UFSM

REUFSM
REVISTA DE ENFERMAGEM DA UFSM

ISSN 2179-7692
Open access

Rev. Enferm. UFSM, v.12, e12, p.1-17, 2022 • https://doi.org/10.5902/2179769267474
Submissão: 08/30/2021 • Aprovação: 03/08/2022 • Publicação: 04/04/2022

Artigo original

Surgical site infections: surgical reoperation and infection in clean and potentially contaminated surgeries

Infecções de sítio cirúrgico: reabordagem cirúrgica e infecção em cirurgias limpas e potencialmente contaminadas

Infecciones del sitio quirúrgico: reoperación quirúrgica e infección en cirugías limpias y potencialmente contaminadas

Larissa Stefani[I], Pollyanna Kássia de Oliveira Borges[II], Maria Dagmar da Rocha[I]

[I] Regional University Hospital of Campos Gerais – HURCG, Ponta Grossa-PR, Brazil.
[II] State University of Ponta Grossa- UEPG, Ponta Grossa-PR, Brazil

Abstract

Objective: to verify the association between the occurrences of surgical site infection (SSI) and the need for re-approach in patients undergoing clean and potentially contaminated surgeries. **Method:** longitudinal study, involving 75 patients with infection; data collection was carried out using a survey form evaluating sociodemographic and clinical aspects. The association was assessed by the odds ratio and its confidence intervals (95%CI). **Results:** patients hospitalized for external causes are four times more likely to be surgically re-approached (p=0.011), in the orthopedic specialty the reason was five times greater (p=0.003), readmissions are 10 times more likely to be re-approached (p=0.000), leukocytosis (p=0.002) and alteration in the value of c-reactive protein (p=0.016) were associated with the need for a new surgery. Positive culture (p=0.001) and therapeutic antibiotic (p=0.04) proved to be protective factors for re-approach. **Conclusion:** the data demonstrate the presence of SSI as a strong influencer in surgical reoperation, guiding hospitals with the same profile.

Descriptors: Cross Infection; Surgical Wound Infection; General Surgery; Orthopedic Procedures; Medical-Surgical Nursing

Resumo

Objetivo: verificar a associação entre a ocorrência de infecção de sítio cirúrgico (ISC) e a necessidade de reabordagem em pacientes submetidos a cirurgias limpas e potencialmente contaminadas. **Método:**

estudo longitudinal, envolvendo 75 pacientes com infecção; a coleta de dados foi em formulário de pesquisa avaliando aspectos sociodemográficos e clínicos. A associação foi avaliada pela razão de chances e seus intervalos de confiança (IC95%). **Resultados:** pacientes internados por causas externas têm chance quatro vezes maior de reabordar cirurgicamente (p=0,011), na especialidade ortopédica a razão foi cinco vezes maior (p=0,003), reinternações, têm 10 vezes mais chances de reabordagem (p=0,000), leucocitose (p=0,002) e alteração no valor de proteína c-reativa (p=0,016) mostraram-se associados à necessidade de realização de nova cirurgia. A cultura positiva (p=0,001) e antibiótico terapêutico (p=0,04) demonstraram-se fatores protetores para a reabordagem. **Conclusão:** os dados demonstram a presença de ISC como forte influenciador à reabordagem cirúrgica, norteando hospitais com o mesmo perfil.
Descritores: Infecção Hospitalar; Infecção de Ferida Cirúrgica; Cirurgia Geral; Procedimentos Ortopédicos; Enfermagem Médico-Cirúrgica

Resumen

Objetivo: verificar la asociación entre la ocurrencia de infecciones del sitio quirúrgico (ISQ) y la necesidad de reoperación en pacientes sometidos a cirugías limpias y potencialmente contaminadas. **Método:** estudio longitudinal, involucrando 75 pacientes con infección; la recogida de datos tuvo lugar en un formulario de investigación que evaluaba aspectos sociodemográficos y clínicos. La asociación se evaluó mediante odds ratio y sus intervalos de confianza (IC95%). **Resultados:** los pacientes hospitalizados por causas externas tienen cuatro veces más posibilidades de reoperación (p=0,011); en la especialidad de ortopedia, la proporción fue cinco veces mayor (p=0,003); los reingresos tienen 10 veces más posibilidades de reoperación (p=0,000); la leucocitosis (p=0,002) y la alteración en el valor de la proteína c-reactiva (p=0,016) se asociaron con la necesidad de nueva cirugía. La cultura positiva (p=0,001) y el antibiótico terapéutico (p=0,04) demostraron ser factores protectores para la reoperación. **Conclusión:** los datos demuestran la presencia de ISQ como una fuerte influencia en la reoperación quirúrgica, guiando a los hospitales con el mismo perfil.
Descriptores: Infección Hospitalaria; Infección de la Herida Quirúrgica; Cirugía General; Procedimientos Ortopédicos; Enfermería Médico-Quirúrgica

Introduction

Surgical Site Infections (SSIs) are related to surgical procedures with or without implant placement in inpatients and outpatients, being classified as: superficial incisional infection, deep incisional infection and organ/space infection, according to the extent of involvement.[1] In the United States, according to the Centers for Disease Control and Prevention (CDC), SSIs are responsible for 20% of healthcare-associated infections (HAIs) and are associated with a 2- to 11-fold increase in mortality risk.[2] Among hospital infections in Brazil, SSIs rank third, corresponding to about 14% to 16% of the cases.[1]

Surgical site infections are among the main risks to patient safety in health services in Brazil: they are the primary reason for rehospitalization and increase in the

the length of stay due to prescribed antibiotic therapy and the need for subsequent surgeries to repair the tissue.[3-4] Among the factors that contribute to the occurrence of SSI are the increase in the preoperative hospital stay, the duration of the surgery, the clinical conditions of the patients (obesity, smoking, diabetes) and the classification of the surgery according to its potential for contamination: clean, potentially contaminated, contaminated, and infected.[5] Clean surgeries are those performed on sterile or decontaminated tissues, without the presence of an inflammatory or infectious process or technical failures.[1] Potentially contaminated surgeries are performed in tissues colonized by microbial flora, in which the processes of infection and inflammation are absent, as well as those surgeries in which discreet intraoperative technical failures occur.[6] Surgeries performed on tissues with a significant presence of microorganisms and that are not subject to decontamination are considered contaminated, and those that present gross contamination or local infectious process are considered infected.[7]

The search for knowledge to understand the factors that predispose to the incidence of SSI is essential for the development of surveillance actions aimed at improving the quality of care provided. Thus, the prevention and control of HAIs are fundamental elements in patient safety. Reducing the risks of preventable HAIs requires a change in culture, attitude and approach to patient care. For these changes to occur, it is necessary to clearly understand the factors that increase the risk of the patient acquiring the infection and the consequences when he ends up developing an SSI, thus enabling the improvement of care practices to reduce the occurrence of SSIs and the promotion of patient safety.[8]

The objective of this study was to verify the association between the occurrence of SSIs and the need for re-approach in patients undergoing clean and potentially contaminated surgeries, and thus obtain knowledge of the health situation of patients undergoing surgery.

Method

This is a longitudinal epidemiological study involving patients undergoing general and orthopedic surgeries classified as clean or potentially contaminated who had SSI in 2019.

The data come from the files of the Epidemiology and Infection Control Center of the University Hospital located in the region of Campos Gerais, Paraná, which serves 12

municipalities in the 3rd Health Regional Center of the state of Paraná and municipalities in the eastern macro-region. The notification forms and infection indicators for the year 2019, the surgical map and the electronic medical records of the patients were evaluated regarding sociodemographic data, length of stay, need for readmission, surgical reoperation, presence of signs suggestive of SSI, laboratory tests and use of prophylactic and therapeutic antibiotics.

Patients aged between 14 and 89 years who had a SSI after undergoing surgeries in the orthopedics and general surgery specialties, classified as clean or potentially contaminated, in 2019 were included. Pediatric surgeries were excluded.

Data collection was carried out from April 1, 2021, to May 31, 2021; patients with SSI were identified through physical sheets for checking criteria for HAI of the epidemiology and infection control nucleus. After identifying the patients who met the inclusion criteria, information was collected online based on the medical records available in the Hospital and Outpatient Management System (GSUS), a management system for outpatient and hospital health services developed by the Ministry of Health and the Health Department of Paraná State. For data collection, a research form was created in the Microsoft® Word Mobile software containing open and closed questions covering sociodemographic and clinical data. This data collection instrument was transcribed into the Google Forms® form and the resulting data were later converted into an Excel spreadsheet of the Microsoft® Office 2007.

Data were analyzed using descriptive statistics, with values expressed as simple frequencies, percentages and measures of central tendency. The association between the variables was evaluated through odds ratio (OR) and confidence intervals (95% CI). The chi-square test was calculated for the categorical variables and the Student's t test or Mann-Whitney test was performed for the numerical variables, according to the distribution of the variables. The IBM SPSS Statistical Products and Service Solutions software, version 22, was used in the statistical analyses.

The study is part of the research project “Studies on Health Surveillance, Mortality and Hospital Epidemiology”, which monitors deaths, incidence or prevalence, survival and health indicators of events of loco-regional or national importance and verifies the factors associated with these epidemiological events. Project approved by the scientific

committee of the studied hospital and by the Ethics Committee in Research with Human Beings of the State University of Ponta Grossa (Coep/UEPG) by opinion 4,110,879/2019 on April 28, 2020. The research was conducted in accordance with the ethical standards required by Resolutions 466/2012, 510/2016 and 580/2018 of the Ministry of Health.

Results

In 2019, a total of 371 HAIs were found in the surveyed hospital, of which 155 were associated with SSIs, corresponding to 41.7% of the total HAIs. In the scope of the present study, 75 patients developed infection in clean and potentially contaminated surgeries throughout the year. Of these, 62.7% (47) were male and 37.3% (28) were female. The mean age was 54.2 years, 44% (33) were from the city where the hospital was located; 38.7% (29) had injuries from external causes and 42.7% (32) had diseases of the digestive system as the reason for hospitalization.

Regarding the classification of the surgery, 80% (60) were elective surgeries and 20% (15) were urgent, 41.3% (31) were classified as clean, 58.7% (44) were potentially contaminated, 30.7% (23) were from the orthopedic specialty, and 69.3% (52) general surgeries. Of the patients, 41.3% (31) remained in the hospital for more than 10 days, 79.9% (60) developed an infection 7 days after the surgery, and 57.3% (43) required a reoperation.

Infections were classified as organ/space infection in 53.3% (40) cases, deep incisional infection in 41.3% (31) cases, and superficial incisional infection in 5.3% (4) cases. The most common clinical signs of infection were purulent secretion 89.3% (67), pain 34.7% (26), hyperemia 28% (21), fever 14.7% (11), suture dehiscence 13.3% (10), and the medical diagnosis of infection in 20% (15) of the cases.

Sixty-five (65.3%) (49) of the patients presented positive cultures. *Escherichia coli* 20% (15), *Staphylococcus aureus* 12% (9), *Klebisiella pneumoniae* 6.7% (5) were the most frequent microorganisms. As for the use of prophylactic antibiotics, 20% (15) did not use them, 80% (60) of the patients used them, with cephalosporin being the most used class with 76% (57). Among the patients, 96% (72) used antibiotic therapy, with the cephalosporin class being the most prescribed, with 42.7% (32). As for laboratory tests, leukocytes showed a mean of 9,160.66 cells/mm^3 (SD=6,682.38), with a median of 9,830/mm^3. The value of C-reactive protein (CRP) showed a mean of 39.12 mg/dL

(SD=39.94), with a median of 19.40 mg/dL.

When the association of exposure variables with the outcome of surgical reoperation was evaluated, it was found that patients hospitalized as a result of injuries from external causes were approximately four times more likely to need surgical reoperation than other hospitalization diagnoses [OR= 3.74 (95% CI=1.33-10.47); p=0.011]. This finding was also found in the orthopedic surgical specialty, with a five times greater chance in relation to general surgery, [OR= 5.54 (95% CI=1.65-18.55); p=0.003]. Patients who are readmitted are 10 times more likely to need a second surgery compared to the others (Table 1).

Table 1 – Surgical reoperation in individuals who had surgical site infection, according to hospitalization characteristics. Campos Gerais, Paraná, 2019.

Characteristics	Surgical reoperation				OR*	95% IC†	*p value*
	YES		NO				
	n	%	n	%			
> 60 years							
Yes	21	67,7	10	32,3	2,10	0,80-5,59	0,130
No	22	50,0	22	50,0			
External Causes							
Yes	22	75,9	7	24,1	**3,74**	**1,33-10,47**	**0,011**
No	21	45,7	25	54,3			
Risk classification							
Urgency	11	73,3	4	26,7	2,40	0,68-8,41	0,164
Elective	32	53,3	28	46,7			
Surgical topography							
Orthopedic	19	82,6	4	17,4	**5,54**	**1,65-18,55**	**0,003**
General surgery	24	46,2	28	53,8			
Contamination potential							
Clean	19	61,3	12	38,7	1,31	0,51-3,36	0,563
Potentially contaminated	24	54,5	20	45,5			
Surgery-related readmission							
Yes	26	86,7	4	13,3	**10,70**	**3,18-36,00**	**0,000**
No	17	37,8	28	62,2			
Length of Stay > 5 Days							
Yes	14	56,0	11	44,0	1,01	0,22-4,72	0,982
No	5	55,6	4	44,4			

* Odds Ratio: reference category: 1; † Confidence interval.

The positive culture and the therapeutic antibiotic, in turn, proved to be

protective factors. Patients without a positive culture were six times more likely to need surgical reoperation, when compared to the others [(OR=0.17(95% CI=0.06-0.50); p=0.001]. Patients who did not use antibiotic therapy, this ratio was twice as high [OR=0.40 (95% CI=0.30-0.53); p=0.04)] (Table 2). When evaluating the positive culture in relation to the prophylactic and therapeutic antibiotic, the study did not find statistical significance, pointing out that the prescription of antimicrobials did not explain the positive culture as a protective factor.

Table 2 – Surgical reoperation in patients who had surgical site infection, according to clinical and classification characteristics of the patients. Campos Gerais, Paraná: 2019.

Characteristics	Surgical reoperation				OR*	95% CI†	*p value*
	YES		NO				
	n	%	n	%			
Superficial infection							
Yes	1	25	3	75	0.23	0.02-2.32	0.182
No	42	59.2	29	40.8			
Deep incisional infection							
Yes	21	67.7	10	32.3	2.1	0.80-5.46	0.129
No	22	50	22	50			
Organ/space infection							
Yes	21	52.5	19	47.5	0.65	0.25-1.64	0.369
No	22	62.9	13	37.1			
Positive culture							
Yes	35	71.4	14	28.6	**0.17**	**0.06-0.50**	**0.001**
No	8	30.8	18	69.2			
Medical diagnosis							
Yes	7	46.7	8	53.3	0.58	0.18-1.82	0.354
No	36	60.0	24	40.0			
Use of prophylactic antibiotic							
Yes	36	60.0	24	40.0	1.71	0.54-5.35	0.350
No	7	46.7	8	53.3			
Use of therapeutic antibiotic							
Yes	43	59.7	29	40.3	**0.40**	**0.30-0.53**	**0.042**
No	0	0.0	3	100.0			

* Odds Ratio: reference category: 1; † Confidence interval.

The patients' laboratory tests were also evaluated and an association was found between the alteration in the tests and the need for surgical intervention. In patients with surgical reoperation, leukocytes had a mean of 9,160.66 cells/mm^3 (SD=6,682.38), and a median of 9,830 cells/mm^3 (p=0.002). The CRP value had a mean of 39.12 (SD=39.94) and a median of 19.40 (p=0.016).

The other variables showed no significant association with the outcome studied (surgical reoperation), being age >60 years [OR=2.10 (95%CI=0.80-5.5); p=0.13], classification of the surgery as elective or urgent [(OR=2.40 (95% CI=0.68-8.41); p=0.16], classification regarding the potential for contamination [OR=1.31 (95% CI=0.51-3.36) p=0.33], classification of superficial incisional infection [OR=0.23 (95% CI=0.02-2.32) p=0.182), deep incisional [OR=2.10 (95% CI=0.80-5.46); p=0.12] and organ or cavity [OR=0.65 (95% CI=0.25-1.64) p=0.36], length of stay longer than 5 days [OR=1.01 (95% CI=0.22-4.72) p=0.001], medical diagnosis [OR=0.58 (95% CI=0.18-1.82) p=0.354] and the use of prophylactic antibiotics [OR=1.71 (95% CI=0.54-5.35) p=0.350] (Tables 1 and 2).

Discussion

The main findings of this study pointed to a figure where SSIs represent around one third (⅓) of the HAIs. Surgical site infections were present in a higher percentage in men and people over 50 years old. A fifth of surgeries were urgent, more than half occurred in potentially contaminated surgeries, and surgical reoperation was associated with external causes, orthopedic surgeries, positive culture, use of therapeutic antibiotics and readmission related to surgical procedures.

The World Health Organization (WHO) assumes that, per year, 230 million surgeries are performed in the world with the occurrence of seven million adverse events, with 1 million patients evolving to death. Among the adverse events related to surgeries are HAIs, as well as intraoperative adverse events, which also contribute to the occurrence of SSIs.[9]

Surgical site infections represented 41,7% of the HAIs, being considered the main cause of infection in the hospital of this study, differing from other findings in the literature in which the percentages of SSIs are between 14 and 20%.[2-10]

High SSI rates have been a worldwide challenge since 2008 and they are included in the patient safety goals created by the WHO to ensure patient integrity during surgery and prevent complications.[11]

In the present study, surgical reoperation predominated in males, similarly to a study evaluating patients admitted to an intensive care unit (ICU) who developed SSI.[12] The mean age was 50 years, similar to the value found among patients with SSI undergoing general surgery.[13]

It is suggested that, among people under 60 years of age, SSIs are related to

surgeries resulting from work and traffic accidents, in patients of productive working age, which could burden the health and social security systems, even beyond the private and family burden. On the other hand, exposure to risk situations, such as falls in older individuals, related to difficulty walking, and loss of visual and hearing acuity contribute to the fact that this patient profile is also prevalent within hospital institutions.[14]

The main causes of hospitalization according to the International Classification of Diseases (ICD-10) were diseases of the digestive system (included in Chapter XI), and injuries, poisonings and other external causes (included in Chapter XIX). Surgical specialties in more than a third were classified as orthopedic surgeries, and two thirds as general surgery, corroborating the prevalence found in an integrative review.[8]

Patients who are victims of external causes have multiple injuries and require rapid assessment and intervention, contributing to the occurrence of surgeries considered urgent. In these cases, agility of the team is necessary and this reduces adherence to the safe surgery checklist and interferes with anesthetic-surgical preparation, use of antibiotic prophylaxis, and alterations in the surgical technique, which may increase the risk of infections.[15-16] In this study, 20% of the patients underwent urgent surgeries, a value close to that found in a study evaluating the risk factors for infection in patients, in which a percentage of 16.3% of surgeries considered urgent was found.[17]

There are factors that increase the chance that a surgical patient will develop an infection. These factors include age, clinical condition of the patient, preoperative preparation, surgery time, and classification regarding the potential for contamination of the surgical site in relation to the presence of microorganisms.[5]

In addition to the urgency risk classification, surgeries are classified according to the potential for contamination, which helps to estimate the possibility of SSI. It is estimated that the risk is up to 2% for clean surgeries and 10% for potentially contaminated ones.[7] The distribution of clean surgeries in this study was 41.3% and potentially contaminated surgeries 58.7%. Clean surgeries are those performed on sterile tissues or those subject to decontamination, without the presence of an inflammatory or infectious process or technical failures.[1] Potentially contaminated surgeries are performed on tissues colonized by microbial flora without processes of infection and inflammation, as well as in surgeries with discrete intraoperative technical failures.[17]

Clean and potentially contaminated surgeries have a low percentage of risk of developing infection,[7] so the presence of SSI implies a reflection on the need to identify factors related to its development. It is necessary to take into account all the aspects that can influence the higher occurrence of infection, such as the fact that the hospital is a teaching institution, which contributes to higher rates of adverse events, including SSIs, according to the result found in a study that evaluated this profile of hospitals.[9]

Conducting a situational diagnosis is critical. Reviewing protocols and implementing process indicators are the way to evaluate actions within the hospital. The variability found in the performance of procedures related to surgery demonstrates fragility in serving the population. Well-established protocols, together with professional training, are simple and effective measures to improve adherence to SSI prevention measures.[18]

As for the length of stay of patients, the present study found a considerable percentage of patients who remained hospitalized for more than 10 days, developing the infection after 7 days of hospitalization. The hospital environment represents a risk factor for the development of infections, as it presents an environmental profile characterized by multiresistant microorganisms, in addition to other factors guided by environmental conditions, performance of health professionals and the clinical conditions of the patients.[19]

On the other hand, the presence of SSI contributes to the patient's permanence in a hospital environment for the treatment of the infection, increasing costs, particularly those related to antibiotic therapy, performing additional tests and the need for new surgical procedures.[20]

Surgical reoperation is considered an adverse event and can be related to infectious and non-infectious causes.[20] In this study, more than half of the patients required surgical reoperation, in line with the finding found in patients hospitalized for trauma in a hospital in Salvador where reoperation is the most frequent complication related to infection.[21] On the other hand, patients who underwent previous surgery have 4 times greater risk of developing SSIs, as found in an analysis that followed patients who had suffered orthopedic trauma.[22]

The realization of subsequent surgeries interferes with the quality of life of patients, who sometimes remain bedridden for long periods, unable to perform basic activities of daily living, having to deal with pain and with the risk of developing pressure injuries.[23]

In the evaluation of the associations between surgical reoperation and the other variables, it was found that injuries from external causes cause a greater chance of need for a surgical reoperation, what was also found when evaluating the orthopedic specialty compared to general surgery.

External causes produce, in addition to high mortality rates, factors that contribute to the chronicity of the patients, leading them to new surgical procedures that may require longer stay in the hospital environment and readmission due to the severity of the infection. External causes are directly linked to the orthopedic specialty, which involves procedures that consist of correction of fractures and deformities in ligaments resulting from trauma and poor body positioning, characterized by the use of specific equipment during the procedure, the need for external fixation and use of implants, factors that contribute to the increased risk of developing SSIs. The formation of biofilm on the implant is one of the most frequent causes of infection that lead to new surgical interventions, due to the need for its removal.[22]

The care team assumes a relevant role in controlling infections in the operating room, working to minimize avoidable risk factors, through the safe surgery checklist, strict control of the entry and exit of people in the operating room, ensuring the maintenance of aseptic technique during the entire procedure and the correct disinfection and sterilization of the materials and instruments used, in addition to monitoring the postoperative aspects of the surgical wound.[24]

Patients who are readmitted have a 10 times greater chance of needing a new surgical intervention, according to the results found, in agreement with the study that evaluated readmissions of post-surgical patients and found that, among the most common causes related to readmissions, are surgical reoperations related to SSIs.[25]

The association was also present between the need for a new surgical approach and changes in laboratory tests. The finding of leukocytosis and alteration in CRP indicate the presence of an established inflammatory or infectious process. This association can be explained by the presence of infection, as patients who had a SSI are more likely to need new surgical procedures. The presence of infections compromises the initial treatment, requiring aggressive debridement, removal of implants and re-implantations, leading to new hospitalizations and new surgical interventions.[22]

Identifying the SSI early is an essential action to promote patient safety; in this sense, the practice of post-discharge surveillance is essential for the perception of cases, facilitating monitoring and rapid intervention and preventing complications.[26]

Organ/space infections were the most frequent, which points to the delay in diagnosing the infections, a fact that contributes to the worsening of the situation, differing from the study that evaluated orthopedic surgical patients finding the prevalence of superficial infections and stated that the high percentages are only detected when the patient is followed up after discharge.[20]

Post-discharge care is essential for the epidemiological surveillance of infections, as it contributes to obtaining accurate indicators and allows for the early identification of the SSI.[26] Qualified professionals are necessary to diagnose the presence of the infection according to the criteria established by guiding bodies, reinforcing the importance of the hospital infection control service (CCIH), as a link between care and surveillance bodies, updating the team regarding the necessary standards.

A study that evaluated patients with SSI,[23] found that the most common clinical signs of infection were the presence of purulent secretion, pain, hyperemia, fever and suture dehiscence, and the medical diagnosis was present in 20% of the cases.

There is a difference in the diagnosis of SSI between the infection control service and the physician in charge. The CCIH adopts the criteria described by the National Health Surveillance Agency (Anvisa), which take into account clinical and laboratory signs at the time of infection closure. In this context, the importance of constant updating in the hospital environment is evident. Scientific knowledge combined with clinical practice favors early identification of infection, contributing to a favorable outcome.

The choice of antimicrobial agent lacks some criteria, including the collection of cultures, knowledge of the host, clinical microbiology, and mechanism of action of antibiotics. Thus, it is possible to conceive the hypothesis that culture occupies the place of a protective factor in this investigation, as it guides the choice of antibiotic for treatment, making the treatment effective and avoiding complications.[27]

The fact that the patient has a positive culture contributes to the nursing team being more attentive to the care related to the wound and to the treatment, contributing so that the infection does not develop unfavorably and does not require a

new surgical intervention.

The hypothesis was raised that the presence of a positive culture would be related to the initiation of early treatment with antibiotics; however, when the positive culture in relation to the prophylactic and therapeutic antibiotic was evaluated, the study did not find statistical significance, the prescription of antimicrobials did not explain positive culture as a protective factor.

As for the microbiological profile found, *Staphylococcus aureus*, *Escherichia coli*, and *Klebisiella pneumoniae* were the most prevalent microorganisms, a finding similar to those found in other studies evaluating patients undergoing surgery.[9,23]

Considering that the transmission of microorganisms occurs by direct contact or by a common source, it is necessary to carefully monitor these pathogens in a hospital environment. Simple measures, such as the correct use of personal protective equipment (apron, sterile gloves, cap and mask) during surgery, as well as hand hygiene at all 5 moments, cleaning surfaces, performing procedures in aseptic technique, for example, changing the dressing of the surgical incision and the rational use of antimicrobials are fundamental for the prevention of adverse events related to infections.

The use of prophylactic antibiotics was high in this study, the most used class being cephalosporin, a factor that contributes to the prevention of SSI. This finding was also seen in other studies that evaluated the prevalence of antibiotic prophylaxis. The choice of prophylactic antibiotic takes into account good penetration into surgical wounds, being safe and effective against various gram-positive and gram-negative microorganisms and also having a reasonable cost.[23] The objective of prophylaxis is to prevent SSIs by reducing the microbial load at the operation site, requiring an effective serum and tissue concentration, above the minimum inhibitory concentration of the antibiotic at the time of skin incision, especially in surgeries considered potentially contaminated.[26]

The erroneous use of surgical prophylaxis contributes to increased cost and the risk of developing bacterial resistance.[16] In this sense, it is necessary to implement a surgical prophylaxis protocol in order to guide prescribers as to the dose and duration of prophylaxis in each surgical specialty.

On the other hand, in the present study, a quarter of the patients did not receive prophylaxis, a fact that could be justified by the emergency surgeries, which do not allow

adequate preoperative preparation. However, this percentage also includes elective patients who did not have adequate prophylaxis, showing the need to sensitize the team about the importance of adequate administration of the prophylactic antibiotic. However, prophylactic antibiotic does not replace other preventive care measures, requiring general adherence to preventive measures from the preoperative period, through the intraoperative period to the postoperative period.

Antibiotic therapy was used in almost all patients studied, being considered a protective factor. Cephalosporin and quinolones were the most prescribed classes. It is emphasized that the prescription of antimicrobials must follow priorities such as the severity of the disease, the effectiveness of the drugs, the previous use of antibiotics, the resistance of microorganisms, the length of hospitalization and the epidemiological impact.[28] The presence of the antibiotic as a protective factor is explained by the early treatment of infections, preventing further complications.

This study brings to the discussion aspects little described in the literature, showing the importance of new studies in the area evaluating other aspects in the context of surgical reoperation, in addition to addressing relevant topics from an epidemiological point of view, which can guide other hospitals that serve the same profile of patients.

It is pointed out as a limitation the fact that the study is local, developed in only one health service, the sample size, the characteristics of the studied group and the period of one year are also highlighted, since in the face of the pandemic context it was not possible to carry out a historical series. Also noteworthy is the difficulty in collecting retroactive data, related to the quality of information present in medical records and in the infection criteria closing forms.

Based on the data found, there is a need for continuous evaluation of the practices developed, seeking to strengthen patient safety in a hospital environment. The prevention of HAIs is the result of a joint role between hospital infection control, the patient safety center, continuing education, hospital managers and the care team, making it essential to raise awareness of the prevention process.

Conclusion

In this research, it was possible to find an association between the need for

surgical reoperation and external causes, the orthopedic surgical specialty, altered results in laboratory tests, hospital readmission. Positive culture and use of therapeutic antibiotic therapy were protective factors against reoperations. The data contribute to the understanding of the factors that influence the need for a new surgical intervention, demonstrating that the presence of SSIs is a strong influencer of the process.

The work brings as a reflection the importance of carrying out the constant situational diagnosis in the hospital units, being essential to raise the awareness of the team involved in patient care, aiming at patient safety.

Finally, further studies are encouraged with a prospective approach and involving a larger sample in order to monitor the population on the risk of developing infection and to elucidate which other factors may be associated with surgical reoperation.

References

1. Ministério da Saúde (BR). Critérios diagnósticos de infecção relacionada à assistência à saúde. [Internet]. Brasília (DF): Agência Nacional de Vigilância Sanitária; 2017 [acesso em 2020 set 17]. (Série Segurança do Paciente e Qualidade em Serviços de Saúde; 2). Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/criterios_diagnosticos_infeccoes_assistencia_saude.pdf

2. Center for Disease Control and Prevention (CDC). National Healthcare Safety Network (NHSN) Patient Safety Component Manual. Surgical Site Infection Event [Internet]. 2022 [cited 2022 Feb 08]. Available from: https://www.cdc.gov/nhsn/pdfs/pscmanual/pcsmanual_current.pdf

3. Trentin T, Pompermaier C. Risco de infecção por sítio cirúrgico. Anuário pesquisa e extensão Unoesc Xanxerê [Internet]. Joaçaba (SC): Unoesc; 2020 [acesso em 2020 set 17];5:e24122. Disponível em: https://portalperiodicos.unoesc.edu.br/apeux/article/view/24122

4. Souza KV, Serrano SQ. Saberes dos enfermeiros sobre prevenção de infecção do sítio cirúrgico. Rev SOBECC. 2020;25(1):11-6. doi: 10.5327/Z1414-4425202000010003

5. Souza ISB, Santana AC, D'Alfonso Júnior G. A ocorrência de infecção do sítio cirúrgico: um estudo de revisão. Rev Med Minas Gerais. 2018 [acesso em 2021 jul 17];28(Supl 5):e-S280521. doi: 10.5935/2238-3182.20180133

6. Martins T, Amante LN, Virtuoso JF, Sell BT, Wechi JS, Senna CVA. Fatores de risco para infecção do sítio cirúrgico em cirurgias potencialmente contaminadas. Texto Contexto Enferm. 2018;27(3):1-12. doi: 10.1590/0104-070720180002790016

7. Costa AC, Santa-Cruz F, Ferraz AAB. O que há de novo em infecção do sítio cirúrgico e antibioticoprofilaxia em cirurgia? ABCD Arq Bras Cir Dig. 2020;33(4):e1558. doi: 10.1590/0102-672020200004e1558

8. Santos GC, Baylão AFG, Borges SCF, Silva LA, Batista MHJ, Leite GR. Incidência e fatores de risco de infecção de sítio cirúrgico: revisão integrativa. Itinerar Reflect. 2015;11(1):1-11. doi: 10.5216/rir.v11i1.34142

9. Batista J, Cruz EDA, Alpendre FT, Rocha DJM, Brandão MB, Maziero ECS. Prevalência e evitabilidade de eventos adversos cirúrgicos em hospital de ensino do Brasil. Rev Latinoam Enferm.

2019;27:e2939. doi: 10.1590/1518-8345.2939.3171

10. Ministério da Saúde (BR). Assistência segura: uma reflexão teórica aplicada à prática [Internet]. Brasília (DF): Agência Nacional de Vigilância Sanitária; 2017 [acesso em 2020 set 17]. (Série Segurança do Paciente e Qualidade em Serviços de Saúde; 1). Disponível em: http://www.saude.pi.gov.br/uploads/divisa_document/file/374/Caderno_1_-_Assist%C3%AAncia_Segura_-_Uma_Reflex%C3%A3o_Te%C3%B3rica_Aplicada_%C3%A0_Pr%C3%A1tica.pdf

11. Correia MITD, Tomasich FDS, Castro Filho HF, Portari Filho PE, Colleoni Neto R. Segurança e qualidade em cirurgia: a percepção de cirurgiões no Brasil. Rev Col Bras Cir. 2019;46(4):2146. doi: 10.1590/0100-6991e-20192146

12. Boaventura JEM, Cordeiro ALAO, Barros CSMA, Moreira BSG, Lobo JO, Pedreira LC. Infecções de sítio cirúrgico: Incidência perfil de resistência antimicrobiana em unidade de terapia intensiva. Rev Baiana Enferm. 2019;33:e3359. doi: 10.18471/rbe.v33.33595

13. Carvalho RLR, Campos CC, Franco LMC, Rocha AM, Ercole FF. Incidence and risk factors for surgical site infection in general surgeries. Rev Latinoam Enferm. 2017;25:e2848. doi: 10.1590/1518-8345.1502.2848

14. Silva LAP, Ferreira AC, Paulino RES, Guedes GO, Cunha MEB, Peixoto VTCP, et al. Análise retrospectiva da prevalência e do perfil epidemiológico dos pacientes vítimas de trauma em um hospital secundário. Rev Med. 2017;96(4):246-54. doi: 10.11606/issn.1679-9836.v96i4p246-254

15. Marquioni FSN, Moreira TR, Diaz FBBBS, Ribeiro L. Cirurgia segura: avaliação da adesão ao checklist em um hospital de ensino. Rev SOBECC. 2019;24(1):22-30. doi: 10.5327/Z1414-4425201900010006

16. Secretaria de Estado do Espírito Santo, Secretaria de Estado da Saúde. Atendimento de urgência ao paciente vítima de trauma: diretrizes clínicas. [Internet]. Vitória (ES): Governo do Estado do Espírito Santo; 2018 [acesso em 2020 set 17]. Disponível em: https://saude.es.gov.br/Media/sesa/Protocolo/Atendimento%20de%20Urg%C3%AAncia%20ao%20Paciente%20V%C3%ADtima%20de%20Trauma.pdf

17. Zarain-Obrador L, Alonso-García M, Gil-Yonte P, Hijas-Gómez AI, Rodríguez-Villar D, Martínez-Amores B, et al. Effect of a surgical care bundle on the incidence of surgical site infection in colorectal surgery: a quasi-experimental intervention. Rev Invest Clin. 2021;73(4):251-8. doi: 10.24875/ric.21000067

18. Gouvêa M, Novaes CO, Iglesias AC. Assessment of antibiotic prophylaxis in surgical patients at the Gaffrée e Guinle University Hospital. Rev Col Bras Cir. 2016;43(4):225-34. doi: 10.1590/0100-69912016004001

19. Governo do Estado de São Paulo, Secretaria de Estado da Saúde. Melhores práticas para higiene e limpeza em ambiente hospitalar [Internet]. São Paulo (SP): Secretaria de Estado da Saúde (SP); 2019 [acesso em 2020 set 17]. Disponível em: http://www.saude.sp.gov.br/cve-centro-de-vigilancia-epidemiologica-prof.-alexandre-vranjac/homepage/noticias/noticias/manual-de-higiene

20. Franco LMC, Ercole FF, Mattia A. Infecção cirúrgica em pacientes submetidos a cirurgia ortopédica com implante. Rev SOBECC. 2015;20(3):163-70. doi: 10.5327/Z1414-4425201500030007.7

21. Castro RRM, Ribeiro NF, Andrade AM, Jaques BD. Perfil dos pacientes da enfermaria de ortopedia de um hospital público de Salvador-Bahia. Acta Ortop Bras. 2013;21(4):191-4. doi: 10.1590/S1413-78522013000400001

22. Bachoura A, Guitton TG, Smith MR, Vrahas MS, Zurakowski D, Ring D. Infirmity and injury complexity are risk factors for surgical-site infection after operative fracture care. Clin Orthop Relat

Res. 2011;469(9):2621-30. doi: 10.1007/s11999-010-1737-2

23. Vidal LS, Silva VHR. Infecções de sítio cirúrgico relacionadas às cirurgias ortopédicas com inserção de implantes [monografia]. Goiânia (GO): Pontifícia Universidade Católica de Goiás; 2018 [acesso em 2021 jul 26]. Disponível em: https://repositorio.pucgoias.edu.br/jspui/handle/123456789/1185

24. Agência Nacional de Vigilância Sanitária (ANVISA). Medidas de prevenção de infecção relacionada à assistência à saúde. Brasília (DF): Agência Nacional de Vigilância Sanitária; 2017 [acesso em 2021 dez 17]. Cap. 5. p. 87-93 (Série Segurança do Paciente e Qualidade em Serviços de Saúde; 4). Disponível em: http://antigo.anvisa.gov.br/documents/33852/3507912/Caderno+4+-+Medidas+de+Preven%C3%A7%C3%A3o+de+Infec%C3%A7%C3%A3o+Relacionada+%C3%A0+Assist%C3%AAncia+%C3%A0+Sa%C3%BAde/a3f23dfb-2c54-4e64-881c-fccf9220c373

25. Rosen AK, Chen Q, Shin MH, O'Brien W, Shwartz M, Mull HJ, et al. Medical and surgical readmissions in the veterans health administration: what proportion are related to the index hospitalization? Med Care. 2014;52(3):243-9. doi: 10.1097/MLR.0000000000000081

26. Garcia TF, Oliveira AC. Infecção do sítio cirúrgico após cirurgias com implante de próteses ortopédicas. Enferm Brasil. 2018;17(2):145-53. doi: 10.33233/eb.v17i2.979

27. SILVA FFS. Perfil do uso de antimicrobianos na profilaxia de intervenções cirúrgicas. [monografia]. Mossoró (RN): Faculdade Nova Esperança de Mossoró; 2019 [acesso em 2021 jul 30]. Disponível em: http://www.sistemasfacenern.com.br/repositorio/admin/acervo/f35de83b51bbfcca6c0cd23d3b0887a5.pdf

28. Melo FS, Azevedo SL, Porto IS, Tavares FG, Braga ALS, Paiva PB. Uso racional de antimicrobianos na unidade de terapia intensiva. Rev UFPE On Line. 2019;13(5):1475-84. doi: 10.5205/1981-8963-v13i5a238666p1475-1484-2019.0

Author contributions

1 – Larissa Stefani
Corresponding author
Nurse - E-mail: larissastefani_2@hotmail.com
Collaborated with the conception and design, analysis and interpretation of the data collected, as well as writing of the article and relevant critical review of the intellectual content

2 – Pollyanna Kássia de Oliveira Borges
Teacher - E-mail: pkoborges@uepg.br
Collaborated with the conception and design, analysis and interpretation of the data collected, as well as writing of the article and relevant critical review of the intellectual content

3 – Maria Dagmar da Rocha
Nurse - Email: nurse67@live.com
Contributions: Collaborated with relevant critical review of the intellectual content.

Editora Científica: Tânia Solange Bosi de Souza Magnago
Editora Associada: Rhanna Emanuela Fontenele Lima de Carvalho

How to quote this article

Stefani L, Borges PKO, Rocha MD. Surgical site infections: surgical reoperation and infection in clean and potentially contaminated surgeries. Rev. Enferm. UFSM. 2022 [Access at: Year Month Day]; vol.12, e12:1-17. DOI: https://doi.org/10.5902/2179769267474