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Original Article

Occurrence of surgical site infection and associated factors in videolaparoscopic cholecystectomy

Ocorrência e fatores associados para infecção de sítio cirúrgico em colecistectomia videolaparoscópica

Elaine Alves Silva Machado[1], Bruna Karla Dutra[2], Miyeko Hayashida[3], Cristina Maria Galvão[3]

Objective: identify the occurrence and risk factors related with surgical site infection in patients submitted to videolaparoscopic cholecystectomy. **Methods:** descriptive study developed at a private hospital, involving 118 patients. For the data collection, a tool was elaborated that was submitted to face and content validation. For the data analysis, the software *Statistical Package for the Social Sciences* was used. **Results:** the occurrence of infection amounted to 5.9% (n=7). The cases were diagnosed during post-discharge surveillance. The results showed no statistically significant difference between the research variables and the presence of surgical site infection (bivariate analysis). **Conclusion:** at the place of study, the occurrence of surgical site infection was high, without an association between the research factors and the presence of this type of infection.
Descriptors: Surgical Wound Infection; Cholecystectomy, Laparoscopic; Risk Factors; Perioperative Nursing.

Objetivo: identificar ocorrência e fatores de risco relacionados à infecção de sítio cirúrgico em pacientes submetidos à colecistectomia videolaparoscópica. **Métodos:** estudo descritivo, realizado em hospital privado, com inclusão de 118 pacientes. Para coleta de dados, elaborou-se instrumento submetido à validação de face e conteúdo. Análise dos dados realizada pelo *software Statistical Package Social Sciences*. **Resultados:** ocorrência de infecção de 5,9% (n=7), cujos casos foram diagnosticados na vigilância pós-alta. Os resultados não apresentaram diferença estatisticamente significante entre as variáveis investigadas e a presença de infecção de sítio cirúrgico (análise bivariada). **Conclusão:** na instituição de saúde estudada, a ocorrência de infecção de sítio cirúrgico se mostrou elevada, não houve associação entre os fatores investigados e a presença deste tipo de infecção.
Descritores: Infecção da Ferida Cirúrgica; Colecistectomia Laparoscópica; Fatores de Risco; Enfermagem Perioperatória.

[1]Universidade de Uberaba. Uberaba, MG, Brazil.
[2]Hospital São José Unimed. Passos, MG, Brazil.
[3]Escola de Enfermagem de Ribeirão Preto, Universidade de São Paulo. Ribeirão Preto, SP, Brazil.

Corresponding author: Elaine Alves Silva Machado
Rua Manoel Coelho, 199, Bl. 01, ap. 103, CEP: 38055-600. Uberaba, MG, Brazil. E-mail: esilvamachado@gmail.com

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Introduction

Surgical site infection is associated with surgery, with or without the placement of an implant in inpatients or outpatients, being classified as superficial, deep or in organ/cavity. Epidemiologically, infection can occur within 30 days after the surgical procedure or up to 90 days in the case of implant use[1]. This complication can mainly lead to increased morbidity, mortality and health service costs. Overall, due to the negative effects on both the patient and the health services, the prevention of surgical site infection has received considerable attention from health professionals, health authorities, the media and the public[2].

In a study conducted by the Society for Healthcare Epidemiology of America and the Infectious Diseases Society of America in the United States, data indicate that surgical site infection affects 2 to 5.0% of surgical patients and that between 160,000 and 300,000 cases of this type of infection occur annually in the country. In patients affected by the infection, the length of the hospital stay increases by 9.7 days, with a cost of approximately US$ 20,842 per person, generating a great financial impact[3].

Videosurgery has emerged as a less invasive option for abdominal cavity access, permitting a reduction of surgical site infection rates, shorter hospitalization times and a smaller number of major complications (stroke, pulmonary embolism, sepsis, coronary events, respiratory complications, among others)[4]. In this type of approach, a shorter hospital stay is advantageous compared to the open technique. If postoperative surveillance is not performed, however, data on the occurrence of surgical site infection may be underreported[5]. Thus, the focus of this study is to investigate this problem in videolaparoscopic cholecystectomy, currently a frequent surgical procedure in health services. In 2018, in Brazil, according to the Department of Informatics of the Unified Health System, 84,784 videolaparoscopic cholecystectomy surgeries were performed in the public health network[6].

Usually, in the literature, surgical site infection rates are low after videolaparoscopic cholecystectomy, depending on factors pertinent to the studied population and other characteristics. In international scientific production, rates range from 0.6 to 1.7%[7-9]. In the Brazilian scenario, there is a lack of recent research aimed at this problem. In a study carried out in the region of Uberaba, state of Minas Gerais, surgical site infection corresponded to 4.9% in patients submitted to videolaparoscopic cholecystectomy (n=428)[5].

Among the risk factors for surgical site infection in videolaparoscopic cholecystectomy, the following stand out: acute cholecystitis, age over 55 years, conversion of the surgical technique from videolaparoscopic to open, surgical procedures lasting more than 60 minutes and obesity[5,7-8].

In view of the above, conducting studies on surgical site infection in minimally invasive surgeries can generate results, which can contribute to the production of knowledge in the area. The importance of knowing measures prevention and control measures of healthcare-associated infections is also emphasized, specifically of the professionals who work in the surgical center[10].

Thus, the guiding question of the study was: what is the occurrence and risk factors related to surgical site infection in patients undergoing laparoscopic cholecystectomy? Therefore, we aimed to identify the occurrence of surgical site infection and related risk factors in patients submitted to videolaparoscopic cholecystectomy.

Methods

A descriptive study was conducted in a private and small hospital, located in the Southwest of the State of Minas Gerais, Brazil. The inclusion criteria for the participants were: patients 18 years of age or older submitted to elective laparoscopic cholecystectomy, classified as potentially contaminated or contaminated (potential surgical wound classification). Surgical

patients converted from the laparoscopic to the open surgical technique were excluded, as well as those who could not be contacted by telephone contact (active search) between the 30th and 33rd postoperative day. Thus, a convenience sample was used.

During the data collection period (March to November 2016), 126 patients underwent videolaparoscopic cholecystectomy. The study sample consisted of 118 patients, due to the loss of seven participants who could not be contacted by telephone, and one patient whose surgical technique was changed from videolaparoscopic to open.

For data collection, an instrument was elaborated based on another also validated tool[11], according to the specific literature and professional experience. The constructed instrument was submitted to face and content validation by three judges, composed of the following items: factors related to the patient; factors related to the anesthetic-surgical procedure; postoperative (hospital) and post-discharge surveillance (hospital return and active telephone search).

Two researchers responsible for the study collected the data through an interview with the patient and verification of the patient's medical records, using the elaborated instrument, and at three moments, namely: perioperative period (from the patient's hospitalization to the discharge); outpatient return (between the eighth and eleventh postoperative days) and active telephone search (telephone contact by the researchers, between the 30th and the 33rd day after surgery). The surgeon or member of the Hospital Infection Control Commission investigated the suspected cases of surgical site infection to conclude the diagnosis.

For the data analysis, the Statistical Package for the Social Sciences software was used. For the quantitative variables, the results were presented according to frequency distributions and statistical descriptive measures (minimum and maximum values, arithmetic mean and standard deviation). The bivariate analysis was used to analyze the association between the research variables (risk factors) and surgical site infection, using Fisher's exact test. The investigated risk factors related to the patient were: gender, age, body mass index, presence of chronic diseases (diabetes mellitus and arterial hypertension) and classification of the general physical condition according to the American Society of Anesthesiologists (ASA). The risk factors studied, related to the anesthetic-surgical procedure, were: time of hospitalization, potential for contamination of the surgical wound, length of anesthesia and length of surgery. The level of significance was $\alpha=0.05$. The development of the study complied with the Brazilian and international ethical standards for research involving human beings, according to the Ethical Approval Certificate nº 52683516,6,0000,5393, issued by the Research Ethics Committee of the University of São Paulo at Ribeirão Preto College of Nursing under Opinion nº 1,435,947.

Results

As mentioned, the study sample consisted of 118 participants. The mean age was 48.9 years (standard deviation (SD) = 14.9), ranging from 20 to 84 years. The age group with the highest frequency was between 40 and 59 years old, totaling 48 patients (40.7%). The majority of the sample was female (81.3%). The education level ranged from zero to 19 years of study, with an average of 11.6 years (SD=4.7). The mean body mass index was 28.7 kg/m^2 (SD=5.7), classified in the overweight category, ranging from 16.7 to 49.6 kg/m^2.

Of the 118 participants in the study, seven patients developed surgical site infection, that is, the occurrence of this type of infection was 5.9%. The cases were classified as superficial incisional infection, diagnosed during post-discharge surveillance. Thus, six patients (85.7%) were diagnosed during the outpatient return (between the eighth and eleventh postoperative day) and one (14.3%) was diagnosed in the active telephone search (between the 30th and 33rd day after surgery). The surgeon diagnosed this case on the 15th postoperative day, as informed by the

patient during the active search, performed by one of the researchers.

Table 1 shows the risk factors related to the patient. In the analysis of the association between the research variables and the presence of surgical site infection, the results did not show a statistically significant difference between the patients with and without infection.

Table 1 – Bivariate analysis between the patient-related risk factors and the presence of surgical site infection

Variables	Surgical site infection			p*
	Yes n (%)	No n (%)	Total n (%)	
Sex				0.345
Female	7 (7.3)	89 (92.7)	96 (100.0)	
Male	-	22(100.0)	22 (100.0)	
Age range (years)				0.421
20 to 39	1 (2.4)	40 (97.6)	41 (100.0)	
40 to 59	3 (6.3)	45 (93.8)	48 (100.0)	
>60	3 (10.3)	26 (89.7)	29 (100.0)	
Body Mass Index (kg/m^2)				0.733
Low weight (<18.5)	-	2 (100.0)	2 (100.0)	
Normal weight (18.5 to 24.9)	2 (6.9)	27 (93.1)	29 (100.0)	
Overweight (25 to 29.9)	2 (4.1)	47 (95.9)	49 (100.0)	
Obese (>30)	3 (7.9)	35 (92.1)	38 (100.0)	
Diabetes mellitus				0.265
Yes	2 (11.8)	15 (88.2)	17 (100.0)	
No	5 (5.0)	96 (95.0)	101(100.0)	
Arterial hypertension				0.679
Yes	3 (7.9)	35 (92.1)	38 (100.0)	
No	4 (5.0)	76 (95.0)	80 (100.0)	
Classification of general physical status according to ASA†(categories)				0.405
I	3 (4.1)	71 (95.9)	74 (100.0)	
II	4 (10.0)	36 (90.0)	40 (100.0)	
III	-	4 (100.0)	4 (100.0)	

*Fischer's exact test; †ASA: American Society of Anesthesiologists

In Table 2, the risk factors related to the anesthetic-surgical procedures were described. In the analysis of the association between the research variables and the presence of surgical site infection, the results did not evidence any statistically significant difference between the patients with and without infection.

Table 2 – Bivariate analysis between the risk factors related to the anesthetic-surgical procedure and the presence of surgical site infection

Variables	Surgical site infection			p*
	Yes n (%)	No n (%)	Total n (%)	
Length of hospitalization (hours)				0.697
11 to 24	5 (7.4)	63 (92.6)	68 (100.0)	
>24	2 (4.0)	48 (96.0)	50 (100.0)	
Contamination potential of surgical wound				0.423
Potentially contaminated	1 (2.6)	38 (97.4)	39 (100.0)	
Contaminated	6 (7.6)	73 (92.4)	79 (100.0)	
Length of anesthesia (minutes)				1.000
≤ 60	3 (6.8)	41 (93.2)	44 (100.0)	
>60	4 (5.4)	70 (94.6)	74 (100.0)	
Length of surgery (minutes)				0.596
≤ 60	7 (7.1)	92 (92.9)	99 (100.0)	
>60	0 (0.0)	19 (100.0)	19 (100.0)	

*Fischer's exact test

Discussion

The sample size and the development at a single hospital were limitations of the study. In this way, the importance of new research on the occurrence and risk factors of surgical site infection in minimally invasive surgeries is shown, in order to advance knowledge and improve the care and safety of surgical patients.

The occurrence of surgical site infection verified in this study (5.9%) was high when compared to the data available in the international literature[7-9]. In contrast, when comparing the results of this study with a Brazilian study, the identified percentage was similar[5], as it depended on factors related to the studied population and other characteristics.

Regarding the classification of the infection site, as mentioned, the patients were diagnosed with superficial incisional infection, in line with the results of other studies that present 93.8, 100.0 and 85.7% of infection cases classified in this area[5,8,12]. Superficial incisional infection is easily diagnosed because it involves only skin and subcutaneous tissue and at least

one of the following most frequent signs and symptoms: purulent drainage of the incision, local edema, increased sensitivity, pain and hyperemia[1].

In this study, the cases of surgical site infection were diagnosed after hospital discharge. In a randomized clinical trial in Japan, including 1,037 patients who underwent cholecystectomy, the diagnostic rate of infection after hospital discharge was 100.0%[13]. In a Brazilian study conducted at the Federal University of Triângulo Mineiro, the diagnostic rate of infection was also 100.0% after the patient's discharge[5].

In the governmental sphere, the country experiences the construction of post-discharge surveillance systems related to healthcare-associated infections. In 2013, the National Health Surveillance Agency, the Health Surveillance and Monitoring Management and the General Management of Health Services Technology published a series of documents aimed at patient safety and quality in health services, among which the Manual of Diagnostic Criteria for Healthcare-Associated Infection, whose main objective is to systematize the surveillance of several types of infections, such as surgical site infection, through the elaboration of outcome indicators (for example, incidence), permitting the analysis of the correlation between the prevention measures health professionals take and the effect on the frequency of infections[1].

The so-called "gold standard" method in post-discharge surveillance is the direct observation of the surgical wound during the patient's outpatient return. This assessment by a health professional provides consistent and reliable data, but generates a high cost and a greater work demand. Several methods are used in post-discharge surveillance, but telephone contact (active telephone search) is the most commonly used feature because it involves less cost and is more practical[14].

The high cost of readmission due to surgical site infection entails significant losses for patients and the health system. Despite the course of time, it seems prudent to include rigorous post-discharge monitoring, under the premise that early recognition of post-discharge infection may permit early intervention and decrease morbidity and readmission rates, thus reducing the financial impact[15].

Results from the Swiss Association of Laparoscopic and Thoracoscopic Surgery, Switzerland, between 1995 and 2008, showed that the patient's increased age (>55 years) resulted in an increased predisposition for the development of surgical site infection when compared to the younger patients (with statistically significant difference)[8]. In this study, 85.7% of the patients with infection were in the age group above 40 years, but no statistically significant difference was observed in the association between age and the occurrence of surgical site infection.

With regard to the Body Mass Index, a study conducted in the United Kingdom, which included patients with obesity and morbid obesity submitted to outpatient videolaparoscopic cholecystectomy (n=571), found an increase in the Body Mass Index associated with an increase in the infection rate[16], which differs from this study, as there was no association.

Diabetes mellitus and arterial hypertension were not associated with the presence of infection. These results are in line with those of another study, whose sample also consisted of patients undergoing laparoscopic cholecystectomy (n=428), 140 of whom were hypertensive (32.7% of the sample) and 32 patients diabetic (7.4% of the sample). In the analysis of the association between diseases and surgical site infection, no statistically significant difference was found[5].

In a Brazilian survey on the occurrence of surgical site infection in patients submitted to videolaparoscopic cholecystectomy, the results showed that 81.0% of the cases of infection, that is, 21 patients were classified in categories II and III in terms of their general physical condition, according to the American Society of Anesthesiologists[5]. These findings are consistent with those obtained in this study. Of the seven cases of infection, four (57.1%) occurred in patients classified in category II.

Regarding the length of hospitalization, the

results were contradictory, when compared to the recommendations in the literature[17] as there was a higher frequency of infection in patients with a shorter hospitalization period.

Regarding the length of surgery, in patients who developed infection, the duration was up to 60 minutes. In a multicenter study, in which the length of surgery was longer (up to 150 minutes), the results showed a statistically significant association between the duration of the surgery over 60 minutes and the infection in videolaparoscopic cholecystectomy[8].

The potential of surgical wound contamination and length of anesthesia were not associated with the presence of surgical site infection. In the literature, no research was identified about the potential of surgical wound contamination and the length of anesthesia in videolaparoscopic cholecystectomy.

Conclusion

At the health institution studied, the occurrence of surgical site infection was high. There was no association between the risk factors investigated and the presence of surgical site infection. In the study, 100.0% of the infection cases were diagnosed after hospital discharge, reinforcing the problem of underreporting of the infection rate in the country, as well as the relevance of implementing a post-discharge surveillance program in health services.

Collaborations

Machado EAS and Galvão CM participated in the project design, data collection, data analysis and interpretation, writing of the article and final approval of the version for publication. Dutra BK contributed to the data collection, writing of the article and final approval of the version for publication. Hayashida M collaborated with the data analysis and interpretation, writing of the article and final approval of the version for publication.

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