

Duration of major surgery and its influence in surgical infection

Tempo operatório em cirurgias de grande porte e sua influência na infecção cirúrgica

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ABSTRACT

Objective: Prospective study to evaluate the influence of duration of surgery on the occurrence of infection as well as the duration of hospitalization, and seek to identify risk factors for the development of infections in the postoperative of major surgery of the digestive tract. **Methods:** We analyzed a sample of 172 patients undergoing elective major surgery in the digestive tract, performed in a teaching hospital, from January 2009 to July 2011. We computed the duration of surgery and hospitalization time, antibiotics use, urine cultures when indicated, and infections associated with urinary and respiratory complaints. We considered surgical infections when they occurred in the surgical site, urinary and/or respiratory tract during the first 30 days after surgery. Statistics: For categorical variables, we employed the chi-square and Fisher's exact tests; for quantitative data we used Pearson's correlation and Student t test, and the Linear Regression Model. $P < 0.05$ was considered statistically significant. **Results:** From 172 evaluated patients, 15 (8.7%) had postoperative infection and 157 (91.3%) did not. There was no relation of dependence ($p > 0.05$) between the variable gender and smoking with the presence of postoperative infection. The ASA surgical risk and the dosage of urea, creatinine, aminotransferases, red blood cells count, coagulation tests and chest x-ray showed no relationship of dependency ($p > 0.05$) with postoperative infection. The Pearson correlation analysis (1% significance) showed that the duration of operations and duration of hospitalization influenced the prevalence of postoperative nosocomial infection ($p < 0.05$). **Conclusion:** In patients undergoing major surgical procedures of digestive tract the prevalence of postoperative infections was 8.7%, correlated with the duration of the operative time and hospital stay.

Key words: Infection. Major surgery. Surgical site infection. Postoperative. Correlation.

RESUMO

Objetivo: Estudo prospectivo, com objetivo de avaliar a influência da duração da cirurgia na ocorrência de infecção, bem como no tempo de internamento hospitalar, além de buscar identificar fatores de risco para o desenvolvimento de infecções pós-operatórias, no pós-operatório de cirurgias de grande porte do aparelho digestivo.

Métodos: Foi analisada amostra de 172 pacientes submetidos a intervenções cirúrgicas eletivas de grande porte no aparelho digestivo, realizadas em hospital escola, no período de janeiro de 2009 a julho de 2011. Foram observados a duração da cirurgia e o tempo de internamento hospitalar, computados o uso de antibióticos, queixas urinárias, uroculturas quando indicadas, queixas respiratórias e infecções associadas. Foram consideradas infecções cirúrgicas quando ocorreram no sítio cirúrgico, no trato urinário e/ou respiratório durante os primeiros 30 dias do pós-operatório. Estatística: para as variáveis categóricas, foram empregados os testes estatísticos de independência, Qui-quadrado de Pearson e Exato de Fisher; para variáveis quantitativas foram utilizados os testes de Correlação de Pearson e t de Student, além do Modelo de Regressão Linear. $P < 0,05$ foi considerado estatisticamente significativo. **Resultados:** Dos 172 pacientes avaliados, 15 (8,7%) apresentaram infecção e 157 (91,3%) não apresentaram. Não houve relação de dependência ($p > 0,05$) entre a variável sexo e tabagismo com a existência de infecção pós-operatória. O risco cirúrgico ASA e os resultados das dosagens de uréia, creatinina, aminotransferases, hemograma, coagulograma e radiografia do tórax demonstram não haver relação de dependência ($p > 0,05$) com infecção pós-operatória. A análise de Correlação de Pearson com nível de significância de 1% demonstrou que a duração das operações e o tempo de internamento hospitalar influenciaram a prevalência de infecção hospitalar pós-operatória ($p < 0,05$).

Conclusão: Em pacientes submetidos a procedimentos cirúrgicos de grande porte a prevalência de infecções pós-operatórias foi de 8,7%, correlacionada com a duração do tempo operatório e com o tempo de internação hospitalar.

Descritores: Infecção. Cirurgia e grande porte. Pós-operatório. Correlação.

INTRODUCTION

Hospital infection is an issue of great relevance today, because it involves high morbidity and mortality as well as high hospital costs. Burke (2003) stated that 5-10% of patients admitted to hospitals develop some type of nosocomial infection, which represents into 2 million patients annually in the USA, resulting in 90,000 deaths, which generates an estimated cost of 4.5 to 5.7 billion dollars per year. These numbers have increased in recent decades¹.

Advances in both surgical technique as well as in the clinical management of surgical patients reflect a drop in morbidity and mortality of patients undergoing surgical procedures. The analysis of its contents is today a control quality parameter

of services provided by hospitals². There is no consensus on the acceptable incidence of postoperative infections. The data in the literature differ according to the type of procedure and patients of each service. The incidence of postoperative infection varies from 0.5% after cholecystectomies to 59% after esophagus surgery³⁻⁸. Biondo-Simões et al (2003) showed that the surgical site infection is the most frequent postoperative complication, totaling 35.7% of postoperative surgical complications⁹.

This study assumed that there is very little information about the prevalence of nosocomial infection in the postoperative highly complexity major surgery. The objective of this study was to examine the influence of operative time and hospital stay on the prevalence of surgical infection in the postoperative of major surgery of the digestive tract, performed at University Hospital Onofre Lopes, Natal/RN- Brazil .

METHODS

Study design

A prospective study was done to evaluate the influence of duration of surgery and hospital stay on the prevalence of surgical infection, and seek to identify other risk factors for the development of postoperative infections. The analysis was performed from the sample of all patients who underwent consecutively major elective surgery in the digestive tract, performed at the University Hospital of the Federal University of Rio Grande do Norte, Brazil, from January 2009 to July 2011. The study was approved by the Ethics Committee in Research of University Hospital Onofre Lopes, and the patients signed the informed consent.

Major surgery was defined as a lengthy surgical procedure, relatively difficult, performed in vital organs and involves high risk¹⁰. The following major surgeries were considered: partial gastrectomy, total gastrectomy, esophagectomy, vagotomy with and without pyloroplasty, esophagocardioplasty, bile ducts surgery, pancreatoduodenectomy, hepatectomy, hemicolectomy, total colectomy, Miles operation, and surgery for portal hypertension.

Data collection

Data for completing the research protocol were obtained directly from patients and by reviewing medical records, and kept the patient treatment up to 30 days postoperatively. In the period related to the preoperative data we collected comorbidities, the surgical risk stated by American Society of Anesthesiologists (ASA score)¹¹, and laboratory tests related to renal and hepatic function, coagulation, red blood cells count and also chest x-radiographs. We observed the duration of surgery and length of hospital stay. Surgical infections were considered when they occurred at the surgical site, urinary tract and / or respiratory tract during the first 30 days after surgery.

The diagnosis of surgical site infection was made based on observation of the wound: presence of inflammatory signs and pus, using diagnostic criteria recommended by the NNIS system (National Nosocomial Infections Surveillance) of the CDC (Centers for Disease Control - USA)¹². The diagnosis of respiratory complications was based on clinical, laboratory and imaging, and included pneumonia, pleural empyema and bronchopneumonia. The diagnosis of urinary tract infection was based on results of urine culture. It was positive when more than 100,000 bacterial colony forming units/ml were identified. The use of antibiotics in the treatment occurred, preferably, as identified by antibiogram.

Statistical analysis

For categorical variables, we employed the statistical chi-square and Fisher's exact tests. On the quantitative data we used Pearson's correlation and Student t test, and a Linear Regression Model. The level of significance for all tests was 5%, ie, $p < 0.05$ was considered statistically significant.

RESULTS

The sample consisted of 96 (55.8%) men and 76 (44.2%) women, both subject to several types of surgery. The mean age was 47.96 ± 16.02 years, with a mean of 50 years. Of the 172 patients evaluated, 15 (8.7%) had infection and 157 (91.3%) did not. The results of the Chi-square and Fisher exact test, summarized in Table 1, show that there was no relationship of dependency ($p > 0.05$) between the variable gender and the presence of postoperative infection. The fact of the patient being a smoker did not have dependent relationship ($p > 0.05$) with the occurrence of postoperative infection. There were no deaths in the sample.

Regarding the classification of surgical risk, from the ASA, the majority of patients were classified between levels II and III, being respectively 58 (33.8%) and 63 (36.6%), which featured a sample of low to moderate risk. However, the present data indicated that there was no dependence ($p > 0.05$) between the degree of surgical risk and postoperative infection. Other data related to laboratory tests such as urea, creatinine, aminotransferases, red cells blood count, coagulation tests and chest x-radiography showed no statistical significance for the study.

Table 1 – Descriptive data of patients by sex, smoking status and surgical risk, and their relationship to postoperative infection.

Characteristics	Postoperative infection				P – valor
	Yes		No		
	N	%	N	%	
Sex					
Male	9	9.4	87	90.6	0.862 ¹
Femiale	6	7.8	70	92.2	
Smoker					
Yes	8	10.8	66	89.2	0.553 ²
No	7	7.1	91	92.9	
Surgical risk					
ASA I	2	4.2	46	95.8	0.133 ¹
ASA II	4	6.9	54	93.1	
ASA III	6	9.5	57	90.5	
ASA IV	3	100.0	0	100.0	

1 – Pearson Qui-square test.

2 – Fisher exact test.

We did the statistical analysis comparing the group of patients with infection and the group without infection, in order to verify the influence of duration of surgery on the occurrence of infection as well as the duration of hospital stay. The data presented in Table 2 show that the duration of hospitalization influenced the prevalence of postoperative infection in patients undergoing major surgery ($p < 0.05$). It was also observed that the duration of surgery was higher ($p < 0.05$) in patients with postoperative infection, which indicates a correlation between these variables.

Table 2 –Descriptive data and related statistical tests for the variables duration of surgery and length of hospital stay.

Variables	Postoperative infection		P – valor ¹
	Sim	Não	
Duration of surgery (hours)	5.28 ± 1.95	3.68 ± 1.67	0.001
Hospital stay (days)	22.79 ± 13.06	9.48 ± 6.06	<0.001

Mean ± standard deviation.

1 – Student t test for independent samples.

We did the Pearson correlation analysis with a significance level of 1%, to verify the correlation between the presence of infection and length of hospital stay, culminating with a simple linear regression analysis. The results demonstrate a positive correlation ($r = 0.508$, $p < 0.001$) between these variables, meaning that the

greater the surgical time, the longer the duration of hospitalization, as can be seen in Figure 1.

Based on this correlation, we tried to fit a regression model to estimate the duration of hospital stay (HS) in days, in patients submitted to major surgeries. For this, we considered the duration of surgery (DS) in hours and time of intensive care unit stay (TICU) on days.

The model, where the length of stay can be estimated from the DS (hs) and TICU (days) it was adjusted using the following formula: $HS=3.648+2.633(DS)+1.225(TICU)$. In this model, the predictor variables resulted statistically significant ($p<0.05$).

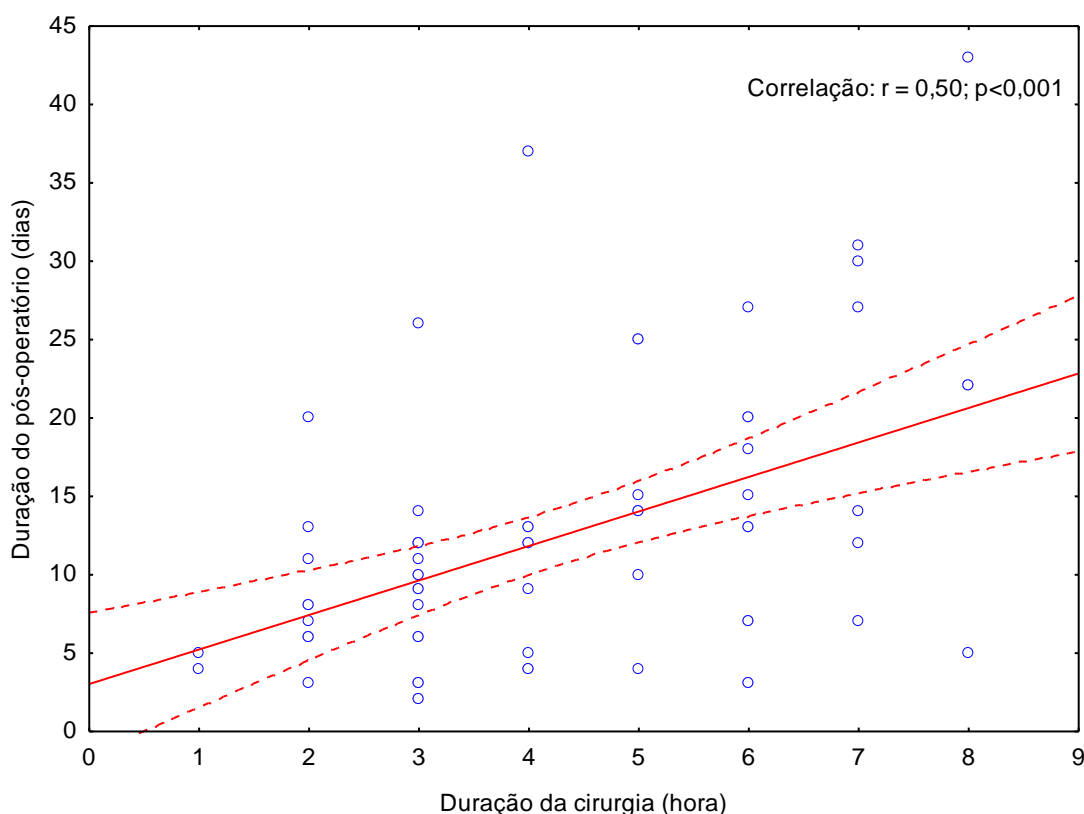


Figure 1 – Correlation between duration of surgery and postoperative hospital stay

DISCUSSION

The prevalence of infection of 8.7% in the postoperative period of major surgery in the general surgery service of University Hospital-UFRN, Brazil, proved to be compatible with that found in international and national literature. Khuri et al. (1995) in 20 years of follow-up in American hospitals for war veterans reported an incidence of 5.1%¹³. Study in general surgery services from Spanish hospitals reported 13.6% of post-operative infection⁷. In a retrospective study of 23 years performed in a general surgery service of Brazil Ferraz et al. (2000) found an incidence of 17.8% of postoperative infection². In most hospitals the rate of patients

undergoing "clean surgery" exceeds 70%. The rate of patients undergoing contaminated or infected surgery, as is the case of many types of gastrointestinal surgery, is around 5-10%¹⁴.

The explanation for the incidence of postoperative infections is multifactorial. Factors directly related to the patient, the surgical procedure itself and/or department to which the procedure is performed positively or negatively affect the incidence of postoperative complications. Factors related directly to the patient include obesity, diabetes, age, medication use, nutritional status, level of immune response, among others. Regarding the surgical procedure itself stands out surgical time, the extent of tissue damage and the degree of the wound contamination. According to the NNIS (National Nosocomial Infections Surveillance System), contaminated wounds have the highest incidence of post-surgical infection. With regard to service-related factors, the quality of hospital, the surgeon's experience, the level of antimicrobial resistance of microorganisms are extremely important^{6,15,16}.

The prevalence of postoperative infections found in this study must have been influenced by the target population, composed exclusively of patients who underwent major surgery of the digestive tract. In this sense, some factors may have contributed to postoperative morbidity, tissue injury due to major procedures, operative time and therefore the hospital stay, as well as the contamination of wounds, since all procedures were potentially contaminated or contaminated¹⁶⁻¹⁸. Moreover, it is essential to emphasize that our institution is a tertiary University Hospital in Rio Grande do Norte, Brazil, and reference in highly complex procedures for patients Brazilian Unified Health System. Thus, it serves a large population of elderly patients with advanced stage cancer, undergoing chemotherapy and/or radiotherapy and carrying large number of comorbidities (hypertension, diabetes mellitus, immunosuppression, previous surgery). These are factors that may influence surgical infection^{19,20}.

The sex of patients, as well as smoking were important risk factors for infection in the postoperative period, according to the results described by Saad (2001)²², who founded postoperative infection in 16.41% of 195 smokers and in only 3.92% of 102 nonsmokers. In contrast, in our study we didn't find statistically significant infection rate in smokers ($p > 0.05$), confirming the study of Barie and Eachempati (2005)²¹. Regarding the association of gender with the risk of postoperative infection, no difference was observed in our study between the sexes, and data from other studies confirm these findings²³⁻²⁶.

The study showed no relationship between the patient's clinical condition as assessed by ASA and the development of infections in the postoperative period. This is in disagreement with the literature, which put the ASA score as an important risk factor for postoperative infection, especially surgical site^{15,27,28}. However, Oliveira and Ciosak (2007), discuss the need for replacement of the ASA score by another method of preoperative assessment in which there is less subjectivity, giving more importance to patients comorbidities²⁹.

Regarding the relationship between the duration of surgery and the incidence of postoperative infections, our data are in agreement with those reported in the

literature. The NNIS (National Nosocomial Infections Surveillance System) uses the duration of the surgical procedure as one of the important factors to calculate the risk for surgical site infection^{4,6}. Moreover, it was noticeable after analysis of our the data that the increased duration of surgery, besides providing postoperative infection, contributed to the increased length of hospital stay, corroborated by the positive correlation ($r = 0.508$, $p < 0.001$) between these variables. Lissovoy et al. (2009) demonstrated that the incidence of wound infection correlates with the length of hospital stay which increases from 8 to 15 days in colorectal surgery and from 4 to 12 days after gastrointestinal surgeries³⁰.

CONCLUSION

In patients undergoing major surgical procedures of the gastrointestinal tract the prevalence of postoperative infections was 8.7%, correlated with the duration of the operative time and hospital stay.

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