Preoperative period of potentially contaminated surgeries: risk factors for surgical site infection

Pré-operatório de cirurgias potencialmente contaminadas: fatores de risco para infecção do sítio cirúrgico

Tatiana Martins[1]
Lúcia Nazareth Amante[1]
Janeisa Franck Virtuoso[1]
Juliana Balbinot Reis Girondi[1]
Eliane Regina Pereira do Nascimento[1]
Keyla Cristine do Nascimento[1]

Keywords
Patient safety; Perioperative nursing; Surgical nursing; Surgical wound infection; Cross infection

Descritores
Segurança do paciente; Enfermagem perioperatória; Enfermagem cirúrgica; Infecção da ferida operatória; Infecção hospitalar

Submitted
July 28, 2016

Accepted
January 30, 2017

Corresponding author
Tatiana Martins
Agronômica street, 69, 88110-505, São José, SC, Brazil.
tatiana_martins15@hotmail.com

DOI: http://dx.doi.org/10.1590/1982-0194201700004

Abstract

Objective: To associate risk factors of the preoperative period of potentially contaminated surgeries performed in a teaching hospital in the southern region of Brazil with the occurrence of surgical site infection in the postoperative period in the hospital and at home.

Methods: A quantitative descriptive cross-sectional study conducted from February to June 2015 with 90 participants by means of individual data collection and observation, from the preoperative period, immediate postoperative period and up to seven days after discharge. The Statistical Package for Social Sciences was used for data analysis. Categorical variables were analyzed descriptively by simple frequency and percentages, and numerical variables by position and dispersion measurements.

Results: The surgical site infection in the postoperative period in the hospital occurred in 10% of participants, and in the postoperative period at home in 46.7%. Risk factors: gender, age, underlying diseases, medications, alcoholism and smoking habits were significant for the development of these infections.

Conclusion: Checking the health history and performing follow-up of surgical patients during the preoperative period and surgical recovery to reduce surgical site infection are recommended.

Resumo

Objetivo: Associar fatores de risco do período pré-operatório, de cirurgias potencialmente contaminadas, realizadas em hospital escola da região Sul do Brasil, com a ocorrência da infecção do sítio cirúrgico no período pós-operatório hospitalar e em domicílio.

Métodos: Estudo transversal descritivo quantitativo realizado de fevereiro a junho de 2015 com 90 participantes mediante a coleta de dados realizada sob a forma de entrevista individual e observação, desde o período pré-operatório, pós-operatório imediato e mediato até sete dias após alta hospitalar. Para análise de dados utilizou-se o *Statistical Package for Social Sciences*, sendo as variáveis categóricas analisadas descritivamente através da frequência simples e porcentagens e as numéricas pelas medidas de posição e dispersão.

Resultados: A infecção do sítio cirúrgico no período pós-operatório hospitalar ocorreu em (10%) e no pós-operatório domiciliar em 46,7%. Fatores de risco: sexo, idade, doenças de base, medicações, etilismo e tabagismo foram significativos para o desenvolvimento destas infecções.

Conclusão: Recomenda-se a realização de histórico de enfermagem e acompanhamento dos pacientes cirúrgicos, durante o período pré-operatório e recuperação operatória, para reduzir a infecção do sítio cirúrgico.

[1]Universidade Federal de Santa Catarina, Florianópolis, SC, Brazil.

Conflicts of interest: no conflicts of interest to declare.

Introduction

The perioperative period encompasses the preoperative, intraoperative and postoperative stages and implies the interdependent performance of the nursing and surgical teams.[1] The preoperative period is the time interval between the recognition of the need for surgery and the patient's arrival at the surgical center. At this moment, nurses identify and evaluate patients' conditions, obtaining information that can diminish their fears and insecurities, and thus promote quality care for the next surgical periods.[2]

Not only in the preoperative period, but also throughout the postoperative period in the hospital and at home, the nursing team should perform specific care for each type of surgical procedure, with infection control, and seeking tools to reduce prevalent rates of infection and predisposing risk factors.[3,4]

The confirmation of risk factors, creation and use of intervention protocols, and management of the nursing team to use care technologies and provide safe care are relevant aspects to provide perioperative nursing care that is active in the control and prevention of complications and hospital infections.[5] Surgical safety is based on saving lives and preventing disabilities through actions to prevent surgical site infection; safe anesthesia; safe surgical teams and indicators of surgical care.[6]

Surgical Site Infection (SSI) results from poor surgical manipulation involving subcutaneous tissue, deep soft tissues (fascia and muscle), organ and cavities with incision. They are characterized as those occurring up to the 30th postoperative day or up to a year for surgeries with prosthesis implants. They rank third among all infections in health services and occur in 11% of surgeries performed in Brazil, since this rate varies according to the type of surgical procedure and the patient's own immunity. It is one of the main infections related to Brazilian health care and the most important cause of postoperative complication in surgical patients.[4,7]

Potentially contaminated surgeries are those performed in tissues colonized by small microbial flora or in colonized tissues absent from infectious and inflammatory processes and with discrete intraoperative technical failures. There is penetration in the digestive, respiratory or urinary tract without significant contamination. Examples of potentially contaminated surgeries are elective surgery in the small intestine, biliary surgery without stasis or biliary obstruction, gastric and duodenal surgery, clean traumatic wounds, cholecystectomy, vagotomy with drainage, prolonged cardiac surgeries with extracorporeal circulation.[2]

In a teaching hospital in southern Brazil, 2259 surgical procedures were performed in 2013, of which 1248 (55.25%) were potentially contaminated and 40 (1.77%) were infected surgeries. Of the 1248 patients who underwent potentially contaminated surgical procedures, 82 (6.57%) acquired Hospital Infection (HI) and 35 (2.80%) developed SSI. These numbers, when added, show a HI incidence within the range recommended by the Centers for Disease Control and Prevention and the Ministry of Health (3 and 11%; and up to 10%, respectively).[8]

The search for scientific knowledge to support the practice of perioperative nursing care is important to perform interventions focused on meeting surgical patients' needs, based on the scientific literature, and with interaction between care practice and the theory.[9]

In relation to protection against situations that endanger the essential aspects of life and physical and mental integrity, the right to health with safety is a central mechanism in the development and implementation of health care actions with quality and safety.[10]

The relevance of this issue is to provide subsidies for infection control, reduction of hospital costs, and improvement of surgical care. The provision of nursing care to surgical patients, especially in the preoperative period, together with the identification of risk factors are indispensable to prevent SSI, thus promoting patient safety. In addition, the importance of the issue of surgeries was given based on the considerable number of the type and classification of this surgery performed at the teaching hospital. According to the number of surgical procedures, it was possible to detect the presence of SSI in potentially contaminated surgeries as a complication at

the teaching hospital, requiring effective prevention measures and early therapy to reduce the number of cases.[11] From this perspective, the question is: Which risk factors of the preoperative period of potentially contaminated surgeries performed in a teaching hospital in southern Brazil are associated with the occurrence of surgical site infection in the postoperative period in the hospital and at home? The aim of this study was to associate preoperative risk factors of potentially contaminated surgeries performed in a teaching hospital in southern Brazil with the occurrence of surgical site infection in the postoperative period in the hospital and at home.

Methods

Descriptive cross-sectional study of quantitative approach conducted in two surgical units of a teaching hospital in the south of Brazil from February 12 to June 30, 2015.

The convenience sample was calculated based on the number of patients submitted to potentially contaminated surgeries performed in 2013, which was 1248 in total according to data collected at the collection site. The sample was calculated using the Web Statistics Teaching-Learning System (SEstatNet - Sistema de Ensino-Aprendizagem de Estatística na Web),[1] with p value of 50% and confidence level of 95%, resulting in a sample of 90 patients.[12,13] Inclusion criteria were age of 18 years or older; auto-alo-chrono-oriented, admitted during the data collection period in the preoperative period of potentially contaminated elective surgeries, and that provided contact information for the period after hospital discharge. The excluded patients were those with previously infected surgeries, who were included in the sample and submitted to a new hospitalization during the data collection period to perform another surgical procedure, or those with any type of systemic infection confirmed prior to surgery.

The instrument used to collect data during the preoperative period was an individual interview through a structured script, and information from the medical records. The script contained data related to the following variables: age (young adult aged up to 24 years, adults aged 25-59 years, and elderly aged 60 years or more); gender; degree of dependency (semi-dependent and independent); living alone or not; diabetes *mellitus* as underlying disease; smoking habits; diagnosis of current disease such as cholelithiasis; use of the following medications: antihypertensive, anxiolytic, antidiabetic, anticoagulant, anticoagulant and gastric protector; use of a peripheral venous catheter and admission to the Intensive Care Unit (ICU) after a surgical procedure.

An interview script and observation were used to collect data in the immediate postoperative period and up to seven days after surgery, and the presence or absence of SSI were verified as categorical variables. For this end, the following were evaluated: characteristics of the surgical site dressings in dry and clean; presence or absence of pain, hyperemia, heat, edema and dehiscence. In addition, the characteristics for SSI classification such as pain, flushing, heat, edema, fever, dehiscence and purulent exudate were investigated to confirm SSI in postoperative periods in the hospital and at home.

Participants were followed up from the preoperative period until their hospital discharge. Seven days after discharge, they were contacted by telephone with the objective of monitoring changes in the cicatricial evolution of the surgical site (favorable or not). Therefore, participants answered some questions of an individual interview script related to the healing process of the surgical incision and the clinical condition evolution, besides monitoring and/or confirming changes in the cicatricial evolution of the surgical site (favorable or not).

Data were stored and analyzed in the Statistical Package for Social Sciences (SPSS), version 22.0. Categorical variables were analyzed descriptively by means of simple frequency and percentages, and numerical variables by position and dispersion measurements. In the inferential analysis of modifiable risk factors and presence/absence of SSI, was applied the Chi-square test (χ^2). The bivariate association was analyzed through binary logistic regression to verify the association between SSI (in the postoperative period in the hospital and at home) and its

preoperative risk factors. For the regression model were inserted only variables with p ≤ 0.200 in comparison with the presence of SSI. The significance level was set at 5% (p = 0.05), where the based limit proves if the deviation originates from chance or not. To confirm the influence of risk factors on the occurrence of SSI, the EXP (B) - OR interval was 1.

The study was approved by the Committee of Ethics and Research with Human Beings (CEPSH - Comitê de Ética e Pesquisa com Seres Humanos) of the Institution and approved under protocol number 925.511/14, and by the Certificate of Presentation for Ethical Appreciation (CAAE - Certificado de Apresentação para Apreciação Ética) under number 39866414.1.0000.0115.

Results

Regarding sociodemographic characteristics of the 90 patients, four (4%) were young adults; 62 (69%) were adults, and 24 (27%) were elderly. The majority were women, 68 participants or 76% of the sample. Of the total number of participants, 82 (91%) had children, 24 (27%) had completed elementary school and 27 (30%) had completed secondary education, which were the most common. In relation to underlying diseases, 48 (54%) had systemic arterial hypertension (SAH); 23 (25%) had diabetes mellitus (DM) and 19 (21%) had morbid obesity, 33 (37%) were alcoholics and 32 (36%) were smokers. Regarding the diagnoses of diseases for surgical intervention, 23 (26%) had acute cholecystitis; 21 (24%) had cholelithiasis, and 17 (19%) were diagnosed with obesity. In relation to degree of dependency, 81 (90%) patients were independent and nine (10%) were semi-dependent, requiring assistance with the sprinkler, support in walking and feeding, and care when leaving and returning to bed. The mean length of hospital stay in the postoperative period in the hospital was 13.71 days for seven (8.3%) patients who developed hospital SSI.

The SSI in the postoperative period in the hospital occurred in nine (10%) participants. The association of SSI with preoperative risk factors was interpreted by bivariate analysis (Table 1) with emphasis on the degree of dependency (χ^2 = 6.049; p = 0.014) and admission to ICU after surgery (χ^2 = 6.429; p = 0.011).

Differently from the postoperative period in the hospital, there was prevalence of SSI at home in 42 participants (46.7%) of the 90 interviewed. Through bivariate analysis, the association of SSI in

Table 1. Bivariate analysis between preoperative risk factors and presence/absence of SSI in the postoperative period in the hospital

Risk factors	Without SSI in the hospital n = 81 (90) n(%)	SSI in the hospital n = 9 (10) n(%)	Total n = 90 (100) n(%)	χ^2	p-value
Gender					
Male	18(22.2)	4(44.4)	22(24.4)	2.166	0.141
Female	63(77.8)	5(55.6)	68(75.6)		
Underlying disease					
Diabetes *Mellitus*					
Yes	19(23.5)	4(44.4)	23(25.6)	1.875	0.171
No	62(76.5)	5(55.6)	67(74.4)		
Smoker					
Yes	27(33.3)	5(55.6)	32(35.6)	1.746	0.186
No	54(66.7)	4(44.4)	58(64.4)		
Diagnosis of current disease					
Cholelithiasis					
Yes	21(25.9)	0(0)	21(23.3)	3.043	0.081
No	60(74.1)	9(100)	69(76.7)		
Medications					
Anxiolytic					
Yes	17(21)	0(0)	17(100)	2.329	0.127
No	64(79)	9(100)	73(81.1)		
Antihypertensive					
Yes	49(60.5)	8(88.9	57(63.3)	2.812	0.094
No	32(39.5)	1(11.1)	33(36.7)		
Antidiabetic					
Yes	19(23.5)	4(44.4)	23(25.6)	1.875	0.171
No	62(76.5)	5(55.6)	67(74.4)		
Anticoagulant					
Yes	11(13,6)	3(33.3)	14(15.6)	2.406	0.121
No	70(86,4)	6(66.7)	76(84.4)		
Invasive device					
Peripheral venous catheter					
Yes	40(49.4)	2(22.2)	42(46.7)	2.401	0.121
No	41(50.6)	7(77.8)	48(53.3)		
Degree of dependency					
Semi-dependent	6(7.4)	3(33.3)¥	9(10)	6.049	0.014*
Independent	75(92.6)¥	6(66.7)	81(90)		
ICU admission					
Yes	15(18.5)	5(55.6)¥	20(22.2)	6.429	0.011*
No	66(81.5)¥	4(44.4)	70(77.8)		

n - %; ICU - Intensive Care Unit; χ^2 - Chi-square; p - significance level; ¥ = Residual adjustment ≥ 2.0; *p ≤ 0.05

the postoperative period at home and preoperative risk factors (Table 2) emphasized the category of living alone or not (χ^2 = 13.448; p < 0.001) with significant difference.

Table 2. Bivariate analysis of modifiable preoperative risk factors and presence/absence of SSI in the postoperative period at home

Risk factors	Without SSI at home n = 48(53.3) n(%)	SSI at home n = 42(46.7) n(%)	Total n = 90(100) n(%)	χ^2	p-value
Age				5.382	0.068
Young adult	4(8.3)	0(0.0)	4(4.4)		
Adult	29(60.4)	33(78.6)	62(68.9)		
Elderly	15(31.3)	9(21.4)	24(26.7)		
Living alone				13.448	< 0.001*
Yes	6(12.5)	20(47.6)¥	26(28.9)		
No	42(87.5)	22(52.4)	64(71.1)		
Diagnosis of current disease				1.957	0.162
Cholelithiasis					
Yes	14(29.2)	7(16.7)	21(23.3)		
No	34(70.8)	35(83.3)	69(76.7)		
Medications				1.676	0.195
Gastric protection					
Yes	28(58.3)	30(71.4)	58(64.4)		
No	20(41.7)	12(28.6)	32(35.6)		
Anticoagulant				2.181	0.140
Yes	10(20.8)	4(9.5)	14(5.6)		
No	38(79.2)	38(90.5)	76(84.4)		

n-%;χ^2-Chi-square; p-significance level; ¥ - Residual adjustment ≥ 2.0; *p≤ 0.05

Table 2 demonstrates that 33 (78.6%) participants with SSI in the postoperative period are adults, 20 (47.6%) live alone, 35 (83.3%) did not present cholelithiasis, 30 (71.4%) used gastric protection medication, and 38 (90.5%) did not use anticoagulants.

In the binary logistic regression, the crude analysis shows that chances of patients presenting SSI in the postoperative period in the hospital according to preoperative risk factors are higher in semi-dependent patients (OR = 6.25 , 95% CI = 1.24 - 31.46) and admitted to the ICU (OR = 5.50, 95% CI = 1.32 - 22.98). The use of a peripheral venous catheter (OR = 0.29, 95% CI = 0.06 - 1.50) was observed as a protective factor, that is, those who used this device had 29% less chance of developing SSI compared to patients who did not use it (Table 3).

In the adjusted analysis, no risk factors of the preoperative period influenced the onset of SSI.

Table 3. Binary logistic regression analysis of preoperative risk factors in the presence of SSI in the postoperative period in the hospital

Risk factors	Gross analysis		Adjusted analysis	
	OR	CI 95	OR	CI 95
Gender				
Male	2.80	0.68 - 11.53	4.95	0.65 - 37.58
Female	1.00		1.00	
Underlying disease				
Diabetes *Mellitus*				
Yes	2.61	0.64 - 10.71	0.41	0.04 - 3.87
No	1.00		1.00	
Smoker				
Yes	2.50	0.62 - 10.07	3.84	0.56 - 26.27
No	1.00		1.00	
Diagnosis of current disease				
Cholelithiasis				
Yes	0.00	0.00 - 0.00	0.00	0.00 - 0.00
No	1.00		1.00	
Medications				
Anxiolytic				
Yes	0.00	0.00 - 0.00	0.00	0.00 - 0.00
No	1.00		1.00	
Antihypertensive				
Yes	5.23	0.62 - 43.79	3.62	0.29 - 45.95
No	1.00		1.00	
Antidiabetic				
Yes	2.61	0.63 - 10.71	0.41	0.04 - 3.87
No	1.00		1.00	
Anticoagulant				
Yes	3.18	0.70 - 14.62	2.40	0.28 - 20.54
No	1.00		1.00	
Invasive device				
Peripheral venous catheter				
Yes	0.29	0.06 - 1.50	0.08	0.007 - 0.98
No	1.00		1.00	
Degree of dependency				
Semi-dependent	6.25	1.24 - 31.46	7.40	0.63 - 87.00
Independent	1.00		1.00	
ICU admission				
Yes	5.50	1.32 - 22.98	1.44	0.22 - 9.27
No	1.00		1.00	

OR - Odds Ratio; CI 95% - 95% Confidence Interval; Adjusted Analysis - All variables were introduced in the independent adjusted p-value model. The variables with p ≤ 0.200 remained in the adjusted model

However, patients who used a peripheral venous catheter as an invasive device had a protective factor (OR = 0.08; 95% CI = 0.007-0.98), that is, 8% less chance of developing SSI over those who did not use this invasive device (Table 3).

The binary logistic regression of the postoperative period at home, in the crude analysis, showed that by preoperative risk factors, the chances of developing SSI were higher for patients living alone (OR = 6.36, 95% CI = 2 , 23 - 18,15), i.e., 6.3 times more opportunities of developing SSI than those who do not live

alone. In the adjusted analysis by preoperative risk factors, the chances of patients developing SSI in the postoperative period at home were also predominant in those living alone (OR = 8.32, 95% CI = 2.45 - 28.21). The risk factor of those diagnosed with cholelithiasis (OR = 0.30, 95% CI = 0.09 - 1.06) was evidenced as a protective factor. In this case, patients diagnosed with cholelithiasis are 30% less likely to develop SSI in the postoperative period at home (Table 4).

Table 4. Binary logistic regression analysis of preoperative risk factors in the presence of SSI with the risk factors of the postoperative period at home

Risk factors	Gross analysis		Adjusted analysis	
	OR	CI 95	OR	CI 95
Age				
Young adult	0.00		0.00	
Adult	1.90	0.00 - 0.00	3.64	0.00 - 0.00
Elderly	1.0	0.72 - 5.00	1.00	0.98 - 13.54
Living alone				
Yes	6.36	2.23 - 18.15	8.32	2.45 - 28.21
No	1.0		1.00	
Diagnosis of current disease				
Cholelithiasis				
Yes	0.48	0.17 - 1.35	0.30	0.09 - 1.06
No	1.0		1.00	
Medications				
Gastric protection				
Yes	1.78	0.74 - 4.31	2.28	0.80 - 6.45
No	1.0		1.00	
Anticoagulant				
Yes	0.40	0.11 - 1.39	0.60	0.13 - 2.82
No	1.0		1.00	

OR - Odds Ratio; CI 95% - 95% Confidence Interval; Adjusted Analysis - All variables were introduced in the independent adjusted p-value model. The variables with $p \leq 0.200$ remained in the adjusted model

The findings indicate that modifiable and non-modifiable variables related to the preoperative period for the development of SSI in the postoperative period in the hospital were: female gender, without DM as comorbidity, smoker, antihypertensive use, no use of peripheral venous catheter as invasive device, admission to ICU, and in relation to degree of dependency, being independent.

Discussion

Among the commitments of the World Health Organization (WHO) and the World Alliance for Patient Safety itself are the development of values that aim at communication improvement, information transparency, empowerment and patient participation in health services.[12]

However, there are risk factors such as conditions or variables associated with the possibility of negative outcomes for the health and well-being that lead to the development of nosocomial infections, in contrast to the commitment assumed by the WHO and the World Alliance for Patient Safety. Among the factors related to patients, the most prevalent were: clinical conditions; advanced age; gender; housing situation; obesity; malnutrition; immunosuppression; smoking habit; alcoholism; medications and degree of dependency; prolonged preoperative period of hospitalization; and associated diseases.[13,14]

In the present study, five (55.6%) of the participants who presented SSI in the hospital setting were female. Thus, it was not possible to establish a relationship between gender and a higher probability of developing SSI, as in a study in which there was moderate prevalence of SSI in women undergoing cardiac surgeries.[15]

Regarding the prevalence of the female gender in the studied population, researchers revealed that men do not have the habit of seeking health services because of cultural, institutional and medical barriers. For them, the disease is not recognized as intrinsic to their condition. On the other hand, they are usually affected by severe and chronic health conditions, and health programs with preventive actions are mostly still focused on the female population.[15]

DM, smoking, the use of antidiabetics and admission to ICU in the immediate postoperative period are considered risk factors.[15,16,18] However, in this study, the difference was not significant to confirm that patients with these risk factors suffered more SSI than those who did not have them.

Although DM was not associated with the occurrence of SSI in the hospital, this comorbidity contributes to the development of this type of hospital infection because it interferes in the phagocytosis of white blood cells, increasing the susceptibility to infections, and therefore increasing the risk of SSI. According to recommendations for SSI

prevention, it is essential to control serum levels of blood glucose in diabetic patients during the preoperative period to avoid perioperative hyperglycemia.[19] To this end, measures of control and prevention are fundamental and related to the postoperative treatment. Health care programs are necessary to address the characteristic aspects of individuals affected by this underlying disease not only during hospitalization, since many postoperative complications result from decompensation associated with this comorbidity.[20-22]

Regarding smoking habits, of the nine (10%) participants in the study who developed SSI in the hospital, five (55.6%) were smokers. Smoking has a vasoconstricting action that leads to a deficit in oxygenation of tissues because of the gas exchange difficulty in the lungs, affecting the cicatricial process of the skin after surgical interventions, and resulting in SSI risk.[17,23]

Regarding the diagnosis of the disease for surgical intervention, the presence of cholelithiasis was not considered a significant factor for SSI in the hospital setting, although it is a risk factor for SSI development because bacteria present in bile at the time of surgery are the main source of postoperative surgical infection.[24]

In the present study, eight (88.9%) participants using antihypertensive medication developed SSI, confirming the association of this drug with SSI, like findings of other studies.[24,25] This fact is justified because SAH is an important element for the patient's prognosis given the systemic consequence, resulting in renal and cardiovascular deficit, decreased peripheral arterial perfusion, besides interfering in the humoral and cellular immunity, collaborating for the appearance of SSI in the postoperative period in the hospital.

The peripheral venous catheter is installed when rapid and immediate action of medication is required. The intravenous infusion therapy is a set of knowledge and techniques for the administration of solutions and medications in the circulatory system. In this study, of the 42 (46.7%) participants who used this invasive device in the preoperative period, two (22.2%) developed SSI in the postoperative period in the hospital. There was no evidence that the presence of a peripheral venous catheter was a risk for SSI in the postoperative period in the hospital, although this is known as a risk factor for hospital infection because of the required procedures with maintenance, salinization, changes and discard.[26] In view of the study results, using a peripheral venous catheter was considered a protective factor in the development of SSI compared to those who did not use this device, considering this is a route of choice for prophylactic antibiotic therapy. Studies indicate that using prophylactic antibiotics in the preoperative period decreases the incidence of SSI.[24,27]

Dependency on nursing care predisposes to SSI in the hospital setting.[27] However, in this study, SSI occurred in six (66.7%) independent participants, a fact corroborated by some studies.[21,23-25,28]

In the present study, five (55.6%) participants who needed ICU admission in the immediate postoperative period developed SSI. The fact of surgical patients admitted to ICU postoperatively developing SSI is justified by surgical stress due to the nature of the surgical procedure and clinical conditions.[29]

At times, there are short periods of manifestation depending on the SSI etiology, usually between the fourth and the sixth postoperative day, requiring constant and effective surveillance during the hospitalization period. In other situations, the period is longer and according to the Center for Disease Control and Prevention (CDC) definition, SSI can occur within 30 or even 90 days of the procedure. Although the CDC recommends the expansion of monitoring after hospital discharge in surgical patients, because of specific factors inherent to the surgical procedure and its condition, surveillance of these patients occurs only during the hospitalization period. Rates of SSI occurrence after hospital discharge range from 12 to 84%. In these cases, the lack of follow-up after hospital discharge generates underreported rates and, consequently, underestimation of the true incidence, impact and relevance of SSI.[30]

Regarding the postoperative period in the hospital, the surgery and monitoring of surgical patients had considerable advances, reflecting in the

reduction of morbidity and mortality of these individuals. However, many hospitals monitor surgical patients only during hospitalization, but the possibility of infection after hospital discharge cannot be discarded.[31]

In this study, there was SSI in the postoperative period at home given the aspects and characteristics of this infection reported by patients and/or family members at the time of the telephone interview. In a different study, 12% to 84% of SSI were diagnosed in the post-discharge period, while in another study 25% of SSI were identified in the hospital setting and 75% at home.[6,31]

The association of preoperative risk factors with the occurrence of SSI in the postoperative period at home did not present relative risk for all the categories evaluated, except for the age factor (adults aged 24 to 59 years or older) and medication use (gastric protector). In other studies, adulthood is also the most susceptible period to the development of SSI at home.[6,31] Regarding the association of gastric protection medication and the occurrence of SSI, there was no evidence in the literature studied. The condition of living alone was proven as a risk factor of greater chance for development of SSI in the postoperative period at home.

The association of living alone and the occurrence of SSI at home was confirmed because people who live alone are 6.3 times more likely to develop SSI at home during this postoperative period than those who live with other people. The criterion of living alone may have been a risk factor, since people without a family member or caregiver in their home context are vulnerable to postoperative care, thus increasing the probability of SSI.

Thus, the main contribution is the confirmation that SSI occurs at home and in people living alone, which can be seen as safety indicators that require continuity of care of high and medium complexity, and in primary care provided by nurses.

Some limitations of the study include reduced data collection period, study conducted only in a teaching health institution, and participants' follow-up in the postoperative period at home only by telephone contact.

Conclusion

The investigated risk factors indicate some aspects that should be evaluated in the perioperative context of potentially contaminated surgeries that require evaluation and the need to implement prevention and control measures. Accordingly, it is essential that professionals acquire knowledge about the inherent and extrinsic factors to patients that collaborate for infections. There are gaps related to the orientation to patients regarding home care, in the surgical site and health conditions, besides the surveillance and control since the preoperative period. Most factors involved in the pathogenesis of SSI are controllable with use of appropriate interventions, considered critical components of any patient safety program. Thus, it was possible to meet the objective of this study in view of the identification of risk factors for the occurrence of SSI in potentially contaminated surgeries, by the association and relationship of the established variables.

Collaborations

Martins T, Amante LN, Virtuoso JF, Girondi JBR, Nascimento ERP and Nascimento KC declare they have contributed to the project design, data analysis and interpretation, article writing, critical review of the intellectual content and final approval of the version to be published.

References

1. Brandão DE, Galvão CM. O estresse da equipe de enfermagem que atua no período perioperatório: revisão integrativa. Rev Rene. 2013; 14(4):836-44.
2. Marques PF, Bastos AQ, Souza RA, Souza FM. Reflections on nursing care in the pre-and postoperative period: an integrative literature review. Ciênc Cuid Saúde. 2013; 12(2):382-90.
3. Sasaki VD, Romanzini AE, Jesus AP, Carvalho E, Gomes JJ, Damiano VB. Vigilância de infecção do sítio cirúrgico no pós-alta hospitalar de cirurgia cardíaca reconstrutora. Texto Contexto Enferm. 2011; 20(2):328-32.

4. Campos JA, Costa AC, Dessotte CA, Silveira RC. Produção científica da enfermagem de centro cirúrgico de 2003 a 2013. Rev SOBECC. 2015; 20(2):81-95.

5. Duarte MR, Chrizostimo, MM, Christovam BP, Ferreira SC, Souza DF, Rodrigues DP. Nursing practice on puerperal infection control: integrative review. J Nurs UFPE. 2014; 8(2):433-41.

6. Agência Nacional de Vigilância Sanitária. Cirurgias seguras salvam vidas. Brasília (DF): Agência Nacional de Vigilância Sanitária; 2009.

7. Batista TF, Rodrigues MC. Vigilância de infecção do sítio cirúrgico pós-alta hospitalar em hospital de ensino do Distrito Federal, Brasil: estudo descritivo retrospectivo no período 2005-2010. Epidemiol Serv Saude. 2012; 21(2):253-64.

8. Masukawa II, Vieira GB, Klein TR. Serviços de Controle de Infecção Hospitalar (SCIH/HU). Bol Epidemiol. 2014. 89p.

9. Ramos IC, Oliveira MA, Braga VA. Assistência de enfermagem no pós-operatório de transplante hepático: identificando diagnósticos de enfermagem. Ciênc Cuid Saúde. 2011; 10(1):116-26.

10. Faria PL. Perspectivas do direito da saúde em segurança do doente com base na experiência norteamericana. Rev Port Saúde Pública. 2010;(10):81-8.

11. Pina E, Ferreira E, Uva MS. Infecções associadas aos cuidados de saúde. In: Paulo SW, organizador. Segurança do paciente: conhecendo os riscos nas organizações de saúde. Rio de Janeiro: FIOCRUZ; 2014. 452p.

12. Nassar SM, Wronscki VR, Ohira M. et al. SEstatNet - Sistema Especialista para o Ensino de Estatística na Web [Internet]. [citado 2017 Jan 21]. Disponível em: http://sestatnet.ufsc.br.

13. Agência Nacional de Vigilância Sanitária. Segurança do paciente e qualidade em serviços de saúde. Brasília (DF): Agência Nacional de Vigilância Sanitária; 2011.

14. Ercole FF, Franco LM, Macieira TG, Wenceslau LC, de Resende HI, Chianca TC. Risk of surgical site infection in patients undergoing orthopedic surgery. Rer Lat Am Enfermagem. 2011; 19(6):1362-8.

15. Oliveira RS, Braga GF, Souza ML, Almeida EC, Oliveira JG, Azevedo NM. Homem gênero masculino: a busca dos serviços de saúde uma análise reflexiva da enfermagem. Rev Uniabeu. 2014; 7(17):107-24.

16. Lilienfield DE, Vlahov D, Tenney JH, McLaughlin JS. Obesity and diabetes as risk factors for postoperative wound infections after cardiac surgery. Am J Infect. Control. 1998; 16(1):3-6.

17. Rodrigues AE. Assistência de Enfermagem no pré e pós-Operatório Mediato ao utente em risco de desenvolver uma infecção do local cirúrgico.[Internet]. Portal do conhecimento. Jul; 2015. [citado 2017 Jan 29] Disponível em: http://hdl.handle.net/10961/4678.

18. Ferreira LG, Rosa ML, Meyuska MA, Santos SB, Aparecida PP. Tricotomia pré-operatória: aspectos relacionados à segurança do paciente. Enferm Global. 2014; (34):264-75.

19. Belusse GC, Ribeiro JC, Campos FR, Poveda VB, Galvão CM. Fatores de risco de infecção da ferida operatória em neurocirurgia. Acta Paul Enferm. 2015; 28(1):66-73.

20. Ahmed D, Cheema FH, Ahmed YI, Schaefle KJ, Azam SI, Sami SA, et al. Incidence and predictors of infection in patients undergoing primary isolated coronary artery bypass grafting: a report from a tertiary care hospital in a developing country. J Cardiovasc Surg (Torino). 2011; 52(1):99-104.

21. Magedanz EH, Bodanese LC, João Carlos Vieira da Costa Guaragna JC, Albuquerque LC et al. Risk score elaboration for mediastinitis after coronary artery bypass grafting. Rev Bras Cir Cardiovasc. 2010; 25(2):154-9.

22. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for Prevention of Surgical Site Infection. Am J Infect Control. 1999; 27(2):97-132; quiz 133-4; discussion 96.

23. Aguiar AP, Prado PR, Opitz SM, Vasconcelos SP, Faro AR. Fatores associados à infecção de sítio cirúrgico em um hospital na Amazônia ocidental brasileira. Rev SOBECC. 2012; 17(3):60-70.

24. Melo EM, Leão CS, Andreto LM, Mello MJ. Infecção cirúrgica em colecistectomia videolaparoscópica usando ácido peracético como esterilizante dos instrumentais. Rev Col Bras Cir. 2013; 40(3):208-14.

25. Silva QC, Barbosa MH. Fatores de risco para infecção do sítio cirúrgico em cirurgia cardíaca. Acta Paul Enferm. 2012; 25(2):89-95.

26. Moncaio AC, Figueiredo RM. Conhecimentos e práticas no uso do cateter periférico intermitente pela equipe de enfermagem. Rev Eletr Enferm. 2009; 11(3):620-27.

27. Lenza, M, Ferraz SB, Viola DC, Garcia Filho RJ, I. Epidemiologia da artroplastia total de quadril e de joelho: estudo transversal. einstein (São Paulo). 2013; 11(2):197-202.

28. Oliveira AC, Bettcher I. aspectos epidemiológicos da ocorrência do enterococcus resistente a vancomicina. Rev Esc Enferm USP. 2010; 44(3):725-31.

29. Guimarães RC, Rabelo ER, Moraes MA, Azzolin K. Everity of postoperative cardiac surgery Patients: na Evolution Analysis According to TISS-28. Rev Lat Am Enfermagem. 2010; 18(1):61-6.

30. Centers for Disease Control and Prevention (CDC). Procedure-associated Module SSI. Atlanta: CDC; 2016. 29p.

31. Oliveira AC, Ciosak SI. Infecção do sítio cirúrgico em hospital universitário: vigilância pós-alta e fatores de risco. Rev Esc Enferm USP. 2007; 41(2): 58-63.