RESEARCH WITH A QUANTITATIVE APPROACH

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As of 2016, I have completed 42 years as a nurse practitioner, 30 of which I spent doing research using a quantitative approach. The principal theme of the studies developed and in development is the safe processing of health products, a topic filled with uncertainties, dogmas, and myths. Undoubtedly, when clean and sterilized material is the subject of research, it is suggested to study it in quantitative terms. The microorganisms and residues of dirtiness act like villains to be eliminated: if all of them were extinguished, if they were only reduced, how much they reduced, or if nothing happened.

Investigations with quantitative approaches are understood by the academic community as hard science, with a defined, concise, limited, reductionist, objective focus that is based on logical and deductive reasoning, and which looks for a relation between cause and effect. They test hypotheses and theories that control the maximum amount of possible variables and use specific and validated instruments and methods, and have, as a basic element of analysis, numbers and statistical analyses.

Tacitly, the intention of quantitative studies is to tend toward a generalization of knowledge produced. It was through this methodological path that I entered into the world of research at the Nursing School of the University of São Paulo (NS-USP) and I contributed and still contribute to the advancement of materials processing science. The privilege of being born as a researcher in the crib of USP made all of the difference in my professional career! Grand masters and colleagues that were excellently trained in research always taught me, inspired me, and motivated me to value the rigor of the method and to give strength to scientific evidence, separate from conflicts of interest.

Everything began with the opportunity to investigate a safe way of sterilizing heat-sensitive materials using paraformaldehyde tablets in environmental conditions, which was my Masters dissertation. I entered into the world of microbiology, developing laboratory skills to produce bacterial spores and challenge them under the conditions of sterilization. In my doctorate, I continued with the subject, exploring the maintenance of the sterilizing action of the already used paraformaldehyde tablets, since reusing the same group of tablets, at that time, was common practice. It is worth noting that early on I incorporated the importance of analyzing the relevance of a produced knowledge: obligingly, it should positively impact day to day practice, benefiting patients, professionals, and the collective. As a researcher, you must always be very attentive to identifying tensions that are not the same in practice. Longingly, I remember the first doctoral thesis I advised. It responded to the question about the safety of the use of double-woven cotton as packaging for autoclaving and the number of possible reuses, during a turbulent time in which the makers of disposable packaging condemned that type of packaging.

Observing my trajectory as a researcher, I recognize that I always had the courage, energy, and perseverance to demystify various dogmas. This was the case with the unsustainable demonstration of the sterility expiration period, with the "right" contamination of wet and stored material, with the contamination of stored materials in environments that did not have controlled humidity and temperature, with the cytotoxicity of surgical instruments when prepared without the use of gloves, with the cytotoxicity of surgical instruments when not rinsed with purified water, with the condemnation of tweezers autoclaving from mounted laparoscopic video-surgery, with the controversy of the reuse of several materials marketed as single use, such as angiographic catheters, electric scalpel pens, laparoscopic video-surgery accessories, hemodialysis devices, vitrectomy probes, sternotomy saws, and also the development of a method to comparatively evaluate the costs of using new and reused material. Some important knowledge about the use of "good and old" alcohol for the decontamination of semicritical material, hand hygiene/ surgical management with respect to environmental surfaces, and with a focus on the impact of previous cleaning, was researched. Studies with an applied quantitative approach to the processing of flexible endoscopes and environmental hygiene are also in development in order to respond to questions like: is it possible to clean the canals of endoscopes without friction? Negative pressure in the cleaning area of the Center of Material and Sterilization (CMS) aggregates value? Are liposuction cannulas and flexible orthopedic cutters cleanable? All of this new

knowledge was and can be rigorously constructed by adopting a quantitative approach, which counts microorganisms and measures organic residues and endotoxins.

A prerequisite *sine qua non* for the production of all of these studies in the area of material processing is the "wild" team of the research group that I coordinated and continue to coordinate, composed of post-doctoral fellows, doctoral students, masters students, students completing a specialization, and undergraduate students. I learn with them all of the time!

The discussions of superiority of one approach over the other with respect to quantitative and qualitative approaches are fruitless. The research question is what defines the methodological strand that will be adopted. If the tension generated in my study is: "What is the significance of the CMS for the hospital administrator," the indicated approach is qualitative. Its characteristics are different from those attributed to quantitative approaches: soft science, having a complex, open, holistic, and subjective, focus that is grounded in dialectic and inductive reasoning and which has meaning and discovery as the basis for the search for knowledge. Such an approach proposes the development of theories and the sharing of interpretations. Communication and observation are key to data collection, and the basic element of analysis are words, which have individual interpretation. Studies with a qualitative approach tend to search for singularity and not for generalization.

The act of research, understood as the search for plausible and consistent responses to a problem for which a response hasn't been found, is a tool of power, emancipation, innovation, and evolution for all of the areas of human knowledge, including the area of CMS. It allows for the information base to be amplified in order to exercise a critical and transformative practice, and contributes to the attainment of professional identity and autonomy. It defines distinct and singular roles and documents social relevance and the efficacy of the professional exercise.

As a researching nurse in the area of materials processing, I am convinced that, if investigations had not given sustenance to the practices of CMSs nationally, we would not only have lost leadership space in the sector but today we would also be impoverished in evidence-based practice for lack of primary studies. We are at a time when the world requires efficiency in what we already do correctly: sustainable (less consumeristic), rational (not to err on the side of excess or lacking) and, above all, patient-accessable practices.

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EVALUATION OF PATIENT SAFETY DURING CARDIAC SURGERY AT A PUBLIC HOSPITAL

Avaliação da segurança do paciente em cirurgia cardíaca de um hospital público

Evaluación de la seguridad del paciente en cirugía cardíaca de un hospital público

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ABSTRACT: Objective: Evaluation of security items in cardiac surgery at a public hospital. **Methods:** Cross-sectional descriptive study. Data collection was performed in 2012 at a public state-owned hospital, where 30 cardiac surgeries were observed and evaluated through a script based on the 3 steps of the World Health Organization (WHO) surgical safety checklist. Procedures were categorized as "in conformance" or "in non-conformance." **Results:** Non-conformance results made up 56% of cases before anesthetic induction, 57% prior to the procedure, and 75% of cases before leaving the operating room. **Conclusions:** Though the WHO checklist is indispensable, professional training and continuing education remain crucial for training a critical health care team that is aware of its role in securing patient safety.

Keywords: Perioperative nursing. Checklist. Quality Management.

RESUMO: Objetivo: Avaliar itens de segurança na cirurgia cardíaca em pacientes de um hospital público. **Método:** Estudo descritivo e transversal. A coleta de dados, desenvolvida em 2012, foi realizada em uma instituição hospitalar pública estadual, onde foram observadas 30 cirurgias cardíacas por meio de um roteiro embasado nas 3 fases do *checklist* de cirurgia segura da Organização Mundial da Saúde (OMS), com alternativas descritas como "em conformidade" e "em não conformidade". **Resultados:** Os resultados de não conformidade corresponderam a 56% dos casos antes da indução anestésica, 57% antes do procedimento e 75% na saída da sala de cirurgia. **Conclusão:** O *checklist* da OMS se faz necessário, porém, o treinamento profissional e a educação permanente constituem a linha mestra para a formação de uma equipe de saúde crítica e consciente do seu papel na segurança dos pacientes.

Palavras-chave: Enfermagem perioperatória. Lista de checagem. Gestão de qualidade.

RESUMEN: Objetivo: Evaluar ítems de seguridad en la cirugía cardíaca en pacientes de un hospital público. **Método:** Estudio descriptivo y transversal. La colecta de datos, desarrollada en 2012, fue realizada en una institución hospitalaria pública estadual, donde fueron observadas 30 cirugías cardíacas por medio de un itinerario basado en las 3 fases del *checklist* de cirugía segura de la Organización Mundial de la Salud (OMS), con alternativas descritas como "en conformidad" y "en no conformidad". **Resultados:** Los resultados de no conformidad correspondieron al 56% de los casos antes de la inducción anestésica, un 57% antes del procedimiento y un 75% en la salida del quirófano. **Conclusión:** El *checklist* de la OMS se hace necesario, sin embargo, la capacitación profesional y la educación permanente constituyen la línea maestra para la formación de un equipo de salud crítico y consciente de su papel en la seguridad de los pacientes.

Palavras clave: Enfermería perioperatoria. Lista de verificación. Gestión de la calidad.

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INSTRODUCTION

To err is human, published in the United States in 1999, describes how mistakes can happen frequently during medical care, leading to thousands of deaths and irreparable damage. Medical errors are the eighth leading cause of death in this country, despite huge investments in this sector. Though not scientific, *To err is human* sparked changes and promoted huge developments in research and practical measures for promoting patient safety not only in the United States, but throughout the world[1].

According to the World Health Organization (WHO), tens of millions of patients worldwide are victims of incapacitating injuries or deaths due to unsafe practices in health every year.[2] These mistakes affect 1 in 10 patients, on average, an estimate that is even more serious in developing countries, in which 1 patient dies for each 300 that were admitted to hospitals[2].

Faced with this scenario, WHO launched the World Alliance for Patient Safety in October 2004, an initiative aimed at describing challenges for patient safety.

One of the products of the Alliance was the Safe Surgeries Save Lives program, based on the use of a transoperative checklist which allows for a full evaluation of the patient. This checklist is divided into three steps: before induction of anesthesia; before the beginning of the surgery; and before the patient leaves the operating room, while also taking into account that different sets of practices may adapt the patient to their own circumstances[2].

A survey conducted in two Brazilian hospitals found that, out of the 1,103 patients studied, 56 suffered adverse events. Infections associated to health care and surgery or anesthesia-related complications made up 44.6% of the damage[3]. Another study, conducted in 2008, showed that 1 in every 150 hospitalized patients dies as a result of an incident, and that almost two thirds of adverse events were related to surgical assistance[4].

Several reasons are listed for the occurrence of adverse effects in surgery, such as communication problems and distraction within the multiprofessional surgical team; the lack of checking of patient identification and of materials during the procedure, among other relevant indicators to measure the susceptibility of errors[4].

It is noteworthy that surgical checklists have been effective in minimizing adverse events, increasing patient safety.

In this context, checklist usage in Brazilian hospitals has been increasing, alongside with investment in team work and the development of protocols and indicators relevant to the subject. Public agencies and professionals in Brazil develop strategies to aid institutions, the greatest achievement of which was the enactment of the Ministry of Health Decree n. 529/2013, focused on the National Program for Patient Safety, an instrument that provides multiple protocols, standards, and guidelines to be applied by hospitals for ensuring patient safety[5].

It is our belief that, although institutions are concerned with patient safety, it is necessary to insist on the observance of good practices in surgical care. With that in mind, the following question sprung: can a surgical procedure be safe without the use of the checklist?

Considering that security must be taken into account in all surgical procedures, we specified a study on the anesthetic procedures in cardiac surgery, because of their high complexity and their high appreciation in Brazil. Published by the Brazilian Society of Cardiovascular Surgery ("Sociedade Brasileira de Cirurgias Cardiovasculares" - SBCCV), the research places Brazil as the world second in number of heart surgeries performed per year, with about 102 thousand surgeries/year, behind only the United States[6].

OBJECTIVE

To assess conformity to the WHO Surgical Safety Checklist in cardiac surgeries performed at a public hospital.

METHODS

Cross-sectional observational study: after approval by the Research Ethics Committee of the institution involved, this research was conducted in March 2012, at the surgical center of the Public servant state hospital of São Paulo ("Hospital do Servidor Público Estadual de São Paulo"), registered in the National Information System for Research Ethics ("Sistema Nacional de Informação sobre Ética em Pesquisa" - SISNEP) under protocol FR-441480.

We observed 30 different variables, which comprise our systematized observation form adapted to the WHO checklist. As inclusion criteria, we selected midsternal thoracotomy cardiac surgery elective procedures, with cardiopulmonary bypass (CPB) in patients over 21 years of both sexes. In full, 30 procedures were followed, a significant sample which represented 68.18% of the total of cardiac surgeries performed at the institution during the data collection period.

Variables were divided into steps: first, the observed was properly identified; second, 19 items were checked before induction of anesthesia; third, 7 items were evaluated before the start of the surgical procedure; in the fourth step, 4 items were analyzed before the patient left the operating room. These items were recorded through binary nominal categorization, thus each item had two possible answers: "yes" (in conformance) or "no" (in non-conformance).

Data are presented through absolute numbers and percentages, and underwent descriptive statistical analysis with the aid of *Microsoft Excel*®.

RESULTS

In step 1, of the 30 procedures observed, 70% (n=21) of the patients were male and 43% (n=13) aged between 61 and 70 years. As to the procedure performed, 90% (n=27) of patients underwent coronary artery bypass grafting.

Before the induction of anesthesia (second step), 8 (44%) out of 19 items observed were found to be "in conformance," while 11 (56%) did not conform. In the third step, 4 out of 7 (57%) items were "in conformance" and 3 (43%) "in non-conformance." In the fourth and last step, we found 1 (25%) item "in conformance" and 3 (75%) "in non-conformance" (Chart 1).

Out of the 30 items observed, 17 (57%) were considered as "in non-conformance".

DISCUSSION

First step: identification data

There were more males than females. In a study conducted in Southern Brazil, the epidemiological profile of patients undergoing cardiac surgery shows that the majority of procedures are made up of coronary artery bypass surgeries performed in patients over 70 years of age. Such findings are consistent with this study[7].

Second step: before induction of anesthesia

Data show that patient identification is not performed, despite being required by Law 10,241 of March 17, 1999, which deals with the rights of patients and users of public health services in the State of São Paulo and which dictates that patients have a right to be identified[8].

American healthcare accreditation organization Joint Commission International started a national challenge for patient safety, alerting about the importance and necessity of inclusion of identification bracelets. In light of the occurrence of mistakes related to inadequate patient identification, the challenge remains an important goal for healthcare institutions seeking quality certification[9].

In our analysis, we observed that the surgical staff knows the patient, but at any time there is a check of the patient with the whole team in the operating room.

Studies that aim to qualify the communication among units and rigorous checking of patient identification data are quite frequent[3,4]. We questioned the lack of informed consent for surgery and anesthesia of the patient, given this is performed in other sectors of the institution. It is clear that surgical treatment should be done with a focus on the patient as an individual, with clear information, and analysis of risks and benefits focused on that particular patient, as well as information about citizen's rights and medical professionals' responsibilities[8]. We found that though this practice exists on the part of the surgeons and anesthesiologists, it is often the case that informed and signed consent by the patient is lacking.

The lack of conformance in relation to knowledge about patient allergies raises questions about the increased possibility of adverse events.

In the United States, at least 1.5 million people are affected each year as a result of incorrect administration of drugs. A study found that perioperative errors contribute significantly to this statistic, and suggested a number of reasons for this, among which is the lack of knowledge about the patient allergies[2].

The American Society of Anesthesiologists' project *Closed Claims* pointed out that mistakes in drug administration of have resulted in serious problems, including death in 24% of cases reviewed and morbidity in 34% of them[10].

Although it is difficult to provide a precise estimate for the extent of damage that can be attributed to perioperative medication errors, it is almost certain that harmful errors are underreported. Reflecting on this problem and considering that it is appropriate to check for possible patient allergies, we believe that undesirable allergy-related complications can be prevented if there is a systematic and effective communication among members of the care team.

We also observed communication problems due to absence of a complete surgical team in the operating room, a situation that suggests poor communication among professionals. Although the nursing team was present, its members often had to leave the room to fetch surgical material, indicating an inadequate preparation the operating room. Everyone involved in the anesthetic-surgical procedure must stay in room constantly, thus avoiding

Chart 1. Results of the systematized observation form adapted to the World Health Organization checklist. São Paulo (SP), 2012.

Items observed		Yes	%	No	%
		In conformance		In non-conformance	
Before induction of anesthesia					
1	Patient identification - Wristband	3	10	27	90
2	Medical records checked	–	0	30	100
3	Informed consent	–	0	30	100
4	Patient has known allergies	–	0	30	100
5	Presence of surgical team in the operating room during anesthesia	–	0	30	100
6	Presence of nursing team in the operating room during anesthesia	30	100	–	0
7	Monitoring	30	100	–	0
8	Checking of anesthetic equipment	30	100	–	0
9	Difficult airway detected	–	0	30	100
10	Presence of specific equipment for difficult airways	–	0	30	100
11	Antimicrobial prophylaxis performed 30 to 60 minutes before incision	–	0	30	100
12	Equipment with chemical indicators	–	0	30	100
13	Presence of equipment and accessories in the room	30	100	–	0
14	Checking of consigned products in the room	30	100	–	0
15	Presence of CPB and accessories in the room	30	100	–	0
16	Blood refitting in the room	–	0	30	100
17	Preparation of materials for venous and arterial access	30	100	–	0
18	Preparation of materials for urinary catheterization	30	100	–	0
19	Imaging exams present	–	0	30	100
Before surgical incision					
20	ID wristband kept on	–	0	30	100
21	Complete surgical team present	–	0	30	100
22	Nursing team present	30	100	–	0
23	Patient observed	30	100	–	0
24	Defibrillator turned on with internal paddles	30	100	–	0
25	CPB set up	30	100	–	0
26	Occurrence of critical anticipated events	–	0	30	100
Before patient left the room					
27	Recordings performed	30	100	–	0
28	Equipment and gauze count	–	0	30	100
29	Wristband ID check	–	0	30	100
30	Safe transfer	–	0	30	100

CPB: cardiopulmonary bypass.

communication failures, which are considered a factor of uncertainty[2].

Another concern of the authors is related to anesthetic procedures, given there is no systematic equipment checking. Checking is often made individually and discretionarily by the anesthetist, which may cause unexpected but avoidable complications.

Reliable anesthesiology depends on careful preparation, which involves not only systematic checking by the anesthetist moments before the procedure, but also preventive, daily and permanent maintenance of all anesthetic equipment by other professionals familiar with the equipment[11].

We consider the risks inherent to surgical infection to be quite expressive, given that observed data have demonstrated inappropriate antimicrobial prophylaxis, unsafe aseptic techniques during the preparation of venous accesses, and urinary catheterization as well as a lack of chemical indicators in the equipment used. Cardiac surgery is, due to its high complexity, inherently more vulnerable to infections, and the observed practices contribute to increase this risk.

A study suggests antimicrobial prophylaxis is recommended whenever there is a high risk of infection, as is the case of elderly patients, diabetics and immunocompromised patients, as well as in high complexity surgeries which include the use of prosthetics. Improper use of this technique may favor natural selection of resistant bacterial strains. American researchers agree that, in general, the drug should be administered between 30 and 60 minutes before incision[12].

However, the use of antibiotics during prophylaxis is not the most important measure for preventing surgical infections; risk identification, adequate pre-operative preparation, and the use of aseptic surgical techniques are essential practices for a good result. Furthermore, the surgical environment must be kept clean, including surgical scrubs and instruments.[12,13].

A paper revealed that, in 83% of cases studied, patient safety was compromised due to exposure and transmission of micro-organisms during anesthetic surgery which occurred as consequence of negative behaviors by the operating team.[13]

Equipment and accessory checking was found to be "in conformance." This is also considered an important factor in avoiding stress during surgery; however, we did not observe systematic checking involving the whole team, as only the circulating nurse was responsible for it.

CPB and equipment checking and control were performed in conformance with the checklist, but were always performed individually by the perfusionist responsible.

In cardiac surgeries it is routine procedure to have blood replacement in the operating room, but no such practice was observed. In a specific study on the risks faced by high complexity surgery patients during the intraoperative period, the matter of imbalance in the volume of liquids is mentioned[13].

When analyzing this step, the most significant items we observed were ineffective communication among team members, lacking of patient identification, and risk of infections.

Third step: prior to surgical incision

In this step, we observed a constant lack of patient identification and an incomplete surgical team, factors that contribute to an unsafe surgery; however, surgical procedures were initiated with perfect patient monitoring through the use of equipment and accessories made specifically the procedure, which brought us some comfort.

The WHO suggests this step should include effective team communication about possible anticipated events, which was not observed[2].

Though surgical teams seem to recognize that communication failures can represent a great obstacle to safe and effective care, such failures were nonetheless observed.[4,13]

It is the authors' view that the most relevant issue in this step was the lack of effective team communication.

Fourth step: before the patient leaves the operating room

In this step, we observed there was no routine for checking and counting surgical equipment after the procedure. The WHO manual describes the importance keeping track of equipment in the operating room, including the creation of specific rules regarding when and by whom surgical counts should be performed, which items should be counted and how counting should be documented.[2]

The Regional Board of Medicine of the State of São Paulo states that, after surgery, it is mandatory to count compresses, which should be verified and confirmed by the surgeon. In case of any doubt over the number of compresses, a radiography of the surgical site should be requested.

A Brazilian study states that any surgery represents a professional act performed by several professionals (members of the surgery team, an anesthesiologist, and room nurses), raising questions on the limits of surgeons' responsibility over other team members' mistakes, given the clear division of tasks in any surgery.[15] In this context, we emphasize the importance of using the WHO checklist, an activity that must be performed by the entire team, thus making all members responsible for a safe surgery.

In this step, we observed a continued lack of patient identification, something that could prove even more dangerous and unsafe in the case of a hospital transfer, which increases patient vulnerability and may lead them to undergo incorrect procedures.

Patient transportation was performed by the surgical team followed by circulating personnel, but no nurse was seen in any case observed.

A study describes that during patient transportation from the operating room to intensive or semi-intensive care units, it is ideal that the nurse should follow the transportation along with the anesthetic surgical team, passing the call to nurses of that unit[16], events not observed in our research. We observed that though the team was concerned with securing patient transportation, the lack of adequate equipment slowed down the transfer, causing delays and increasing risks for the patient.

In this last step, patient identification was the major cause of concern.

CONCLUSION

Health institutions wish to improve their patients' safety; therefore, we suggest that, before any action, it is necessary to invest in an internal patient safety policy as the first and most important guideline of institutional planning. It is important to promote the goals of the Safe Surgeries Save Lives program and its importance for all health professionals, making it a collective commitment.

For us, observing surgical security flaws in a given surgical center demonstrates a clear need to make use of surgical checklists in such institution. However, the greater challenge is not simply printing sheets of paper, but focusing on patient safety throughout the institution, so that the checklist is not another form to be filled, but an effective safety instrument.

With this study, we support the need for immediate action toward investment in continuous patient identification and increasing effectiveness of communication among team members, given that our findings in this area were unfavorable and relevant. It is also necessary to understand that the prevalence of unsafe practices related to the surgical infection increases surgical risks. Therefore, we suggest the immediate correction of such practices with the help of continuous training of all professionals involved in surgical procedures.

We conclude that the checklist is necessary to increase safety during cardiac surgeries in this institution. Though operating teams presented a positive work flow, procedures presented problems that could be avoided through conscientious usage of the checklist.

REFERENCES

1. Kohn LT, Corrigan JM, Donaldson MS, McKay T, Pike KC. To err is human. Washington: National Academy Press, 2000.
2. World Health Organization. Safe surgery saves lives. The second global patient safety challenge. Geneva: World Health Organization, 2009.
3. Boeckmann LMM, Rodrigues MCS. Segurança cirúrgica na cesárea: revisão integrativa. Cogitare Enferm. 2015;20(4):758-76.
4. Bohomol E, Tartali JAA. Adverse effects in surgical patients: knowledge of the nursing professional. Acta Paul Enferm. 2013;26(4):376-81 [acesso em 2016 jul. 21]. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-21002013000400012&lng=en
5. Brasil. Ministério da Saúde. Portaria nº 529, de 1º de abril de 2013. Institui o Programa Nacional de Segurança do Paciente (PNSP). Brasília: Ministério da Saúde, 2013 [acesso em 2015 mar. 04]. Disponível em: http://bvsms.saude.gov.br/bvs/saudelegis/gm/2013/prt0529_01_04_2013.html
6. Gomes W. Brasil é o segundo país do mundo em cirurgias cardíacas, 2013 [acesso em 2015 jul. 25]. Disponível em: http://saudeweb.com.br/30501/brasil-e-o-segundo-pais-do-mundo-em-cirurgias-cardiacas/
7. Bonotto JM, Boer LA. Estudo sobre o perfil do paciente submetido à cirurgia de revascularização do miocárdio, em um hospital da região sul catarinense, 2013 [acesso em 2015 jan. 27]. Disponível em: http://www.uniedu.sed.sc.gov.br/wp-content/uploads/2013/10/Janete-Morangoni-Bonotto.pdf

8. Brasil. Ministério da Saúde. LEGIS - Sistema de Legislação da saúde. Dispõe sobre os direitos dos usuários dos serviços e das ações de saúde no Estado e dá outras providências. Brasília: Ministério da Saúde, 2009 [acesso em 2014 ago. 15]. Disponível em: http://governo-sp.jusbrasil.com.br/legislacao/168477/lei-10241-99

9. The Joint Commission. Universal protocol, 2013 [acesso em 2016 jul. 16]. Disponível em: http://www.jointcommission.org/PatientSafety/UniversalProtocol/

10. Bowdle TA. Drug administration errors from the ASA closed claims project. ASA Newsletter. 2003;67(6):11-3.

11. Paranaguá TTB, Bezerra ALQ, Silva AEBC, Azevedo Filho FM. Prevalence of no harm incidents and adverse events in a surgical clinic. Acta Paul Enferm. 2013;26(3):256-62. [acesso em 2016 jul. 27]. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-21002013000300009&lng=pt

12. Barreto RASS, Barbosa MA, Souza ACS. A segurança do paciente na sala operatória: incidentes críticos relacionados à prevenção de infecção de sítio cirúrgico, 2010 [acesso em 2015 fev. 02]. Disponível em: http://www.sbpcnet.org.br/livro/63ra/conpeex/doutorado/trabalhos-doutorado/doutorado-regiane-aparecida.pdf

13. Pancieri AP, Santos BP, Avila MAG, Braga EM. Checklist de cirurgia segura: análise da segurança e comunicação das equipes de um hospital escola. Rev Gaúcha Enferm. 2013;34(1):71-8.

14. Conselho Regional de Medicina de São Paulo. Corpos estranhos intra-abdominais. Jornal do Cremesp, 2005 [acesso em 2016 jul. 20]. Disponível em: http://www.cremesp.org.br/?siteAcao=Jornal&id=590

15. Filho GR, Silva LFN, Ferracini AM, Bahr GL. Protocolo de Cirurgia Segura da OMS: o grau de conhecimento dos ortopedistas brasileiros. Rev Bras Ortop. 2013;48(6):554-62.

16. Meeker MH, Rothrock JC. Alexander Cuidados de enfermagem ao paciente cirúrgico. 10ª ed. Rio de Janeiro: Guanabara Koogan; 1997.

TRANSFUSION PROFILE OF THE FIRST ONE HUNDRED PATIENTS UNDERGOING LIVER TRANSPLANT IN FORTALEZA

Perfil transfusional dos cem primeiros pacientes submetidos a transplante hepático em Fortaleza

Perfil de transfusión de los primeros cien pacientes sometidos a trasplante de hígado en Fortaleza

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ABSTRACT: Objective: To identify the profile of the first hundred transfusion patients undergoing liver transplantation at a university hospital in Fortaleza, Ceará. **Method:** An observational, analytical, and retrospective study was performed. **Results:** There were 10 retransplantations among the 100 patients initially enrolled in the study. One patient was excluded from the study owing to the inability to access the medical records. For this reason, 89 medical records were analyzed. **Conclusion:** Most patients were male adults with an average age of 47 years, and a high prevalence of previous abdominal surgeries were observed among them. The most common blood group was group A, and the leading cause of transplantation was cirrhosis induced by alcohol. On average, patients received 6 units of blood components, and the most frequently transfused were packed red blood cells.

Keywords: Liver cirrhosis. Liver transplantation. Blood transfusion. Perioperative nursing.

RESUMO: Objetivo: Traçar o perfil transfusional da primeira centena de pacientes submetidos a transplante hepático em um hospital escola, em Fortaleza, Ceará. **Método:** Trata-se de um estudo observacional, analítico e retrospectivo. **Resultados:** Dentre os cem pacientes inicialmente incluídos no estudo, houve dez retransplantes. Um paciente foi excluído do estudo por impossibilidade de acesso ao prontuário. Por esses motivos, 89 prontuários foram analisados. **Conclusão:** Os pacientes, em sua maioria, eram adultos com idade média de 47 anos, do gênero masculino e com grande prevalência de cirurgias abdominais prévias. O grupo sanguíneo mais prevalente foi o grupo A, e a principal causa do transplante, a cirrose por álcool. Em média, os pacientes receberam seis unidades de hemocomponentes, sendo o concentrado de hemácias o mais frequentemente transfundido.

Palavras-chave: Cirrose hepática. Transplante de fígado. Transfusão de sangue. Enfermagem perioperatória.

RESUMEN: Objetivo: Trazar el perfil de transfusión de los cien primeros pacientes sometidos a trasplante de hígado en un hospital universitario en Fortaleza, Ceará, Brasil. **Método:** Se realizó un estudio de observación, analítico y retrospectivo. **Resultados:** Entre los 100 pacientes incluidos inicialmente en el estudio, hubo 10 re-trasplantes. Se excluyó un paciente del estudio porque no había acceso a sus registros médicos. Por estas razones, se analizaron 89 registros médicos. **Conclusión:** La mayoría de los pacientes eran adultos con una edad promedio de 47 años, sexo masculino y con un alto predominio de cirugías abdominales previas. El grupo sanguíneo más frecuente fue el grupo A y la principal causa del trasplante fue la cirrosis inducida por alcohol. En promedio, los pacientes recibieron seis unidades de componentes sanguíneos, siendo el concentrado de glóbulos rojos el más frecuentemente transfundido.

Palabras clave: Cirrosis hepática. Trasplante de hígado. Transfusión de sangre. Enfermería perioperatoria.

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INTRODUCTION

Liver transplantation has become an alternative in the treatment of patients with end-stage liver disease. However, owing to the systemic effects of end-stage liver disease, the patients with liver cirrhosis usually present with involvement of multiple organs and systems, which imposes several challenges to the transplantation services[1].

One of the main problems in these patients is their hematologic management, especially concerning the transfusion therapy. Patients with liver cirrhosis frequently present with anemia and have a complex hemostatic system. In addition, transplantation surgery often involves several factors that contribute to bleeding, such as extensive surgical dissection, presence of vast network of collateral blood vessels, tendency to develop hypothermia, hypocalcemia, hyperfibrinolysis, anemia, and production of heparinoids, in addition to the phase of the surgery in which the patient cannot rely on the role of the liver in coagulation (anhepatic phase)[2].

In the last two decades, we witnessed a reduction in demand for blood components during liver transplantation, probably owing to the development of surgical and anesthetic techniques, and the use of intraoperative blood savage (Cell Saver). However, the demand for transfusion in these patients is still high nowadays, and the occurrence of massive transfusion is not uncommon[3].

In addition, the potential deleterious effects that such transfusions may have on patient and transplantation outcomes, the high demand for blood components is a major challenge to the maintenance of adequate stocks of blood in the blood banks. Therefore, knowing the transfusion needs of these patients, their possible predictors and the impact of the use of the Cell Saver facilitate better maintenance of stocks of components and adequate blood bank logistics. Moreover, the assessment of the impact of transfusions on patient and transplantation outcomes raises the awareness of the professionals involved in the surgery and enables the consequent rational use of the transfusion therapy.

In addition to the recognized undesirable consequences of transfusions, more recently, various studies have also demonstrated the deleterious role of transfusions in morbidity and mortality of patients undergoing orthotopic liver transplantation (OLT) and in the graft survival[4].

Given the scarcity of national studies to clarify the aforementioned issues, this study intended to evaluate the transfusion demands of the first hundred patients undergoing liver transplantation in a university hospital, to identify possible predictors of transfusion requirements, and to assess the impact of the Cell Saver on the transfusion of allogeneic red blood cell concentrates.

METHODS

An observational, analytical, and retrospective study was carried out in a specialized and reference hospital for liver transplantation. This institution assists patients of the public Unified Health System (SUS). Data collection was conducted from November 2014 to January 2015. Data were collected from medical records and transferred to a data collection tool developed by the researcher, using all the records of the first one hundred patients undergoing liver transplantation at the *Hospital Geral de Fortaleza* as the object of study. Data collection was initiated after the approval of the Research Ethics Committee of the *Hospital Geral de Fortaleza* under the opinion (CAEE) 33999914.9.0000.5534, and the signing of the *bona fide* depositary term. The rules of the Resolution number 466/12 of the National Health Committee[5] were followed.

During the OLT, the piggyback technique was used. This technique comprises the anastomosis between the suprahepatic vena cava of the donor liver and the suprahepatic veins of the receiver, with subsequent connection of the lower stump of the vena cava of the graft, which can shorten anhepatic phase and consequently the bleeding[6].

The blood lost during the surgery is collected, immediately anticoagulated (continuously irrigated by a solution of 30,000 sodium heparin units in 1000 mL of saline solution), processed by the Cell Saver, and then immediately returned to the patient.

With regard to the use of blood components, the following protocol was used: packed red blood cells (PRBCs) when hemoglobin is <7 g/dL, fresh frozen plasma (FFP) when prothrombin time (PT) or activated partial thromboplastin time (aPTT) is >1.5 x control, platelet concentrate (PC) if platelets are <50,000 mm^3, and cryoprecipitate when bleeding and fibrinogen are <80 g/dL, and there is bleeding caused by von Willebrand disease unresponsive to Desmopressin (DDAVP)[7].

The absolute and relative frequencies were calculated for categorical variables, and means and standard deviations were calculated for the numeric variables. Comparisons between two numerical variables were carried out using both the

Pearson correlation coefficient and the test of significance of the variables. Comparisons involving a numeric and a categorical variable were performed by the nonparametric Mann–Whitney test (due to the nonnormality of the figures). Finally, the comparison of two categorical variables was performed using the χ^2 test and odds ratios. The tests were performed considering a 5% significance level.

RESULTS

Among the 100 patients initially included in the study, there were 10 retransplantations. In addition, one patient was excluded from the study for the inability to access the medical records. For these reasons, 89 records were analyzed.

Table 1 shows that the majority of the transplanted patients (71.9%) were male. Almost half of patients (46.1%) had undergone previous abdominal surgeries. The most prevalent blood groups were groups A (41.6%) and O (39.3%). With regard to the liver disease leading to the transplantation, alcoholic cirrhosis was the most prevalent cause (29.2%).

Table 2 shows an average age of 47 years, average weight of 76.1 kg, and an average model for end-stage liver disease (MELD) of 26±9. On average, conventional tests (PT, aPTT, and platelet count) presented alterations in relation to the reference values. An average cold ischemia

Table 1. Profile of the patients – Part 1, Fortaleza, Ceará, 2015.

Variable	n (%)
Gender	
Female	25 (28.1)
Male	64 (71.9)
Previous abdominal surgery	
Yes	41 (46.1)
No	39 (43.8)
Blood group	
A	37 (41.6)
O	35 (39.3)
B	13 (14.6)
AB	04 (4.5)
Cause of transplantation	
OH	26 (29.2)
CRYPTO	13 (14.6)
Other	12 (13.5)
HVC	10 (11.2)
Fulminant	09 (10.1)
AH	05 (5.6)
HC	04 (4.5)
HVC + OH	04 (4.5)
OH + HC	02 (2.2)
HVB	01 (1.1)
HVC + HC	01 (1.1)
HVB + HC	01 (1.1)
Not informed	01 (1.1)

HC: hepatocellular carcinoma; CRYPTO: cryptogenic cirrhosis; Fulminant: fulminant hepatitis; AH: autoimmune hepatitis; OH: cirrhosis by alcohol; HVB: hepatotropic virus B; HVC: hepatotropic virus C.

Table 2. Profile of the patients – Part 2, Fortaleza, Ceará, 2015.

Variable	n	Mean ± standard deviation
Age (years)	89	47±15
Weight (kg)	82	71.6±14.1
MELD score	81	26±9
Preoperative platelet count (/mm^3)	87	106.9±73.8
Preoperative PT (seconds)	84	29.5±19.7
Preoperative aPTT (seconds)	83	62.5±38.2
Cold ischemia time (hours)	78	5.5±1.5
Warm ischemia time (hours)	75	51±0.6
Duration of transplantation surgery (hours)	89	5.1±1.2
Red blood cell concentrate (units)	89	3±3
Fresh frozen plasma (units)	89	2±2
Cryoprecipitate (units)	89	1±3
Platelet concentrate (units)	89	0±1
Blood components transfused (units)	89	5.5±7.0
Colloids volume* (units of 550 mL)	89	7.2±4.5
Diuresis volume (mL)	88	358.9±343.8
Highest value of SGOT (U/L)	87	2,172±2,754
Highest value of SGPT (U/L)	87	1,444±1,596
Length of stay in ICU (days)	89	6±8
Time until hospital discharge or death (days)	87	19.9±20.8

MELD: model for end-stage liver disease; PT: prothrombin time; APTT: activated partial thromboplastin time; SGOT: glutamic oxaloacetic transaminase; SGPT: glutamic pyruvic transaminase, *Ringer's lactate solution (500 mL) combined with human albumin 20% solution (50 mL).

time of 5.5±1.5 hours and a mean warm ischemia time of 51 minutes were observed. The mean duration of surgery was five hours and six minutes. The use of colloids during the intraoperative period was equivalent to an average of 3,600 mL, which intended to prevent hypovolemic shock by increasing the intravascular oncotic pressure, with a smaller volume of liquid. The average volume of diuresis was 358.9 mL. The average values of serum glutamic oxaloacetic transaminase (SGOT) (2,172) and serum glutamic pyruvic transaminase (SGPT) (1,444) are sensitive indicators of liver damage. Considering that these values are from postoperative period, they do not indicate liver necrosis, but a delayed functioning. With regard to the care procedures, these patients had an average length of stay in the intensive care unit (ICU) of 5 days and length of stay in the hospital until the discharge of 20 days.

Table 3 shows a statistically significant difference between the averages of total blood components transfused and the occurrence, or not, of tracheal extubation within six hours after the surgery. A correlation between the means of all transfused blood components and the occurrence of in-hospital deaths was also found.

Table 4 shows that there was correlation between age and the number of cryoprecipitate units (p=0.027) and transfused platelets (p=0.032). However, the MELD score was correlated with the number of transfused units of red blood cells concentrates (p=0.021), FFP (p=0.017), and the total number of blood components transfused (p=0.009). Finally, the PT measured in the preoperative period correlated with the number of FFP units transfused (p=0.035).

Table 5 shows midsize surgeries, as most of the previous surgeries to the transplantation (29.2%). Consequently, there was no statistically significant association with the use of blood components (Table 6).

Table 7 shows from a statistical point of view that the use of the Cell Saver did not significantly influence the number of RBC concentrates transfused or the total number of blood components used, which can be explained by the protocol on the use of blood components followed

Table 3. Variables related to the use of blood components in the intraoperative period, Fortaleza, Ceará, 2015.

Variables	Blood components					p-value
	Total	0	1 a 3	4 a 9	>10	
	n (%)					
Tracheal extubation within 6 hours after the surgery						
Yes	36 (40.4)	16 (44.4)	06 (16.7)	10 (27.8)	04 (11.1)	0.015
No	53 (59.6)	08 (15.1)	17 (32.1)	14 (26.4)	14 (26.4)	
Need of hemodialysis in the ICU						
Yes	36 (40.4)	06 (16.7)	09 (25.0)	14 (38.9)	07 (19.4)	0.111
No	56 (59.6)	18 (34.0)	14 (26.4)	10 (18.9)	11 (20.8)	
Required reoperation because of bleeding in less than 12 hours after tp						
Yes	08 (09.0)	–	04 (50.0)	–	04 (50.0)	0.128
No	81 (91.0)	24 (29.6)	19 (23.5)	24 (29.6)	14 (17.3)	
Fail in the functioning of the graft						
Yes	15 (16.9)	02 (13.3)	05 (33.3)	02 (13.3)	06 (40.0)	0.162
No	74 (83.1)	22 (29.7)	18 (24.3)	22 (29.7)	12 (16.2)	
Retransplantation						
Yes	10 (11.2)	01 (10.0)	06 (60.0)	01 (10.0)	02 (20.0)	0.995
No	79 (88.8)	23 (29.1)	17 (21.5)	23 (29.1)	16 (20.3)	
Death before discharge						
Yes	33 (37.1)	04 (12.1)	09 (27.3)	10 (30.3)	10 (30.3)	0.026
No	55 (61.8)	19 (34.5)	14 (25.5)	14 (25.5)	08 (14.5)	

Mann–Whitney test.
ICU: intensive care unit; tp: transplantation.

Table 4. Correlation between different variables and the use of blood transfusions during surgery, Fortaleza, Ceará, 2015.

	Pearson correlation	p-value
Comparison with age (units)		
Red blood cells concentrate	-0.03	0.798
Fresh frozen plasma	-0.15	0.174
Cryoprecipitate	-0.23	0.027
Platelet concentrate	-0.23	0.032
Blood components transfused	-0.21	0.052
Comparison with MELD score (units)		
Red blood cells concentrate	0.26	0.021
Fresh frozen plasma	0.27	0.017
Cryoprecipitate	0.15	0.168
Platelet concentrate	0.19	0.083
Blood components transfused	0.29	0.009
Comparison with platelet count (units)		
Red blood cells concentrate	0.08	0.484
Fresh frozen plasma	0.06	0.552
Cryoprecipitate	-0.10	0.364
Platelet concentrate	-0.15	0.161
Blood components transfused	-0.02	0.832
Comparison with the preoperative PT (units)		
Red blood cells concentrate	0.17	0.118
Fresh frozen plasma	0.23	0.035
Cryoprecipitate	0.08	0.448
Platelet concentrate	-0.06	0.559
Blood components transfused	0.17	0.124
Comparison with preoperative aPTT (units)		
Red blood cells concentrate	0.148	0.181
Fresh frozen plasma	0,055	0,619
Cryoprecipitate	-0.036	0.745
Platelet concentrate	-0.074	0.504
Blood components transfused	0,045	0,685

Pearson's correlation test.
PT: prothrombin time; aPTT: activated partial thromboplastin time; MELD: model for end-stage liver disease.

by the team. It is also worth noting that the patient who underwent intraoperative cell savage (Cell Saver) had a major bleeding, which can recover up to 60% of the lost red blood cells.

With respect to Table 8, the in-hospital mortality and discharge time were not associated with the use of Cell Saver.

DISCUSSION

In the present study, several variables to characterize the most common profile of the first one hundred patients undergoing liver transplantation at the *Hospital Geral de Fortaleza*, Ceará, were outlined.

Generally, the various parameters of time evaluated (warm ischemia, cold ischemia, total duration of the transplantation surgery, length of stay in ICU, and time to hospital discharge) were within values usually described[8].

The reduced cold ischemia time obtained is important to highlight. This parameter is fundamentally determined by optimizing the logistics involved the harvesting process of organs, back-table surgery, anesthetic induction, and hepatectomy.

The average duration of the transplantation surgery can also be considered low, especially when considering that the first hundred surgeries for liver transplantation performed by the team of this hospital were assessed. This probably reflects the extensive planning and preparation for the service implementation. Other determining factors were probably the shared experiences and the previous training of various team members in other liver transplantation services and related surgeries. Finally, after the effective

Table 5. Distribution of the number of previous abdominal surgery to the liver transplantation, Fortaleza, Ceará, 2015.

Variable	n (%)
Umbilical hernia repair	12 (29.2)
Appendicitis	03 (7.3)
Cesarean section	03 (7.3)
Exploratory laparotomy	02 (4.8)
Splenectomy	02 (4.8)
Renal transplantation	01 (2.4)
Not informed	13 (56)

implementation of the service, it is necessary to maintain an alert, motivated, and committed team to achieve the best possible outcomes.

However, despite such remarkably positive results obtained, transfusion rates can be considered high. In addition to the high frequency, the number of transfused blood components was also considerable. In liver transplantation, blood loss is determined both by the extent of the surgical damage and by the degree of hemostasis impairment.

With regard to the extent of surgical damage, one of the main determinants is the adhesion resulting from previous surgeries. In this study, the prevalence of previous surgeries was 46.1%, which possibly hinders hepatectomy and increases the bleeding surface. The alcoholic etiology is another possible determinant. It was the most prevalent among the causes that led to transplantation and is commonly associated with adhesions and hypertrophy of the caudate lobe, which complicate the surgery.

Regarding the degree of hemostasis impairment, the main determinants were preoperative hemostatic reserve levels, the intensity of the damage to the hemostasis during surgery and the quality of the implanted graft. In this study, the variables age, MELD score, and preoperative PT were mapped as independent predictors of the use of blood components.

With regard to the variable age, it was observed that the older the patient was, the lower the number of concentrates was infused. The authors consider this finding counterintuitive and found no reasonable and feasible explanations for this result.

Table 6. Association of previous abdominal surgery with the use of blood components in the intraoperative period, Fortaleza, Ceará, 2015.

Variable (units)	Previous abdominal surgery			p-value
	n	Yes	No	
		Mean±standard deviation		
Red blood cell concentrate	80	2.2±2.4	2.9±3.1	0.475
Fresh frozen plasma	80	1.3±1.9	1.7±2.2	0.523
Cryoprecipitate	80	0.6±3.1	1.5±3.5	0.253
Platelet concentrates	80	0.1±0.3	0.5±1.7	0.216
Transfused blood components	80	4.2±4.5	6.5±8.4	0.442

Mann–Whitney test

Table 7. Analysis of the use of Cell Saver and the demand for red blood cells concentrates and the other blood components, Fortaleza, Ceará, 2015.

Variable	Used Cell Saver	Did not use Cell Saver	p-value
	Mean±standard deviation		
RBC concentrate	2.4±2.8	2.6±2.8	0.768
Total blood components	6.0±7.8	5.0±6.1	0.669

Mann–Whitney test.

Table 8. Analysis of the use of the Cell Saver and death before discharge and discharge time, Fortaleza, Ceará, 2015.

Used Cell Saver	In-hospital mortality	Discharge time	OR (95%CI)	p-value
	n (%)			
Yes	14 (42.4)	30 (54.5)	1.00	0.271
No	19 (57.6)	25 (45.5)	1.63 (0.68–3.89)	

χ^2 test; OR: odds ratio; 95%CI: 95% confidence interval.

The MELD score is calculated using three variables (serum bilirubin, serum creatinine, and international normalized ratio – INR) and thus reflects the degree of impairment of the hepatocellular function of the cirrhotic individual. Consequently, this score indirectly correlates with the hemostatic ability of the patient to control a vascular damage. In addition to this study, the correlation between MELD score and transfusion of blood components had already been demonstrated in other studies[9,10].

The PT is calculated using the plasma of the patient and adding to it calcium and a thromboplastin rich in tissue factor. Therefore, this test evaluates the coagulation factors involved in the extrinsic pathway (VII, V, X, II, and fibrinogen). As the liver is the main (or unique) site of synthesis of these factors, the PT is the examination which most commonly presents alterations in the liver diseases, although it assesses just some of the factors involved in coagulation. As a general impairment of hepatocellular function occurs in cirrhosis (that is, all the factors have a reduced synthesis), it is possible to infer that the PT is also correlated with the degree of impairment of hemostasis. Although in this study the PT has been shown as an independent risk factor for the use of blood components during the intraoperative period, its predictive capacity for bleeding during liver transplantation is usually poor. This apparent paradox can be explained by the fact that this test evaluates only few plasma coagulation components, whereas it is currently recognized that hemostasis must be widely assessed, as by means of the thromboelastography.

The great effort directed to the reduction of blood transfusion rates is explained by the recognized adverse effects related to the use of blood components[11]. This study showed that, among the evaluated postoperative variables, time to tracheal extubation and mortality were significantly affected by the use of blood components.

The exposure of the patient to the transfusion is associated with an inflammatory effect in different territories, especially in the lungs, resulting in increased pulmonary capillary permeability. Moreover, depending on the volume of administered blood components, a circulatory overload may occur. If these two factors (increased pulmonary capillary permeability and circulatory overload) are combined, a pulmonary edema occurs, which delay the tracheal extubation. Mortality associated with transfusions is due to multiple and intricate pathophysiological mechanisms; among them, immunosuppression and predisposition to infections may play an important role.

Surprisingly, the use of Cell Saver did not significantly influence the demand for red blood cell concentrates ($p=0.768$) or the overall demand for blood components ($p=0.669$). This can be attributed to other factors that determine the transfusion demands, such as preoperative hemoglobin level and the level of hemostasis. Since these factors were not compared between the two groups, it is not possible to further analyze them. Moreover, a formal sample size calculation to measure this effect was not carried out.

The use of Cell Saver also caused no significant impact on in-hospital mortality and on the discharge time ($p=0.271$). By reducing the demand for allogeneic red blood cell concentrates, it is intuitive to assume that the Cell Saver should result in improvements in postoperative outcomes. Owing to the same limitations described in the previous paragraph, to deeply explore this finding is not feasible.

CONCLUSIONS

The patients were mostly male adults, with an average age of 47 years, and a high prevalence of previous abdominal surgeries were observed among them. The most prevalent blood group was group A, and the main cause of transplantation was cirrhosis caused by alcohol consumption. On average, patients received six blood component units, and the concentrate transfused most often was RBCs. With regard to the hemostatic blood components, the FFP had the highest average number of transfused units.

The variables age, MELD score, and preoperative PT proved to be independent predictors of major transfusion demands. There was no significant impact of the use of the Cell Saver on the transfusion demands, and their use did not significantly alter in-hospital mortality.

Patients with higher average of transfused blood components had delayed extubation, increased demand for hemodialysis in the ICU, and higher in-hospital mortality.

It is worth noting that this study had some limitations such as the retrospective nature, which imposes all the difficulties inherent to the availability and quality of the evaluated records. Although this study is descriptive-analytic, it is valuable because it indicates the strengths and the aspects of improvement and optimization, which leads to a reflection on security, better quality of service, and the rational use of blood components.

REFERENCES

1. Ginès P, Fernández J, Durand F, Saliba F. Management of critically-ill cirrhotic patients. J Hepatol. 2012;56 Suppl 1:S13-24.

2. Triulzi DJ. Specialized transfusion support for solid organ transplantation. Curr Opin Hematol. 2002;9(6):527-32.

3. Ozier Y, Tsou MY. Changing trends in transfusion practice in liver transplantation. Curr Opin Organ Transplant. 2008;13(3):304-09.

4. Clevenger B, Mallet SV. Transfusão e gestão de coagulação em transplante de fígado. Mundo J Gastroenterol. 2014;20(20):6146-58.

5. Brasil. Conselho Nacional de Saúde. Resolução nº 466, de 12 de dezembro de 2012. Trata-se de pesquisas e testes em seres humanos. Brasília: Diário Oficial da União, 13 jun. 2012. Seção 1.

6. Pereira WA. Manual de transplante de órgãos e tecidos. 4ª ed. Belo Horizonte: Coopemed; 2012.

7. Pratice Guidelines for perioperative blood transfusion and adjuvant therapies: an updated report by the American Society of Anesthesiologists Task Force on blood transfusion and adjuvant therapies. Anesthesiology. 2006;105(1):198-08.

8. Boin IF, Leonardi MI, Luzo AC, Cardoso AR, Caruy CA, Leonardi LS. Intraoperative massive transfusion decreases survival after liver transplantation. Transplant Proc. 2008;40(3):789-91.

9. Ozier Y, Pessione F, Samain E, Courtois F. Variabilidade institucional na prática transfusional para transplante de fígado. Anesth Analg. 2003;97(3):671-79.

10. Mangus RS, Kinsella SB, Nobari MM, Fridell JA, Vianna RM, Ward ES, et al. Predictors of blood product use in orthotopic liver transplantation using the piggyback hepatectomy technique. Transplant Proc. 2007;39(10):3207-13.

11. Morais BS, Sanches MD, Lima AS, Ribeiro DD, Ferreira TCA, Duarte MMF, et al. Associação entre uso de hemocomponentes e mortalidade em cinco anos após transplante hepático. Rev Bras Anestesiol. 2011;61(3):286-92.

PERCEPTION OF A NURSING TEAM ABOUT THE USE OF SURGICAL CHECKLIST*

Percepção de uma equipe de enfermagem sobre a utilização do checklist cirúrgico

Percepción del equipo de enfermería sobre la utilización de lista de verificacion quirúrgica

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ABSTRACT: Objective: To understand how nursing professionals who work in a surgical center, perceive the use of a surgical checklist. **Method:** Exploratory, qualitative study. The data were collected from March to April 2015, through recorded interviews with a semi-structured script containing ten questions. The data were analyzed by using thematic analyses. **Results:** The study included 13 nursing professionals. The results were organized into three categories: risk management in a surgical center: difficulties in concept and in work practice; checklist for safe surgery and its contribution to the working practice; strengths and weaknesses on using the checklist for safe surgery. **Conclusion:** Nursing professionals realize the need to ensure patient safety and think that protocols contribute to the quality of care and services. The checklist is the main tool used by the health team in order to reduce adverse events and damage.

Keywords: Risk management. Safety. Checklist. Nursing. Patient safety.

RESUMO: Objetivo: Conhecer a percepção de profissionais de enfermagem que atuam em centro cirúrgico em relação à utilização do *checklist* cirúrgico. **Método:** Estudo exploratório, qualitativo. Os dados foram coletados de março a abril de 2015, por meio de entrevista gravada, com roteiro semiestruturado contendo dez perguntas, analisada sob a ótica da análise temática. **Resultados:** Participaram do estudo 13 profissionais de enfermagem. Os resultados foram organizados em três categorias: gerenciamento de risco em centro cirúrgico: dificuldades conceituais e na prática de trabalho; *checklist* de cirurgia segura e sua contribuição na prática de trabalho; e potencialidades e fragilidades na utilização do *checklist* de cirurgia segura. **Conclusão:** Profissionais de enfermagem percebem a necessidade de garantir a segurança do paciente, apontam que protocolos contribuem para a qualidade da assistência e dos serviços. O *checklist* é a principal ferramenta utilizada pela equipe visando à redução de danos e eventos adversos.

Palavras-chave: Gestão de riscos. Segurança. Lista de checagem. Enfermagem. Segurança do paciente.

RESUMEN: Objetivo: Conocer la percepción de los profesionales de enfermería que trabajan en la sala de operaciones para el uso de la lista de verificación quirúrgica. **Método:** Estudio exploratorio, cualitativo. Se recogieron datos de marzo a abril de 2015 a través de entrevista grabada, semiestructurada que contiene diez preguntas. Los datos fueron analizados según el análisis temático. **Resultados**: Participaron del estudio 13 profesionales de enfermería. Los resultados fueron organizados en tres categorías: gestión de riesgos en el centro quirúrgico: dificultades conceptuales y prácticas del trabajo; lista de verificación para una cirugía segura y su contribución a la práctica del trabajo; potencialidades y debilidades de la lista de verificación de cirugía segura. **Conclusión**: Profesionales de enfermería reconocen la necesidad de garantizar la seguridad del paciente y señalan que los protocolos contribuyen a la calidad de la atención. La lista de verificación es la principal herramienta utilizada con el fin de reducir los eventos adversos y daños.

Palabras clave: Gestión de riesgos. Seguridad. Lista de verificación. Enfermería. Seguridad del paciente.

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INTRODUCTION

Surgical assistance has been an essential aspect of health care in Brazil and around the world. With the increasing incidence of traumatic injuries, cancers, and heart disease, there is a consequent impact of surgical intervention on public health systems. For every 25 people in the world, one undergoes surgery, and that number shows the importance of considering the safety of a procedure, since half of the surgeries present complications and death as the main outcomes; 50% of them could have been prevented[1].

With the advent of risk management in health institutions, it is possible to observe improvements in health care, because the risk management actions which work to prevent and control them, focus on the safety of the patients, besides identifying the circumstances and opportunities that put patients at risk[2]. Quality programs in health services encourage actions to observe patterns of conformity, with the perspective of improving the performance of the organization and the safety of the patients who are hospitalized[3].

In this context, risk management is believed to allow nursing professionals to assess the care provided to the patient, observing and proposing the best practices that can minimize problems, or even anticipate them.

In October 2004, the World Health Organization (WHO) launched the World Alliance for Patient Safety, which aimed at raising professional awareness and political commitment to provide more safety in health care and develop public policies that can lead to good care practices. Among the global challenges that encourage the world commitment to the culture of patient safety, is the concern for safe clinical and surgical procedures, which are the basics for health care, thereby increasing the quality pattern and preventing adverse events and damage to the patient[1].

The adverse event occurs when there is a flaw in the process of the organizing services, as well as lack of leadership or of conducts that can change a reality, causing permanent damage and even death[4]. Therefore, when there is an adverse event, the entire organizational structure suffers the consequences of it, be it social, economic or material[5].

In Brazil, the Ministry of Health, together with the Pan-American Organization and the WHO, was in charge of presenting the manual Safe Surgery Saves Lives, which aims at a collaboration of the practice of preventing risks allied to the quality of patient care[6].

This manual presents a surgical safety checklist developed by experts and is divided in three steps, described as: identification (before anesthesia induction), confirmation (before surgical incision), and record (before the patient leaves the operation room). In patient care, this tool has not always contributed to better communication; however, it makes the procedure safer[6,7]. Besides, professionals have been more sensitive to the matters of patient safety, and have manifested a favorable opinion as to the application of the surgical checklist, as well as its implementation in health services[8].

WHO suggests that the checklist should be applied by the nurse; however, it can be done by another health professional who is properly skilled for this end, involved with the proposed surgical procedure[9].

A multicenter study conducted with eight institutions, in which the surgical checklist was experimentally used, showed that the use of this instrument almost doubled the chances of patients receiving proper treatment, that is, free of damage. Besides, the application of the checklist reduced postoperative mortality in 47%, and surgical complications in 11%[10].

The understanding of the reasons why incidents occur makes it easier to elaborate strategies and actions to reduce risk, increasing patient safety. The organizational response to the incident provides learning, generating changes in the system of improving quality in health. The quality of health services is a determining element, which ensures and controls the risks to which patients are submitted[11]. Health institutions notice their fragilities in order to identify the source of eventual mistakes and correct them[12].

Taking into consideration the use of the safe surgery checklist, this study aimed at answering the following research question: what is the perception of nursing professionals who work in a surgical center with regard to the safe surgery checklist?

This study aimed at getting to know the perception of nursing professionals who work in surgical centers, as to the risk management in work practice, besides knowing the strengths and weaknesses in the use of the safe surgery checklist, and identifying the benefits for the nursing team if they use the safe surgery checklist.

METHOD

This is an exploratory, qualitative study. The data were collected in the surgical center of a private medium-sized hospital,

which performs about 150 surgeries per month, in the city of Porto Alegre, Rio Grande do Sul.

The inclusion criteria were nursing professionals who work exclusively at the surgical center, in the morning and afternoon shifts, and who agreed to participate in the study after reading and signing the Informed Consent Form. Nursing professionals who had less than three months of experience, and those who were dismissed from work due to health issues, vacation, or days off at the time of data collection were excluded. Professionals working in the night shift are not exclusive of the sector, working in shifts; therefore, they did not fit the inclusion criteria.

To ensure the anonymity of the research subjects, participants were identified by letters, followed by Arabic numbers, like, E1 and T1 – E referring to nurses and T to nurse technicians – followed by the numbers corresponding to the order of interviews. The data collection took place in March and April 2015, by a semi-structured script containing nine questions. Three of them were about the profile of the interviewees (professional category, work shift and time of work), and seven open questions about risk management and the checklist regarding benefits, difficulties, facilities for the usage of the checklist and communication between professionals. These questions are believed to be sufficient to meet the research goals. The data were collected by MP3 recordings, which where transcribed afterwards.

The data treatment took place from the thematic analysis[13]. First, the answers were grouped by themes, and then the following categories of analysis were identified: risk management in a surgical center: difficulties in concept and in work practice; safe surgery checklist and its contribution to work practice; and strengths and weaknesses of the safe surgery checklist.

The research project was submitted to and approved by the ethics and research committees of the institutions involved, both proponent and co-participant, with report numbers 924.294 and 947.103, respectively, according to Resolution n. 466/12, from the National Health Council[14].

RESULTS AND DISCUSSION

The study comprised 13 nursing professionals, namely 4 nurses and 9 nursing technicians.

Regarding the time of experience in a surgical center, two nurses have one to five years of experience, one nurse has five to ten years of experience, and one has more than ten years of experience. Among the nursing technicians, two professionals have one to five years of experience, five of them have five to ten years of experience, and two technicians have more than 10 years of experience.

The results are presented according to the categories of analysis.

Risk management in a surgical center: difficulties in concept and in work practice

Generally, nursing professionals in a surgical center have difficulties to define risk management; however, they see its importance as something directly related to the safety both of the patient and the worker, connected to the institutional rules and protocols. By conceptualizing risk management, professionals describe it as a set of actions that anticipate future problems, therefore reducing and preventing damage, as observed in the following lines:

> [...] Risk management involves all protocols and attitudes to care for the patient, to prevent risk, the work we do inside the block to prevent the patient from being at risk [...] (E3)

This line is an adequate illustration of the concept that risk management promotes patient care in a systematic way, identifying possible events that can harm him or her, strengthening the safety and the quality of processes[15].

It is possible to notice, in the answers of the interviewees, some of the recommendations from the WHO, related to patient safety, such as the correct identification, risk of falls, administration of medicines, and correct location and laterality among others. Matters related to safety are believed to go through several stages of care, from hospitalization to patient discharge, regardless of the place where the patient is inserted. The following line illustrates this reflection:

> [...] It is the care we must provide for the patients, not letting them fall, not offering wrong medication; having the direct contact

> with the client, welcoming them and providing comfort for them and their family members [...] (T3)

Even though it is difficult to conceptualize risk management, professionals understand the processes involving patient safety and believe that risk management includes previous actions, and prevent the occurrence of mistakes related to health.

> [...] Risk management is a way the institution has of predicting events, something that can lead to future problems, be it for the patient, the family member or the team. I understand it is the prevention against something more serious [...] (T9).

This perception about the systemic aspect of risk management is supported by the literature, which points out that patient safety is directly related with the reduction and/or mitigation of acts in the health system considered to be unsafe, aiming at using best practices with the purpose of obtaining the expected results[12].

Safe Surgery Checklist: contribution to the work practice

The surgical checklist is a useful tool to reduce adverse events in hospitals; however, its effective implementation is challenging[16]. This is an instrument addressed to patient safety, and it can be used in different situations, anticipating possible damage and promoting quality in care, as shown in the next line:

> [...] The *checklist* is the certainty that we are doing the right thing, with the right patient, at the right time. It is the confirmation that everything is right [...] the checklist ensures us the surgery is safe, the patient knows he is in the right place, being operated by the right doctor and the right team [...] (T5)

The literature supports the idea that this tool aims at considerably reducing the more common and preventable risks during the perioperative period, and is correlated with the period related to the normal surgery flow from a sequence of established actions[17].

After the reflexive analysis of the lines, it is possible to observe that the checklist not only ensures the surgical safety of the patient, but also qualifies the work of the team involved in the operative process, thus promoting a dialogue between its actors and an interface between nursing professionals and the multi-professional team, as observed in the following line:

> [...] we talk more about the patients' difficulties, about our observations for them; if there are allergies, we didn't use to mention it, if the doctor wants antibiotics [...] before the checklist these questions did not exist, this interchange in the team [...] (T3)

The use of the surgical checklist as part of the work process ratifies the centrality in patient care. This tool has the potential to qualify nursing care[7]. It is believed that the implementation of protocols in the service, such as the checklist, promotes the effective communication between professionals of the multi-professional team.

However, whereas this tool is a safety element, its use can also lead to embarrassing moments in the team, as mentioned in lines of T1 and T6:

> [...] older doctors do not take the checklist serious [...] so we are a little embarrassed that we won't do our jobs right [...] (T1)

> [...] it doesn't work very well sometimes, it is hard to make everything work, it is not always accepted [...] (T6)

Despite being a challenge faced by the nursing team, this aspect should be considered, because, by using the checklist, all members of the team participate in the communication actively during the confirmation of items, communicating their actions and concerns to everyone in the operation room[7].

Strengths and weaknesses in the use of the safe surgery checklist

From the perception of the nursing professionals analyzed, the main advantage related to the checklist, is its use, to make decisions and take action aiming at patient and team safety,

preventing mistakes, providing effective actions, as observed in the following lines:

> [...] It contributed with the proper procedure, location, team, if there was no mistake in the treatment [...] (E1)

> [...] It is easy because it prevents mistakes, of calling the wrong patient, of making a wrong surgery. This was useful to prevent these mistakes [...] (T8)

If conducted in a complete and trustworthy way by the teams, the checklist provides the observation of the critical stages of surgical procedures, reducing the complications and mortality, preventing infections in the surgical location, errors related to the surgery, thus improving the efficiency of the teams and the anesthesiology[18].

As one of the strengths of the checklist, it is worth mentioning the role of the nurse as a manager of the care process, enabling better teamwork, as we can observe in the next line:

> [...] the nurses have embraced the cause, and that was positive because it shows how the function as managers with the entire multi-professional team. In all situations, the nurse facilitates it, and here the role of the nurse was very positive [...] (E4)

Management is essential in the work of the nurse, since this professional works closely with different multi-professional teams. The nurses should not overestimate control, hierarchy and impersonality, but instead, they should participate in a work process based on dialogue, on the participation and on the debate with the team, leading to better decisions[19].

Among the difficulties pointed out by technicians and nurses about the checklist, the resistance to it and its banalization from the point of view of the medical team stand out, as analyzed in the next lines:

> [...] The difficulties are related to the doctors, since they are more resistant to answering the checklist [...] (T2)

> [...] the doctor who doesn't take it very well laughs [...] sometimes the doctor is anxious to get the surgery over with and has no patience for the checklist [...] (T4)

The biggest difficulty found for the good performance of the surgery team lies within the team itself. Surgeons, anesthetists, nurses, and other professionals involved with the surgical procedure should have a good relationship and an effective communication. The teams that work closely, with the purpose of applying their knowledge and skills for the benefit of the patient, end up preventing the life-threatening complications related to the surgery considerably[20].

The results of this study on the weaknesses and strengths of the safe surgery checklist, ratify the findings in other similar analyses. Concerning the weaknesses, there is a long way to go around the management of work processes in the surgical center, as well as the role of the nurse with the multi-professional team.

FINAL CONSIDERATIONS

Nursing professionals in a surgical center realize the need to ensure patient safety. The perception of nursing professionals about risk management in the work practice of a surgical center is directly related with the best assistance practices, institution of protocols that lead to the prevention of adverse events and the qualification of care, by reducing errors and, consequently, the damage to the patient. The relationship of the team, the reduction in the chances of error, and the active participation of nurses appear as the main strengths in the checklist. On the other hand, the resistance of the medical staff is one of its main weaknesses. The checklist contributes not only for the safety of the patient, but also for the safety of the team, once this tool allows identifying the patient, the procedure, the laterality, among so many other aspects. Educational processes are required to sensitize the team as to the importance of this checklist, as well as to promote the integration of the multi-professional team, reinforcing the group work to provide safe and qualified care to the surgical patient.

REFERENCES

1. Organização Mundial da Saúde. Aliança Mundial para a Segurança do Paciente. Segundo desafio global para a segurança do paciente: cirurgias seguras salvam vidas. Rio de Janeiro: Organização -Mundial da Saúde; 2009.

2. Silva LFN. Reorientação do gerenciamento de risco hospitalar do Instituto Nacional de Traumatologia e Ortopedia (dissertação). Rio de Janeiro: FIOCRUZ; 2009.

3. Lima HO, Dutra ECD. O gerenciamento de riscos na saúde: aplicação na atenção hospitalar. Rev Adm Hosp Inovação Saúde; 2010:87-90 [acesso em 24 jan 2015]. Disponível em: http://revistas.face.ufmg.br/index.php/rahis/article/view/1114

4. Branco -Filho JRC. Construindo um modelo de segurança do paciente. Prát Hosp. 2010;13(74):8-9.

5. Universidade de São Paulo. Faculdade de Medicina. Hospital das Clínicas da Faculdade de Medicina de Ribeirão Preto. Cartilha de gerenciamento de riscos e segurança do paciente. Ribeirão Preto: USP; 2010 [acesso em 05 jan 2015]. Disponível em: http://www.sbrafh.org.br/site/public/temp/510f0a460507f.pdf

6. Monteiro F, Silva LR. "Checklist" lista de verificação de segurança cirúrgica: avaliação e intervenção. Rev Ciênc Méd Biol. 2013;12(Esp):482-5.

7. Pancieri AP, Santos BP, Avila MAG, Braga EM. Checklist de cirurgia segura: análise da segurança e comunicação das equipes de um hospital escola. Rev Gaúcha Enferm. 2013;34(1):71-8.

8. Valido SCN. Checklist cirúrgica: contributo para uma intervenção na área da segurança do doente (dissertação). Évora: Universidade de Évora; 2011 [acesso em 21 jan 2015]. Disponível em: http://hdl.handle.net/10400.21/1594

9. Gomes JRAA, Melanda VS. Elaboração de rotinas para uma enfermagem de excelência em centro cirúrgico. Rev SOBECC. 2012;17(2):48-55.

10. Schalack WS, Boermeester MA. Patient safety during anaesthesia: incorporation of the WHO safe surgery guidelines into clinical practice. Curr Opin Anaesthesiol. 2010;23(6):754-8.

11. Belo AC. A criança segura em serviço de saúde. In: Ministério da Saúde. Assistência segura: uma reflexão teórica aplicada prática. Brasília: Anvisa; 2013.

12. Grigoleto ARL, Gimenes FRE, Avelar MCQ. Segurança do cliente e as ações frente ao procedimento cirúrgico. Rev Eletr Enferm. 2011;13(2):347-54.

13. Gomes R. Análise e interpretação de dados de pesquisa qualitativa. In: Deslandes SF, Gomes R, Minayo MCS (Orgs.). Pesquisa social: teoria, método e criatividade. 26 ed. Petrópolis: Vozes; 2007. p. 79-108.

14. Brasil. Resolução nº 466, de 12 de dezembro de 2012. Diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Brasília: Diário Oficial da União; 2013. Seção 1. p. 59-62.

15. Lima CA, Faria JS, Machado APN, Gonçalves RPF, Teixeira MG, Oliveira RS, et al. Gestão de risco hospitalar: um enfoque na qualidade e segurança do paciente. Rev Eletr Gestão Saúde. 2014;2682-76 [acesso em 24 jan 2015]-. Disponível em: http://gestaoesaude.unb.br/index.php/gestaoesaude/article/viewFile/692/pdf

16. Freitas MR, Antunes AG, Lopes BNA, Fernandes FC, Monte LC, Gama ZAS. Avaliação da adesão ao checklist de cirurgia segura da OMS em cirurgias urológicas e ginecológicas, em dois hospitais de ensino de Natal, Rio Grande do Norte, Brasil. Cad Saúde Pública. 2014;30(1):137-48.

17. Porto KLH. A segurança do paciente na utilização do checklist. Enferm Rev. 2014;17(2)103-15.

18. Araújo MPS, Oliveira AC. Contribuições do programa "cirurgias seguras salvam vidas" na assistência ao paciente cirúrgico: revisão integrativa. Rev Enferm UFPE. 2015;9(4):7448-57.

19. Gomes LC, Dutra KE, Pereira ALS. O enfermeiro no gerenciamento do centro cirúrgico. Rev Eletr Fac Metodista Granbery. 2014;16:1-21 [acesso em 25 mar 2015]-. Disponível em: http://re.granbery.edu.br/artigos/NTEy.pdf

20. Panesar SS, Noble DJ, Mirza SB, Patel B, Mann B, Emerton M, et al. Can the surgical checklist reduce the risk of wrong site surgery in orthopaedics? Can the checklist help? Supporting evidence from analysis of a national patient incident reporting system. J Orthop Surg Res. 2011;6:18.

ADVERSE EVENTS IN A HOSPITAL SURGICAL UNIT: A DESCRIPTIVE STUDY

Eventos adversos em uma unidade de internação cirúrgica: estudo descritivo

Eventos adversos en una unidad de internación quirúrgica: estudio descriptivo

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ABSTRACT: Objective: Verify the occurrence of infection at surgical sites, loss, or infection of venous access and falls in patients hospitalized in the Surgical Inpatient Unit of a Teaching Hospital. **Method:** Descriptive study with a quantitative approach. The period of data collection was between March 23 and April 14, 2015 on alternating days, totaling 94 patients. **Results:** The average hospitalization time was 8.46 days, with a standard deviation of 11.294. A total of 20 (7.9%) adverse events were observed. There were nine (3.6%) records of venous access loss, seven records of surgical site infections (2.8%), and four (1.6%) records of venous access infection. **Conclusion:** It was observed that the occurrence index of the adverse events was greater than in a similar study, showing the need for actions that stimulate the recording of adverse events and the promotion of patient's safety.

Keywords: Perioperative nursing. Patient Safety. Iatrogenic disease.

RESUMO: Objetivo: Verificar a ocorrência de infecção do sítio cirúrgico, perda ou infecção do acesso venoso e quedas em pacientes internados em Unidade de Internação Cirúrgica de um Hospital de Ensino. **Método:** Estudo descritivo de abordagem quantitativa. O período de coleta de dados foi entre 23 de março e 14 de abril de 2015, em dias alternados, totalizando 94 pacientes. **Resultado:** A média do tempo de internação foi de 8,46 dias, com desvio padrão de 11,294. Observou-se um total de 20 (7,9%) eventos adversos. Houve nove (3,6%) notificações de perda do acesso venoso, sete notificações de infecção do sítio cirúrgico (2,8%) e quatro (1,6%) notificações de infecção do acesso venoso. **Conclusão:** Observou-se que o índice de ocorrência dos eventos adversos foi superior a um estudo semelhante, evidenciando a necessidade de ações que estimulem a notificação de eventos adversos e a promoção da segurança do paciente.

Palavras-chave: Enfermagem perioperatória. Segurança do paciente. Doença iatrogênica.

RESUMEN: Objetivo: Verificar la ocurrencia de infección del sitio quirúrgico, pérdida o infección del acceso venoso y caídas de pacientes internados en Unidad de Internación Quirúrgica de un Hospital Escuela. **Método:** Estudio descriptivo de abordaje cuantitativo. El período de colecta de datos fue entre el 23 de marzo y el 14 de abril de 2015, en días alternados, totalizando 94 pacientes. **Resultado:** El promedio del tiempo de internación fue de 8,46 días, con desvío estándar de 11,294. Se observó un total de 20 (7,9%) eventos adversos. Hubo nueve (3,6%) notificaciones de pérdida del acceso venoso, siete notificaciones de infección del sitio quirúrgico (2,8%) y cuatro (1,6%) notificaciones de infección del acceso venoso. **Conclusión:** Se observó que el índice de ocurrencia de los eventos adversos fue superior a un estudio semejante, evidenciando la necesidad de acciones que estimulen la notificación de eventos adversos y la promoción de la seguridad del paciente.

Palabras clave: Enfermería perioperatoria. Seguridad del Paciente. Enfermedad iatrogênica

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INTRODUCTION

The health system develops curative and preventive actions in order to promote patient safety; however, even in the best institutions, patients present risks of being victims of adverse events (AE).[1]

To foster the commitment toward the promotion of patient safety in all of states that are a member of the World Health Organization (WHO), the World Alliance for Patient Safety, every two years, formulates the Global Challenges for patient safety. In 2009, surgical assistance was listed as a problematic area for the second global challenge for patient safety, and a Manual for Safe Surgery was prepared, entitled Safe Surgery Saves Lives, with the purpose of minimizing unnecessary loss of life and serious complications.[2]

Despite WHO announcing surgical assistance as a problematic area, the second global challenge contemplates the operating period with little or no emphasis on the pre-operating and post-operating periods. However, other actions are recommended and stimulated by WHO, contributing to the surgical patient's safety in all phases, such as avoiding the exchanging of patients to provide any care, ensure proper communication between the teams, and avoid bad connection tubes and catheters.[3]

Even with the creation of commissions, alliances, and public policies aimed at the promotion of patient safety in various aspects, the occurrence of incidents and AE exists in the reality of health services. These occurrences can impact the Single Health System (SUS) by resulting in, in some situations, the increase of mortality, morbidity, length of patient's treatment time, assistive costs, among others.[4]

As such, under this scenario, the health and nursing teams have a fundamental role in the promotion of patient safety and quality of services, which influences directly in the prevention of occurrence of the incidents, errors, and AE[5]. The occurrence of AE may have many causes, among them, those related to the sizing up of professionals; the professional training and qualification; the available materials and equipment; structural conditions; access to new technologies and information; work process, among others.[6]

In relation to surgical AE, a study was performed by means of retrospective revision of records of patients admitted in 2003 at three general public and teaching hospitals located in the state of Rio de Janeiro. The final sample was composed of 1,103 patients, of which 18 had some surgical AE, configuring an incidence of 3.5%. Among the patients with surgical AE, three (7.9%) had more than one AE, resulting in an average of 1.1 events per patient, and the proportion of avoidable surgical AE was estimated at 68.3%. The most common surgical AE were related to surgical wounds, which occur in 46.3% of the AE. 19.5% were because of surgical wound infection and 26.8% were because of other problem with a surgical wound. Infection not related to surgical wounds occurred in 14.6%, and hemorrhages in 12.2% of the AE.[7] Some studies performed in surgical inpatient units highlighted the occurrence of several specific AE, like, for example, falls, removal of probes, drains, and catheters, and surgical site infection (SSI).[7-9]

In light of this context, and recognizing of the fact that the actions of the nursing team can prevent the occurrence of errors and AE promoting patient safety, this study has the following research question: what is the occurrence of infection of the surgical site, loss or infection of the venous access, and falls in hospitalized patients in a Surgical Inpatient Unit of a Teaching Hospital (TH)?

Thus, the objective of the study was to verify the occurrence of surgical site infection, venous access loss or infection, and falls in patients hospitalized in the Surgical Inpatient Unit of a TH.

METHODS

Descriptive, quantitative research, performed in a surgical inpatient unit of a university hospital in southern Brazil. Data collection was conducted between March 23 and April 14, 2015, on alternate days. The unit of choice attends to head and neck surgery, gastrointestinal and biliary tract, chest, otolaryngology, maxillofacial, liver transplantation, and neurosurgery. In the year 2013, 1,489 patients were hospitalized in that unit, with a monthly average of approximately 730 hospitalizations. 2,259 surgeries were performed, 738 clean surgeries, 1,248 potentially contaminated surgeries, 233 contaminated surgeries, and 40 infected surgeries.[10]

To calculate the sample size, we considered the number of patients admitted in this surgical unit in 2013, with data obtained from the Epidemiological Bulletin of the Hospital Infection Control Commission, which was from 1,489 patients. SestatNet, the teaching and learning statistics computer

program was used, resulting in a sample of 94 patients, with a 95% confidence level. This study included all patients of both sexes, older than 15 years old, admitted to the Inpatient Surgical Unit I (UIC I) until reaching the minimum number of 94 patients.

Four instruments were used for data collection:

1. A guide for the characterization of patients and identification of EA;
2. A guide for assessing the occurrence of falls;
3. A guide for assessing the occurrence of SSI;
4. A guide for assessing the occurrence of venous access loss or infection.

The instruments were validated by means of a pretest conducted with 28 patients, prior to data collection, the results of which were not used for data analysis. These instruments were built from the concepts and studies found in the literature review.

In the days of data collection, all hospitalized patients were evaluated and interviewed in order to identify the occurrence of EA. 252 assessments were made in 94 selected patients.

Data were recorded in the Statistical Package for the Social Sciences (SPSS) statistical software. For the analysis of categorical variables, the frequency distribution and the χ^2 test were used, and for quantitative variables the mean, standard deviation (SD), and analysis of variance with a fixed factor were utilized. For inferential analyses, the significance level was 5%.

The project was submitted to the Ethics and Research Committee with Humans Beings of the original Teaching Institution, and received a favorable opinion - Presentation of Certificate for Ethics Assessment 39652314.6.0000.0115.

RESULTS

The data found were analyzed and divided into three categories for analysis, which were patient demographics; occurrence of surgical site infection; occurrence venous access loss; and occurrence venous access infection.

Patient Demographics

An age variation between 15 and 83 years was observed. The average patient age was 50.04 years with SD of 16.928. Regarding gender, 57 patients (60.6%) were women and 37 (39.4%) were men. Assessing marital status, it was found that 51 of them (54.3%) were married, 21 (22.3%) were single, 12 (12.8%) were widowed, 6 (6.4%) were divorced, and 4 (4.3%) had stable partners. Observing education, it was found that 27 (28.7%) patients had not completed elementary education; 26 (27.7%) had completed high school; 14 (14.9%) had completed elementary education; 10 (10.6%) had not completed higher education; 8 (8.5%) had not completed high school; 7 (7.4%) had completed higher education; and 2 (2.1%) patients were illiterate.

The length of stay of patients ranged from 0 to 59 days, with a mean of 8.46 hospital stay days, with PD of 11.294.

The reasons patients were admitted were different. Hospitalizations for laparoscopic cholecystectomy video (LCV) and endoscopic retrograde cholangiopancreatography (ERCP) were the most prevalent. Admissions for appendicitis, hernioplasty, gastroplasty, and thyroidectomy were also observed. With a lower prevalence, gastric cancer and parioectamy were observed. It is possible to view this data in Figure 1.

Regarding the presence of infection prior to the admission date, it was observed that 76 (80.9%) patients did not show any previous infection and 18 (19.1%) patients were admitted with some type of previous infection.

In relation to the occurrence of EA, SSI, venous access loss, venous access infection, and falls in 252 evaluations, a total of 20 (7.9%) EA were observed. There were nine (3.6%) records of venous access loss, seven (2.8%) SSI records,

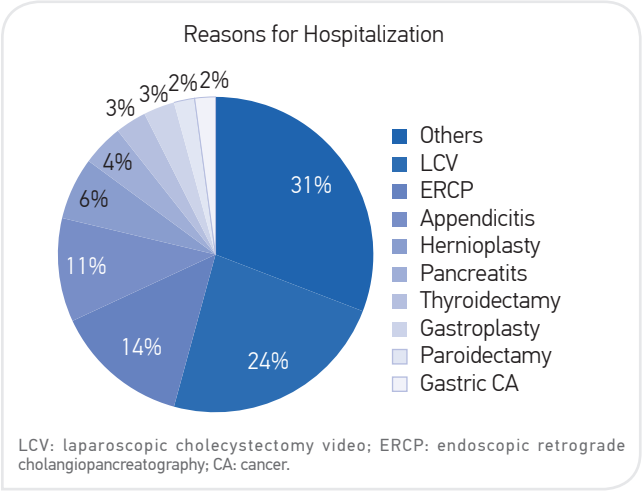

Figure 1. Percentage of Reasons for Hospitalization. Florianópolis, Santa Catarina, Brazil, 2015.

four (1.6%) records venous access infection, and there was no occurrence of falls (Figure 2).

Occurrence of surgical site infection

Patients who developed SSI were an average age of 46.7 years. Four of them were female and three were male. Most of them had a low level of education. Reasons for hospitalization were heptic abscess, acute abdomen, cholecystitis, appendicitis, exploratory laparotomy, liver cell carcinoma, and choledocholithiasis.

The average preoperative hospital stay of seven patients who developed SSI was 4.86 days with a DP of 7,493. The minimum preoperative hospital stay time was zero days, and the maximum time was 21 days.

Regarding the degree of surgery contamination of the patients who developed SSI, two performed what is considered clean surgery, three practiced surgery that was considered potentially contaminated and there were two surgeries that were considered contaminated. Regarding the type of surgery of patients who developed SSI, three surgeries were chosen and four were in an emergency situation. Regarding the size of the surgery, patients who developed SSI, two surgeries were small, three surgeries were medium-sized, and two were large. Regarding the surgical risk all patients who had developed SSI presented ASA II – a score for a subjective evaluation of the general health of the patient by the American Society of Anesthesiologists (ASA).

In relation to the classification of the wounds of the patients who developed SSI, six wounds were classified as deep incisional infections and one as an organ/space infection.

After the first record of SSI, the wounds were accompanied and evaluated in their evolution, resulting in 24 evaluations of infected wounds. Figure 3 to follow, shows the presence of phlogistic signs during the evaluations of the infected surgical wounds:

Pain was mentioned in 9 (37.5%) evaluations and wasn't mentioned in 15 (62.5%) of them; flushing was identified in 3 (12.5%) evaluations and wasn't identified in 21 (87.5%) of them; edema was verified in 6 (15%) evaluations and absent in 18 (75%); and fever was absent in all of them.

In relation to the presence of suture dehiscence during the evaluations of the infected wounds, 4 (16.6%) wounds were observed with an absence of dehiscence and 20 (83.3%) with dehiscence. In relation to the presence of exudate in the infected wound, the presence of exudate in all of the wounds was found.

With respect to the presence of drainage in the patients with SSI, the absence of drainage was observed in 11 (45.8%) evaluations, 10 (41.6%) with penrose drainage, and 3 (12.5%) with tubular drainage. About the type of drainage exudate, it was observed that in 11 (45,8%) evaluations exudate was absent, in 5 (20,8%) the drainage was purulent, in 3 (12.5%) the drainage was serosanguineous, in 2 (8.3%) the drainage was bilious, in 2 (8.3%) the drainage was serous, and in 1 (4.1%) the drainage was seropurulent.

Occurrence of venous access loss

It was found in this study that in the nine occurrences of venous access loss, the type of access was peripheral, so there was no occurrence central venous access loss in any of the observations.

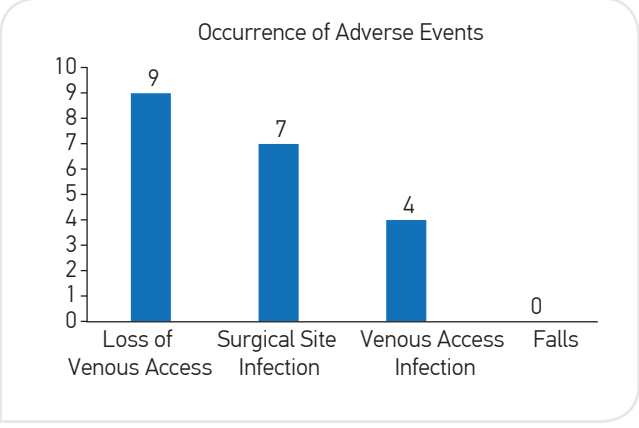

Figure 2. Occurrence frequency of the adverse events in the 252 evaluations. Florianópolis, Santa Catarina, Brazil, 2015.

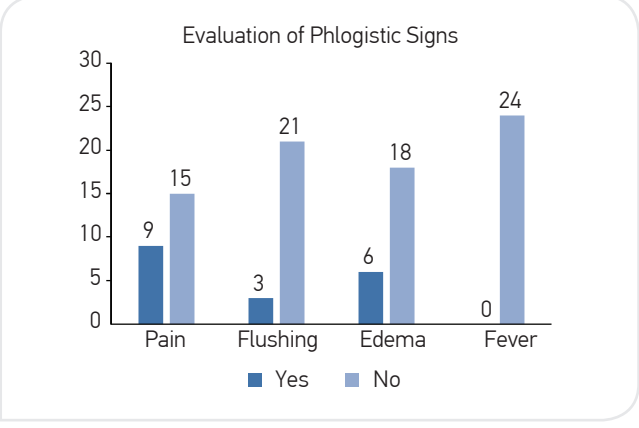

Figure 3. Presence or absence of Phlogistic Signs in Surgical Site Infections. Florianópolis, Santa Catarina, Brazil, 2015.

In relation to the length of time of venous puncture, in days, in the occurrences of venous access loss, a statistical significant difference was not observed. In three occurrences, the length of time of venous puncture was in one day; in two occurrences, the length of time was two days; in two occurrences, the length of time was three days; and in two occurrences the nursing team did not register the length of time of puncture.

In relation to the exchange of treatment of the venous access, it was noted that 100% of the treatment exchanges were performed every 72 hours, by mid-level nursing professionals, using alcoholic chlorhexidine 0.5% as an antiseptic. And, in relation to the fixing of the catheter, five were fixed with micropore and four with transparent film.

Regarding the site of venous puncture, in the occurrence of venous access loss, it was observed that four punctures were in the arm, three in the forearm, one in the antecubital fossa, and one in the dorsum of the hand. In relation to the coloration of the skin in the occurrence of loss of venous access, five patients were observed with white skin color, two patients with brown skin, and two patients with black skin.

Upon observing the occurrence environment of the loss of venous access, it was found that in six occurrences the serum medium was fixed on a wall and in three, the serum medium was rotating. In relation to the type of venous infusion, it was perceived that in seven occurrences, the infusion was continuous and in two the infusion was slow.

Concerning the solution infused in the venous access, the presence of a physiological solution was observed in nine occurrences and antibiotics in four occurrences, and the absence of the infusion of glucose solutions at 5, 10, and 50%; ringer; ringer lactate; vasoactive drugs; antifungal and parenteral nutrition. Upon observing the devices used in venous access, it was perceived that eight of them used intermediate extenders and one used only equipment with a lateral injector. In relation to the size of the catheter under the needle used for venipuncture, eight were a 24 gauge and one was a 22 gauge.

In relation to the presence of the phlogistic signs, there was a local pain in four occurrences and flushing in four occurrences. Phlebitis, fever, and purulent exudate were absent.

Occurrence of venous access of

Upon analyzing the instances of venous access infection, it was observed that of the four instances of venous access infection, the type of access was peripheral, and there was not an instance of loss of central venous access in any of the observations.

In relation to the length of time of venous puncture in days, in the instances of venous access infection, it was observed that in two instances, the length of time of venous puncture was one day, in one instance it was two days, and in one instance, it was three days, showing the absence of statistically significant difference.

Upon observing the frequency of exchange treatment of the venous access, it was found that in 100% of the instances, mid-level nursing professionals, using alcoholic chlorhexidine 0.5% as an antiseptic, performed the healing exchange every 72 hours. In relation to the fixing of the catheter, one was with micropore and three were with transparent film.

Concerning the site of venous puncture in the instance of access infection, three punctures in the arm and one in the forearm were observed. In relation to the skin coloring in the instance of venous access infection, two patients were observed with white skin, one patient with brown skin, and one black patient.

Observing the environment where the venous access infection occurred, it was found that in three instances the serum medium was fixed on the wall, and in one the serum medium was in rotation. In relation to the type of venous infusion, it was perceived that in three instances the infusion was continuous and in one the infusion was slow. Regarding the solution infused in the venous access, the presence of a physiological solution was observed in four instances and an antibiotic solution was observed in one. And therefore the infusion of glucose solutions at 5, 10, and 50%, ringer, ringer lactate, vasoactive drugs, antifungal drugs, and parenteral nutrition were absent. By observing the devices used in the venous access, it was perceived that three use intermediate extenders and only one used equipment with a lateral injector. Concerning the catheters used in venipuncture, all of them were of a 24 caliber.

Regarding the presence of the phlogistic signs, there was local pain observed in four occurrences and flushing in four occurrences. Phlebitis, fever, and purulent exudate were absent.

It was observed that there was a simultaneousness between the loss of venous access and the occurrence of infection of the venous access in four patients.

DISCUSSION

The average time of the patients' hospitalization was 8.46 days. According to the National Supplementary Health Agency

(ANS), this data is an indicator of hospital performance, and an average over 7.0 days of hospitalization in acute hospitals increases the risk of hospital infection. This same document indicates that some general hospitals, without teaching activities, reported an average of patient hospitalization time between 3.5 and 6.4 days.[11] However, in this TH, the average length of hospitalization time was greater than indicated by ANS and greater than other general hospitals without teaching activities.

As such, we can consider that this prolonged hospitalization period is related to the characteristic of the hospital being studied that develops teaching activities and the specificity of treatment performed in clinical surgery, in which the patients find themselves in particular moments that make up the surgical experience, like the pre-, intra-, and post-operative periods.[12] However, the majority of patients were hospitalized for punctual and surgical situations and a few days after surgery, patients received discharge.

Regarding the index of occurrence of surgical AE, it was observed that this was greater than a similar study, performed in three general public hospitals and teaching hospitals, which with the incidence of the 1,104 patients with surgical AE was 3.5%.[7]

Among surgical AEs, SSI stands out in that it is contained in the scenario of hospital infections, defined as any infection acquired after admission and manifested during hospitalization or after discharge, when related to hospitalization or hospital procedures.[13] Even though it was the most characteristic surgery, the incidence of SSI in this study was small compared to another study that obtained a prevalence index of 3.68% in a total of 2,203 patients. Nevertheless, a similarity in relation to the classification of surgical risk was observed, and ASA II was the most prevalent, just like in relation to the characteristics of the patients who demonstrated low education levels, were of the female sex, were an average age of 48 years, and were submitted to CVL and Exploratory Laparotomy.[14]

The reasons for the interruption and complications related to intravenous therapy could arise from various factors, including simultaneous occurrence, as was observed in this study, just like in a study performed in 2011, which indicates the incidence of phlebitis in hospitalized adults were on average five times higher than accepted by the *Infusion Nurses Society.*[15]

In this study, the prevalent AE was the loss of the peripheral venous catheter, and it was found that of the nine losses, four resulted from infection of the venous access. A study performed in 2011, which involved 76 hospitalized patients in an infirmary, observed the prevalence in the occurrence of phlebitis in 25.8% of the patients with peripheral intravenous catheter, and of them, 40% showed clinical manifestations like pain, edema, and erythema. In this study, it was possible to observe the clinical manifestations of pain and erythema in four observations of venous access infection. There were also similarities in relation to the intravenous catheter dwell time, such that in both of the studies it was less than or equal to 72 hours.[15]

There was not an occurrence of fall during the data collection days; however, there is evidence in other studies of the frequency and relevance of this AE in the hospital and surgical sphere. A study performed in 2010 demonstrates that 10.7% of the record bulletins of AE are related to falls, resulting in a monthly average of 2.6 falls,[16] just like in a study performed in 2014, which shows the occurrence of 93.5% of falls in Inpatient Surgical Unit and 6.5% in the Emergency Services.[17]

In this context, the nursing team has the fundamental function in the prevention of AE in the Inpatient Surgical Unit, highlighting the occurrence of SSI, as well as in the reduction of complications related to peripheral venous access, keeping in mind that this procedure is the responsibility of the nurse and affects the cutaneous integrity of the patient, increasing the risk of infection. The prevention of infection related to the peripheral venous catheter is, principally, the nursing team's responsibility, reflecting in the quality of assistance given and the security of the patient in addition to reducing the length of hospitalization time and costs.[18]

One way to diminish the distance between ideal nursing care and real nursing care is to work with health teams on the occurrence of error and professional fault, taking this opportunity to discuss and engage professionals in critical thinking about the care actions and attitudes in relation to their own errors or their colleagues errors, using the occurrences as a learning moment, and, in this way, avoiding new errors related to the same cause.[19]

As such, it is essential to modify, in hospital environments, the way of accepting errors as individual mistakes and encouraging the notification of errors. Equally important, assistance should centered on the patient, based on

models that facilitate collaborative and interdisciplinary work in teams.[3]

Concomitantly to this, it is necessary that institutions and managers are committed to patient safety, establishing it as guiding axis of their organization. However, its is fundamental to offer subsidies to direct care providers, looking to understand the difficulties and challenges of assistance so that effective communication between all levels of the hierarchy are possible, which allows for the confidence between all of the professionals involved.[19]

The promotion of patient safety should be in line with the an institutional and professional culture of security, and it some changes must occur in hospital environments, namely changing the idea of errors as personal failings to understanding them as the cause of failings of the system; changing the environment from one of punishment to a culture in which error notification is stimulated; avoiding secrecy, showing transparency; centralizing patient care and not doctor care; not using care models based on individual and independent performance excellence, but rather on care models performed by interdependent professional teams, collaborators, and interdisciplinary workers; highlighting universal and reciprocal accountability, and not top down accountability.[3]

In this way, the creation of a culture of patient safety within health institutions allows for teams to feel more secure in reporting the occurrence of AE incidents, because it enables these changes.[20]

Still, a limitation of this study is in the data collection period. To obtain more consistent and impactful data, the length of time would need to be increased, resulting in more evaluations.

CONCLUSION

It became evident that the presence of AE in the surgical environment of this TH is relevant when compared to similar studies in which the incidence of occurrence of AE was less than in this study. Among the events observed, the most recurrent was venous access loss, followed by SSI and venous access infection. It is interesting to highlight that there was not an occurrence of falls in the data collection; however, it is not possible to exclude the possibility of this occurrence in a surgical inpatient unit, keeping in mind the reduced time of data collection in this study.

The presence of AE in the Surgical Inpatient Unit demonstrates failures in the quality of assistance provided. Therefore, after the occurrence, the EA should be analyzed to elucidate the possible causes and allow for reflections and moments of ongoing education for the health and nursing staff, aimed at measures that promote the prevention and reduction of errors.

The promotion of a security culture should be established among the professionals so that the notification of incidents, errors, and AE, does not denote a punitive character about the professional, but an understanding that the error is multifactorial and is not the responsibility of a single professional.

The main causes of EA occurrences should be investigated to make it possible to perform actions that are aimed at its prevention, such as continuing education, appropriate professional quantitative, devices and materials in excellent condition, well-established routines, prepared clinical protocols, standard operating procedures that are easily accessible and consistent with the institutional reality, and an EA notification tool that is available for the team.

REFERENCES

1. Pedreira MLG. Nursing interventions and outcomes to ensure patient's safety. Acta Paul Enferm. 2009;22(4):v-vi. [acesso em 10 dez 2015]. Disponível em: http://www.scielo.br/scielo.php?pid=S0103-21002009000400001&script=sci_arttext&tlng=en

2. Organização Mundial de Saúde. Segundo desafio global para a segurança do paciente: Cirurgias seguras salvam vidas. Rio de Janeiro (RJ): Organização Pan-Americana da Saúde/Ministério da Saúde/Agência Nacional de Vigilância Sanitária; 2009. [citado 2015 jun. 20]. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/seguranca_paciente_cirurgia_salva_manual.pdf

3. Brasil. Portaria nº 529, de 1º de abril de 2013: Institui o Programa Nacional de Segurança do Paciente (PNSP). Diário Oficial da República Federativa do Brasil, 02 abr. 2013. Seção 1.

4. Brasil. Agência Nacional de Vigilância Sanitária. Investigação de eventos adversos em serviços de saúde. Série Segurança do paciente e qualidade em serviços de saúde. Brasília: ANVISA; 2013. [citado 2015 jun. 20]. Disponível em: http://www20.anvisa.gov.br/segurancadopaciente/images/documentos/livros/Livro5-InvestigacaoEventos.pdf

5. Bohomol E, Tartali JA. Adverse effects in surgical patients: knowledge of the nursing professionals. Acta Paul Enferm. 2013;26(4):376-81. [acesso em 19 set 2015]. Disponível em: http://www.scielo.br/scielo.php?pid=S0103-21002013000400012&script=sci_arttext&tlng=en

6. Arboit EL, Silva LAA. Eventos adversos na enfermagem relacionados ao dimensionamento de pessoal. Rev Enferm. 2012;8(8):128-39. [acesso em 28 abr 2015]. Disponível em: http://www.revistas.fw.uri.br/index.php/revistadeenfermagem/article/view/481/877

7. Moura MLO, Mendes W. Assessment of surgical adverse events in Rio de Janeiro hospitals. Rev Bras Epidemiol. 2012;15(3):523-35. [acesso em 20 jun 2015]. Disponível em: http://www.scielo.br/scielo.php?pid=S1415-790X2012000300007&script=sci_arttext&tlng=en

8. Carneiro FS. Eventos adversos na clínica cirúrgica de um hospital universitário: instrumento de avaliação da qualidade. Rev Enferm. 2011;19(2):204-11. [acesso em 20 jun 2015]. Disponível em: http://www.facenf.uerj.br/v19n2/v19n2a06.pdf

9. Oliveira AC, Braz NJ, Ribeiro MM. Incidência da infecção do sitio cirúrgico em um hospital universitário. Cienc Cuid Saúde. 2007;6(4):486-93. [acesso em 20 out 2015]. Disponível em: http://eduem.uem.br/ojs/index.php/CiencCuidSaude/article/view/3685/2687

10. Masukawa II, Vieira GB, Klein TR. Boletim Epidemiológico – Serviço de Controle de Infecção Hospitalar (SCIH/HU). 5º Título. Florianópolis (SC); 2014.

11. Agência nacional de saúde suplementar. Média de permanência geral. Ministério da Saúde; 2013 [citado 2016 sep. 01]. Disponível em: http://www.ans.gov.br/images/stories/prestadores/E-EFI-05.pdf

12. Cheregatti AL. Enfermagem em clínica cirúrgica no pré e no pós-operatório. São Paulo (SP): Martinari; 2012.

13. Brasil. Portaria nº 930/MS, de 27 de agosto de 1992. Resolve expedir, na forma de seus anexos, normas para o controle das infecções hospitalares. Diário Oficial da República Federativa do Brasil, 04 set. 1992. Seção 1.

14. Aguiar APL, Prado PR, Opitz SP, Vasconcelos SP, Faro ARMC. Fatores associados à infecção do sitio cirúrgico em um hospital na Amazônia ocidental brasileira. Rev SOBECC. 2012;17(3):60-70. [acesso em 20 jun 2015]. Disponível em: http://itpack31.itarget.com.br/uploads/snf/arquivos/Ano17_n3_%20jul_set2012_(Fatores_associados_infeccao_de_sitio_cirurgico_em_um_hospital_na_amazonia_ocidental_brasileira).pdf

15. Magerote NP, Lima MHM, Silva JB, Correia MDL, Secoli SR. Associação entre flebite e retirada de cateteres intravenosos periféricos. Texto Contexto - Enferm. 2011;20(3):486-92. [acesso em 21 ago 2015]. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-07072011000300009

16. Paiva MCMS, Paiva SAR, Barti HW, Campana AO. Caracterização das quedas de pacientes segundo notificação em boletins de eventos adversos. Rev Esc Enferm. 2010;44(1):134-8. [acesso em 21 ago 2015]. Disponível em: http://www.scielo.br/pdf/reeusp/v44n1/a19v44n1.pdf

17. Prates CG, Luzia MF, Ortolan MR, Neves CM, Bueno ALM, Guimarães F. Quedas em adultos hospitalizados: incidência e características desses eventos. Cienc Cuid Saúde. 2014;13(1):74-81. [acesso em 10 dez 2015]. Disponível em: http://www.periodicos.uem.br/ojs/index.php/CiencCuidSaude/article/view/20728/pdf_115

18. Mendonça KM, Neves HCC, Barbosa DFS, Souza ACS, Tipple AFV, Prado MA. Atuação da enfermagem na prevenção e controle de infecção de corrente sanguínea relacionada ao cateter. Rev Enferm. 2011;19(2):330-33. [acesso em 20 jun 2015]. Disponível em: http://www.facenf.uerj.br/v19n2/v19n2a26.pdf

19. Paese F, Dal Sasso GTM. Patient safety culture in primary health care. Texto Contexto - Enferm. 2013;22(2):302-10. [acesso em 21 ago 2015]. Disponível em: http://www.scielo.br/scielo.php?pid=S0104-07072013000200005&script=sci_arttext&tlng=en

20. Nascimento CCP, Toffoletto MC, Gonçalves LA, Freitas WG, Padilha KG. Indicators of healthcare results: analysis of adverse events during hospital stays. Rev Latino-am Enfermagem. 2008;16(4):746-51. [acesso em 21 ago 2015]. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-11692008000400015

ELECTRIC SCALPEL USAGE AND RELATED SAFETY MEASURES: INTEGRATIVE REVIEW

O uso do bisturi elétrico e cuidados relacionados: revisão integrativa

Uso del bisturí eléctrico y cuidados relacionados: revisión integradora

Márcia Aline de Castro Olímpio[1], Vanessa Emille Carvalho de Sousa[2], Michelle Alves Vasconcelos Ponte[3]

ABSTRACT: Objective: To analyze scientific evidence on the use of electric scalpel and precaution measures related to the use of this equipment. **Method:** An integrative review was developed from April to May 2016, by searching the following databases: PubMed (digital archive created by the National Library of Medicine), *Biblioteca Virtual em Saúde* and Google Scholar. The search was conducted by using the following descriptors: *bisturi elétrico* and electric scalpel. **Results:** The search strategy resulted in six studies that covered the following themes: risks associated with the use of electric scalpel, knowledges of the health team about the use of electric scalpel and nursing role in preventing risks related with electrocoagulation. **Conclusion:** There is a need to adopt strategies for improving the knowledge of nurses and nursing assistants in regards to the safety of patients submitted to electrocoagulation.
Keywords: Perioperative nursing. Nursing, team. Electrocoagulation.

RESUMO: Objetivo: Analisar evidências científicas sobre a utilização do bisturi elétrico e os cuidados relacionados ao uso desse equipamento. **Método:** Revisão integrativa da literatura realizada em abril e maio de 2016 nas bases de dados PubMed (arquivo digital produzido pela *National Library of Medicine*), Biblioteca Virtual em Saúde (BVS) e Google Acadêmico. Para o levantamento de artigos, foram utilizados os descritores não controlados: bisturi elétrico e *electric scalpel*. **Resultados:** A estratégia de busca permitiu a análise de seis artigos que abordaram três temas principais: riscos associados ao uso do bisturi elétrico, conhecimento da equipe em relação ao uso do bisturi elétrico e papel do enfermeiro na prevenção de riscos associados à eletrocirurgia. **Conclusão:** Conclui-se que é necessário implementar ações para que enfermeiros e técnicos de enfermagem adquiram um nível adequado de conhecimentos e habilidades relacionados à segurança do paciente submetido à eletrocirurgia.
Palavras-chave: Enfermagem perioperatória. Equipe de enfermagem. Eletrocoagulação.

RESUMEN: Objetivo: Analizar evidencias científicas sobre el uso de bisturí eléctrico y la atención relacionada con el uso de este equipo. **Método:** Revisión integradora de la literatura llevada a cabo en abril y mayo de 2016, en las bases de datos PubMed (archivo digital producido por el National Library of Medicine), Biblioteca Virtual en Salud y Google Scholar. Para la búsqueda de los artículos se utilizaron los descriptores: bisturi elétrico e electric scalpel. **Resultados:** La estrategia de búsqueda permitió el análisis de seis artículos que abordaron tres temas principales: Riesgos asociados con el uso del bisturí eléctrico; Conocimiento del personal sobre el uso el bisturí eléctrico; y Papel de la enfermera en la prevención de los riesgos asociados a la electrocirugía. **Conclusión:** Se concluye que acciones deben ser implementados para que enfermeros y técnicos en enfermería adquieran un nivel adecuado de conocimientos y habilidades relacionados con la seguridad de los pacientes sometidos a la electrocirugía.
Palabras clave: Enfermería perioperatoria. Grupo de enfermería. Electrocoagulación.

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INTRODUCTION

The first surgical centers have emerged linked to the history and evolution of medicine. In ancient times, the procedures were predominantly conducted in body areas where it was not necessary to open cavities because typically these procedures were conducted in the external tissue and extremities[1]. With the scientific development of surgical medicine in the mid-sixteenth century, three major challenges inherent to the surgical procedure have emerged: pain, infection, and bleeding[2].

As a bleeding control measure during surgery, the first electric scalpel was developed in 1920 in the United States. This instrument promoted tissues desiccation and hemostasis by means of a radio frequency current that passes through a portion of the human body producing electrodesiccation and electrocoagulation. This discovery enabled a significant reduction in the risk of bleeding in surgical procedures when compared to the use of manual scalpel[1].

In 1968, the electrosurgery was revolutionized by the isolated generator technology, which dramatically reduced the hazards of the current division and alternate site burns[3]. Since then, there is an increasing demand for in-depth knowledge of the interventions and surgical instruments and equipment, owing to the speed and complexity of the advances in surgical procedures. Among these advances are minimally invasive surgeries, the various changes in previously recommended practices, and promotion of guidelines and best practices related to the operating room[4].

Technological innovations have also been implemented in the manufacture of new electric scalpel models. The electric scalpels used in the past worked with a return system called neutral plate, in which the electric current is removed from the equipment. Modern electric scalpels have a monitoring system for the return electrode, in which the electric current returns to a generator. In this type of device, if the plate is disconnected while using the equipment, the generator cuts the current, which minimizes the possibility of burns in patient's skin[4].

Perioperative nursing care is essential to promote the patient well-being and safety in surgical procedures. The term "perioperative nursing" implies a systematic and dynamic process. The nursing staff ensure that patients receive professional care, which should be established based on scientific evidence, by means of the patient care planning and identification of required nursing interventions[4].

In view of these considerations and the perception that nurses do not always have the knowledge and skills to handle new technological devices, we consider relevant to investigate the literature content on the usage and care related to electric scalpels.

In 2014, a literature review was carried out to investigate scientific evidence on the nursing care in the intraoperative period related to the use of electric scalpel[5]. However, the study requires detailed information about its methodological characteristics, such as information sources, research period, and descriptors applied. Thus, we consider that a new integrative review on the use of electric scalpel is necessary and that this type of study contributes to the professional practice through the integration and dissemination of evidence, which are not always accessible to healthcare professionals.

OBJECTIVE

To analyze scientific evidence on the use of electric scalpel and on the nursing care related to the use of this equipment.

METHOD

This is an integrative review on the use of electric scalpel and related nursing care, which used a methodological framework containing five stages: problem formulation, data collection, data evaluation, data analysis and interpretation, and presentation of results[6].

For the problem formulation, the following guiding question was elaborated: What does literature show on the usage and care related to the use of electric scalpel? Data were collected during April and May 2016.

Data collection consisted in the search for scientific articles published in the last five years (2011–2016), focusing on the guiding question, published in Portuguese, English, and French, and indexed in PubMed (digital archive produced by the *National Library of* Medicine), *Biblioteca Virtual em Saúde* (BVS), and Google Scholar. Uncontrolled descriptors used for the search were *bisturi elétrico* and electric scalpel.

Only articles published in the last five years were chosen, which aimed at including recent and updated data from studies on the topic of interest. The choice of the inclusion criterion related to language – Portuguese, English, and French – was made because of language-related matters. The flowchart of the data collection and of the papers included in final sample of this review is shown in Figure 1.

For the data collection, an instrument specifically designed for this study was applied. This instrument was filled out with the following information, which was obtained by the reading of each article: study identification (title, authors, region where the study was carried out, and year of publication), type of journal, and methodological characteristics of the study (study type, objective, results, and major implications and level of evidence).

Evidence levels were rated on a scale of I to VII, as follows:

I. Systematic review with meta-analysis of randomized controlled clinical trials;
II. Randomized controlled clinical trial;
III. Nonrandomized clinical trial;
IV. Cohort study and well-delineated case – control;

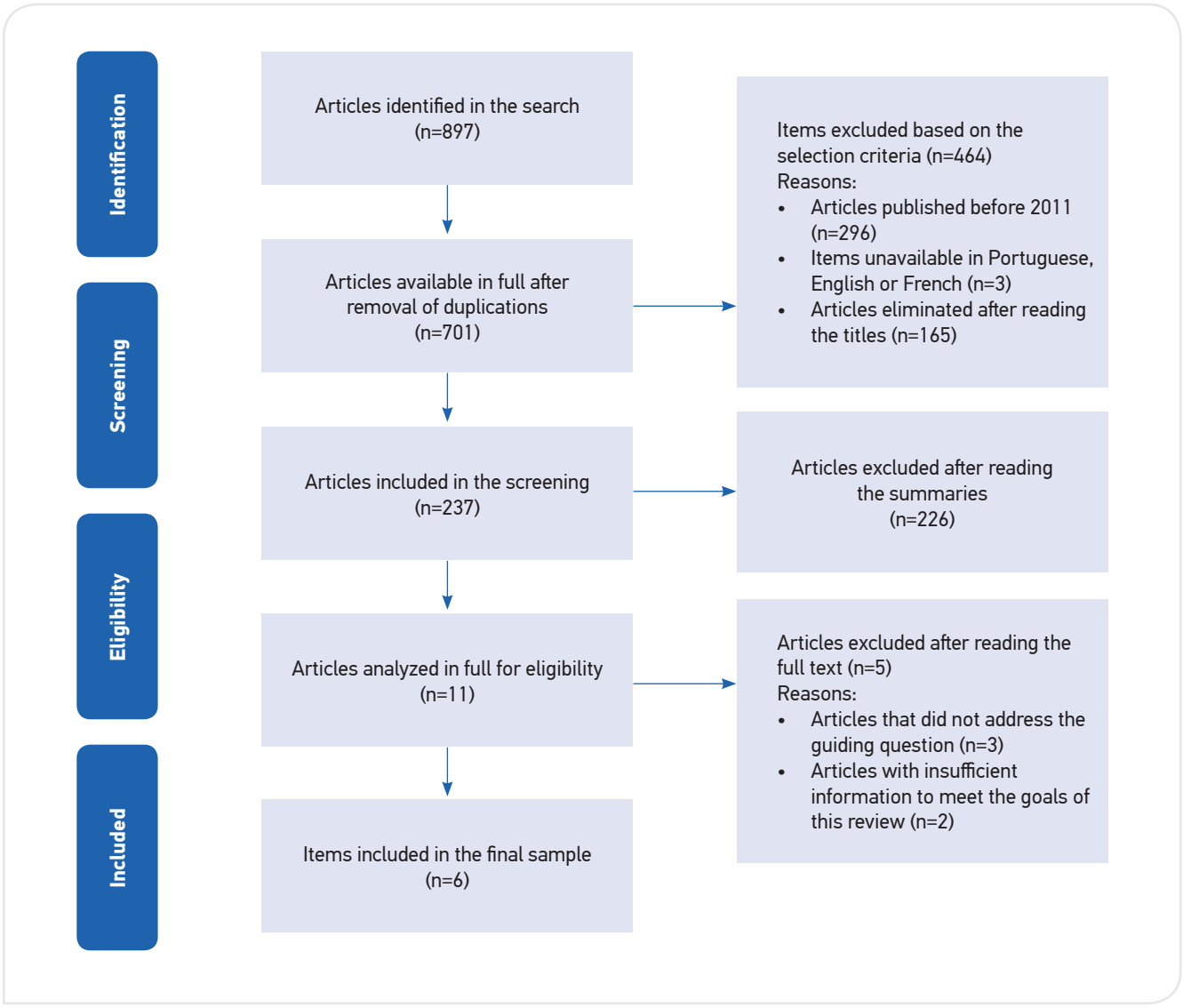

Figure 1. Flow chart of the search process for scientific articles.

V. Systematic or integrative review of quantitative and qualitative descriptive studies;
VI. Quantitative or qualitative descriptive study and
VII. Opinion of authorities and/or expert committee reports[7].

The classification of the selected articles according to the level of evidence is recommended for any literature review study, as it enables to determine the confidence in the use of the results arising from these studies and reinforces the conclusions concerning the current knowledge status on the investigated subject[8].

Data evaluation was carried out by an in-depth reading of the selected articles and by the identification of the key elements that could answer the guiding question of the integrative review. Analysis and interpretation of data was carried out through the critical assessment of the selected studies, in which the results of the different studies were compared and conclusions and implications from this critical analysis were identified. The results are presented descriptively in a table that summarizes the characteristics and major implications of the selected studies.

RESULTS

Table 1 shows the main characteristics of the studies included in the integrative review.

Among the six selected papers, three were review studies (level of evidence V) and three were descriptive studies (level of evidence VI), and two of which were case studies. The most frequent publication year was 2012, with three studies in total. The other studies were published in 2014, 2010, and 2009. Each study was published in a different journal and all studies, except one, were published in Brazilian journals.

Based on the critical analysis of the articles included in the review and its implications, three main themes have been identified: risks associated with the use of electric scalpel, team knowledge on the use of electric scalpel, and nurse's role in preventing the risks associated with electrosurgery.

DISCUSSION

The literature review identified a majority of "integrative review" and "case reports" study types. These study types had the level of evidence V[7], considering the methodological framework used. This result indicates the need to invest in the development of studies with more robust methodologies in the field of surgical nursing. These studies may help to improve the level of scientific evidence on this subject. Despite this weakness, the selected studies contain important concepts and information to answer the main question of this review, and therefore have been adopted. The main themes identified from the review of the selected articles and its implications are presented and discussed below.

Risks associated with the use of electric scalpel

Risk factors identified in one study include the time of exposure to electric current, the area exposed (highlighting an increased risk when the dispersion plate is not fully adhered to the patient's skin), and the use of monopolar system (in this type of equipment, the electric current transmitted by the active electrode passes through a larger body area of the patient before finding the dispersive electrode)[13].

Other risk factors identified in a literature review were the elective procedures scheduling, the lack of communication between the nursing and medical teams, and lack of knowledge of professionals about functioning, usage, and care required for the safe use of electric scalpel[9].

An environment rich in oxygen, which is a combustible substance, associated with the use of devices capable of providing ignition such as electric scalpel, was also identified as a risk factor for incidents in the intraoperative period[9,11].

The lack of knowledge of the professionals on the system linked to the electric scalpel and its correct functioning was appointed as another risk factor in two studies[2,5]. Both studies report the existence of deficiencies in continuing education and training of nurses and nursing technicians who work in the operating room.

The prevention of complications inherent to the surgical anesthetic procedure is a crucial role of nurses, who are responsible for the planning and implementation of interventions to minimize risks and ensure privacy and security for the surgical patient[14].

It is worth mentioning that the patient stay in the operating room should be considered itself a risk factor for skin lesions, as it is related to several factors such as inadequate

Table 1. Categorization of articles included in the integrative review (n=6). Sobral (CE), Brazil, 2016.

Authors/year/ type of study	Journal	Objectives	Main results	Key findings	Level
Afonso Carvalho & Oliveira/2014/ Integrative review[5]	Rev Invest Enferm	To verify to which extent the knowledge of the nursing team on the use of electric scalpel influences patient safety, and to identify risk factors and prevention of accidents.	Ineffective communication among members of the surgical team was indicated as an intensifying factor for the occurrence of complications and for the risk of incidents in the surgical environment.	It is necessary to adopt measures to promote patient safety in the operating room, such as implementation of a meeting of the multidisciplinary team before the surgical procedures and the use of continuing education measures for professionals concerning preventive measures and actions in case of fire.	V
Brito & Galvão/2009/ Integrative review[9]	Rev Gaúcha Enferm	To search and evaluate the scientific knowledge produced on nursing care related to the use of electrosurgery in the intraoperative period.	The study indicated that the technical and scientific knowledge is imperative for nurses working in the surgical context. The evidence of the study supports the implementation of policies and procedures to promote the safety of the surgical patient.	The conclusion of the study indicates the need to implement actions that contribute to the improvement of nursing care quality in the perioperative period.	V
Almeida et al. 2012/Case Study[10]	Rev Bras Anestesiol	To report a case of fire in a surgery facility during a blepharoplasty in which oxygen was administered through a nasal catheter.	Authors indicated the occurrence of fire in the operating room as a reflection of the importance of continuing education actions for surgeons, nursing assistants, and technicians regarding the composition of surgical materials. Authors also connected the incident to the requirement of maintaining O_2 sources distant during the use of electric scalpel, to the knowledge on appropriate use of antiseptics, and ignition mechanisms that trigger a fire. In the case described, the fire was caused by the ignition mechanism.	The study led to the conclusion that the first step for preventing fire in the surgical field is the constant reminder of the possibility of fire. All professionals working in the operating room should pay attention to this possibility, especially anesthetists, surgeons, and nursing assistants and technicians.	VI
Parra, Giannasttasio & Diniz/2012/ Quantitative study[2]	Rev SOBECC	To identify the knowledge of nursing professionals in the operating room as the use of electric scalpel.	Among the results, the authors indicate that although the use of electric scalpel is frequent in the operating room, there was effective training for only 54% of the professionals. 72% of respondents were unaware of specific care to patients with pacemakers who need to use the electric scalpel.	The authors concluded that there are gaps in training of nursing teams regarding the use of electric scalpel and it is necessary to adopt measures to minimize such gaps.	VI
Khales et al./2012/ Case study[11]	Ann burns Fire Disasters	To describe the measures taken in cases of skin burns to patients caused by electric scalpel.	The authors describe cases of burns caused by electric scalpel and report: (1) the inexistence of complications of underlying diseases as a result of the burns suffered by patients; (2) the extension of hospital stay in four cases; and (3) the provision of psychological support to all patients.	The authors concluded that the burn by electric scalpel plate is a rare, but serious, accident owing to the depth of the lesion, to its location, and especially because it is caused during a surgery. The management of the burn should be carried out in a specialized environment and the prevention is the best action to avoid this type of accident.	VI
Afonso et al./2010/ Integrative review[12]	Arq Bras Cir Dig	To discuss aspects related to the proper use of electrocautery.	The authors offered a number of recommendations related to the use of electrocautery and recommended the use of insulating devices on the table and in the arms and legs support.	The authors concluded that it is essential for the multidisciplinary team to know the basics of electrosurgery to minimize the risk of accidents.	V

surgical positioning, failures in adornments withdrawal, risk of developing pressure ulcers, and risk of burns from electrical equipment or chemical substances[7]. Again, it is imperative that health professionals are aware of such risk factors so they can promote patient safety.

Team knowledge on the use of electric scalpel

A survey focused on the current knowledge of operating room nurses about the system linked to the electric scalpel and its correct functioning. The study found significant deficiencies in the training of these professionals, as only 54% received effective training on the use of electric scalpel, and 72% were not aware of specific care for pacemaker patients[2].These results indicate the urgency of implementing continuing education actions for the professionals working in the operating room, such as courses and periodic training. A study developed with surgeons from 19 UK hospitals found that the knowledge of the surgeons on patient's safety improved significantly after participating in a training program. It was also found that attitudes related to error analysis, improvement of patient's safety, and the ability to influence other professionals to promote patient's safety improved significantly in the post-training period compared to the pre-training period[14].

It is worth mentioning that the nurse should focus on the use of electric scalpel, mainly because it is widely used. Technological advances are accompanied by the need for ongoing training and update of the nursing team in order to build technically and scientifically grounded knowledge for a quality care to surgical patients.

Nurse's role in the prevention of risks associated with electrosurgery

The role of the nurse was the main subject of one of the studies included in this review. The authors of this study highlighted the following precaution procedures that should be performed by nurses: the use of aqueous antiseptic solution instead of alcohol (because alcohol is a flammable solution); the electric scalpel power adjustment to a level that do not produce sparks; placing surgical cloths as far as possible from heat sources; the rational use of oxygen, which should only be administered to patients at risk of hypoxemia and giving preference to well-adapted nasal glasses; and effective communication among members of the health team in order to prevent incidents related to the use of electric scalpel[5].

The importance of nursing care plan in the intraoperative period should be highlighted. This plan should include the assessment of risks associated with surgical procedure and include diagnosis and nursing interventions focused on these risks. The operating room is designed to provide a safe therapeutic environment to the patient, but this is only possible when the patient needs are identified and fulfilled. Thus, it is nurse's responsibility to recognize and minimize potential environmental hazards involving the patient or members of the surgical team during all phases of the surgical care[15].

Nurses have a significant role in promoting best practices in the operating room, including the correct use of the electric scalpel and the implementation of measures to avoid accidents related to the use of this equipment. For being in the front line of care, nurses are in an ideal position to inform and advise other team members in relation to such practices aimed at patient safety, to oversee the use of the equipment, and to adopt the necessary security procedures in the surgical environment.

Although the nurse is in front of the line of care, prevention of accidents related to the use of electric scalpel and other incidents is a result of teamwork. Learning from mistakes is essential, such as occurred in the incident that was reported in one study[10] and this is also a recommendation of the patient safety program Comprehensive Unit-based Safety Program (CUSP). This program, originally designed for intensive care units (ICUs), emphasizes the collaboration among members of the healthcare team to minimize incidents in hospitals. This program is already under test in operating rooms in the USA. Authors of a study observed a significant and steady increase in the scores that measure patient safety culture, and a decrease in the replacement rate of nurses in the unit from 27 to 0% in a period of three years after the implementation of CUSP in a surgical center[16].

The findings of this review can be used by nurses, teachers and hospital managers – especially of surgical units – to acquire updated knowledge about the care related to the use of electric scalpel and to disclose results of research on attitudes and practices of nurses related to the use of such equipment.

According to the studies, gaps in the acquisition of knowledge and training for proper and safe handling of

electric scalpel serve as a warning for the need of a greater investment in the actions for continuing education of health professionals. This integrative review can also serve as a source of information for the development of training, preparation of manuals and guidelines, or for the elaboration of policies in the near future, to promote best practices in the use of electric scalpel. Such actions are necessary to improve the quality of the care provided and to ensure the safety of the patient.

Limitations

This integrative review has some limitations. First, the reduced number of studies included in the final sample has limited the research findings. This limitation was expected owing to the specificity of the research theme and the scarcity of publications on the subject under study. Second, among the studies analyzed, only three were developed in practical application scenarios (and one is a case report the generalization of which is restricted). The lack of studies related to knowledge and practice of nurses in the operating room with respect to the handling and supervision of the use of surgical equipment should be highlighted. Finally, the search strategy adopted a limited use of keywords and databases. This may have caused the exclusion of potentially relevant studies and some papers of difficult access. In addition, studies with negative results are not usually published and can be accessed only by specific searches in the gray literature (documents produced by ministries, government agencies, private organizations, and academic institutions), which were not part of the search strategy adopted in this review.

CONCLUSION

This study allowed identifying evidence in the scientific literature concerning the risks associated with the use of electric scalpel and the necessary care to minimize these risks. The studies included in the review highlighted the importance of communication among members of the multidisciplinary team to develop joint prevention actions related to electrosurgery which are capable of minimizing the risks associated with surgical procedures. We also concluded that actions must be implemented so that nurses and nursing technicians can acquire an appropriate level of knowledge and skills related to safety of patients undergoing electrosurgery.

REFERENCES

1. Possari JF. Centro cirúrgico: planejamento, organização e gestão. 4ª ed. São Paulo: Iátria; 2009.
2. Parra RLC, Giannasttasio MB, Diniz TRZ. O conhecimento dos circulantes de sala sobre a utilização do bisturi elétrico. Rev SOBECC. 2012;17(4):24-32.
3. Oliveira BC, Pirovano RSV. Educação continuada para os profissionais de enfermagem em centro cirúrgico. In: 9° Congresso Brasileiro de Enfermagem em Centro Cirúrgico, Recuperação Anestésica e Centro de Material e Esterilização. Anais... São Paulo: SOBECC; 2009. p. 100.
4. Rothrock JC. Cuidados de enfermagem ao paciente cirúrgico. 13ª ed. Rio de Janeiro: Elsevier; 2007.
5. Afonso FIS, Carvalho MSLE, Oliveira LMN. O papel do enfermeiro na prevenção de complicações associadas à prática da eletrocirurgia. Revista Investigação em Enfermagem. 2014;9:76-80.
6. Galvao CM, Sawada NO, Trevizan MA. Revisão sistemática: recurso que proporciona a incorporação das evidências na prática da enfermagem. Rev Latino-Am Enfermagem. 2004;12(3):549-56. doi: 10.1590/S0104-11692004000300014
7. Ursi ES. Prevenção de lesões de pele no perioperatório: revisão integrativa da literatura [Dissertação]. Ribeirão Preto: Universidade de São Paulo; 2005.
8. Polit DF, Beck CT. Using research in evidence-based nursing practice. In: Polit DF, Beck CT (Eds.). Essentials of nursing research. Methods, appraisal and utilization. Philadelphia: Lippincott Williams & Wilkins; 2006. p. 457-94.
9. Brito MFP, Galvão CM. Os cuidados de enfermagem no uso da eletrocirurgia. Rev Gaúcha Enfermagem. 2009;30(2):319-27.
10. Almeida CED, Curi EF, Brezinscki R, Freitas RCD. Incêndio no centro cirúrgico. Rev Bras Anestesiol. 2012;62(3):435-8.

11. Khales A, Achbouk A, Belmir R, Cherkab L, Ennouhi MA, Ababou K, et al. Brulure par plaque de bistouri electrique: a propos de quatre Cas. Ann Burns Fire Disasters. 2010;23(3):151-4.

12. Afonso CT, Silva AL, Fabrini DS, Afonso CT, Côrtes MGW, Sant'Anna LL. Risco do uso do eletrocautério em pacientes portadores de adornos metálicos. ABCD Arq Bras Cir Dig. 2010;23(3):183-6. doi: 10.1590/S0102-67202010000300010

13. Galvão CM, Sawada NO, Rossi LA. A prática baseada em evidências: considerações teóricas para sua implementação na enfermagem perioperatória. Rev Latino-Am Enfermagem. 2002;10(5):690-5. doi: 10.1590/S0104-11692002000500010

14. Arora S, Sevdalis N, Ahmed M, Wong H, Moorthy K, Vincent C. Safety skills training for surgeons: A half-day intervention improves knowledge, attitudes and awareness of patient safety. Surgery. 2012;152(1):26-31.

15. Monahan FD, Sands JK, Neighbors M, Marek JF, Green-Nigro CJ. Enfermagem médico-cirúrgica: perspectivas de saúde e doença. 8ª ed. Loures: Lusociência; 2010.

16. Timmel J, Kent PS, Holzmueller CG, Paine L, Schulick RD, Pronovost PJ. Impact of the Comprehensive Unit-based Safety Program (CUSP) on safety culture in a surgical inpatient unit. Jt Comm J Qual Patient Saf. 2010;36(6):252-60.

LOGISTICS OF A SURGICAL BLOCK IMPLEMENTATION IN THE FOREST: THE NURSE'S ROLE

Logística de implementação de bloco cirúrgico na floresta: atuação do enfermeiro

Logistica de la implementación del bloque quirúrgico en el bosque: actuación del enfermero

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ABSTRACT: Objective: To report the experience of volunteer nurses at the Civil Society Organization for Public Interest "Expedicionários da Saúde" during the implementation process of surgical, supply and sterilization centers of a field hospital in an indigenous village in northern Brazil. **Methods:** Descriptive and narrative experience report, with a qualitative approach conducted from September to November 2015. **Results:** The structural process and the implementation of surgical, supply and sterilization centers in isolated areas included five stages, which depended on the participation and involvement of nurses in activities ranging from planning and management to the execution phase. **Conclusion:** Nurse's professional engagement and commitment in all stages contribute to ensuring the safety and quality of surgeries performed on indigenous patients, an effort that prioritizes organization, systematization, and scientific processes.
Keywords: Nursing. Logistics. Surgicenters. Health of indigenous peoples. Volunteers.

RESUMO: Objetivo: Relatar a experiência de enfermeiros voluntários na Organização da Sociedade Civil de Interesse Público Expedicionários da Saúde no processo de implementação de centro cirúrgico e centro de material e esterilização de hospital de campanha em aldeia indígena na região norte do Brasil. **Método:** Pesquisa descritiva, narrativa, com abordagem qualitativa, do tipo relato de experiência, realizada entre os meses de setembro e novembro de 2015. **Resultados:** O processo de estruturação e implementação de um centro cirúrgico e centro de material e esterilização em áreas isoladas conteve cinco etapas e contou com a participação e o envolvimento de enfermeiros desde o planejamento e gerenciamento das atividades até a etapa de execução. **Conclusão:** O engajamento e o compromisso dos profissionais enfermeiros em todas as etapas contribuem para a garantia da segurança e da qualidade das cirurgias realizadas no paciente indígena, por meio de um trabalho que prima pela organização, sistematização e cientificidade dos processos.
Palavras-chave: Enfermagem. Logística. Centros cirúrgicos. Saúde de populações indígenas. Voluntários.

RESUMEN: Objetivo: Reportar la experiencia de enfermeros voluntarios en la "Organización de la Sociedad civil de Interés Público Expedicionarios de Salud" en el proceso de la implementación de quirófanos y centros de material de esterilización en hospitales de campaña en aldeas indígenas en la región norte del Brasil. **Método:** Investigación descriptiva, narrativa, con enfoque cualitativo, de tipo de relato de experiencias realizadas entre septiembre y noviembre del 2015. **Resultados:** El proceso de estructuración e implementación de un quirófano y centro de material y esterilización en áreas aisladas contiene cinco etapas, y cuenta con la participación y el desarrollo de enfermeros desde la planificación y el gerenciamiento de las actividades hasta la etapa de ejecución. **Conclusión:** El empeño y lo compromiso de los profesionales enfermeros en todas las etapas contribuyen para la garantía de la seguridad y de la cualidad de las cirugías realizadas en el paciente indígena, por medio de un trabajo que prioriza la organización, la sistematización y los procesos científicos.
Palabras clave: Enfermería. Logística. Centros quirúrgicos. Salud de poblaciones indígenas. Voluntarios.

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INTRODUCTION

The assistance to indigenous people in Brazil is marked by challenges that simultaneously consider universal, equal access to healthcare services, as well as the assurance and respect to culture, beliefs, traditions and customs of the multiple ethnicities present in the country. The Federal Constitution of 1988, in articles 231 and 232, recognizes the rights of indigenous peoples concerning the land and social and cultural organization. It also demonstrates that it is up to the Brazilian state to guarantee those rights, so that they can fully exercise their citizenship[1].

However, the 1990 Organic Health Law established the commitment to prevention, promotion, recovery, and rehabilitation of indigenous health in the Unified Health System (SUS), by forming the Subsystem of Indigenous Health Care[2]. In 2002, an important initiative from the Ministry of Health to restructure Indigenous Health Care reinsured the specialized and differentiated characteristics of the healthcare provided to these peoples by instituting the National Policy of Health Care for Indigenous Peoples (PNASPI)[3].

In this context, several movements in Brazilian society act in order to increase the access to health practices among indigenous peoples. The Civil Society Organization of Public Interest (OSCIP) Expedicionários da Saúde (EDS) began working in 2003 with the intention of promoting, complementing, and integrating specialized surgical care through volunteer work to indigenous peoples in isolated areas of the country. After the articulation and technical cooperation established with public institutions (i.e. Ministry of Defense, Ministry of Health and National Indian Foundation [FUNAI]), and private companies, with financial donations, services and materials, EDS was established and collectively built a process of volunteer work as well as provided essential information to promote and contribute to indigenous population health.

For being practical, volunteer work brings social and collective values to the individual, according to their lived experiences. The importance of taking part in volunteer activities lies in the fact that it actively encourages social responsibility, autonomy, and creativity in the participants[4,5].

By being agents of health education, care, and management, nurses compose the multi-professional team of EDS, aiming at implementing and developing technical skills and procedures on a scientific basis, focusing on promoting an efficient work process. Working in accordance with the Resolution from the Federal Nursing Council (COFEN) n. 424/2012[6], the nurses are involved and present in all stages of the Expedition, especially concerning the logistics to construct a surgical center (SC), and a material and sterilization center (MSC) in Indian villages. Currently, besides nurses, the EDS team is composed of doctors (anesthetist, surgeon, pediatrician, gynecologist, ophthalmologist, general practitioner and orthopedists), pharmacists, odontologists, and other professionals working with logistics.

Nursing gains visibility and new opportunities by demonstrating its integrative and interactive care skills, whether in health promotion and education, in the sensitization and mobilization to implement policies addressing the well-being of families and communities[7]. The holistic component present in the professional behavior of nurses leads to the inseparability of their presence and the implementation of actions, interventions and work processes in safe, participative, continuous, whole, individualized, documented and evaluated SCs and MSCs[8].

Concerning their relationship with indigenous health practices, the nursing professional needs to understand the population's ethnic and cultural differences, in addition to the health and sickness profiles of this population, by respecting and appreciating the traditional knowledge and their sociocultural identity. Additionally, it is essential to be aware of the juridical-political aspects that legitimates, qualifies and guarantees the rights of these peoples, thus contributing to minimize the history of inequality they experience in the country[9,10].

In EDS, the professional nurse plays an essential role: beginning with the stage of planning/organization, executing the work, and ensuring the systematic operation of the processes of storage, conservation, distribution, transportation and management of materials and equipment that will be used; with the goal to maintain their integrity, validity, and quality to guarantee the safety of the patients. The processes have been systematically organized by professionals with experience and practice, on a scientific basis.

Key elements in the work of EDS include valuing nurses, dialogue and communication, which are well established among the members of the multi-disciplinary team. The activities, when carried out as a group and in respect to the background and participation of each member, lead the team to incorporate the human aspect of the work in understanding that the meaning of their presence in the group is greater than the simple execution of services[11].

Therefore, contextualized in this evolving environment of social skills, the nurse generates and shares new knowledge

in the SC and MSC environments, in isolated areas, and trains these teams on hospital processes, focusing on stimulating the self-critical thinking that can contribute to advancing a safe, high quality practice.

OBJECTIVE

To report the experience of volunteer nurses in the process of implementing SC and MSC of a campaign hospital in an Indian village in the North of Brazil.

METHOD

This is a descriptive and narrative study, with a qualitative approach, characterized as an experiential report. The report was based on the experiences of volunteer nurses in the logistics of implementing a SC and a MSC in an Indian village in the North, between September and November 2015, regarding the 34th Expedition named "Munduruku." However, it is important to mention that this experience has been improved over the course of 13 years, enabling the development of competencies and technical-scientific skills, as well as ethical, social, and cultural skills.

SC and MSC are structured based on campaign hospitals for humanitarian actions. These hospitals are characterized by a mobile modular structure, with equipment that assures logistical autonomy for healthcare (generators, lightning, thermic isolation, purification of water, acclimatizing units, fuel etc.). Therefore, they have the potential to provide healthcare at different levels of attention in isolated areas, in addition to intervening in environments where the health structure is poor. The mobile SC of EDS depends on six surgical tents to provide care in the fields of ophthalmology, gynecology and odontology, in addition to state-of-the-art equipment to guarantee care according to the principles of safety, prevention, and quality.

The study aimed at describing the five necessary logistical stages to reach the objectives of the 34th Expedition:

1. Preparation of the material and the equipment in the distribution center;
2. Logistic preparation of the structure of the Expedition;
3. Setting up the SC and the MSC;
4. Maintaining the SC and the MSC;
5. Returning the materials and the equipment in the distribution center.

RESULTS

The association Expedicionários da Saúde began its activities 13 years ago, and it is based in the state of São Paulo. This office not only handles administrative and management issues, but also hosts the meetings of the multi-professional team. Additionally, there is a distribution center (DC) to store and keep the materials and equipment that will be used in the Expeditions. Since the beginning, the nurse is part of the team and participates in the planning and decision-making processes in all stages of the Expedition.

Currently, EDS has a nursing team composed of a nurse coordinator and a rotating group of volunteer nurses. Each Expedition has the ability to include ten volunteer nurses, in addition to a nurse coordinator. During the execution of the Expedition, the volunteer nurses of EDS and the nursing team from the Special Sanitary District of Indigenous Health (DSEI), are distributed among the SC, MSC, preoperative, postoperative sectors, gynecology outpatient clinic, ophthalmology outpatient clinic, other clinics and screening centers.

Preparing the material and equipment in the Distribution Center

The first stage regarding logistical and operational preparation is called mobilization, which begins 60 days before the operation stage. It comprises the set of processes and actions that prepare and distribute the staff and load to the operation location, as well as assemble, turn on, and test all of the equipment.

The management of material resources and equipment is a responsibility of the nurse coordinator, which includes the prediction and provision of materials and equipment, whereas the process of checking, preparing and organizing the temporary and permanent material is conducted mainly by volunteer nurses, but with the coordinator. It is important to mention that some equipment is borrowed from partner companies.

The work dynamics, at first, includes a list of the available stored materials, in order to control the stock and the adequate use of materials to avoid waste. It is essential that the professional involved in this stage pay attention to the quality and quantity of the material to be used, verifying the expiration date and the integrity of the package, in order to reduce risks and guarantee the continuity of care.

The stage of organizing boxes (such as containers) with the material predicted for the Expedition is called waybill, and it takes two to three days to be finalized through group work. The inputs are checked (expiration date, integrity of the package and quantity), placed in individual plastic bags according to type, and then stored in larger plastic bags inside the box (Figure 1). The use of plastic bags aims at preventing the damage to the material in case the box is opened due to extreme transportation conditions until the final destination, which is the village.

The box is made of a hard, waterproof plastic material with a lid, includes a variety of different colors and numbers, and has a capacity of 180 liters. However, it is ideal to store up to only 30 kg to make transportation easier. Each box has a list of types and number of materials, which should be signed by the professional in charge of organizing it. The equipment load and inputs account for an approximate total of 15 thousand kg in each expedition.

Logistics preparation to organize the Expedition

Logistical preparation occurs approximately six days before the Expedition. One volunteer is in charge of leading the assembly and is introduced to all participants. Every day the team regrouped and was oriented regarding the designated activities, and communication took place through radios and meetings, according to the need.

The assembly team is composed of groups, and each one is responsible for specific areas such as: installation of the electrical network and generators, tent assembly, furniture cleaning and reallocation, equipment, medication and inputs. The assembly is concluded two days before the Expedition. At this time, the full electric charge is simulated using all of the electrical and electronic equipment in the Expedition, with the objective of detecting possible overload. In case the generators fail, contingency plans are developed regarding the distribution of drinking water, problems in the sanitary network, among others. There are volunteers to repair electric, hydraulic, and general services. The Expedition has the potential of up to 40 surgeries a day.

Source: Expedicionários da Saúde, 2015.

Figure 1. Transportation containers to take material and equipment, placed in the Center of Material Distribution, in Manaus.

Assembling the Surgical Center and the Material and Sterilization Center

The organization of the SC and the MSC constitutes one of the most important stages for the efficacy of the surgical process. However, the technical-scientific knowledge of the nurse during the Expedition is essential in supporting the other volunteers in the logistics department, as most of these volunteers come from other areas.

Therefore, nursing knowledge becomes a useful tool in adapting the physical structure of a SC and a MSC to the reality of a campaign hospital in the forest, guiding its actions according to RDC n. 50 and 15[12,13]. It is also possible to use support tools, such as the nursing process, which establish and quantify indicators of quality and quantity.

The place chosen to construct the SC and the MSC was a shed, previously built by the local Indian community, which included the SC, the MSC and the ophthalmology outpatient clinic. Strategically, the MSC was placed next to the SC in order to optimize the delivery and collection of materials, as well as processing the medical instruments (Figure 2).

After the logistics team set up the tent structures, installed the air-conditioning equipment and the entire electric and hydraulic structure, the SC and the MSC were ready to receive the final assembly and to validate the equipment.

In the SC, the team of volunteer nurses at EDS have to: administrate and assist in the process of organizing the main equipment for surgery; clean and organize operation room; provide inputs; and guarantee the control of the influx of patients in addition to their safety and comfort. With the medical team, the nurses manage the schedule of procedures by determining which cases are of higher surgical complexity. Additionally, other factors are considered to prioritize the surgery, such as age,

chronic conditions, capacity of preoperative demand, and daily surgical potential.

Among the responsibilities mentioned, considering the extreme transportation conditions (land, air, and water) that can cause breakage or miscarriage, the materials and equipment were checked for integrity, and tests for the electronic devices were conducted.

With the nursing team from DSEI, the nurses volunteering at EDS began to clean the SC and MSC tents and then cleaned the furniture. After these procedures, two rooms were organized, one for general surgery and another one for ophthalmologic surgery. The clinical engineering team assembled the equipment.

The corridor to enter the SC has surgical clothes and personal protective equipment (PPE): caps, masks and foot protection. Even though the latter has not been so common lately[14], it is still used in the Expedition in order to reduce the contamination with external dirt, not with the goal of preventing infections. The restroom is placed between both surgical rooms. The nursing team is also in charge of providing surgical brushes with antiseptic solution and liquid soap to disinfect hands.

The structure of the MSC was based on a model of campaign hospital tents (Figure 3). According to the recommendations of RDC n. 15[13], it was divided in a clean and a dirty area in order to maintain them independent and to guarantee the unidirectional flow.

The cleaning station is composed of a stainless sink with two bowls, two ultrasonic washers, besides, tables and benches. The materials coming from the SC, the ophthalmologic clinic, the gynecology outpatient clinic, pediatrics and odontology come in sealed boxes, exclusively to transport used material, and are delivered through a window, also exclusive for this type of material.

The cleaning area has benches, shelves and tables, which are used to keep 5 steam gravity autoclaves, with the capacity for 21 L, 1 54 L autoclave, 1 water distiller, 1 incubator for biological tests, and 2 surgical sealants. Additionally, 2 21 L autoclaves and 2 back-up sealants were available. The processed materials are distributed in closed boxes, also through an exclusive window.

The final assembly of the MSC also counted on the support of DSEI's nursing specialists in addition to the expert volunteer of EDS and the technical person in charge of the sector. The EDS nurses and the clinical engineering team checked the electric and hydraulic areas to guarantee the equipment was functional, as well as the safety of the team.

Only after the safe conclusion of the final assembly (Figure 4), in which all equipment and inputs were installed and allocated, tests were conducted to validate the autoclaves and the other equipment, all with satisfactory results. These results initiated the document records of quality and quantity indicators. These indicators are important tools to improve these processes, which include logistics[14].

The role of nursing in organizing both the sector and the Expedition makes logistics easier, generates costs reduction, optimizes the processes, and guarantees the safety of the team and the patients.

Source: Expedicionários da Saúde, 2015.

Figure 2. External structure of the Campaign Hospital, view of the entrance and exit of the surgical center.

Source: Expedicionários da Saúde, 2015.

Figure 3. Internal structure of the material and sterilization center, view to the clean and dirty areas.

Disassembling the Surgical Center and the Material and Sterilization Center

On the last day of the Expedition, the sectors began to be disassembled with the help of DSEI's nursing team. When the procedures were concluded, all equipment and materials were cleaned, dried, packed and stored in transportation boxes. A box with sterilized surgical instruments was organized in case there were possible complications with patients and/or team.

The procedures to disassemble the SC and the MSC require skilled professionals with specific knowledge. Therefore, the nursing professional is an essential participant in this stage as well[14]. In the disassembly, the logistics team had a checklist that facilitated the organization and the checking of furniture and equipment used during the Expedition, which afterwards were inputted into software to control the output of materials, equipment and supplements used during the Expedition and the return to the DC.

In this stage, nursing and logistics volunteers conducted an inspection at EDS, which generated a maintenance report of the equipment. The equipment and furniture were stored in the same way they were organized to enter, that is, sealed in container boxes and identified by colors and numbers. At the end of this stage, other teams continued to disassemble the tents and the entire electric and hydraulic structure.

Return of the materials and equipment to the distribution center

On the next day, after the conclusion of the Expedition (Figure 5), all of the accounted material was accompanied on the return to the DC by the EDS logistics team. Since this logistics involved land, water and air transportation, climactic variations caused a delay in the return of the load – it took 20 days to arrive to the DC.

After the boxes were kept in the DC by the EDS logistics team and professionals in the transportation company, the process of demobilizing the load began. Groups, including the nursing and the logistics team of EDS, conducted this process.

In the demobilization step, all boxes were opened to check the materials and inputs for their quantity and integrity, and then reorganized in the DC. The equipment lent to EDS was returned to the original companies, and the EDS equipment were sent to preventive and corrective maintenance.

At this stage of concluding the Expedition, some transportation boxes were damaged. However, the internal content was not compromised nor lost.

DISCUSSION

A large part of the population does not have access to surgical services since there is deficit of surgeons, anesthetists, and obstetricians in the world. Historically, non-governmental organizations (NGOs) have been trying to fill this specific need. However, the exact contribution of these institutions has not been well documented[15].

Between 2008 and 2012, all of the continents presented significant rates of volunteer work, with an average of 37.9% in Oceania, 22.8% in the Americas, 19.7% in Asia, 17.2% in

Source: Expedicionários da Saúde, 2015.

Figure 4. Internal structure of the surgical center, operation room.

Source: Expedicionários da Saúde, 2015.

Figure 5. Moment of celebration of the volunteers in Expedicionários da Saúde and Indians of the Munduruku and Kaiapó community, after the conclusion of the 34th Expedition Expedicionários da Saúde.

Europe, and 17.0% in Africa. These data show that active and regular volunteer participation is vital to sustain the activities of communities and nonprofit organizations[16,17].

An integrative review conducted with the objective of numbering and describing the NGOs offering surgical care found 403 working in 139 countries, but only 2% work in mobile surgical centers in rural or remote areas[15]. EDS was not included in this review. However, it should be highlighted that EDS is part of a minority, which, in this specific case, mounts a campaign hospital in the forest.

The nursing work with indigenous peoples is based on two basic premises: on the technical skill of the professional and on the relationship of trust. In support centers for indigenous health (CASAIs), the nursing team plans the assistance and the actions that should be conducted with indigenous patients, which includes managing transportation, food and lodging, since they need to travel great distances to have access to medical care[18]. However, the EDS is mobilized and adapts its logistics so that surgical care to the indigenous peoples are offered in the forest and in the villages that were previously selected according to the demand and the support of FUNAI, the Special Secretariat of Indigenous Health (SESAI) and DSEI.

The measure of good performance of a SC is directly related to the quality of its own processes and the services it supports, which results from the combination of physical and technological installations, adequate equipment, and the skilled, trained and competent work of the nursing team. Therefore, to maintain the agility and organization of the surgical process, it is necessary that the members of the nursing team have deep knowledge and experience in the field[19].

Since this is a different environment, focused on the health of the indigenous population, the work dynamics and the professional relationships on an Expedition should be reciprocal with a skilled, trained team able to face the demands and the challenges imposed by the changes in the environment, the culture, the technology, and the sociopolitical and economic issues of public health[20]. Since there are not many Brazilian publications on nursing work concerning the logistics of a health Expedition, especially regarding care in isolated areas, there is a need for more studies in this field.

From this perspective, EDS recognizes and values the importance of the nurse; therefore, it has a relationship with a team of nurse volunteers who actively participate in all the logistical stages of an Expedition. These professionals understand the influence of their collaboration, which surpasses their physical presence. In this context, technical and scientific knowledge, creativity, and dynamism are essential to assist the medical team and obtain success in surgical procedures offered to indigenous peoples.

CONCLUSION

The possibility of working as volunteer nurses with indigenous peoples in isolated areas contributes to the development of human and social competencies and skills. The technical knowledge based on evidence, improved with the experiences of logistics in the implementation of SC and MSC, is only possible because of the engagement and commitment of the professionals involved. Their maximum effort is the guarantee of safety for the indigenous patient, through work that emphasizes the organization, the systematization and the quality of the processes.

The planning and management steps that come before the Expedition itself are essential to control the work processes, in order to minimize and/or prevent the occurrence of avoidable damage. Additionally, the systematic record of all actions conducted in all stages is a valued and mandatory tool in EDS, since it allows for assessing the results, generating indicators and qualifying care.

Implementing a SC and a MSC in the forest becomes viable from the moment when there is a dedication to fulfilling technical rules. Each professional involved is aware of their responsibility, both technical and ethical, so that surgical procedures can be executed with the same care from their original work environments.

The obstacles faced by transportation and geographic and cultural barriers are overcome by the multidisciplinary composition of EDS, by the inclusion of professionals and health workers of DSEIs, by the partnerships established with governmental institutions and private initiatives; and, above all, by the respect to the culture and the traditions of indigenous peoples.

EDS intends to create a referential model of specialized medical care to geographically isolated populations and facilitate the access to qualified care. Therefore, its mission is to bring excellent medical care, especially surgeries, to isolated indigenous populations, through quality services and responsible management. Therefore, by being inserted in contexts with characteristics that are completely different than usual, by receiving opportunities and defining their roles, nurses demonstrate the importance of nursing as an art, science, and practice to bring efficient healthcare services to different populations.

REFERENCES

1. Brasil. Constituição da República Federativa do Brasil: texto constitucional promulgado em 5 de outubro de 1988, com as alterações adotadas pelas Emendas constitucionais nºs 1/1992 a 86/2015, pelo Decreto legislativo nº 186/2008 e pelas Emendas constitucionais de revisão nºs 1 a 6/1994. 45a ed. Brasília: Câmara dos Deputados, Edições Câmara; 2015.

2. Brasil. Lei nº 8.080, de 19 de setembro de 1990. Dispõe sobre as condições para a promoção, proteção e recuperação da saúde, a organização e o funcionamento dos serviços correspondentes e dá outras providências. Brasília: Diário Oficial da União, 20 set. 1990. Seção 1, p. 18055.

3. Brasil. Política nacional de atenção à saúde dos povos indígenas. Brasília: Fundação Nacional de Saúde; 2002 [acesso em 2016 mar 13], 40 p. Disponível em: <http://bvsms.saude.gov.br/bvs/publicacoes/politica_saude_indigena.pdf>

4. Fior CA, Mercuri E. Formação universitária e flexibilidade curricular: importância das atividades obrigatórias e não obrigatórias. Psicol Educ. 2009;29:191-215.

5. Nunes DCG. Qual a importância do trabalho voluntário para a sustentabilidade de organizações não-governamentais? [dissertação]. Programa de Pós-Graduação em História, Política e Bens Culturais. Rio de Janeiro: Fundação Getúlio Vargas; 2009.

6. Conselho Federal de Enfermagem (COFEN) [Internet]. Resolução COFEN nº 424, de 19 de abril de 2012. Normatiza as atribuições dos profissionais de enfermagem em Centro de Material e Esterilização e em empresas processadoras de produtos para saúde. Brasília: Diário Oficial da União, 23 abr. 2012. Seção 1, p. 186.

7. Backes DS, Backes MS, Erdmann AL, Büscher A. O papel profissional do enfermeiro no Sistema Único de Saúde: da saúde comunitária à estratégia de saúde da família. Ciênc Saúde coletiva. 2012;17(1):223-30.

8. Fonseca RMP, Peniche ACG. Enfermagem em centro cirúrgico: trinta anos após criação do Sistema de Assistência de Enfermagem Perioperatória. Acta Paul Enferm. 2009;22(4):428-33.

9. Oliveira JWB, Aquino JM, Monteiro EMLM. Promoção da saúde na comunidade indígena Pankararu. Rev Bras Enferm. 2012;65(3):437-44.

10. Silva NC, Gonçalves MJF, Lopes Neto D. Enfermagem em saúde indígena: aplicando as diretrizes curriculares. Rev Bras Enferm. 2003;56(4):388-91.

11. Braga EM, Berti HW, Risso ACMCR, Silva MJP. Relações interpessoais da equipe de enfermagem em centro cirúrgico. Rev SOBECC. 2009;14(1):22-9.

12. Brasil. Resolução RDC nº 50, de 21 fevereiro de 2002. Regulamento técnico para planejamento, programação, elaboração e avaliação de projetos físicos de estabelecimentos assistenciais de saúde. Brasília: Diário Oficial da União, 20 mar. 2002.

13. Brasil. Resolução RDC nº 15, de 15 de março de 2012. Dispõe sobre requisitos de boas práticas para o processamento de produtos para saúde e dá outras providências. Brasília: Diário Oficial da União, 19 mar. 2012. Seção 1, p. 43-6.

14. Sociedade Brasileira de Enfermeiros de Centro Cirúrgico, Recuperação Anestésica e Centro de Material e Esterilização (SOBECC). Práticas Recomendadas SOBECC. 6a ed. São Paulo: SOBECC; 2013.

15. Ng-Kamstra JS, Riesel JN, Arya S, Weston B, Kreutzer T, Meara JG, et al. Surgical non-governmental organizations: global surgery's unknown nonprofit sector. World J Surg. 2016;40(8):1823-41.

16. Charities Aid Foundation. World Giving Index 2013: a global view of giving trends [Internet]. 2013 dez [citado 2016 mar. 28]. Disponível em: <https://www. cafonline.org/PDF/WorldGivingIndex2013_1374AWEB.pdf>

17. Snyder M, Omoto AM. Volunteerism: social issues perspectives and social policy implications. Soc Issues Policy Rev. 2008;2(1):1-36.

18. Ribeiro AA, Fortuna CM, Arantes CIS. Nursing work in an indigenous support institution. Texto Contexto - Enferm. 2015;24(1):138-45.

19. Santos MC, Rennó CSN. Indicadores de qualidade da assistência de enfermagem em centro cirúrgico: Revisão Integrativa da Literatura. RAS. 2013;15(58):27-36.

20. Freitas NQ, Dissen CM, Sangoi TP, Beck CLC, Goulart CT, Marion R. O papel do enfermeiro no centro cirúrgico na perspectiva de acadêmicas de enfermagem. Rev Contexto & Saúde. 2011;11(20):1133-6.

NURSING PRACTICE IN MINIMALLY INVASIVE VIDEO-ASSISTED CARDIAC SURGERY*

Atuação da enfermagem em cirurgia cardíaca minimamente invasiva videoassistida

Enfermería de práctica en cirugía cardiaca asistida por video mínimamente invasiva

Elisabete Silvana de Oliveira Sene[1], Dulcilene Pereira Jardim[2]

ABSTRACT: Objective: To report the nursing practice in the perioperative period of minimally invasive video-assisted heart surgery. **Method:** This is an account of the experiences of the nursing staff, during the perioperative period in this surgical technique, carried out in a teaching hospital that is a reference center for cardiology in the State of São Paulo. **Results:** The observation on the importance of the role of the nursing department in the preparation of the operating room, as well as in the reception of patients, assistance to anesthesia, preparation of patients for surgery, assistance to the team in the intraoperative period and when the patient leaves the operating room, and meeting the demands of this innovative surgical procedure. **Conclusion:** The nursing practice in the surgical center must be able to monitor the evolution of the surgical techniques, both in the handling of new materials and equipment and in direct patient care, aiming at surgical safety.

Keywords: Perioperative nursing. Operating room nursing. Thoracicsurgery,video-assisted.

RESUMO: Objetivo: Relatar a atuação da enfermagem no perioperatório da cirurgia cardíaca minimamente invasiva videoassistida. **Método:** Trata-se de um relato de experiência da equipe de enfermagem no perioperatório dessa técnica cirúrgica, realizada em um hospital-escola que é referência em cardiologia no Estado de São Paulo. **Resultados:** Observa-se a importância da atuação da enfermagem no preparo do centro cirúrgico (CC), recepção do paciente, assistência ao ato anestésico, preparo do paciente para a cirurgia, atendimento à equipe no período intraoperatório e na saída do paciente de sala operatória (SO), atendendo às demandas desta modalidade cirúrgica inovadora. **Conclusão:** A enfermagem de centro cirúrgico (CC) deve ser capacitada a acompanhar a evolução das técnicas cirúrgicas, tanto no manuseio dos novos materiais e equipamentos como na assistência direta ao paciente, visando à segurança cirúrgica.

Palavras-chave: Enfermagem perioperatória. Enfermagem de centro cirúrgico. Cirurgia torácica videoassistida.

RESUMEN: Objetivo: Presentar la práctica de enfermería en cirugía cardíaca mínimamente invasiva trans operativa videoassistida. **Método:** Se trata de un relato de la experiencia personal de enfermería durante la cirugía de esta técnica quirúrgica que se realiza en unos centros de referencia hospital universitario de São Paulo. **Resultados:** Toma nota de la importancia del papel de enfermería en la preparación de la sala de operaciones, así como en la recepción del paciente, la asistencia a la anestesia, la preparación del paciente para la cirugía, llame al equipo en el período intraoperatorio y la salida del paciente del sistema operativo, la satisfacción de las demandas de este procedimiento quirúrgico innovador. **Conclusión:** Un centro de Enfermería Cirurgico debe ser capaz de controlar la evolución de las técnicas quirúrgicas, tanto en el manejo de nuevos materiales y equipos como en la atención directa al paciente, el objetivo de la seguridad quirúrgica.

Palabras clave: Enfermería perioperatoria. Enfermería de quirófano. Cirugía torácica asistida por vídeo.

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INTRODUCTION

Historically, cardiac surgery has been performed for a little more than six decades; since then, its progress has been remarkable. The first successful heart surgery took place in 1938, in the United States of America (USA), by Dr. Robert Edward Gross, for the correction of patent ductus arteriosus, and the first correction of intracardiac defect was in 1952, performed by Dr. Floyd John Lewis, in a patient with interatrial communication. In 1951, it was the first time an extracorporeal circulation (ECC) was conducted in humans[1].

Transsternal median sternotomy is the most common access used in heart surgery. It was first introduced in 1957, to replace bilateral anterior thoracotomy, benefitting many patients by reducing the time of the surgery, and providing excellent exposure of the heart and reducing respiratory trauma, thus becoming the most used access nowadays. However, in the past few years, there has been great interest in reducing surgical trauma and providing more comfort for the patients. The new phase of heart surgery began in 2005 – minimally invasive surgeries, including video-assisted surgery and intra-cavitary procedures through peripheral ECC, vacuum assistance, and minithoracotomies. The surgical method employed was gradually progressive, giving space to possibilities of surgical approaches for different valve heart disease, coronary obstructions, and congenital anomalies[2,3,4].

Conceptually, the word "minimally invasive" refers to surgery conducted through small incisions, without a direct access to the heart or another organ to be operated; however, it obtains the same therapeutic results achieved from conventional surgery[4].Add to that the use of videoscope in the minimally invasive surgery, which provides a better view of intra-cavitary cavities in adequate moments of the procedure, ensuring success to the technique[5,6].

Therefore, minimally invasive video-assisted cardiac surgery (MIVACS) is a safe technique that reduces pain and postoperative complications, leading to reduced time of hospital stay and a consequent reduction of hospitalization costs; besides, it leads to the aesthetic satisfaction of the client resulting from reduced surgical trauma[5,6].

Comparatively, in conventional surgery by transsternal median sternotomy, the entire intracardiac cavity is exposed to the environment. If this situation is prolonged, it leads to an exponential increase in the risk of infections and hydroelectrolytic balance, which contributes to the weakening of the immunological response, thus resulting in a longer hospital stay for the patient[7].

With so many technological advances, new challenges and responsibilities came up for the nursing team in the surgical ward. So, the whole team needs to be specifically trained to work with accuracy in minimally invasive surgeries, both in the direct care for the patient and to accompany the fast evolution of equipment and devices used[7]. Therefore, it is important to share the experiences of the nursing team in the surgical center (SC) in this type of procedure, aiming at contributing with the growth of other professionals and at improving perioperative nursing care.

OBJECTIVE

To report the work of the nursing team in the perioperative period of MIVACS in a teaching hospital considered to be reference in cardiology in the State of São Paulo.

METHOD

This is a descriptive study, an experience report, aiming at studying an unknown or little known phenomenon in society, by exploring data to build a scenario. The study was based on the premise that problems can be solved and practices can be improved by the description and analysis of objective and direct observations[8].

The study aimed at describing the experience of the researcher and her team at the perioperative of patients submitted to MIVACS in a reference teaching school in cardiology, located in São Paulo. This major institution has 3 buildings and capacity for 373 beds, and is considered to be one of the largest cardiology hospitals in Latin America.

The surgical division is organized to meet the high institutional demand: ten conventional heart surgeries and five peripheral vascular surgeries per day are performed in eight surgical rooms and one room for hybrid procedures, besides four beds for anesthetic recovery. The latter are basically used for the recovery of patients submitted to hybrid minor procedures, such as carotid dissection for the access of cardiac catheterization and percutaneous procedures without indication of recovery in the intensive care unit (ICU). The ICU counts on 50 beds for post-surgery recoveries and post-heart transplant.

The nursing staff who work directly in SC care is constituted of 2 nurses in the morning shift and 2 nurses in the afternoon shift, 13 nursing technicians in the morning and 11 in the afternoon. Night shifts have six technicians and one nurse each. The elective surgical procedures are conducted only by day. The night shift only does emergency surgeries. There are also 12 surgical instrumentation technicians (6 in the morning and 6 in the afternoon).

In another building of the institution, there are more than four surgical rooms addressed to procedures such as implantation of pacemakers, peripheral vascular surgeries, and kidney transplants. In this same building, there is a fifth surgical room, with the objective of implementing the fetal medicine center, which will count on 15 neonatal ICU beds and 10 pediatric ICU beds.

On an average, 350 surgical procedures are conducted per month. MIVACS, specifically, has had only one procedure per month since November 2014, which is currently conducted by the same surgical team.

RESULTS

The main MIVACSs conducted in the analyzed institution are mitral prosthesis implant with biological or mechanical prosthesis and mitral valve repair; in some cases, epicardial electrode implantations are conducted.

In this experience report, the work of perioperative nursing in the implantation of mitral pericardial bioprosthesis in its isolated activities, as well as those shared with the other professionals in the operating room (OR), such as anesthetists, the main surgeon, the assistant surgeon, the perfusion technician, the surgical instrument technician, the clinical engineering technician and the echocardiography technician.

Because it is a specific and innovative surgical procedure, it was necessary to prepare the nursing team for a systematic work, aiming at preventing risks for the patient that are related to the surgical procedure itself, following the steps to come whose actions were guided by education, management and care.

In terms of education, the idea was to ensure the proper use of the new devices and equipments used in MIVACS. Practical classes were offered by the company in charge, and were addressed to the nursing team of the SC and the material and sterilization center (MSC), and surgical instrument technicians.

Concerning management, materials, and equipment necessary for the performance of MIVACS were properly predicted and provided, besides the standardization of items to execute the surgical procedure, with the creation of checklists used in the OR and requirements for specific materials. Regarding patient safety, institutional protocols were created referring to patient care in the intraoperative period.

As to care, Chart 1 shows the sequence of actions and procedures conducted by the multiprofessional team, including the nursing of SC for the video-assisted minimally invasive mitral pericardial bioprosthesis implantation (Figure 1).

DISCUSSION

The introduction of new surgical procedures considered innovative, like MIVACS, came as a response to the need for minor incisions, but with the increased visualization of the operation field, providing the same results obtained throughout the years with conventional surgery. This aggregates perceptible advantages to the clinical picture of the patient in the intra- and post-operative periods[9].

The technique demands adaptation of the surgeon when approaching heart cavities in a restricted manner due to the limited length of the incision, which is compensated by the use of videothoracoscopy. The handling of long instruments and the indirect visibility of the operative field are difficulties, which can be gradually overcome by the succession of surgical interventions, through which the skills and abilities in manipulations are improved[10].

Likewise, the procedure represents a challenge for the multiprofessional team, including the nursing staff in the SC, since it requires the assistant and the circulating nurse to adjust to the needs of the team and the patient in the trans-operative period.

In this sense, it is essential that the nursing team involved in MIVACS receive adequate training to perform their actions with knowledge and safety, both in care activities and in the handling of devices and specific equipment for this procedure, aiming at patient safety during the entire anesthetic-surgical procedure.

In order to facilitate the proper care of the surgical team and the patient in MIVACS, it is necessary to predict and provide these materials and equipment, besides standardizing them by creating a checklist with the minimum

Chart 1. Sequence of procedures to perform minimally invasive video-assisted surgery in a teaching cardiological hospital in the State of São Paulo.

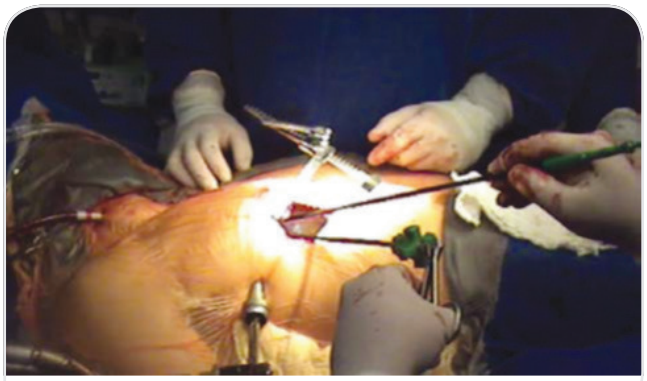
Surgicalindication
The criteria indicating the possibility to perform MIVACS in the institution include elective patients, without previous heart or thoracic surgery, weighing more than 50 kg and ejection fraction above 50%. Exclusion criteria: Obese patients, dilation of the ascending aorta, and thoracic deformities (*pectus excavatum e pectus carinatum*). The decision for the procedure is made by the cardiologist with the heart surgeon, with the proper clarifications to the patient and the family. Afterwards, the surgery notice is filled out and sent to the SC by the cardiologist to schedule the surgery.
Surgery schedule
It is made directly in the SC by the main and assistant surgeons, after analysis of the patient history and complementary preoperative examinations (electrocardiography, thoracic x-ray, transesophageal echocardiography, carotid artery ultrasound, abdominal, iliac and femoral aorta), by filling out a specific form describing data about the patient, surgery, and team, besides the necessary materials and equipment for the surgical procedure. The note is then given to the nurse of the SC, in charge of the surgical map, who predicts and provides them to the drugstore, MSC, and warehouse for the day of the surgery.
Preparation of the operating room
On the date scheduled for the surgery, the assistant nurse checks items such as reservations of blood derivatives, bed available in the ICU, besides checking, with the circulating, the institutional checklist of the assembly of the OR. This checklist verifies the presence and functioning of general items, such as preparatory cleansing, presence of equipment, cart for consumption material, cart of anesthetic drugs, materials necessary for orotracheal intubation and furniture, besides permanent materials and equipment, specific for MIVACS, requested at scheduling. The clinical engineering technician performs the test of all the equipment in the OR before the patient's entrance.
Receiving the patient in the SC
The patient is referred to the SC in a stretcher, accompanied by family members and the nursing staff in the hospitalization unit. At the entrance of the SC, the nurse receives the patient with the assistant surgeon, they check and confirm the following data: full name, identification bracelet, medical chart, and the anesthetic and surgical consent form. They both clarify possible doubts that may come both from the patient and the family members, then the nurse refers the patient to the OR.
Receiving the patient in the OR
In the OR, the patient is welcomed by the circulating nurse, who is assisted by the nurse and transfer him/her to the operating table under a thermal blanket at 38ºC, in the horizontal dorsal position. In this period, the air-conditioner of the operating room remains off. The circulating nurse checks the identification bracelet once again, as well as the medical chart and the consent form (signed). The nurse fills out the SAEP, including the admission in the room and prescribing, through a checklist, the nursing interventions to be carried out during surgery, as well as the items of surgical safety, which is carried out in a different form. All items prescribed are checked by the circulating nurse during the surgery.
Preparing the operating table
In parallel, the surgical instrument technician reviews the presence of single-use sterile materials, permanent and consigned materials (prosthesis, arterial and venous canal, PTFE neocorda – surgical suture made of polytetrafluoroethylene, Goretex and Carpentierrigid rings). After verification, the instrument technician gets ready and starts to assemble the operating room, with the assistance of the circulating nurse, who disposes the materials, previously separated, and checks the integrators, stored in a form in the patient's records.
Preparing the patient for anesthesia
With the patient in an operating room, the nurse performs a non-invasive verification (electrodes, invasive blood pressure and wrist pulse oximeter) followed by venous puncture by the anesthetist in the right forearm. The patient is placed sitting to perform the rachianesthesia, followed by the placement of disposable blades for external cardiac defibrillation, placed in the right scapular region and the left anterolateral hemithoracic region, as well as the insertion of a disposable electric scalpel in the right lumbar region. The patient is then placed in the horizontal dorsal decubitus position, the continuous electroencephalogram electrode is positioned in a frontal region to monitor the brain dynamics during anesthesia. Then, anesthetic induction begins (inhaling and venous), leading to orotracheal intubation, tube fixation, ocular protection, passage of the esophageal temperature sensor, and echocardiography probe.

Continue...

Chart 1. Continuation.

Preparingthepatient
After anesthesia, the patient's clothes are removed, respecting his privacy and comfort, enabling the verification of skin integrity, body hygiene, and trichotomy (anterior and posterior thorax, axillary, right and left inguinal region), which is performed in the room immediately after the patient is referred to the SC. The assistant surgeon is equipped to perform the central and arterial venous puncture, according to the institution's protocol to place the accesses – right side for the peripheral access (forearm) and central double lumen catheter (subclavian) to administrate the vasoactive drugs, anesthetics, and to measure CVP; and left side for the control of MAP and arterial gasometry. After these procedures, the indwelling bladder catheter for the control of urinary output. The horizontal dorsal position is maintained, however, with the placement of a cushion under the right lumbar region, to guarantee an inclination angle of 30º. The arms are maintained and fixated at the extension of the body. The main surgeon makes the incision markings of minithoracotomy and the assistant proceeds to degermation (solution of chlorhexidine degermante) and skin antisepsis (solution of alcoholic chlorhexidine). The team, which is already prepared, places the surgical fields and leaves the thorax exposed, as well as the right inguinal, to install the ECC canulla.
The intraoperativeperiod: MIVACS
The instrumental and auxiliary table with all of the materials is close, and the number of big, small compresses and gauze is checked by the instrument technician, with a proper note from the circulating nurse in a specific form. Then, the clinical engineering technician, the circulating and the nurse place the two video shelves, electric scalpel, defibrillator, hampers, besides opening the consigned materials and other specifics (box with optic fiber and boxes for minimally-invasive surgery), after the nurse checks it. An adherent and transparent film, made of chlorhexidine, is placed on the skin of the patient to fixate the surgical fields and to protect the operative field. The main surgeon begins the 4 cm incisions, to the level of 4th EICD, between ALL and RMCL (Figure 1). The ECC machine and the echocardiogram device are close together, and the first sample of arterial blood is analyzed to control blood parameters. After the full heparinization of the patient, ECC is established by femoral cannulation to the right, and temperature is established at 30ºC. Then comes the surgical act itself, with aortic cross-clamping, left atriochtomy, valvular excision, passage of stitches through the valvular ring, biological prosthesis and knots with surgical threads, by using the exclusive visibility through the video monitor. During the procedure, the position of the surgical table is rotated in Trendelemburg, reverse Trendelemburg, right and left lateral by the anesthesiologist. In the ECC period, the values of arterial gasometry, hematocrits, hemoglobin, electrolytes, and TTPA are verified every 30 minutes by the perfusion technician and the anesthetist, allowing the performance of the necessary corrections. The tests are sent and the results are received by the nursing staff, besides checking the blood derivatives, when necessary. After concluding the surgery, an inspection is conducted in the cavities with the assistance of transesophageal echocardiography, and the circulating nurse helps to re-heat the patient with a thermal blanket at 38ºC, warm venous infusions and by turning off the air-conditioner. To return the heart to the sinus rhythm, the surgeon requests the circulating nurse to prepare an external defibrillation load of 10 joules. The active and joint conference of blood loss is made by compresses and gauze and hydric balance (registered in a proper form), besides the correct storage of materials removed from the patient for posterior pathological anatomy, properly protocoled by the nursing team. The bandages and drains are installed by the introduction of a 0.9% physiological solution in the bottles for air drainage and blood in the cavity. The circulating nurse in the room labels the bottle informing the volume in mLand the time for control. The nursing staff turn off the equipment, putting them away to remove the surgical fields, checking for the presence of lost instruments, as well as checking the patient's skin for integrity, especially in the dorsal, sacral-gluteal and calcaneal regions, concluding the filling out of SAEP – nursing diagnoses and necessary intervention in the immediate postoperative period.
Discharging patients from the OR
The nurse passes the shift to the ICU nurse by telephone, with the following data: name and age of the patient, anesthesia and surgery conducted, positions and conditions of the peripheral, central and arterial venous catheter, drains, bandages, and drug infusions, as well as intercurrences. The nurse also checks the proper filling out of notes regarding the preoperative period, besides postoperative care, as well as other forms in the anesthetist, perfusionist, and surgeon's responsibility chart. This professional gathers the used and not-used consigned material in surgery, and sends it to the drugstore. The patient is transferred from the operating table to the bed with the help of a transfer, and the multiparameter portable transmitter and supplementary oxygen are placed. Drug infusions are identified, drains and other devices are reorganized and the patient is covered. The transportation of the patient to the ICU is accompanied by the anesthesiologist, the assistant surgeon and the circulating nurse to the room. The main surgeon sees the family members in a separate room close to the SC for providing information about the intra- and post-operative periods of the patient.

ECC: extracorporeal circulation; SC: surgical center; OR: operating room; CVP: central venous pressure; MAP: mean arterial pressure; RICS: right intercostal space; AAL: anterior axiliary line; LHD: right midclavicular line (RMCL); APTT: activated partial thromboplastin time; ICU: intensive care unit; SAEP: Perioperative Nursing Care System.



Source: Fortunato[9].

Figure 1. Panoramicviewofright lateral minithoracotomy to access the mitral valve.

necessary items to conduct the procedure. The objective is to facilitate the assembly of the OR by the circulating nurse and the verification by the nurse before the patient enters the SC[11].

Standardization is an important administration tool and, as such, it provides uniformity to the actions, besides reducing dispersion and enabling each professional to perform their services in a guided and safe manner[12].

With a well-trained team and the materials and equipment available in the OR, perioperative-nursing care will be more effective. Add to that important measures, such as the application of a surgical safety verification list (checklist), with the following steps: Sign in – before anesthetic induction; Timeout – before the skin incision; and Sign out – at the end of the surgery, before the patient leaves the OR. These actions are performed by the coordinator of the verification list, usually a nurse, aiming at patient safety[11,13].

For the success of the anesthetic-surgical act, it is essential that the nurses have an active participation in the entire trans-operative period, from the reception of the patient in the SC until his/her discharge in the OR, providing individualized and humanized care[14].

It is recommended that the nurse receive the patient in the SC, preferably by the same professional who made the preoperative nursing visit, so that this person can continue to apply the Perioperative Nursing Care System (SAEP). Besides, the fact that the patient knows this professional can provide more safety. Likewise, preferably, the patient should be received in the OR by the same professional who received him/her in the SC, and then the patient should be introduced to the environment and the team[14].

The assistance to the anesthetic act should be first conducted by the nurse, who must be prepared for emergencies, simultaneously to the preparation of the surgical table, conducted by the surgical instrument technician with the help of the circulating nurse, as well as the preparation of the surgical team.

The anesthetist introduces an echocardiography transducer, because, in MIVACS, the use of an esophageal echocardiography in the pre and intraoperative periods is essential, in order to identify mechanisms of valve insufficiency, as well as to make sure that the entire intracavitary cavity has no residual air in the exit of ECC. Since the technique is being used in the institution, transesophageal echocardiography is standard in every video procedure, aiming at providing safety and efficiency to the surgical procedure.

The nurse should participate in the surgical positioning both for the performance of the anesthetic act and for the surgical act. This action is shared by the team focusing on patient safety and on identifying risks to prevent the formation of pressure ulcers in major surgeries, with prevalence of the horizontal dorsal decubitus position because of the long duration and mobilization. General anesthesia provides absence of sensitivity, and since it is used for longer periods, such as in heart surgeries, it is damaging for the exchange of oxygen and carbon dioxide, because the body loses its compensation mechanisms, being prone to the development of lesions[15].

The use of electrosurgery requires special care from the staff. It is recommended that the dispersive plate be placed after surgical positioning, close to the surgical incision, over the clean, dry, hairless skin, on the muscle mass and in a vascularized region; there is no specific location for that. At the end of the procedure, the plate must be removed carefully, with the observation of possible lesions, paying attention to the nursing records related to the use of the equipment[16].

The preparation of the surgical patient includes the conduction of techniques such as trichotomy, degermation of the skin and indwelling bladder catheter (IBC), which can be executed by the nurse in the OR. Specifically in the analyzed institution, trichotomy is conducted in the room immediately before the patient is referred to the SC, and the demergation of the skin and IBC are performed by the assistant surgeon after the procedures of central accesses already described.

When the team and the patient are ready, the surgery begins, and the role of the circulating nurse is more addressed to meeting the intraoperative needs.

In MIVACS, the use of ECC plays an important role for a safe perfusion, with rigorous control of blood flows, oxygen levels and temperature, conducted by the perfusion technician and the anesthesiologist by controlling blood parameters, gas exchange and blood volume for the necessary corrections[17], according to results of the tests brought in by the circulating nurse.

In this surgery, the duration of ECC and aorta impingement is longer when compared to the traditional technique via transsternal median thoracotomy. However, this is a safe procedure, associated to lower morbidity, postoperative pain, bleeding and need for blood transfusion, time of extubation, permanence in the ICU and hospitalization, returning to daily activities faster[18].

To conclude the surgery, the circulating and the nurse make procedures such as checking the compresses, identifying the items for pathological anatomy, filling out forms and organizing the medical chart, transferring the patient to the bed, transporting, and passing the shift for the ICU. Another important factor is that a member of the surgical team can arrange the communication with the patient's family members to provide information about the procedure, the situation and the location of the patient.

For major surgeries, like heart surgeries, it is important that the operation room has the adequate physical dimensions, due to the number of equipment and professionals involved in the procedure. The OR should have at least 36 m^2, with minimum dimension of 5m[19] – size of the operation rooms in this analyzed institution.

It is worth to mention that a surgical site infection (SSI) is still one of the complicating factors in heart surgery. However, statistic data prove a 90% reduction in the risk of SSI in MIVACS when compared to conventional methods of transsternal median thoracotomy, whose risk of presenting an infection is over 30%, with mortality rate of 10 to 47%[20].

In the face of the exposure, it is essential that all members of the nursing team be aware of their role, working together to guarantee the quality of care provided to the surgical patient. It is important to provide constant evaluation of quality, prevention and correction of possible mistakes in the process and reformulation of care, in order to ensure the rights, the safety and the well-being of the patient.

FINAL CONSIDERATIONS

With the constant evolution of surgeries — among them, heart surgery — new technologies have been developed with the objective of making surgical procedures safer and less invasive, leading to better functional and aesthetic results.

MIVACSs, like other surgical procedures, require an active participation of perioperative nursing. It starts with the preparation of the environment, the reception of the patient, the assistance to anesthesia, to the preparation of the patient for surgery, the service to the team in the intraoperative period until the discharge of the patient from the OR and transportation to the ICU, meeting the demands of this innovative surgical modality.

With so many advances, new challenges and responsibilities, the nursing team in the SC needs constant update and training in search of technical and scientific base to develop their activities, aiming at the success of the anesthetic-surgical procedure.

In this sense, this experience report aimed at assisting other hospitals and perioperative teams in the preparation and conduction of minimally invasive heart surgeries involving safe and humanized care.

REFERENCES

1. Felcar MJ, Guitti JCS, Marson CA, Cardoso RC. Fisioterapia pré-operatória na prevenção das complicações pulmonares em cirurgia cardíaca pediátrica. Rev Bras Cir Cardiovasc. 2008;23(3):383-8.
2. Castro Neto JV, Melo EM, Silva JF, Rebouças LL, Correa LC, Germano AQ, et al. Procedimentos minimamente invasivos: formas direta e videoassistida no tratamento das cardiopatias. Arq Bras Cardiol. 2014;102(3):219-25.
3. Fortunato Júnior AJ, Fernandes AG, Sesca JR, Paludo R, Paz ME, Paludo L, et al. Troca valvar aórtica minimamente invasiva: uma alternativa a técnica convencional. Rev Bras Cir Cardiovasc. 2012;27(4):570-82.
4. Moreira LFP, Celullari AL. Cirurgia cardíaca minimamente invasiva no Brasil. Rev Bras Cir Cardiovasc. 2011;26(4):3-5.

5. Grossi EA, Goldman S, Wolfe JA, Mehall J, Smith JM, Ailawadi G, et al. Minithoracotomy for mitral valve repair improves inpatient and postdischarge economic savings. J Thorac Cardiovasc Surg. 2014;148(6):2818-22.

6. Granov N, Kacila M, Solinas M, Glauber M. Minimally invasive mitral valve surgery through right lateral minithoracotomy--early experience of Clinical Centre of University of Sarajevo. Med Arch. 2012;66(5):357-8.

7. Pereira MCO, Lário A. Cirurgias minimamente invasivas. In: Carvalho R (Coord.). Enfermagem em centro de centro cirúrgico e recuperação anestésica. Barueri: Manole; 2015. p.12-6.

8. Brevidelli MM, Sertório SM. Trabalho de conclusão de curso: guia prático para docentes e alunos da área da saúde. 4ª ed. São Paulo: Iátria; 2010.

9. Fortunato Junior AJ, Branco Filho AA, Branco A, Martins ALM, Pereira LM, Ferraz JGG, et al. Padronização da técnica para cirurgia cardíaca videoassistida: experiência inicial. Rev Bras Cir Cardiovasc. 2008;23(2):183-9.

10. Milani R, Brofman PRS, Oliveira S, Patrial Neto L, Rosa M, Lima VH, et al. Minimally invasive redo mitral valve surgery without aortic crossclamp. Rev Bras Cir Cardiovasc. 2013;28(3):325-30.

11. Jardim DP, Carvalho R. Assistência de enfermagem na sala operatória/ cirurgia segura. In: Carvalho R (Coord.). Cadernos de Especialidades - Enfermagem em Centro Cirúrgico e Recuperação Anestésica. Barueri: Manole; 2015. p. 104-28.

12. Lima GF, Rinaldi PA, Catunda KA, Bianchi ERF, Bittar E. Atuação do enfermeiro na estruturação e implantação de uma sala operatória híbrida. Rev SOBECC. 2014;19(2):110-8.

13. Pancieri PA, Carvalho R, Braga ME. Aplicação do checklist para cirurgia segura: relato de experiência. Rev SOBECC. 2014;19(1):26-33.

14. Jardim DP, Coutinho RMC, Bianchi ERF, Costa ALS, Váttimo MFF. Assistência de enfermagem no período transoperatório. In: Carvalho R, Bianchi ERF (Orgs.). Enfermagem em centro cirúrgico e recuperação. 2ª ed. Barueri: Manole; 2016. p.146-59.

15. Saraiva LI, Paula MFC, Carvalho R. Úlcera por pressão no período transoperatório: ocorrência e fatores associados. Rev SOBECC. 2014;19(4):207-13.

16. Parra RLC, Giannasttasio MB, Diniz TRZ. O conhecimento dos circulantes de sala sobre a utilização do Bisturi elétrico. Rev SOBECC. 2012;17(4):24-32.

17. Dienstamann C, Caregnato RCA. Circulação extracorpórea em cirurgia cardíaca: um campo de trabalho para o enfermeiro. Rev SOBECC. 2013;18(1):35-43.

18. Fortunato Júnior JA, Pereira ML, Martins AL, Pereira DS, Paz ME, Paludo L, et al. Video-assisted cardiac surgery: 6 years of experience. Rev Bras Cir Cardiovasc. 2012;27(1):24-37.

19. Brasil. Ministério da Saúde (MS). Agencia Nacional de Vigilância Sanitária (ANVISA). Resolução da Diretoria Colegiada (RDC) nº. 307, de 14 de novembro de 2002. Altera a Resolução RDC nº. 50 de 21 de fevereiro de 2002 que dispõe sobre o regulamento Técnico para planejamento, programação, elaboração e avaliação de projetos físicos de estabelecimentos assistenciais de saúde. [acesso em 14 out 2015]. Disponível em: www.cvs.saúde.sp.gov.br

20. Gelape CL. Infecção do sítio operatório em cirurgia cardíaca. Arq Bras Cardiol. 2007;89(1):3-9.

BASES FOR SAFE USE OF THERMAL WASHER DISINFECTORS EMPHASIZING THE RELEASE FOR USE AFTER TECHNICAL INTERVENTION

Fundamentos para uso seguro das lavadoras termodesinfetadoras com ênfase na liberação para uso após intervenção técnica

Bases para el uso seguro de las lavadoras termodesinfectantes colocando énfasis en la liberación para el uso después de la intervención técnica

Paulo Roberto Laranjeira[1], Jeane Aparecida Gonzalez Bronzatti[2], Rafael Queiroz de Souza[3], Kazuko Uchikawa Graziano[4]

ABSTRACT: It is seen, in the daily routine of Material and Sterilization Centers (CMEs, acronym in Portuguese), that thermal washer disinfectors submitted to technical interventions for correcting failures are released for use without evidence of operation following the required parameters for the effective performance of cleaning and thermal disinfection. Given the importance of preventing healthcare-related infections, this study presents innovated systematization of assays required for the release of thermal washers after technical interventions, as well as the necessary information to preserve such equipment in optimal operation conditions. Safe release of the equipment should include the evaluation of temperature and time parameters compared to data obtained during qualification, the conference of admitted detergent volume during cleaning, the evaluation of cleaning effectiveness with commercially available monitors, the establishment of a change control, and a protocol for directing the requalification, following the Brazilian regulations and international recommendations.

Keywords: Equipment maintenance. Detergents. Disinfection.

RESUMO: No cotidiano dos Centros de Material e Esterilização (CMEs), observa-se que as lavadoras termodesinfetadoras submetidas a intervenções técnicas para correção de falhas são liberadas para uso sem evidência de operação conforme os parâmetros requeridos para realizar limpeza e termodesinfecção eficientes. Considerando a importância da prevenção das infecções relacionadas à assistência à saúde, este estudo apresenta como inovação a sistematização dos ensaios requeridos para a liberação de termolavadoras após intervenções técnicas, assim como as informações necessárias para a conservação desses equipamentos em condições ótimas de operação. A liberação segura do equipamento deve incluir a avaliação dos parâmetros de temperatura e tempo em comparação aos dados obtidos na qualificação, a conferência do volume de detergente admitido durante a limpeza, a avaliação da eficácia da limpeza com monitores comercialmente disponíveis, o estabelecimento de um controle de mudanças e um protocolo para direcionar a requalificação, atendendo à legislação nacional e Às recomendações internacionais.

Palavras-chave: Manutenção de equipamento. Detergentes. Desinfecção.

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RESUMEN: En lo cotidiano de los Centros de Material y Esterilización (CMEs), se observa que las lavadoras termodesinfectantes sometidas a intervenciones técnicas para corrección de fallas son liberadas para uso sin evidencia de operación según los parámetros requeridos para realizar limpieza y termodesinfección eficientes. Considerando la importancia de la prevención de las infecciones relacionadas a la asistencia a la salud, este estudio presenta como innovación la sistematización de los ensayos requeridos para la liberación de termolavadoras tras intervenciones técnicas, así como las informaciones necesarias para la conservación de esos equipos en condiciones excelentes de operación. La liberación segura del equipo debe incluir la evaluación de los parámetros de temperatura y tiempo en comparación a los datos obtenidos en la calificación, la conferencia del volumen de detergente admitido durante la limpieza, la evaluación de la eficacia de la limpieza con monitores comercialmente disponibles, el establecimiento de un control de cambios y un protocolo para direccionar la recalificación, atendiendo la legislación nacional y las recomendaciones internacionales.
Palabras clave: Mantenimiento de equipo. Detergentes. Desinfección.

INTRODUCTION

The worldwide healthcare system has recently suffered great pressure for decreasing costs, increasing productivity, and maintaining quality and safety with the need of remaining updated following the new technologies[1]. With the aim of making surgical procedures less invasive and traumatic, the design of instruments has considerably evolved and has become more complex. Therefore, the cleaning process needs to be perceptive, automated, and reproducible to provide reliable results and optimization of work processes.

Hence, the thermal washer disinfectors have satisfied this demand at Material and Sterilization Centers (CMEs, acronym in Portuguese). However, like any other equipment, they require qualification, maintenance, and monitoring to meet the criteria of safety and reliability of results[2,3].

In the daily routine of the CMEs, the thermal washer disinfectors submitted to technical interventions for correcting failures are released for use only based on the indicated values of temperature and time, with no evidence of their efficient performance during cleaning or thermal disinfection. Thus, since the instruments that indicate time and temperature values in the equipment panel may not be following the values obtained in qualification, the cleaning and thermal disinfection may not be effective and may compromise safety during health products processing.

The Resolution of the Joint Board of Directors No. 15 (RDC-15), from the Brazilian Health Surveillance Agency (ANVISA)[2], as well as the Brazilian Association of Technical Standards (ABNT)[3] determine the annual qualification, gauging, maintenance, requalification, and monitoring of thermal washers in order to ensure the effectiveness of cleaning and thermal disinfection processes. However, there are no instructions on the procedures that should be performed after a technical intervention.

Since the prevention of healthcare-related infection (IRAS, acronym in Portuguese), as well as the patient's safety, is a global issue, this review presents an innovated systematization of assays required for releasing thermal washers after technical interventions, as well as the necessary information to preserve such equipment in optimal operation conditions.

PHASES OF WASHING AND THERMAL DISINFECTION CYCLE

In general, cleaning of health products in thermal washer disinfectors is done by means of spraying rods that use water under pressure associated with detergent effect to help the dirtiness extrication. There are specific racks adjusted to the product conformation to do such process, which aim at promoting water under pressure achievement in outer and inner surfaces.

The cleaning and thermal disinfection cycles performed in thermal washer disinfectors are presented in Figure 1, and they are described in the following text with details:

1. Pre-cleaning: in this stage, the inner and outer surfaces of the products are exposed to a spray of cold water under pressure to remove the excess of organic and inorganic residues;
2. Cleaning: performed with water at temperatures usually varying between 40 and 60°C for 5 minutes, by means of detergent that does not produce foam of neutral or alkaline pH[4]. In Brazil, the commonly

used enzymatic detergents should follow the determinations of the ANVISA RDC-55 from 2012[5];

3. Neutralization: this stage should be conducted when the health service chooses to use alkaline detergent. In such case, neutralizing acids should be added to water for supporting the removal of detergent residues and avoiding the formation of salt storages[4];
4. Rinsing: with hot or cold water and no additives[4]. According to ANVISA RDC-15 from 2012[2], this stage requires purified water for rinsing critical products used in orthopedic and ophthalmologic implant surgeries, cardiac and neurological surgeries. Supplementary rinsing stages may be scheduled, such as for ophthalmologic and orthopedic instruments.
5. Thermal disinfection: it occurs in purified water at temperatures varying between 80 and 95°C with exposure time calculated based on the required A0 (A zero), as further described[4];
6. Drying: controlled by the thermal washer disinfector or by driers for health products[4].

Water quality control is necessary in the cycle stages. The Association for the Advancement of Medical Instrumentation (AAMI) from the United States of America establishes the quality of water for processing health products, and recommends the control of bacteria, endotoxins, total organic carbon, pH, hardness, resistivity, total dissolved solids, chloride, iron, copper, manganese, color, and turbidity, because these factors may cause corrosion in surgical instruments, damage equipment, decrease detergent activity level, and provoke toxic reactions in patients[6].

It is upon the manufacturer of health products or thermal disinfectors to establish the required water quality for the correct operation of the equipment and maintenance of product quality; however, such information has not been clearly spread and it is absent in some cases.

A daily monitoring routine of the water being supplied to the thermal washer disinfector should be adopted in order to measure chemical purity, temperature, feeding pressure, microbiological contamination, among others, following the frequency recommended by the equipment manufacturer[3]. The point of collection should be as close as possible from the washer entrance so that all contamination sources could be monitored.

Manufacturers indicate the Brazilian standard (NBR) criteria from ABNT ISO 17665-2 (2013)[7] for the quality of the water being supplied to the equipment and for the optimal preservation and operation of the thermal washer disinfector. Values are reproduced in Chart 1.

Some water components cannot be easily measured on a daily basis and their samples must be sent for a specialized laboratory. There are available devices that enable real-time measurement of water conductivity through increase of dissolved inorganics, whose operational limits can be determined by comparing the quality of water before and after the treatment system. Therefore, if the

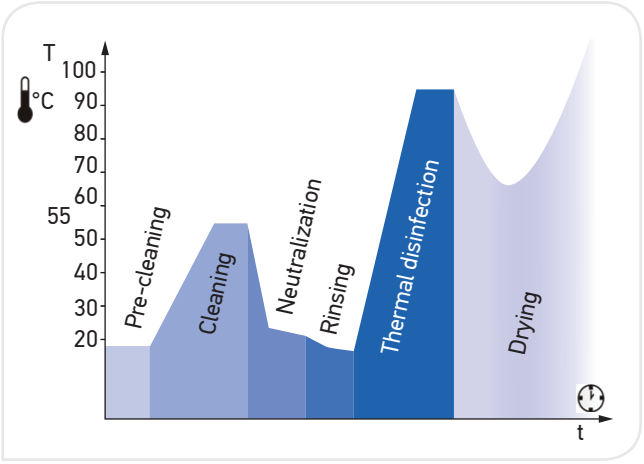

Figure 1. Example of cycle stages of a thermal washer disinfector. Translated and adapted from Arbeitskreis Instrumentenaufbereitung (AKI), 2012[4].

Chart 1. Limit values recommended for contaminants in the supplied water of thermal washer disinfectors, adapted of the NBR ISO 17.665-2:2013[7].

Component	Value
Silicate (SiO_2)	≤ 0.1 mg/L
Iron	≤ 0.1 mg/L
Cadmium	≤ 0.005 mg/L
Lead	≤ 0.05 mg/L
Other heavy metals, except iron, cadmium, and lead	≤ 0.1 mg/L
Chloride	≤ 0.1 mg/L
Phosphate (P_2O_5)	≤ 0.1 mg/L
Conductivity	≤ 3 µS/cm
pH	5 to 7
Appearance	Clean, dull, without Hsediments
Hardness	≤ 0.02 mmol/L

water conductivity exceeds the established limit, it is clear that the physical chemical characteristic of such water had been altered and it should not be used until the identification of the altered component[8].

There are also commercially available tests that enable to monitor the water pH and hardness (amount of $CaCO_3$ and manganese in parts per million), by using tapes that chemically react with the presence of these components, thus changing the color according to its level, or electronic systems with digital indication of the values found[8].

ASSAY ROUTINES FOR EVALUATING THE THERMAL WASHER DISINFECTOR OPERATION

Professionals in charge of the CME operationalization should implement actions to ensure proper functioning of the department's technological equipment, ensuring the quality of processed products, and avoiding interruptions owing to technical failures. Equipment failures result in delays and increase the risks of errors caused by emergent actions and contingent plans. Thus, a routine of daily, quarterly, and annual assays is suggested to evaluate the operation of thermal washer disinfectors[9], which should be a supplement to the manufacturer's recommendations. Routine assays are presented in Chart 2.

ROUTINE FOR RELEASING THERMAL WASHER DISINFECTORS AFTER TECHNICAL INTERVENTION

The safe release of thermal washer disinfectors after intervention comprises not only the evaluation of cycle temperature and time, but also the volume conference of the detergent admitted during cleaning and evaluation of cleaning efficacy with the commercially available monitors in association with guidelines to elaborate an evaluation and maintenance plan of the operation, as previously described.

A graduated cylinder is used for checking whether the detergent dilution remains with the scheduled amount. It should be positioned in the dosage exit inside the washer. The dosage command is operated subsequently; the volume obtained inside the cylinder represents the amount

Chart 2. Guidelines to elaborate an evaluation and maintenance plan of thermal washer disinfectors operation based on periodicity.

Item to be evaluated	Periodicity		
	Daily	Quarterly	Annual
Water conductivity**	X		
Detergent volume	X		
Cleaning and fixation of water storage grate inside the chamber	X		
Movement of spraying rods	X		
Printer paper	X		
Printer ink cartridge	X		
Water leaks	X		
Cleaning visual inspection of all loads	X		
Indication of low detergent volume*		X	
Dosage system of detergent volume*		X	
Cleaning efficacy using dirtiness simulators*		X	
Temperature of a cycle with load, with outer instrument*		X	
Door locking system*		X	
Qualification (minimal)**			X
Gauging (minimal)**			X
Requalification	Based on the events stabilized during change control		

*NBR ISO 15.883-1[3]; **RDC-15 from ANVISA, of 2012[2].

of admitted product in each cycle. The result of this action should be compared to predetermined parameters of the equipment and to the detergent manufacturer's recommendations, thereby proving if the detergent volume admitted in each washing cycle is correct.

Then, a cleaning cycle should be scheduled and the thermal disinfection and drying phases may be excluded, thus challenging cleaning with tests that simulate dirtiness based on the recommendations of the ISO 15.883-5:2005[10]. Several monitors with different markers, like proteins, blood, and adenosine triphosphate (ATP)[10-13], are available for cleaning monitoring. Interpretation of the results obtained with these products may be performed following the manufacturer's guidance; nevertheless, it is worth noting that there are no fast tests to detect the residues of fat, biofilms, and prion proteins for use during the CME routine.

After the equipment has been approved during the cleaning phase, one need to check whether the thermal disinfection is being achieved by using a commercially available indicator during a standardized cycle that will show if the scheduled time and temperature were actually being achieved[3]. Exposure time and temperature parameters are challenged in the thermal qualification process, which should be conducted at least once a year[2], in compliance with the frequency and procedures indicated by the manufacturer, or if any component of this measurement chain has been replaced.

The thermal disinfection phase has its efficiency determined by means of the statistical calculation identified by A0 (A zero). This concept is established in ISO 15.883-1:2013[3], in which, based on the disinfection process and for a specific time at a certain temperature, predictable lethality occurs on a population of standardized microorganisms.

The formula used for calculating A0 in Figure 2 is the same as that used for calculating F0 (F zero) in sterilization processes through saturated vapor, in which F indicates the reference temperature of 121°C and A indicates reference temperature of 80°C in the thermal disinfection case. The Z value represents the temperature variation that will determine the decrease of 1 log for each instant and is fixed at 10°C. Therefore, the formula will provide the total time requested to obtain the desired level of disinfection.

This formula was idealized with reference temperature of 80°C, assuming that the temperature raise would decrease exposure time, and not the contrary. Thus, the use of this formula is not recommended for temperatures below 80°C[3]. For such temperatures, the A0 formula can only be applied until the 70°C limit, and at least 75°C are suggested so that inactivation of thermal-resistant bacteria and virus occur comparable to the A0[14] integration. Since inactivation of bacteria like *Enterococcus*, *Legionella,* and some kinds of protozoans is generally effective at temperatures above 65°C, the A0 formula integration should be carried out with this temperature henceforth[14].

The A0 value is calculated in seconds. The NBR ISO 15.883-1[3] standard establishes the minimum value of 600 seconds for products that will be sterilized and 3,000 seconds for those that will not[15]. The exposure times for each temperature are shown in Chart 3.

There is neither an indicator available in the Brazilian market that can be used as reference to determine A0, nor a monitoring device of the thermal disinfection phase with microbial load reduction proof. The only commercially available devices are chemical indicators that report whether the temperature has been achieved during a certain period of exposure.

Brazilian CMEs still have difficulties in understanding and implementing thermal disinfection parameters based on A0, according to Rosenberg[15] and ABNT[3], owing to many reasons, including thermal sensitivity of the products.

The A0 calculation formula is not recommended for temperatures below 80°C in thermal disinfection. If the calculation was for 70°C – such temperature is usually adopted in our area for thermal disinfection of inhalotherapy and

$$A0 = \sum 10^{\frac{(T-Tref)}{Z}} \times \Delta t$$

Source: ABNT NBR ISO 15883-1:2013[3]

Figure 2. A0 formula.

Chart 3. Minimum time of exposure for each temperature of the requested A0, according to NBR ISO 15.883-1:2013[3] and Rosenberg (2003)[15].

A0 (seconds)	Temperature (°C)	Time (minutes)
600	80	10
	90	1
	93	0.5
3,000	80	50
	90	5
	93	2.5

ventilator support products – the required time, according to the formula, would be 500 minutes at 70°C for A0 from 3,000 and 100 minutes for A0 of 600.

Hepatitis B virus requires 20 minutes at 80°C to be inactivated and for 70°C temperature, almost 200 minutes would be necessary to reach the same reduction[16].

In 2000, an investigation evaluated the efficacy of 77°C parameters for 30 minutes applied through a pasteurizer machine (a "bain-marie" with temperature control) to disinfect the ventilator support and anesthesia devices. A high number of testing microorganisms (10^4 to 10^6 colony-forming units) were inoculated against plastic and metallic tubes (3 mm of diameter and 40 cm of length), and submitted to thermal disinfection cycle. *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Candida albicans,* and *Mycobacterium terrae* were removed; however, *Bacillus subtilis* spores were not. In this study, the authors concluded that such equipment is effective for ventilator support and anesthesia devices and pasteurization was focused as an alternative for disinfection using chemical disinfectants[17]. Therefore, release and monitoring of thermal disinfection phase for temperatures below 80°C, based on A0 integration, should have theoretical and scientific basis proving that the adopted time and temperature are appropriate for reaching the necessary efficacy for the process.

Every equipment can fail, we therefore recommend the elaboration of a change evaluation protocol to establish the impact of interventions on the equipment performance, thus indicating the qualification stages that should be repeated in order to determine the operation continuity in the work range that had been challenged in the annual qualification. The ABNT NBR ISO 17.665-1[18] provides guidelines for sterilization process validation that may help to develop a protocol and may also be adjusted to thermal disinfection. This document, as well as this investigation, should help professionals working at CMEs to determine when the piece of equipment needs to be requalified after technical intervention, following the requirements of article 41 from RDC-15 of ANVISA, in 2012[2].

Since NBR ISO 17.665-1[18] is directed to vapor sterilization equipment, we recommend the development of a specific standard for elaborating a change evaluation protocol with qualification stages that require repetition after technical interventions in thermal washer disinfectors. Results obtained with such procedures have to be confronted with tests performed during qualification, including comparison with physical records and, if they are in compliance, the thermal washer disinfector should be released for use.

CONCLUSION

The adoption of a continuous procedure of assays to evaluate the operation of thermal washer disinfectors enables early diagnosis of failures, providing more control and quality to the cleaning and thermal disinfection automated process.

Equipment submitted to intervention need more attention before their routine use, because only data provided in the panel do not certify the safety of the cleaning and thermal disinfection process. Safe release of the equipment should include the evaluation of temperature and time parameters compared to data obtained during qualification, checking of admitted detergent volume during cleaning, evaluation of cleaning effectiveness with commercially available monitors, and establishment of a change control and of a protocol for directing the requalification following the Brazilian regulations and international recommendations.

REFERENCES

1. Giambrone GP, Hemmings HC, Sturm M, Fleischut PM. Information technology innovation: the power and perils of big data. Br J Anaesth. 2015;115(3):339-42.

2. Brasil. Ministério da Saúde. Resolução da Diretoria Colegiada nº. 15, de 15 de março de 2012. Dispõe sobre requisitos de boas práticas para o processamento de produtos para saúde e dá outras providências. Brasília: 2012.

3. Associação Brasileira de Normas Técnicas (ABNT). NBR ISO 15883, Lavadoras desinfetadoras. Parte 1: Requisitos gerais, termos, definições e ensaios. Rio de Janeiro: ABNT; 2013.

4. Arbeitskreis Instrumenten-Aufbereitung. Instrument reprocessing: reprocessing of instruments to retain value, 10. Ed. 2012. Disponível em: http://www.a-k-i.org/index.php?id=11&L=1

5. Brasil. Ministério da Saúde. Resolução da diretoria colegiada nº. 55, de 14 de novembro de 2012. Dispõe sobre os detergentes enzimáticos de uso restrito em estabelecimentos de assistência à saúde com indicação para limpeza de dispositivos médicos e dá outras providências. Brasília: 2012.

6. Association for the Advancement of Medical Instrumentation (AAMI). Water for the reprocessing of medical devices. Arlington, VA: Association for the Advancement of Medical Instrumentation; 2007. AAMI Technical information report 34. TIR34:2007.

7. Associação Brasileira de Normas Técnicas (ABNT). NBR ISO 17665-2, Esterilização de produtos para saúde - Vapor – Parte 2: Guia de aplicação da ABNT NBR ISO 17665-1. Rio de Janeiro: ABNT; 2013.

8. Blechschmidt T. Routine Control of Washer-Disinfectors. Zentralsterilisation – Central Service. 2012;5:330-5.

9. Harty Z, Benz L. Washer monitoring: A must-have for today's best practices (part 2). Healthcare Purchasing News. Self-Study Series. Sarasota (FL): KSR Publishing; 2012. p. 30.

10. International Standard Organization. ISO 15883-5, Washer-disinfectors. Part 5: Test soils and methods for demonstrating cleaning efficacy; 2005.

11. Alfa MJ, Olson N. Comparison of washer-disinfector cleaning indicators: impact of temperature and cleaning cycle parameters. Am J Infect Control. 2014;42(2):e23-6.

12. Alfa MJ. Monitoring and improving the effectiveness of cleaning medical and surgical devices. Am J Infect Control. 2013;41(5 Suppl):S56-9.

13. Alfa MJ, Olson N, Al-Fadhaly A. Cleaning efficacy of medical device washers in North American healthcare facilities J Hosp Infect. 2010;74(2):168-77.

14. McCormich PJ, Schoene MJ, Dehmler MA, McDonnell G. Moist heat disinfection and revisiting the A0 Concept. Biomedical Instrumentation & Technology: Challenges and Solutions for Medical Devices; 2016. p. 19.

15. Rosenberg, U. Thermal Disinfection – The A0 Concept and the Biological Background. Zentralsterilisation – Central Service. 2003;11:118-20.

16. Uetera Y, Kawamura K, Kobayashi H, Saito Y, Yasuhara H, Saito R. Studies on Viral Disinfection: An evaluation of moist heat disinfection for HBV by using A0 concept defined in ISO 15883-washer-disinfectors. PDA J Pharm Sci Technol. 2010;64(4): 327-36.

17. Rutala WA, Weber JD, Gergen MF, Gratta A R. Efficacy of a washer-pasteurizer for disinfection of respiratory-care equipment. Infect Control Hosp Epidemiol. 2000;21(5):333-6.

18. Associação Brasileira de Normas Técnicas (ABNT). NBR ISO 17665-1, Esterilização de produtos para saúde - Vapor – Parte 1: Requisitos para o desenvolvimento, validação e controle de rotina nos processos de esterilização de produtos para saúde. Rio de Janeiro: ABNT; 2010.