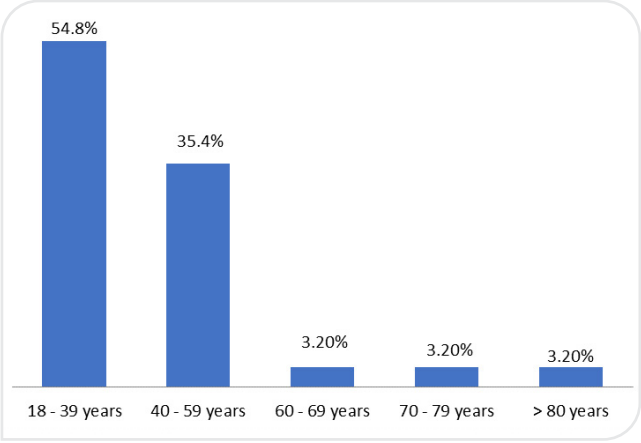
In Graph 2 it is demonstrated that, among the causes of hospitalization of the study patients, there was a predominance of motorcycle accidents (16/51.6%), followed by work accidents and same-level falls (4/12.9% each).

Regarding the type of surgical specialty, there was a higher frequency of plastic surgery procedures (14/45.2%), followed by orthopedics/traumatology (9/29%) and neurology (3/9.6%).

In Table 1 the surgical procedures that the 31 patients underwent are highlighted, with emphasis on debridement (9/29%), followed by surgical fracture reduction (4/12.9%).

In Table 2 the analysis of the seven ELPO variables applied to the patients in the study sample is presented. There was a prevalence of the supine position (26/83.8%), surgery time of up to one hour (21/67.7%), and local anesthesia (18/58%). All patients (31/100%) used the operating table mattress and foam pads as the support surface. As for the position of the limbs, most patients (21/67.7%) had their upper limbs open at a <90° angle. The vast majority of patients did not have comorbidities (30/96.7%) and the predominant age group was young adults, aged from 18 to 39 years (17/54.8%), followed by the age group of subjects aged between 40 and 59 years (11/35.4%).

Considering the distribution of the scores of each ELPO item (Table 2), it was observed that all 31 (100%) patients participating in the study had scores lower than or equal to 19, classified, therefore, as of low risk of developing injuries due to surgical positioning in the perioperative period (Table 3).



Graph 1. Age group of study patients.

DISCUSSION

The prevalence of occurrences in men is due to their greater exposure to risky economic and recreational activities, as well as to violence and drugs, gender-specific behavior, in addition to the influence of cultural and social factors[11,12].

As for ethnicity, there was a predominance of mixed-race people (90.3%). When asked to identify their race, some patients had difficulty responding. Race is represented by skin color, self-reported in the main Brazilian censuses carried out by the Brazilian Institute of Geography and Statistics (IBGE), and is characterized as a group of individuals who share certain features[13-15].

Regarding age group, in this study there was a predominance of young adults (54.8% aged between 18 and 39 years). The youngest patient was 18 years old and the oldest, 83 years old. Corroborating the study[11], when analyzing the age group, the population of young adults is the most affected by cases of violence, with several theories about the reasons for such cases, such as inexperience, impulsiveness, irresponsibility, lifestyle, search for risky situations for personal satisfaction, and substance abuse[11]. In Brazil, there are serious problems of youth exclusion and social inequality that contribute to this significant number of young victims[12].

When evaluating the causes of hospitalization, there was a predominance of accidents involving motorcycles (51.60%), followed by work accidents and same-level falls (12.9% each). The causes of hospitalization in the study are consistent with the characteristics of the research site, a large public hospital, specialized in trauma, which mostly serves victims of traffic accidents.

Regarding the type of surgical specialty, the most frequent were plastic surgeries (45.16%) and orthopedic surgeries due to trauma (29.0%). There is disagreement with other studies[15,16] whose target population consisted in patients undergoing elective procedures of any surgical specialty.

A study carried out in a rehabilitation hospital in the city of Brasília (DF), Brazil[16], found a prevalence of the surgical specialty of orthopedics (48.1%), followed by neurosurgery (36.8%), and plastic surgery (11.3%). In another study, carried out in the state of Minas Gerais, Brazil[15], there was a predominance of digestive system surgeries (33.7%), head/neck and orthopedics (13.5% each), and otolaryngology (11.2%).

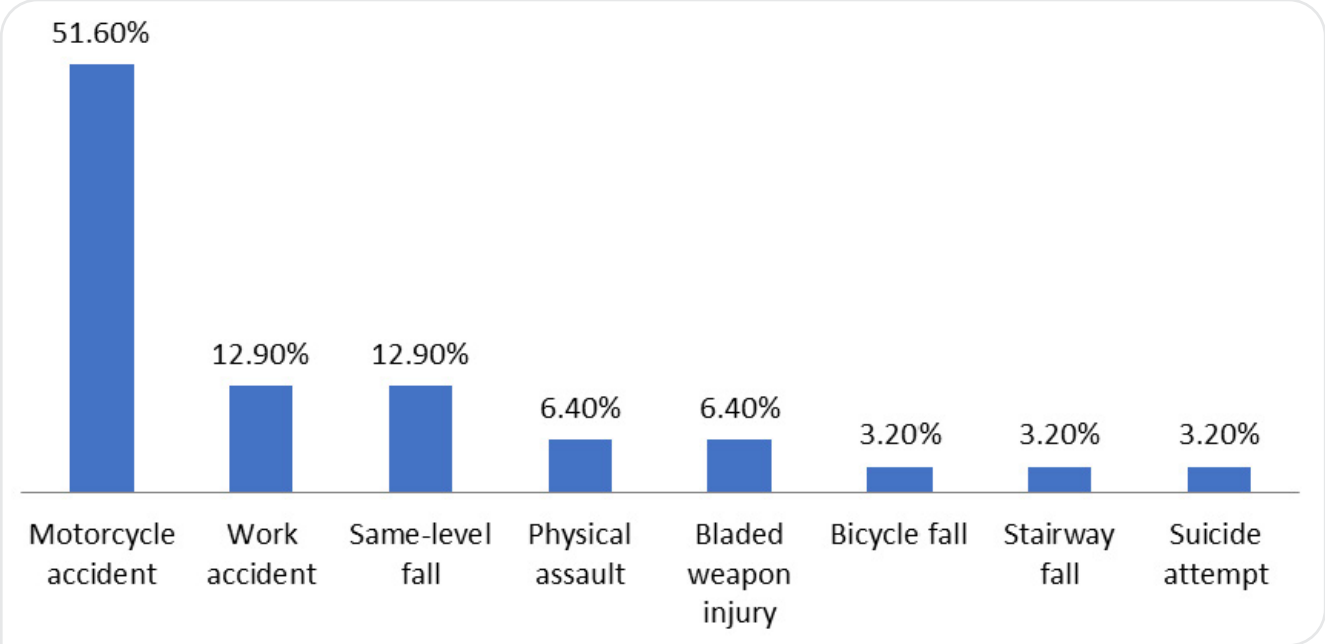
As for the type of surgical procedure, it is observed that, in traumatic cases, the highest incidence of surgeries was debridement (29%), followed by fracture reduction (12.9%). Another study[15] showed that the highest prevalence of surgeries were breast (33.7%), maxillofacial (13.5%) and otolaryngology procedures (11.2%). However, differences between institutions where the studies were carried out should be considered.

In the analysis of the ELPO variables, regarding the position in which the patients remained, the supine position had the highest incidence (83.8%). In this position, care must be taken to protect the patient's prominences in contact with the operating table considering that, with prolonged time and immobilization, subjects can develop pressure ulcer in the occipital, shoulders, scapula, elbows, lumbar and sacral, gluteal and heel regions. In addition, heart rate, vascular resistance, and lung capacity can be decreased in the supine position[4].

Regarding surgical time, there was a prevalence of procedures with short duration, up to one hour (67.7%). Surgical time of up to one hour results in an ELPO score of 1.

Table 1. Surgical procedures underwent by the study patients.

Surgical procedure	Number	Percentage (%)
Debridement	9	29
Surgical fracture reduction	4	12.9
Amputation	2	6.5
Lumbar cerebrospinal fluid drainage	2	6.5
Osteotomy	2	6.5
Repair of substance loss	2	6.5
Thoracostomy	2	6.5
Arthroplasty	1	3.2
Cervicotomy	1	3.2
Cranioplasty	1	3.2
Grafting	1	3.2
Gastrostomy	1	3.2
Catheter implantation	1	3.2
Partial reconstruction	1	3.2
Surgical treatment for fractures	1	3.2
Total	31	100



Graph 2. Causes of hospitalization of the study patients.

As for the type of anesthesia, local anesthesia was administered to 58% of the 31 patients studied in the investigated sample. This type of anesthesia has the highest frequency of use in surgical procedures. Anesthesia is a temporary condition of loss of sensation and, depending on its type, complications may occur, which require actions that involve great responsibility on the part of professionals in providing safe care. The prolonged time of the anesthetic-surgical process alters the maintenance of skin integrity and may cause some harm to the patient and increase the risk of injuries due to surgical positioning[17].

Concerning the distribution of support surfaces used for the surgical positioning of patients in the hospital, all subjects (100%) used the conventional operating table mattress, made of foam, and foam pads. The study SC is composed of 10 OR, where this support surface is used in all operating tables, providing greater protection to the patient and lower risk of developing injuries. This finding corroborates a study[16] in which there was a prevalence of the use of operating table mattress made of conventional foam and foam pads as support surfaces for most patients (59.4%).

As for the position of patients on the operating table in the intraoperative period, the most prevalent (21 / 67.7%) was

Table 3. Study patients according to the score of the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning.

ELPO	n	%
Low risk (≤19)	31	100
9	4	12.9
10	4	12.9
11	6	19.3
12	5	16.1
13	4	12.9
14	6	19.3
16	1	3.20
19	1	3.20
High risk (>19)	0	0

Table 2. Descriptive analysis of variables of the Risk Assessment Scale for the Development of Injuries due to Surgical Positioning, applied to the study patients.

	Variables	N	%
Surgical positioning	Supine	26	83.8
	Lateral	5	16.1
Surgery time	Up to 1 h	21	67.7
	Over 1 h and up to 2 h	9	29
	Over 2 h and up to 4 h	1	3.2
Type of anesthesia	Local	18	58
	Sedation	3	9.6
	Regional	8	25.8
	General	2	6.5
Support surface	Operating table mattress made of foam + foam pads	31	100
Position of the limbs	Body alignment	6	19.3
	Opening of upper limbs <90°	21	67.7
	Knees elevated at <90° and opening of the lower limbs <90º	1	3.2
	Knees elevated at >90° and opening of the lower limbs >90°	3	9.6
Comorbidities	No comorbidities	30	96.7
	Diabetes mellitus	1	3.2
Age	18–39 years old	17	54.8
	40–59 years old	11	35.4
	60–69 years old	1	3.2
	70–79 years old	1	3.2
	>80 years old	1	3.2

the opening position of the upper limbs <90°. The surgical team is responsible for the surgical positioning procedure, which must be carefully, safely performed, and specifically focused on each type of patient, as it implies risk during care provision[16].

Regarding the specific comorbidities listed in the ELPO scale, only one patient had diabetes mellitus and had a higher score in this item on the scale. Most patients in the study (96.7%) had no preexisting pathology/comorbidity. In the study conducted in Minas Gerais[15], as for preexisting diseases, most patients (48.3%) had no comorbidities as well, corroborating the findings of this study.

In the age group variable of the ELPO scale, most patients in the present study (54.8%) aged between 18 and 39 years, which favored the lower risk of developing injuries. This finding is in line with another study[15], which found the same age group as the most prevalent one (34.8%). Studies show that the incidence of complications increases proportionally to age due to the decrease in tolerance to prolonged positioning. This finding is also evidenced in the obese population because, depending on the type of position, it favors abdominal compression and hinders chest expansion[18,19].

When estimating the risk of injuries due to surgical positioning, the ELPO score showed that all patients in the sample (31/100%) were classified as low risk (scores lower than or equal to 19), as they were in the supine position (83.80%), had their surgeries performed within one hour (67.7%), were administered with local anesthesia (58%), had no comorbidities (96.7%), and belonged to the age group of 18 at 39 years (54.8%). For each of these items of the variables evaluated in the ELPO scale, the score equals one point (score=1), which resulted in low total scores (total score≤19), indicating a lower risk of developing injuries due to perioperative positioning.

Therefore, the incidence of injuries due to surgical positioning in the present study was considered low when compared with other studies[15,16]. Another study[15] also found a higher prevalence of patients with low risk score (53.9%), but almost half of them (46.1%) had an ELPO risk score>19, which corresponds to higher risk of developing injuries due to surgical positioning. Conversely, authors of a research[16] predominantly found patients at higher risk of developing perioperative positioning injuries (54.7%) compared with those at lower risk (45.3%). Once again, the characteristics of the institution must be considered in addition to the type of patients served by it.

Taking these results into consideration, the importance of the care provided in the SC is highlighted, more specifically in the OR, with the availability of different resources for proper positioning, nurses following up the patient and the procedure, using the PNCS, and being directly responsible, with the other team members, by positioning the patient for surgery.

Thus, it is possible to verify the effectiveness of using the ELPO scale by proposing the evaluation of seven specific items, closely interconnected, whose total sum/final score means the propensity that each evaluated patient has to present or not with injuries due to surgical positioning.

FINAL CONSIDERATIONS

The study proposal enabled the author to apply the ELPO scale in a hospital in the northeast of Brazil, where the ELPO instrument was not used in PNCS.

The study provided the assessment of its items with a consequent review of scientific evidence and enabled the profile of patients undergoing surgical procedures in the institution to be known, characterizing them as to the risk of developing injuries due to surgical positioning. The 31 patients followed up in the pre- and intraoperative periods were classified as at low risk of developing such injuries, considering that ELPO scores were lower than or equal to 19.

These results made it impossible to implement modifiable care practices in the prevention of injuries during surgical positioning, as there were no patients at high risk of developing injuries. Modifiable care practices would be performed with patients with high-risk scores. During the intraoperative period, the surgical team should perform care-related practices: transitions in the type of surgical positioning, in the support surface, adding pads (made of cotton, foam, or viscoelastic ones) or padding support, or even changing the position of the limbs in order to promote comfort on the operating table and avoid possible injuries.

It is noteworthy that, in the research hospital, the care provided by the team during surgical positioning favored the low risk of injuries, demonstrating the quality of the care provided to patients undergoing surgery.

As relevant contributions of this study to the field of surgical nursing, in the scientific field and in clinical practice, good results were obtained in patient care. The authors suggest further research to be carried out, with the application of the ELPO scale to patients from other surgical specialties, age groups, and evaluation of protective equipment.

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NURSING CARE IN ELECTROSURGERY: INTEGRATIVE REVIEW

Assistência de enfermagem no uso da eletrocirurgia: revisão integrativa

El cuidado de enfermería en el uso de la electrocirugía: una revisión integradora

Patrício de Almeida Costa[1]*, Eduarda Layane da Silva Buriti[2], Iara Mayanne de Castro Araújo[2], Andrielly Cavalcante Fonseca[2], Adriana Montenegro de Albuquerque[3], Magaly Suênya de Almeida Pinto Abrante[4]

ABSTRACT: Objective: To identify the scientific knowledge produced under the care of nursing related to the use of electrosurgery in the intraoperative period. **Method**: Integrative review based on the databases: Latin American and Caribbean Health Sciences Literature (LILACS), PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and in the virtual library *Scientific Electronic Library Online (SciELO)*, using the descriptors "electrosurgery", "nursing care" and "enhanced recovery after surgery", correlated by the Boolean operator *and*, in Portuguese, English, Spanish and French. Of the 213 studies we found, seven composed the sample. We used the *Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires* (IRAMUTEQ) software, through methods of lexical analysis and similitude. For the analysis of methodological quality, we applied the scientific level of evidence, according to recommendations from the Agency for Healthcare Research and Quality (AHRQ). **Results:** The publications of 2010 to 2012 stand out, with level of evidence V, indexed in LILACS and CINAHL. In the word cloud, we observed the following terms had higher relative frequency: "patient"(n=14); "surgical risk" (n=12); "electrosurgery" (n=10); "nurse" (n=8); "knowledge" (n=6); "care" (n=6); and "prevention" (n=5). After the similitude analysis, we identified the semantic range of more frequent words. **Conclusion**: There are a few studies in the literature with significant information to aggregate knowledge and build new analyses.

Keywords: Electrosurgery. Nursing care. Enhanced recovery after surgery.

RESUMO: Objetivo: Identificar o conhecimento científico produzido sobre os cuidados de enfermagem relacionados ao uso da eletrocirurgia no período intraoperatório. **Método:** Revisão integrativa, realizada nas bases de dados Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS), PubMed, *Cumulative Index to Nursing and Allied Health Literature* (CINAHL) e na biblioteca virtual *Scientific Electronic Library Online (SciELO)*, por meio dos descritores "eletrocirurgia", "cuidados de enfermagem" e "recuperação pós-cirúrgica melhorada", correlacionados pelo operador booleano *and,* nos idiomas português, inglês, espanhol e francês. Dos 213 estudos encontrados, sete compuseram a amostra. Utilizou-se o *software Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires* (IRAMUTEQ), por meio dos métodos de análise lexical e de similitude. Para a análise da qualidade metodológica, aplicou-se o nível de evidência científica, segundo recomendações da *Agency for Healthcare Research and Quality* (AHRQ). **Resultados:** Destacam-se publicações entre 2010 e 2012, com nível de evidência V, indexadas nas bases de dados LILACS e CINAHL. Verificaram-se, na nuvem de palavras, termos com maior frequência relativa: "paciente" (n=14); "risco cirúrgico" (n=12); "eletrocirurgia" (n=10); "enfermeiro" (n=8); "conhecimento" (n=6), "cuidado" (n=6) e "prevenção" (n=5). Feita a análise de similitude, identifica-se um leque semântico de palavras mais frequentes. **Conclusão:** Evidencia-se escassez de estudos, na literatura, com informações significativas para agregação de conhecimentos e construção de novos trabalhos.

Palavras-chave: Eletrocirurgia. Cuidados de enfermagem. Recuperação pós-cirúrgica melhorada.

[1]Nursing student at Centro de Educação e Saúde (CES), Universidade Federal de Campina Grande (UFCG) – Cuité (PB), Brazil.
[2]Nursing student at CES/UFCG – Cuité (PB), Brazil.
[3]PhD in Nursing at Universidade Federal da Paraíba. Professor at UFCG – Cuité (PB), Brazil.
[4]Nurse, Doctoral student in Clinical Psychology, Interventions in Psychoanalysis at Universidade de São Paulo (USP). Professor at UFCG – Cuité (PB), Brazil.
*Corresponding author: patricioalmeida13@hotmail.com
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RESUMEN: Objetivo: Identificar el conocimiento científico producido sobre la atención de enfermería relacionada con el uso de electrocirugía en el período intraoperatorio. **Método:** Revisión integradora, realizada en las bases de datos LILACS, PubMed, CINAHL y en la biblioteca virtual SciELO, a través de los descriptores Electrocirugía, Atención de enfermería y Recuperación posquirúrgica mejorada, correlacionados por el operador booleano *and,* en portugués, inglés, español y francés. Siete de los 213 estudios encontrados compusieron la muestra. Se utilizó el *software* IRAMUTEQ, mediante los métodos de análisis léxico y de similitud. Para el análisis de la calidad metodológica se aplicó el nivel de evidencia científica, según las recomendaciones de la *Agency for Healthcare Research and Quality* (AHRQ). **Resultados:** Destacan las publicaciones entre 2010 y 2012, con nivel de evidencia V, indexadas en las bases de datos LILACS y CINAHL. En la nube de palabras se encontró términos con mayor frecuencia relativa: Paciente (n=14); Riesgo quirúrgico (n=12); Electrocirugía (n=10); Enfermero (N=08); Conocimiento (N=6), Atención (N=6) y Prevención (n=5). Se identifica un rango semántico de palabras más frecuentes a partir del análisis de similitud. **Conclusión:** Se demostró la escasez de estudios en la literatura, con información significativa para la agregación del conocimiento y la construcción de nuevas obras.

Palabras clave: Electrocirugía. Atención de enfermería. Recuperación mejorada después de la cirugía.

INTRODUCTION

Electrosurgery, or diathermy, consists of a surgical procedure which uses electric currents of high-frequency polarity in biological tissues, by handling a dielectric material for therapeutic purposes, such as dieresis and/or hemostasis. This is an old practice that has been improving throughout time, with the advances in technology[1].

Electrosurgery is considered to be a routine practice, widely used in operating rooms (OR). It brings several benefits and ensures higher quality in perioperative care. However, even with the advances in technology, there are often complications in the surgery environment, presenting potential risks for the patient, the surgery staff and the entire multidisciplinary team[2].

Concerning the main complications related to the use of diathermy, the following stand out: smoke inhalation, burns, interferences in the electric field and in pacemakers. Burns are one of the most frequent complications among patients who undergo this procedure[3].

Therefore, the literature points out that the lack of communication between the members of the surgery staff and the insufficient knowledge about the use of electric equipment in surgery are predisposing factors to the increased risk of major complications related to the procedure. It is important to emphasize that the safe procedure reflects on the quality of care provided to the patient, and performed by the surgery staff in the pre, intra and postoperative periods, in order to reduce possible damage, sequelae and adverse events[2].

In the surgery staff, nursing stands out as to the quality of care and reduction of common risks in the perioperative period, by providing systematized care that enables the control and planning of strategies to guarantee complete, continuous, safe and humanized care to the patients. Besides, these lead to a considerable reduction in possible errors in the staff in general. The possibility of a direct approximation with the patient favors the evaluation of conducts and proper instruction in all surgical periods[3,4].

Even though the importance and size of the theme be internationally recognized, there are only a few studies addressed to nursing care in the use of electrosurgery. This study is a result of the discipline "Special Topics: theoretical notions of nursing in an operating room and Central of Material and Sterilization".

OBJECTIVE

To identify, in the literature, the scientific knowledge produced under the care of nursing related to the use of electrosurgery in the intraoperative period.

METHOD

This is an integrative review whose method allows to gather and analyze scientific studies published in the literature in a systematic and broad manner, composing the synthesis of results without changing its epidemiological affiliation, relating them to build new knowledge[5].

The study was carried out between October and November, 2020, by four students attending the eighth period of the Nursing Course of a federal institution, advised by two professors. It was conducted in the discipline:

"Special Topics: theoretical notions of nursing in an operating room and Central of Material and Sterilization", in the 2020.3 semester, in the virtual modality due to the Coronavirus pandemic.

Regarding the stages of the integrative review, there are similarities with the several models presented in the scientific literature: the used model was composed of six stages:

- Definition of the theme of interest;
- Construction of the guiding question;
- Crossing of the selected descriptors, correlated using the Boolean operator "and" in the selected databases;
- Selection of articles related to the theme, which met the inclusion criteria;
- Selection of the information extracted after reading the existing articles in the databases[6].

For the demonstration of the study question, we used the patient intervention, comparison, outcomes (PICO) strategy. This strategy allows the correlate definition of the necessary evidence to create the clinical research question, which potentializes the recovery of evidence in the databases, focuses the target of the study and prevents unnecessary searches. In this strategy, P=patient or problem, I=intervention, C=comparison or control, O=outcomes[7]. It is important to mention that the third element, that is, comparison, was not used in this study. The result was the following guiding question: which items of nursing care are related to the use of electrosurgery in the intraoperative period described in the scientific literature?

The selection and search of studies was independent and double-blind, carried out by two authors, in order to prevent study bias and ensure the scientific quality and reliability of the findings in the literature. The results were compared, and the differences were solved by consensus or with the inclusion of a third reviewers, in order to favor the consistency of the selection and the analysis of the studies. The following databases were consulted: Latin American and Caribbean Health Sciences Literature (LILACS), PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and in the virtual library *Scientific Electronic Library Online (SciELO)*.

The descriptors and their combinations, correlated by the Boolean AND, were used in Portuguese, English, Spanish and French: "electrosurgery" ("eletrocirurgia"; "electrocirugia"; "électrochirurgie"), "nursing care" ("cuidados de enfermagem"; "atención de enfermería"; "soins infirmiers"), "perioperative nursing ("enfermagem perioperatória"; "enfermería perioperatoria"; "soins infirmiers périopératoires"), "enhanced recovery after surgery"; ("recuperação pós-cirúrgica melhorada"; "recuperación mejorada después de la cirugía"; without translation).

The inclusion criteria were: texts available in full; in the referred languages; online; and published in the past 11 years (2009-2020). We excluded repeated articles in the databases and literature considered to be gray. We used an adaptation of the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) model (Figure 1) for the presentation of the stages of article selection.

For the extraction of information from the final sample of articles, we used an instrument with data related to title, authors, language, year of publication, method, level of scientific evidence (SE), study objectives and main conclusions.

In order to increase the possibilities of analysis, the final considerations of the selected articles were used as text corpus and submitted to processing in *Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires* (IRAMUTEQ). This software organizes the distribution of vocabulary in an easily understandable manner, besides being visually clear[8].

In the text analysis performed by IRAMUTEQ, we separated the corpus in a single file, divided in seven initial text units (UCI); twenty segments were withheld, and 60.34% of the corpus was used. Afterwards, the results were presented considering two aspects of analysis: lexical analysis – word cloud method –, and similitude analysis.

Besides, for the analysis of methodological quality, we used the model of levels of scientific evidence from the *Agency for Healthcare Research and Quality* (AHRQ), according to the following classification:

- level I: meta-analysis of multiple controlled studies;
- level II: individual study with experimental design;
- level III: study with near-experimental design as an analysis without randomization with a single pre and post-test group, temporal series or case-control;
- level IV: study with non-experimental design, such as correlational and qualitative descriptive study or case studies;
- level V: case reports or data obtained in a systematic manner, of verifiable quality, or data of program evaluation;
- level VI: opinion of respectable authorities, based on the clinical competence or on the opinion of expert committees, including interpretations of information that is not based on research[9].

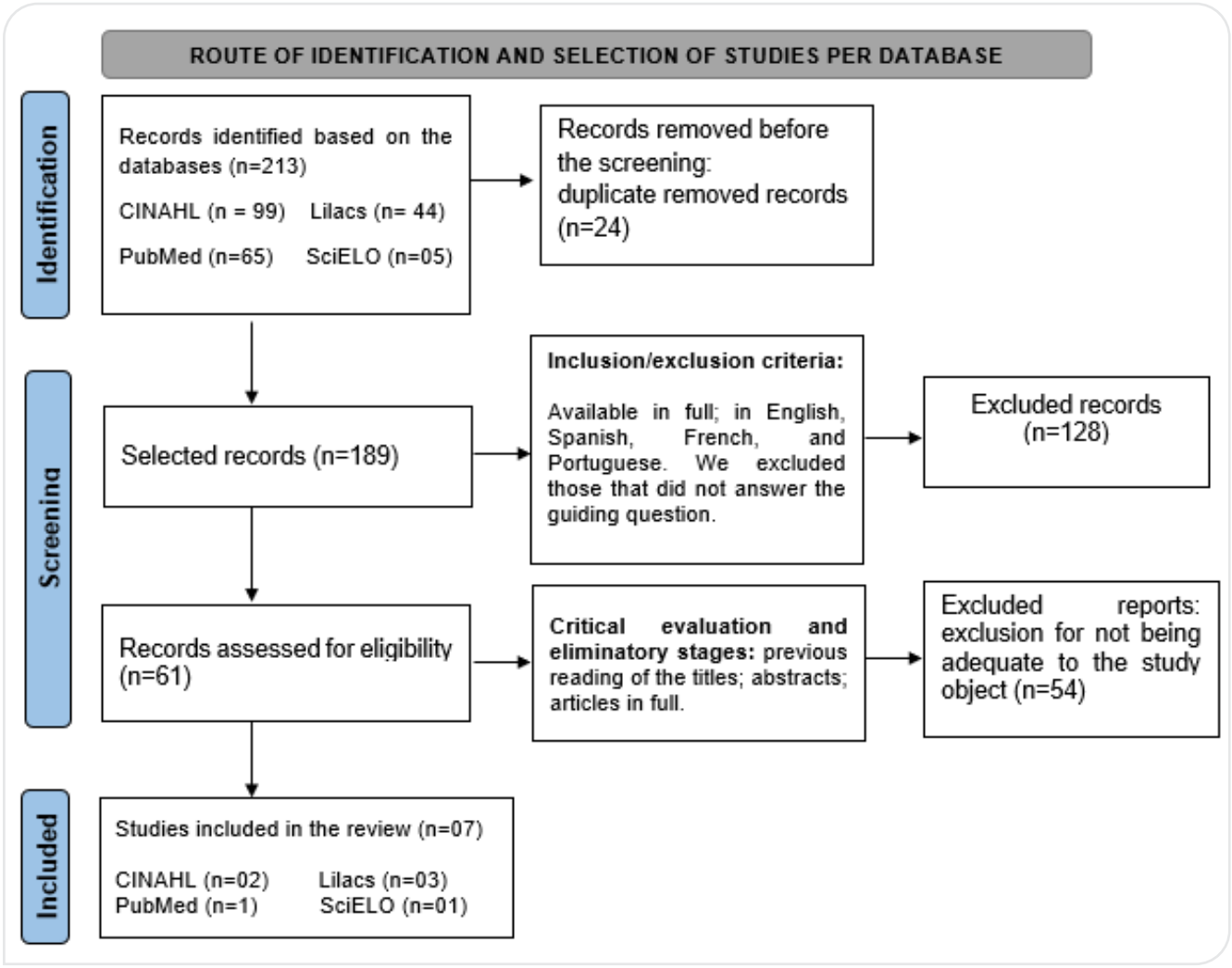

Figure 1. Flowchart of identification, screening and selection of the scientific production, adapted from the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses*.

The data were analyzed, synthetized and presented in tables, word cloud and similitude tree. For the construction of an integrative review, we considered and respected the ethical aspects in the aforementioned stages.

RESULTS

Seven articles composed the final sample of the study, of a universe of 213, extracted from different journals and according to the eligibility criteria. Chart 1 shows the bibliometric characterization of the articles, composed of: number/author/year/language, title, method, database and LE.

It is possible to identify the prevalence of publications in 2010 and 2012, level of evidence V, indexed in LILACS and CINAHL. There are five articles in Portuguese, and two in English. Regarding the research methods, they include: integrative review, narrative, and studies of descriptive and exploratory design.

Chart 2 summarizes the objective, the main results and the conclusion of each article of this integrative review.

It is observed that, in Chart 2, the verbs of the objectives were all different to describe the thematic, such as: search and evaluate (A1), elaborate (A2), analyze (A3), provide (A4), discuss (A5), characterize (A6), and identify (A7). It is also possible to notice that, in four of the analyzed articles (A1, A3, A4 and A7), the theme of nursing

care related to electrosurgery is configured as the core of the discussion of the studies. Other associated topics are: recommendations for the use of electrosurgery and elaboration of safety protocols (A2); complications related to the procedure (A5), and exposure of the team to surgical smoke (A6).

In the construction of a word cloud, the terms that obtained higher relative frequency were: "patient" (n=14); "surgical risk" (n=12); "electrosurgery" (n=10); "nurse" (n=8); "knowledge" (n=6), "care" (n=6), and "prevention" (n=5), which gained central position and were larger in relation to other words, as represented in Figure 2.

In the odds ratio analysis between the selected terms in the processing of data based on the similitude analysis (Figure 3), there is a semantic range of more frequent words: "patient", "electrosurgery", "nurse", and "surgical risk".

Chart 1. Bibliometric categorization of the articles included in the integrative review.

N	Author/Year Language	Title	Method	Database	LE
A1	Brito e Galvão[10] 2009 Portuguese	*Os cuidados de enfermagem no uso da eletrocirurgia*	Integrative review	LILACS	V
A2	Brito e Galvão[11] 2010 Portuguese	*Protocolo de cuidados no uso de eletrocirurgia monopolar*	Integrative review	LILACS	V
A3	Olímpio et al.[12] 2016 Portuguese	Electric scalpel usage and related safety measures: integrative review	Integrative review	CINAHL	V
A4	Spruce e Braswell[13] 2012 English	Implementing AORN recommended practices for electrosurgery	Narrative review	CINAHL	V
A5	Afonso et al.[14] 2010 Portuguese	*Risco do uso do eletrocautério em pacientes portadores de adornos metálicos*	Integrative review	SciELO	V
A6	Steege et al.[15] 2017 English	Secondhand smoke in the operating room? Precautionary practices lacking for surgical smoke	Descriptive and exploratory	PubMed	IV
A7	Parra et al.[16] 2012 Português	*O conhecimento dos circulantes de sala sobre a utilização do bisturi elétrico*	Descriptive and exploratory	LILACS	IV

LE: level of evidence; AORN: Association of periOperative Registered Nurses.

Chart 2. Synthesis of the objective, main results and conclusion of the publications.

N	Objective	Main Results	Conclusion
A1[10]	To search and assess the produced scientific knowledge about nursing care related to the use of electrosurgery in the intraoperative period.	The following categories were presented: complications resulting from the electrosurgery; complications resulting from high potency electrosurgery; complications resulting from electrosurgery, other electric equipment and antiseptic agents; knowledge of the nurses about the unit of electrosurgery; practical recommendations for the use of electrosurgery.	It is imperative that the perioperative nurse have technical and scientific knowledge about electrosurgery, and the evidence found provides subsidies for the implementation of policies and procedures to ensure patient safety, minimizing the potential risks of this technology.

Continue...

Chart 2. Continuation.

N	Objective	Main Results	Conclusion
A2[11]	To elaborate a care protocol for the use of monopolar electrosurgery.	For the elaboration of the protocol, seven articles were analyzed and their practical recommendations were synthetized. The protocol was developed including the following items: pre, intra and post-operative care.	The elaboration of care protocols allows the reduction of error and minimizes risks, thus providing improved quality of care in the pre, intra and post-operative periods.
A3[12]	To analyze scientific evidence about the use of an electric scalpel and the care related to the use of this equipment.	The search strategy allowed to analyze six articles, which approached three main themes: risks associated with the use of the electric scalpel, knowledge of the team regarding the use of this instrument, and role of the nurse to prevent the risks associated with electrosurgery.	It is necessary to implement actions so that nurses and technicians can acquire the proper level of knowledge and skills related to patient safety in electrosurgery.
A4[13]	To provide guidance to the perioperative nurses in the use and care of electrosurgical equipment, including high frequency, ultrasound and modalities of argon beam.	The recommendations include the selection of electrosurgical units and accessories for purchase, minimizing the potential of injuries in patients and staff, defining precautions to be taken during the minimally invasive surgery, and ways to prevent risks of surgical smoke.	The recommendations include education, skills, documents, policies, procedures, quality, guarantee and improved performance. Perioperative nurses should consider the use of verification lists and safety posters to remind the staff members of the dangers of electrosurgery and the measures to be taken to minimize the risks of injury.
A5[14]	To discuss the aspects related to complications and the adequate use of electrosurgery.	The injuries in monopolar electrosurgery are more common in the place of the dispersive plate, but also happens in places with monitoring electrodes and sites of accidental contact with metal objects, which work as an alternative path for electricity dispersion. The main complications related to electrosurgery are thermal lesions, followed by shock and interference with other electric equipment and devices.	It is essential to know the basics of electrosurgery, its proper use, safe equipment, constant monitoring and immediate investigation in case of any suspicions to minimize the risk of accidents in patients with metallic ornaments. The patient's cooperation to follow the preventive measures should be mandatory.
A6[15]	To characterize the use of exposure controls and barriers to use local exhaust ventilation and individual protection equipment (including respiratory protection) by health professionals who were exposed to surgical smoke generated by laser or electrosurgical procedures.	It is worth to mention that 4,533 interviewees reported exposure to surgical smoke; 4,500 during electrosurgery, and 1,392 during laser surgery procedures. The following were interviewed: nurses (56%) and anesthesiologists (21%). Only 14% of the exposed individuals during electrosurgery reported that the local exhaust ventilation was always used during these procedures, whereas 47% reported its use during laser surgery. A few interviewees reported the use of respiratory protection.	The results of the study can be used to raise awareness about the marginal use of exposure controls and hindrances for its use.
A7[16]	To identify the knowledge of nursing professionals in the operating room as to the use of an electric scalpel.	Even though the use of an electric scalpel is frequent in the operating room, only 54% of the users had undergone efficient training. As to the specific care with patients with pacemakers who had to use the electric scalpel, 72% of the interviewees were unaware of such care.	There are flaws in the training of the nursing team in the operating room regarding the use of an electric scalpel. The suggestion is to provide permanent training on this subject, in order to guarantee quality and safety in the care of the surgical patient.

Figure 2. Word cloud.

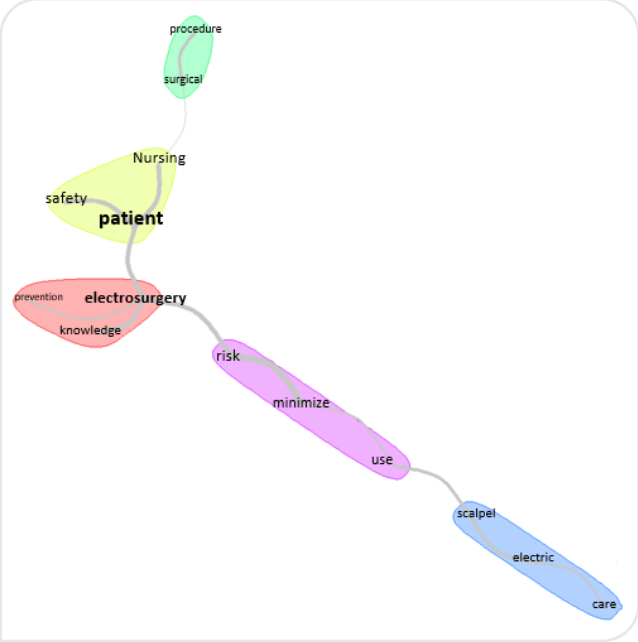

Figure 3. Similitude analysis of text corpus.

DISCUSSION

In the analysis of the articles, the studies pointed out to the main risks and complications that may arise from the inadequate use of the electrocautery. The following risk factors stand out: time of exposure to electric current, use of the monopolar system, lack of communication between the members of the surgical staff, damage or inadequate use of the gas network, insufficient knowledge of professionals about its functioning, necessary care regarding the safe handling of the electric scalpel[13,14,16].

We identified that the patient is exposed to direct or indirect risks related to the surgery, as aforementioned. The time of exposure to the electric current or duration of the current has an influence on the effects of its passage through the human body; so, the longer the exposure, the higher the effects and risks of the injury[12,17].

The main complications identified while summarizing the selected articles were burns, electric shocks and inhalation of surgical smoke, which lead to significant impairment for the patient. One of the studies emphasizes that the risk of injury is associated with the onset of burns resulting from three secondary causes: unintentional thermal trauma or inappropriate use of the active electrode; unwanted thermal trauma at the plate region; and the third cause may occur when the electric current takes an unwanted path through the patient's body, and not of the dispersive electrode[14].

Shocks are complications in the electrosurgery unit commonly mistaken for burns, which occur when the surgeon holds the instrument on the tissue to be cauterized. In order to prevent the shock from the active electrode, it should be placed on the region of interest before its activation. Metallic materials and ornaments may potentialize the risk, increasing, in proportion, the occurrence of injuries[1,12,14].

Researchers observed that the smoke dispersed in electrosurgery can contain toxic gas and steam, such as benzene, hydrogen cyanide, formaldehyde, bioaerosols, live and dead cellular material and virus. One of the recommendations to contain this damage is the use of smoke evacuation systems, so that the potential acute and chronic risks to health be reduced, both to patients and to the surgical staff[1,17,18].

It is necessary to highlight that the operating room is a therapeutic environment that aims at promoting safety and well-being to the patient. It is the nurse's role to recognize and minimize the possible risks and prevent complications, planning and establishing nursing interventions to contribute with the patient's well-being and rehabilitation. To care for a patient in an operating room, it is mandatory that the perioperative nursing care can plan and implement actions, being categorized by a dynamic and systematic process[14,19].

Concerning the analysis of the similitude tree, it was possible to consider, by linking the words, that the sense given to nursing care in the intraoperative period of an electrosurgery, aims at ensuring the patient's safety during the procedure, therefore reducing associated risks and complications; for that, some recommendations must be established.

In this sense, the nursing team is essential to perform the professional care based on scientific evidence that can meet the patient's needs. Besides, the nursing procedures carried out during the electrosurgery are divided in care addressed to the patient and the room during the perioperative period. The following stands out: verification of personal data, proper surgical procedure, indication, laboratory tests, vital signs in normal parameters, instructions and preparation of the patient in the preoperative period[20].

Besides care related to transportation and reception of the patient in the OR, the use of aqueous antiseptic solutions instead of alcohol, the surgical positioning of the patient and the rational use of oxygen stand out. Besides, the patients with a pacemaker should be constantly monitored, because even though the devices are modern, they are still subjected to the interference of the electric current. Other types of care, such as monitoring the patient's parameters during the procedure, proper placement of the dispersion plate, follow-up in the post-anesthesia recovery room, monitoring and surgical dressings must be strictly followed[11,19,21].

Electrosurgery is a routine practice in the OR. Therefore, nursing care in the perioperative environment is essential: preparation of the OR; adjustment of the focus and potency of the electric scalpel, so that there are no sparks; placement of surgical fields as far as possible from sources of heat; making sure that every outlet and device in the OR is functioning; providing the material to be used; making sure there is no accumulation of inflammable liquids in any cavity of the patient's body; the patient must not be in contact with metal objects; cables and electrodes must be verified before use to make sure the isolation is intact, among other conducts[10,12].

In electrosurgery, nursing care is related to patient care itself; it is necessary to pay attention to maintain the equipment to be used, as well as the location where the surgical procedure will take place[11,22].

As to the limitations of this study, there is the low level of scientific evidence between the sample of the articles and the scarce literature about the theme. Therefore, it is necessary to develop new scientific productions that can fill the gaps in the current literature, thus contributing with significant information to integrate new knowledge and favor qualified nursing care to the patient who undergoes electrosurgery.

However, despite the limitations, the findings in this study can be used both in the academic and professional level, in order to favor the acquisition of updated knowledge about nursing care related to the use of electrosurgery in the intraoperative period, besides indirectly promoting qualified and safe care to the surgical patient.

CONCLUSION

This study enabled to identify scientific evidence about the necessary care regarding the use of electrosurgery and its associated risks. We analyzed publications that highlight the importance of the effective dialogue between the members of the multidisciplinary team for the development of prevention actions that can minimize the risks of procedures related to electrosurgery, including the constant monitoring of the safe equipment. Besides, we observed the need for self-training by using strategies of continuous and permanent education among the team professionals.

It is necessary to execute strategies that allow nursing professionals to acquire proper technical and scientific knowledge, as well as skills related to the safety of the patient who undergoes electrosurgery. The goal is to reduce the chances of adverse effects during the procedure, such as burns, shocks and inhalation of surgical smoke, which directly interfere in the physical integrity of the patients and professionals.

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PREPARATION OF A SURGICAL CENTER IN NORTHEAST BRAZIL FOR SURGERIES DURING THE COVID-19 PANDEMIC

Preparação de um centro cirúrgico do Nordeste do Brasil para cirurgias durante a pandemia da COVID-19

Preparación de un centro quirúrgico de Noreste de Brasil para cirugías durante el pandemia de COVID-19

Eduardo Tavares Gomes[1*], Marcone César Tabosa Assunção[2], Mayana Camila Barbosa Galvão[3], Jacqueline Augusta do Nascimento Oliveira[4], Caline Sousa Braga Ferraz[5], Priscilla Glazielly dos Santos de Moraes[6], Cinthia Regina Albuquerque de Souza[7], Mauricia Figueiroa da Silva[8]

ABSTRACT: Objective: To report the experience of preparing the operating room of a Brazilian university hospital for surgeries for patients suspected and confirmed for COVID-19. **Method**: Experience report of the operating room of a university hospital in Northeast Brazil, conducted in March and April 2020, for care during the COVID-19 pandemic. **Results**: The implementation of the care protocol for suspected and confirmed cases of COVID-19 was carried out through its elaboration by a team of professionals based on national and international guidelines, training and updates. Improvement cycles allowed the protocol to be refined over the two months reported. Barriers and facilitators to the process are discussed and strategies are drawn up for possible adjustments. **Conclusion**: There was an adaptation of care protocols related to the routine of patient flow and care in the operating room to better serve patients and reduce the risk of contamination of other patients and professionals.

Keywords: Surgicenters. Operating rooms. Perioperative nursing. Coronavirus infections.

RESUMO: Objetivo: Relatar a experiência da preparação do centro cirúrgico de um hospital universitário brasileiro para o atendimento de cirurgias em pacientes suspeitos e confirmados de COVID-19. **Método:** Relato da experiência do centro cirúrgico de um hospital universitário do Nordeste do Brasil, em março e abril de 2020, para o atendimento durante a pandemia da COVID-19. **Resultados:** A implementação do protocolo de atendimento a pacientes suspeitos e confirmados de COVID-19 foi realizada por meio da sua elaboração por um time de profissionais norteados por diretrizes nacionais e internacionais, treinamentos e atualizações. Os ciclos de aprimoramento permitiram que o protocolo fosse aperfeiçoado ao longo dos dois meses relatados. Barreiras e facilitadores para o processo são discutidos e estratégias são elaboradas para adequações possíveis. **Conclusão:** Houve adequação de protocolos assistenciais relacionados à rotina de fluxo de pacientes e da assistência em sala operatória no intuito de melhor atender os pacientes e reduzir os riscos de contaminação de outros pacientes e profissionais.

Palavras-chave: Centros cirúrgicos. Salas de cirurgia. Enfermagem perioperatória. Infecções por coronavírus.

RESUMO: Objetivo: Informar la experiencia de la preparación del centro quirúrgico de un hospital universitario brasileño para la atención de cirugías en pacientes sospechosos y confirmados de COVID-19. **Método:** Informe de la experiencia del centro quirúrgico de un hospital universitario del Noreste del Brasil, en marzo y abril de 2020, para la atención durante la pandemia de COVID-19. **Resultados:** La implementación del protocolo de la atención

[1]Doctoral student in Sciences from the Graduate Program in Adult Health Nursing, Nursing School, Universidade de São Paulo. Clinical Nurse at the Surgical Center Unit of Hospital das Clínicas of Universidade Federal de Pernambuco (UFPE) – Recife (PE), Brazil.
[2]Doctoral Student in Health Management and Economics at UFPE – Recife (PE), Brazil.
[3]MD in Nursing from the Universidade Federal do Rio Grande do Norte. Clinical Nurse at the Surgical Center Unit of Hospital das Clínicas UFPE – Recife (PE), Brazil.
[4]MD in Ergonomics from UFPE. Clinical Nurse at the Surgical Center Unit of Hospital das Clínicas UFPE – Recife (PE), Brazil.
[5]Specialist in Child Health Nursing from the Nursing Residency Program of Instituto de Medicina Integral Professor Fernando Figueira (IMIP). Clinical Nurse at the Surgical Center Unit of Hospital das Clínicas UFPE – Recife (PE), Brazil.
[6]Specialist in Surgical Nursing from the IMIP Nursing Residency Program. Clinical Nurse at the Surgical Center Unit of Hospital das Clínicas UFPE – Recife (PE), Brazil.
[7]Master's student in Health Assessment at IMIP. Clinical Nurse at the Surgical Center Unit of Hospital das Clínicas UFPE – Recife (PE), Brazil.
[8]Clinical Nurse at Hospital das Clínicas UFPE – Recife (PE), Brazil.
*Corresponding author: edutgs@hotmail.com
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a los pacientes sospechosos y confirmados con COVID fue llevada a través de la elaboración por un equipo de profesionales guiados por las directrices nacionales e internacionales, entrenamientos y actualizaciones. Los ciclos de mejora permitieron mejorar el protocolo durante los dos meses informados. Las barreras y los facilitadores para el proceso se discuten, y las estrategias son elaboradas para los ajustes posibles. **Conclusión:** Se adecuaron protocolos asistenciales relacionados a la rutina del flujo de pacientes y de la asistencia en centro quirúrgico, con la intención de atender mejor a los pacientes y reducir los riesgos de la contaminación de otros pacientes y profesionales.

Palabras-clave: Centros quirúrgicos. Quirófanos. Enfermería perioperatoria. Infecciones por coronavirus.

INTRODUCTION

The COVID-19 pandemic (Coronavirus Disease, 2019) reached Brazil, with community transmission, at the end of March 2020[1]. Amidst many uncertainties, surgical center (SC) professionals had their tension levels increased in the face of exposure to the new virus.

Operating rooms (OR) are recognized, since the beginning of the pandemic, as places with great potential for contamination and dissemination of the virus[2]. The SC had to prepare for the protection of their professionals[3]. Initially, the greatest concern were patients with respiratory symptoms, considering that the confirmation of cases took days due to the scarcity of tests in the health network in Brazil in February and March. However, with the beginning of community transmission in the country and in the location of the hospital under study the capital of a state in the Northeast of Brazil—, any patient and all professionals working together could be sources of contamination. In this scenario, alerts for material rationing and the possibility of shortage of personal protective equipment (PPE) were also generators of stress[1,4-6].

In addition, many professionals had employment relationships with more than one health establishment, increasing their exposure and favoring the circulation of the virus. Even though surgeries were not performed in a service on suspected patients, asymptomatic patients started being considered potential sources, as well as professionals in the surgical team.

Many surgical departments reported how the pandemic impacted their surgery scheduling routines, changed their queues and their way of prioritizing. However, there are very few discussions on how the pandemic influenced the routines, within the OR, of garment management, assembly, disassembly and de-assembly[7-12].

OBJECTIVE

To report the experience of preparing the SC of a university hospital for surgeries in patients with suspected and confirmed infection by COVID-19, and the adequacy of such protocols to the OR routine.

METHOD

This is an experience report that took place in the SC of a university hospital located in the Northeast region of Brazil, in March and April 2020, for assistance in the COVID-19 pandemic. The service has ten medium and large ORs for high complexity surgeries and another four small ORs for outpatient surgeries. In this hospital, the obstetric center is separate from the SC. In addition, there are two post-anesthetic recovery rooms (PARR), one for each OR block. The process of implementation of measures followed the guidance of the PDCA cycle: plan, do, check, act.

This report was approved by the Institution's Research Ethics Committee.

RESULT: EXPERIENCE REPORT

At first, the unit temporarily suspended outpatient surgeries and started prioritizing larger and urgent surgeries, in view of the crisis of supply of materials and PPE. Besides that, over these two months (March and April 2020), several professionals were put on leave from their jobs because they were from risk groups or because they were infected by the virus, which prevented the functioning of the SC at its fullness.

Then, a team formed by the authors of this report began elaborating a protocol for the care of patients infected with the SARS-CoV-2 coronavirus. Professionals from the Hospital Infection Control Service (SCIH) and from the Assistance Risk Management Unit (UGRA) prepared guidelines and workflows for the hospital, especially hand hygiene and PPE use protocols. The use of PPE included equipment that was not yet used in SCs in Brazil, such as the face shield, in addition to the specific dressing routine.

The team of professionals, led by the head of the SC, started building a specific evidence-based protocol. After starting the process and completing the first version of the institutional protocol, guidelines were released by the bodies that guide the practice in ORs to be consulted and followed in the preparation of the document. The guidelines and recommendations adopted were those of the Brazilian Society of Surgical Nurses, Anesthetic Recovery and Material and Sterilization Center (SOBECC), the Brazilian Society of Anesthesiology (SBA), the Association of periOperative Registered Nurses (AORN), Surgical Infection Society, Centers for Disease Control and Prevention (CDC), and others mentioned in other reviews on the subject[13-18].

Figure 1 shows a scheme of the process as a PDCA cycle.

The planning stage (plan — P) included consulting sources and guidelines to preparing the protocol. The doing step (do — D) included all the training given. In all, 58 professionals participated in the training during their work shifts. The step of checking the protocol (check — C) occurred when the first patients were admitted, in April 2020. As the appointments took place and possible improvements to the protocol were suggested, the team evaluated and took action, making adjustments to the protocol and disseminating updates among the professional involved (act — A).

The protocol had two main versions as a result of changes that also affected the guidelines followed. Training began on the day before the completion of the second version. A training session was developed with a expository dialogue presentation, followed by a practical activity of dressing and undressing, then a simulation of assembly and disassembly

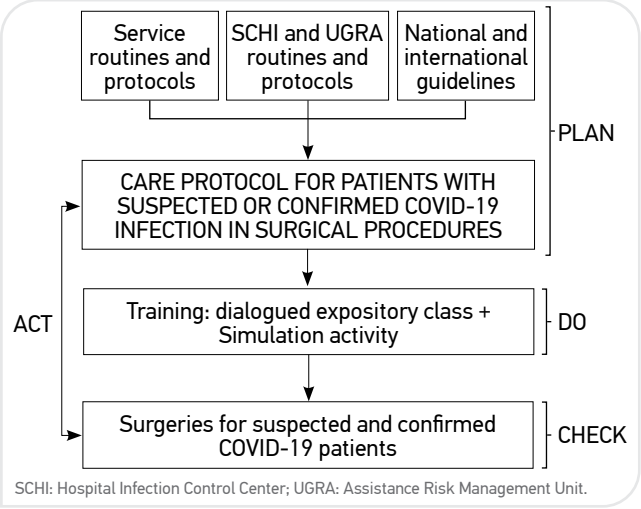

Figure 1. Implementation of care protocol for patients with suspected or confirmed infection by COVID-19 in surgical procedures.

of the OR according to the protocol. The professionals were trained in the sector and by the team who worked on the theoretical elaboration of the protocol, reaching the mark of 80% of professionals trained in the service, considering the absences in the period. The initial stage of training in dressing/undressing was also offered to anesthesiology professionals, surgeons, resident physicians, as well as cleaning service professionals. The intensive care unit (ICU) team provided orotracheal intubation and cardiopulmonary resuscitation training for the entire hospital, including the SC professionals.

Summary of protocol adaptations for the care of suspected and confirmed cases of COVID-19 in the operating room

To achieve success at all stages of the protocol, communication is essential. Surgical teams must notify the SC in advance of patients' status in order for the protocol to be initiate

For a surgery, two ORs are used: one in which the dressing takes place before the surgery and the undressing afterwards; the other in which the surgery itself is performed, after adaptations in the assembly of the room. The ORs are identified on the door with identification signs of contact isolation, respiratory isolation, and COVID-19.

Some routines used to be already performed in infectious surgeries or for patients in contact isolation; for example, the team would remove as much material and furniture from the OR as possible. Furthermore, until anesthetic induction, the air conditioning would be turned off to prevent hypothermia, and the protocol kept this practice until after orotracheal intubation, an aerosol generating procedure[16,18-21].

The anesthesia workstation were prepared with a bacterial filter for the ventilatory circuit, and placement of a gripper for the orotracheal tube wrapped in plastic film[16,18-21]. The forceps should be used whenever there was an opening of the closed airway ventilation system[16,18-21]. The proximal route of the orotracheal tube should also be sealed, allowing only the passage of the bougie or guide, not allowing the scape of aerosols.

Plastic film was placed on all furniture, including scalpel consoles, infusion pumps and aspirators. When disassembling the OR, the routine is to disinfect the plastic film with a 70% alcohol solution, then remove it and disinfect the surface again.

The permanence of people in the OR was reduced, excluding, for example, undergraduate students. Nursing technicians, who circulate in the OR, are scheduled for surgery

always in pairs: one inside the OR and the other at the door to meet any needs, so that the one inside the room does not have to leave.

According to the protocol, all professionals in the OR must wear the N95 or PFF2 mask, a cap, shoe protectors, procedure gloves, waterproof aprons over private clothing (to be changed at the end of the procedure), in addition to a face shield. After undressing, all professionals are taken to the locker room, where they take a shower and change their private clothes.

Finally, the patient recovers from anesthesia in the OR, for later referral directly to their bed in the inpatient unit.

DISCUSSION

The COVID-19 pandemic changed the routine of healthcare facilities around the world. Practices that were previously not considered became essential for the prevention of contamination and cross-contamination[19]. OR usage rates decreased, waiting time increased along with the notification of incidents, both in the service of the institution of this study and in others[10,11].

The surgical center organized a crisis committee that was part of the hospital's general committee, just like in other services[2]. This favored the rapid implementation of the PDCA cycle and online adaptations aligned with new guidelines and with the experiences specific to each type of surgery.

The success in coping with the pandemic in SCs is mainly related to the ability of managers and professionals to anticipate, so that preparations and adaptations are carried out as early as possible and with the necessary training, as in this report[9-11,20]. One of the factors favoring the success of the experience is the fact that the surgical department does not assist emergency surgeries, in which the risk of contamination and protocol breach are even greater[10,11,20]. It is also worth emphasizing the role of the previous safe surgery checklist protocol, since the moment of completion of the checklist served to review the points of this specific protocol.

The guidelines of the main societies in the world used previous evidence for an extrapolation that would allow quick answers for the preparation of surgical centers, converging on the guidelines[16,18-21]. Routines for patients in respiratory and contact isolation were already widely used in the SC, however, for the care provided to COVID-19, patients and aerosol-generating procedures became even more relevant. However, the main focus of publications in the first semester of the pandemic was on how to deal with the cancellation of elective surgeries, how to prioritize the ones that should not be suspended, and how to manage waiting patients[7,10,11,21].

One of the concerns about performing surgeries for patients with COVID-19 is related to surgical smoke, produced mainly when electrocautery is used, and has been studied for over 40 years[22]. Some authors even suggested avoiding its use and reinforced that the bipolar scalpel generates less smoke than the monopolar one[13,23,24].

One of the challenges was the reduction of professionals inside the ORs. With the involvement of the teams and the awareness of the university, it was possible to keep undergraduate students out of these procedures, moving them to other outpatient activities and wards, as it happened in other services[7,10,11,24].

The implementation of an evidence-based protocol brought to the team, in addition to more security, a greater sense of confidence for professionals when carrying out their activities. The change in institutional climate is notorious in terms of promoting unity and partnership, in which professionals help each other, especially in dressing and undressing procedures, and in all the work. Several references report that, elective surgeries during the pandemic period require preparation of the team and availability of PPE, being strictly necessary[11,19,24,25]. In addition, proper training helps to prevent the spread of the virus from the surgical department into the rest of the hospital[24].

In this center, elective surgeries have been performed only according to a prioritization specific to each specialty, as in other places, with general considerations regarding the preoperative status of the underlying disease, clinical conditions, presence or absence of suspected or confirmed coronavirus contamination[7,10,11,21,26]. The next step is the reopening of activities for all elective surgeries, awaiting national and international guidelines and following safe references for prioritizing cases and reorganizing the procedures' queue[7,8,10,11].

The execution of the OR assembly and disassembly protocol, with the covering of equipment with plastic film and all adaptations, in addition to dressing and undressing schema, increased the use of the room by approximately one hour—not considering the post-anesthetic recovery time[19].

Finally, we still need to reflect on aspects of the protocol that were not subject to intervention. The limitations

were mainly in structural, as the ORs had a conventional exhaust system, without negative pressure or high-efficiency particulate air filter (HEPA)[19]. Also, it was not possible to cover the entire team because some left the service early. Therefore, a professional from the training team continued to supervise the dressing/undressing steps for all professionals[19]. Another structural limitation is the fact that printed tools are still used in the surgical department for room records; even though they remained outside the OR, there was a high risk of being fomites for the dissemination of the SARS-CoV-2 virus[19].

CONCLUSION

The elaboration and implementation of the care protocol for suspected and confirmed cases of COVID-19 was carried out by a team of professionals guided by national and international guidelines, training and updates. The PDCA cycle allowed t improve the protocol over the two months of this report. Barriers and facilitators to the process were identified and strategies were drawn up for possible adjustments. Many gains in terms of protocols and procedures are expected to remain and be used after the pandemic.

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AEROSOL MANAGEMENT DURING THE COVID-19 PANDEMIC

Manejo de aerossóis durante a pandemia da COVID-19

Manejo de aerosol durante la pandemia COVID-19

Aline Coutinho Sento Sé[1]*, Raquel Calado da Silva Gonçalves[2], Perla da Silva Antunes[3], Nébia Maria Almeida de Figueiredo[4], Teresa Tonini[5]

ABSTRACT: Objective: To describe the prototyping process of a filtration device for aerosol management in laparoscopic procedures during the SARS-CoV-2 coronavirus pandemic. **Method**: Descriptive study with the report of experience on the prototype filter device for aerosol management in laparoscopy during the SARS-CoV-2 COVID-19 pandemic, based on immersion, ideation and design thinking prototyping processes. **Results**: Preliminary and deep immersion processes allowed the problem to be addressed. The use of a mental map helped to identify factors related to surgery suspensions due to the SARS-CoV-2. Based on the measurements of the operating room aspirator, the necessary material resources were idealized: suction extender, bacteriological and viral filter, connector and tip. **Conclusion**: The device for filtering carbon dioxide from the pneumoperitoneum was well accepted by the surgical team and incorporated into the sector's routine for laparoscopic surgeries.

Keywords: Betacoronavirus. Laparoscopy. Pneumoperitoneum, artificial. Equipment and supplies. Surgery department, hospital.

RESUMO: Objetivo: Descrever o processo de prototipação de um dispositivo de filtragem para manejo de aerossóis em procedimentos laparoscópicos durante a pandemia do coronavírus SARS-CoV-2. **Método:** Estudo descritivo, tipo relato de experiência sobre o protótipo de dispositivo de filtragem para manejo de aerossóis em laparoscopia durante a pandemia de COVID-19 pelo SARS-CoV-2, com base nos processos de imersão, ideação e prototipação do *design thinking*. **Resultados:** Os processos de imersão preliminar e profunda permitiram a abordagem do problema. A utilização do mapa mental proporcionou a identificação dos fatores relacionados às suspensões de cirurgias em decorrência do SARS-CoV-2. Pelas medidas do aspirador das salas cirúrgicas, idealizaram-se os recursos materiais necessários: extensor de aspiração, filtro bacteriológico e viral, conector e ponteira. **Conclusão:** O dispositivo para filtragem do dióxido de carbono do pneumoperitônio obteve boa aceitação da equipe cirúrgica e foi incorporado à rotina do setor durante a realização de cirurgias laparoscópicas.

Palavras-chave: Betacoronavírus. Laparoscopia. Pneumoperitônio artificial. Equipamentos e provisões. Centro cirúrgico hospitalar.

RESUMEN: Objetivo: Describir el proceso de prototipado de un dispositivo de filtración para el manejo de aerosol en procedimientos laparoscópicos durante la pandemia de Coronavirus SARS-CoV-2. **Método:** Estudio descriptivo, un relato de experiencia sobre el prototipo de dispositivo de filtrado para el manejo de aerosol en laparoscopia durante la pandemia de COVID-19 por SARS-CoV-2, a partir de los procesos de inmersión, ideación y prototipado del *Design Thinking*. **Resultados:** Los procesos de inmersión profunda y preliminar permitieron abordar el problema. El uso del Mapa Mental permitió identificar los factores relacionados con la suspensión de cirugías debido al SARS-CoV-2. A partir de las mediciones del aspirador de las salas quirúrgicas, se idearon los recursos materiales necesarios: extensor de aspiración, filtro bacteriológico y viral, conector y férula. **Conclusión:** El dispositivo para filtrar dióxido de carbono del neumoperitoneo obtuvo buena aceptación por parte del equipo quirúrgico y fue incorporado a la rutina del sector durante las cirugías laparoscópicas.

Palavras clave: Betacoronavirus. Laparoscopía. Neumoperitoneo artificial. Equipos y suministros. Servicio de cirugía en hospital.

[1]PhD in Sciences. Nurse specializing in Occupational Health and Human Ecology at the Ministry of Health – Rio de Janeiro (RJ), Brazil.
[2]PhD in Sciences. Nurse specializing in Surgical Center, Anesthetic Recovery and Material and Sterilization Center at the Ministry of Health – Rio de Janeiro (RJ), Brazil.
[3]Nurse at the Ministry of Health – Rio de Janeiro (RJ), Brazil.
[4]PhD in Nursing. Professor at the Nursing School Alfredo Pinto, Universidade Federal do Estado do Rio de Janeiro – Rio de Janeiro (RJ), Brazil.
[5]PhD in Public Health. Professor at the Nursing School Alfredo Pinto, Universidade Federal do Estado do Rio de Janeiro – Rio de Janeiro (RJ), Brazil.
*Corresponding author: aline2506@hotmail.com
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INTRODUCTION

In December 2019, physician Li Wenliang warned about the first cases of a pneumonia of unknown etiology in Wuhan, Hubei Province, China. Most of the infected people worked or lived close to the local seafood market, where live animals were also sold[1,2].

One month later, the Chinese Centers for Disease Control and Prevention identified the coronavirus 2 (SARS-CoV-2) in a swab sample taken from a patient with the severe acute respiratory syndrome. A new coronavirus with considerably higher morbidity and mortality than other viruses belonging to the same family, such as the SARS-CoV and the Middle East respiratory syndrome coronavirus (Mers-CoV)[3].

Thus, the so-called coronavirus disease 2019 (COVID-19) emerged, a disease caused by the SARS-CoV-2, characterized by mild symptoms such as flu-like illness, and good prognosis in most patients, but with the possibility of severe acute respiratory infection symptoms, with rapid development to an acute respiratory distress syndrome, acute respiratory failure, severe pneumonia, pulmonary edema, multiple organ failure, other serious complications, and death[2].

In Brazil, the first confirmed case of COVID-19 was identified on February 26, 2020. The patient was an elderly man, resident in the city of São Paulo (SP), who had recently returned from a trip to Italy. On March 17, 2020, the first death was registered in the country: also a male elderly resident in São Paulo, who had diabetes and hypertension, but no history of traveling abroad[4]. In the same month, the SARS-CoV-2 pandemic was officially declared and governments around the world began to implement strategies to try and slow the spread of the virus[2].

Considering the growing number of confirmed cases in Brazil, with a total of 3,997,865 cases almost five months after the first notification, being 3,210,405 recovered patients and 123,780 deaths[5], health authorities recommended the rescheduling of elective surgical procedures under the justification of providing beds and mechanical ventilation equipment for critically ill patients and the increased local demand[6].

During the pandemic, urgent and emergency surgeries were advised to be performed through an action plan, in which the entire multidisciplinary team was guided on how to proceed effectively and using personal protective equipment (PPE), as well as allowing a minimum number of people in the operating room (OR) to avoid the contamination of professionals[6].

The laparoscopic surgery has become increasingly frequent in health services[7]. It is a minimally invasive surgical technique that aims to reduce the length of stay of patients, reduce postoperative pain and provide comfort in the postoperative period and better aesthetic results compared to the conventional surgical technique[8].

In laparoscopic surgeries, carbon dioxide (CO_2) is used to expand the abdomen. This space constitutes the pneumoperitoneum, in which the insufflation of gas is usually made in the umbilical scar by a Veress needle, allowing the surgeon to handle surgical instruments for the procedure. In the end, the abdominal cavity is emptied, that is, CO_2 is eliminated[9].

Considering the SARS-CoV-2 pandemic, experts recommend using ultrafiltration systems during gas removal and avoiding sudden emptying of the pneumoperitoneum, emphasizing that the incisions for the passage of surgical instruments should be performed in the smallest possible diameter, decreasing the possibility of leakage. Such concerns are pertinent, as they relate to the risk of aerosolization of SARS-CoV-2 in the environment and the risk of contamination of health professionals involved[10].

In laparoscopic surgeries, the procedure must be performed by the most experienced surgeon, with special care during the introduction and removal of trocars, while checking valves and sealing rubbers, reducing the number of puncture sites and using filtering mechanisms during inflation and deflation of the pneumoperitoneum, thus allowing for a lower possibility of CO_2 dispersion into the surgical environment[11] and exposure of professionals to the coronavirus.

The guidelines of use of filtering systems for the evacuation of the pneumoperitoneum guided the problematization of this study. In the absence of this resource in a hospital, how to ensure safe laparoscopic surgical procedures while avoiding the dispersion of contaminating aerosols?

OBJECTIVE

To describe the prototyping process of a filtration device for aerosol management in laparoscopic procedures during the SARS-CoV-2 COVID-19 pandemic.

METHOD

This is a descriptive study, experience report type, on the prototyping process of a filtering device for laparoscopic

procedures, based on design thinking[12] and on the professional experience of nurses from surgical centers, working in the area for over 10 years.

The setting of this study was the surgical center of a public hospital in the state of Rio de Janeiro, with seven operating rooms (ORs), used by urology, gynecology, vascular, proctology, pediatrics and general surgery clinics. The research was carried out during May and June of 2020, period of the first wave of contamination by SARS-CoV-2 in Brazil.

Design thinking, the guiding axis for this research, is defined as a creative methodology for the development of innovative products, an approach focused on identifying problems and building solutions based on immersion, ideation and prototyping processes[12,13].

The first phase was immersion, in which the needs are identified in an exploratory way to analyze the context of a problem and establish an initial understanding, proceeded in two stages: preliminary immersion and in-depth immersion[12].

In the preliminary immersion, strategic alignment discussions were held with an interdisciplinary team on the necessary adjustments to the return of elective surgeries, until then suspended due to restrictive measures to contain the advance of contamination by the coronavirus, for the reframing process.

Anchored in the concept of desk research, a vast search for information on the subject[12] was carried out, with a theoretical deepening related to laparoscopic surgical procedures and safe evacuation of CO_2 from the pneumoperitoneum in the intraoperative period.

The in-depth immersion began with the elaboration of an observational plan to map the settings to be considered for product development and problem solving. Then we had the observation in the operating field, with reflections and screenings by surgery-specializing nurses, regarding the steps that involved the supply, propagation and elimination of CO_2 during laparoscopic procedures.

The immersion the field, with an eye on mapping the needs of direct users of technology (surgeons and patients) and indirect users (other members of the interdisciplinary team of the operating room) allowed the designing of the product's requirements, the process of use, and the mitigation of the problem of environment contamination and, perhaps, infection of workers by the CO_2 eliminated from the abdominal cavity of a patient with SARS-CoV-2.

After surveying the data in the immersion phase, the analysis and synthesis were carried out through the construction of a mind map, in the free web application GoConqr[14], a visual representation with words, images and colors for information and knowledge management as a tool for understanding and solving problems[15].

Afterwards, the ideation process was instituted based on immersion and the mental map, all in compliance with guidelines[10] for the return of elective surgeries during the SARS-CoV-2 pandemic, review of the surgical-laparoscopic care process, assessment of feasibility, safety and usability of the technology, as well as justification for its implementation.

The device's prototyping, which consists of transforming the abstract idea into a physical product, was made in a way it could represent the reality and allow validations[12] and took place in the study setting. After two phases of adjustments, the final prototype for filtering CO_2 from the pneumoperitoneum was chosen. The device was tested and evaluated by surgeons and nursing professionals, who received prior training on its purpose and on the handling and installation techniques.

RESULTS

The preliminary and deep immersion processes allowed addressing the target problem of this study: the need for a device to filter CO_2 from the pneumoperitoneum of patients undergoing laparoscopic surgery during the SARS-CoV-2 pandemic, according to current guidelines.

Based on literature mainly related to surgical activities, based on desk research, interdisciplinary discussions, observation of the surgical environment, description of surgical care, infrastructure, worker health and patient safety, the analysis process to build solutions was initiated.

The mental map helped to identify factors related to the suspension of surgeries due to SARS-CoV-2 in line with patients, health professionals and infrastructure, synthesis, planning and structuring of thought, exploration of ideas while keeping the focus on the need for a CO_2 filtration system, as shown in Figure 1.

After tracking the primordialities and mapping the spaces of care, an ideation report was prepared with a justification for implementation and inputs available in the institution to prototype the device, object of this study.

Based on the measurements of ORs' aspirators, the product was idealized: an aspiration extender and a bacteriological and viral filter (Figure 2).

Due to the incompatibility of the diameters, a connector and a tip were used as adapter (Figure 3).

Figure 4 shows the idealization of the prototype of the CO^2 filter for the pneumoperitoneum and connection to the trocar.

Figure 5 shows the device for filtering CO_2 coupled to a portable vacuum and a wall vacuum.

The device was presented to the surgical medical and nursing teams, including the elements that compose it, in order to provide information to implement and disseminate the concept.

DISCUSSION

The methodology applied through the processes of immersion, ideation and design thinking prototyping, associated with the elaboration of a mental map, allowed us to achieve the objective of this study.

Creativity was used as a resolving measure, considering the negative impacts on the physical and emotional health of patients resulting from the increased wait to perform a surgical procedure, the need to protect professionals and the work environment, minimizing the risk of contamination and the difficulty in acquiring supplies/equipment in the public health service.

The prototype was incorporated into the sector's routine of videolaparoscopic surgeries using CO_2. The use of filters in laparoscopic surgeries is ratified, emphasizing that adaptations and associations are necessary for the prevention and protection of the risk of infection of health professionals in the context of SARS-CoV-2[16].

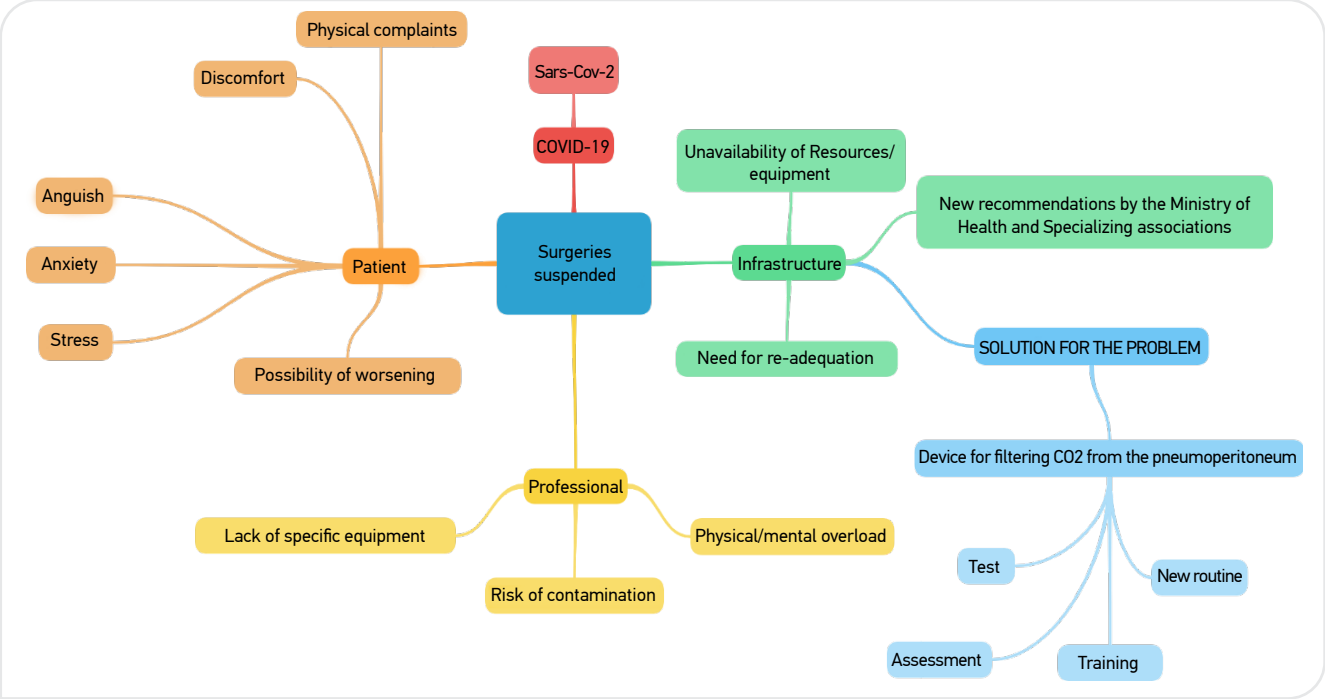

Figure 1. Mental map of aspects related to the suspension of surgeries.

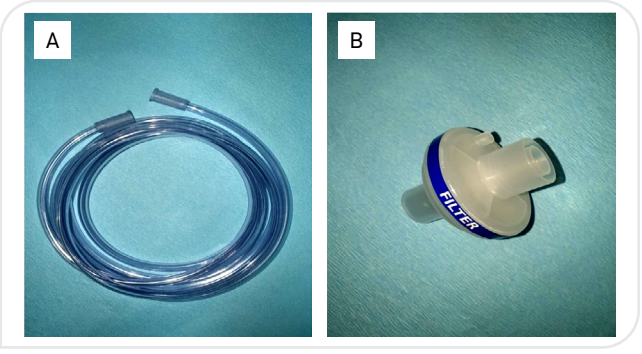

Figure 2. (A) Suction extensor and (B) bacteriological and viral filter.

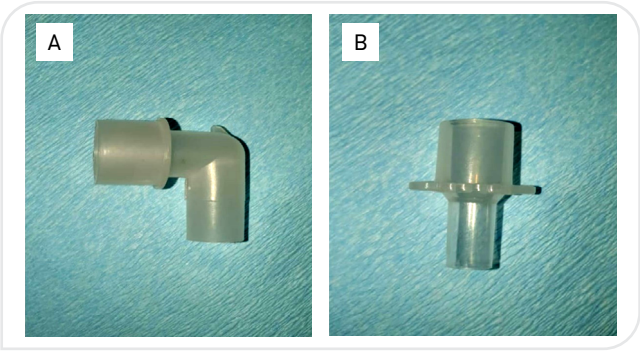

Figure 3. Connector and tip.

Caution is recommended in the management of pneumoperitoneum during laparoscopic procedures, for both insufflation and deflation, due to dispersing aerosols in the room. Given the potential risk of contamination, the association of PPE with a pneumoperitoneum filtering barrier is cited as prevention against SARS-CoV-2. The use of filtering devices coupled to an extender is suggested, so the surgical team can keep a distance of at least two meters from the patient as a safety measure[11,17].

Another study reported a device prototyping with materials that are easy to purchase in the hospital environment, due to the unavailability of filtering devices in the market either due to high demand or to lower financial potential from health institutions or government agencies[18].

The initial surgical procedures using the CO_2 filtering prototype were monitored by one of the authors, who was responsible for setting up with the nursing team assigned to the OR and for providing guidance to surgical instrumentators and surgeons in the preoperative phase. Later on, after training nurses, circulators and surgical instrumentators in the study setting, the prototype was incorporated into the sector's routine for laparoscopic surgeries. It is noteworthy that no leaks, handling difficulties and disconnections during surgical procedures were identified.

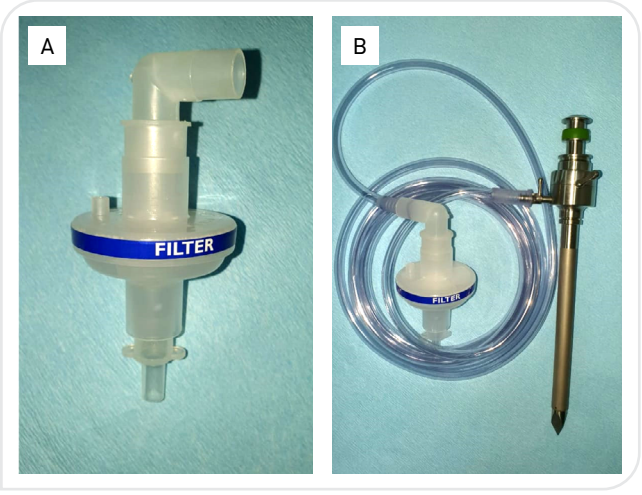

Figure 4. Prototype for filtering CO_2 from the pneumoperitoneum and connecting to the trocar.

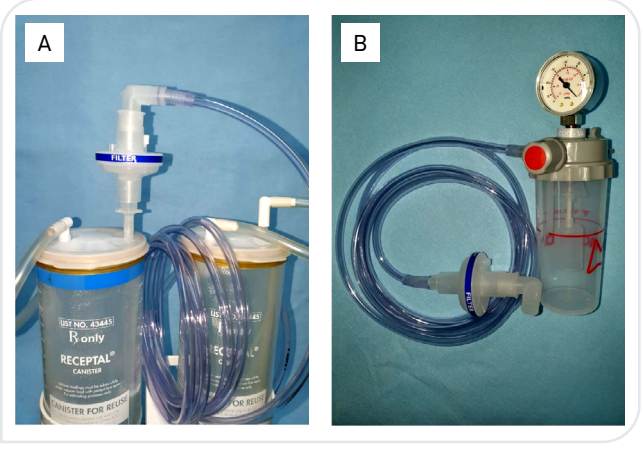

Figure 5. Device for filtering CO_2 coupled to a portable vacuum and a wall vacuum.

The health team involved in the surgical process had good acceptance. This is believed to be related to the ease of its composition with materials already known by professionals. As this was the prototype of an unfunded and emergency device for the maintenance of the surgical service, patient care and worker safety, inputs available in the hospital material grid were used and added with creative reasoning[13] and the authors' expertise.

In the case of surgical procedures, it is advisable to carefully evaluate the possibility of conservative treatment[16] and/or postponement of surgeries.[17] However, in some cases, the surgical approach becomes essential, impacting the functioning routine of the surgical center, which has an exclusive area for patients with suspected or diagnosed SARS-CoV-2[17,18].

The SARS-CoV-2 pandemic made the implementation of new care protocols mandatory, based on scientific evidence and development of professional skills, which include remodeling and replacement of supplies for the maintenance of essential health care, such as laparoscopic surgical procedures. The implementation of institutional guidelines and the adequacy of surgical practices to care for patients with suspected or confirmed SARS-CoV-2 infection is emphasized, in order to minimize the exposure of health professionals and other patients to the virus[17,19].

A limitation of this study was the clinical validation, the last step for the expansion of knowledge and reliability of the pneumoperitoneum CO_2 filtering device as an effective resource to prevent the dispersion of aerosols into the environment.

CONCLUSION

We concluded that the design thinking processes and the integration of the knowledge of nurses from surgical centers allowed the development of a prototype to manage aerosols in videolaparoscopic procedures, taking into account the

technical recommendations on pneumoperitoneum filtering barriers as prevention of SARS-CoV-2.

It is an easy-to-assemble device, whose use has a short learning curve, and consisting of supplies available in the hospital grid, used to provide greater safety for health professionals and patients.

The prototype was included in the routine of the study setting, with good acceptance by the surgical team, being used during videolaparoscopic procedures in patients with suspected or confirmed SARS-CoV-2 infection during the first wave of the pandemic in Brazil.

It is reiterated that the prototyping was necessary because of the unavailability of resources to filtering CO_2 from the pneumoperitoneum and maintenance of surgical care in the institution. However, scientific deepening is needed with regard to clinical validation, to assess the reliability of the device and the continuity of the study.

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