RISK FACTORS FOR RESPIRATORY INFECTION IN PATIENTS SUBMITTED TO CARDIAC SURGERY

FATORES ASSOCIADOS À INFECÇÃO RESPIRATÓRIA EM PACIENTES SUBMETIDOS ÀS CIRURGIAS CARDÍACAS

LOS FACTORES DE RIESGO PARA LA INFECCIÓN RESPIRATORIA EN PACIENTES SOMETIDOS A CIRUGÍA CARDÍACA

Maria Helena Barbosa¹, Thuanne Cristina Sousa e Aleixo², Érica Vieira de Andrade³, Karoline de Faria Oliveira⁴, Raissa Bianca Luiz⁵, Jesislei Bonolo do Amaral⁶, Suzel Regina Ribeiro Chavaglia⁷

ABSTRACT

Objective: To identify the incidence and factors associated with respiratory infection in patients undergoing cardiac surgery. Methods: Study quantitative, retrospective, analytical approach, which evaluated 460 patients who underwent surgery period 2005-2010, in a public teaching hospital. We conducted bivariate and logistic regression analysis using the Statistical Package for Social Sciences software. Results: It was found that 95 (20.7%) patients developed respiratory infection. Prolonged intubation time, the use of nasogástrica tube, the age group (> 60 years), previous heart surgery history, duration of surgery (> 180 minutes) and a history of Chronic Obstructive Pulmonary Disease (COPD) were significantly associated with the outcome respiratory infection. Conclusion: The risk factors predictors for the occurrence of respiratory failure were: prolonged intubation time, use of nasogástrica tube, age greater than 60 years, previous cardiac surgery, duration of surgery and history of COPD.

Keywords: Perioperative Nursing; Risk Factors; Cross Infection; Thoracic Surgery.

RESUMO

Objetivo: Identificar a incidência e os fatores associados à infecção respiratória em pacientes submetidos à cirurgia cardíaca. Métodos: Estudo de abordagem quantitativa, retrospectivo, analítico, avaliou 460 pacientes, submetidos a cirurgia cardíaca no período de 2005 a 2010, em um hospital público de ensino. Realizou-se a análise bivariada e regressão logística em software Statistical Package for the Social Science. Resultados: Verificou-se que 95 (20,7%) pacientes evoluíram com infecção respiratória. A intubação prolongada, o uso de sonda nasogástrica, o grupo etário (> de 60 anos), história de cirurgia cardíaca prévia, duração da cirurgia (>180 minutos) e história de Doença Pulmonar Obstrutiva Crônica (COPD)

¹ PhD in Adult Health Nursing. Associate Professor at the Scientific Nursing Department in Hospital Assistance of the Health Science Institute (ICS) and Stricto sensu Postgraduate Program in Health Care at the Federal University of Triângulo Mineiro – UFTM.
² Nurse at UFTM, Multiprofessional resident of Health Care network Program UNIUBE.
³ Nurse, Master in Healthcare – Federal University of Triângulo Mineiro – UFTM.
⁴ Nurse, Master in Health Care by UFTM, studying for Doctorate at the Health Care Postgraduate Program at UFTM. Nurse at the Scientific Nursing Department in Hospital Assistance of the Health Science Institute (ICS), UFTM.
⁵ Nurse, Master in Health Care by UFTM. Nurse at the School Hospital of UFTM.
⁶ Nurse, Master in Fundamental Nursing. Studying for Doctorate at the Health Care Postgraduate Program at UFTM. Adjunct professor at the Scientific Nursing Department in Hospital Assistance of the Health Science Institute (ICS), UFTM.
⁷ PhD in Nursing. Associate professor at the Scientific Nursing Department in Hospital Assistance of the Health Science Institute (ICS), UFTM and the Stricto sensu postgraduate Health Care Program at Federal University of Triângulo Mineiro – UFTM.
apresentaram associação estatisticamente significativa com o desfecho infecção respiratória. Conclusão: Os fatores de risco preditores para infecção respiratória foram tempo de intubação prolongado, uso de sonda nasogástrica, idade maior que 60 anos, cirurgia cardíaca prévia, duração da cirurgia e história de COPD.

**Palavras-chave:** Enfermagem perioperatória; Fatores de risco; Infecção Hospitalar, Cirurgia torácica.

**RESUMEN**

Objetivo: Identificar la incidencia y los factores asociados a la infección respiratoria en pacientes sometidos a cirugía cardíaca. Métodos: Estudio cuantitativo, retrospectivo, enfoque analítico, que evaluó a 460 pacientes que se sometieron a cirugía período 2005-2010, en un hospital público de enseñanza. Se realizó un análisis bivariante y regresión logística en el software Statistical Package for the Social Sciences. Resultados: Se encontró que 95 (20,7%) pacientes desarrollaron una infección respiratoria, intubación prolongada, uso de nasogástrica sonda, el grupo de edad (> 60 años), antecedentes de cirugía cardíaca previa, duración de la cirugía (> 180 minutos) y una historia de la Enfermedad Pulmonar Obstructiva Crónica (EPOC) se asociaron significativamente con infección respiratoria resultado. Conclusión: Los factores de riesgo predictores de la aparición de insuficiencia respiratoria fueron: tiempo de intubación prolongada, uso de nasogástrica sonda, la edad superior a 60 años, la cirugía cardíaca previa, duración de la cirugía y la historia de la EPOC.

**Palabras clave:** Enfermería Perioperatoria; Factores de Riesgo; Infección Hospitalaria Cirugía Torácica.

**INTRODUCTION**

Respiratory infection occurred in the postoperative period is the most common infection after cardiac surgery (CS), with a prevalence between 2% and 10%. It is associated with increased mortality up to 40% and increase in hospitalization costs.1-4

Among the known risk factors for respiratory infection in patients undergoing heart surgery it can be mentioned age, clinical status of the patient, general surgery, endotracheal intubation, use of mechanical ventilation (MV), nasogastric tube, occurrence of re-operations, incision in the upper abdomen and chest, surgeries longer than 180 minutes, prolonged preoperative hospitalization and smoking.1-4

The length of stay in the Intensive Care Unit (ICU), location where the post-cardiac surgery patients are transferred, has been associated with respiratory infection.1,3

High mortality associated with respiratory infection in patients undergoing cardiac surgery emphasizes the need to identify patients at risk with a view to prevention.1

We note an emphasis on studies that show risk factors for infection in patients undergoing cardiac surgery. However, we identify gaps in relation to studies on factors associated with respiratory
infections in this population. Knowing the risk factors for pulmonary infection in the postoperative period by the nursing staff is essential for the identification of potentially susceptible patients and to support actions for prevention and control of this complication.

By the above we propose to develop this study aiming to identify the incidence and factors associated with respiratory infection in patients undergoing cardiac surgery.

METHOD

This is a descriptive, analytical, quantitative, retrospective, longitudinal study, conducted in a public teaching hospital located in the city of Uberaba. The hospital has 290 beds and serves medical and surgical specialties.

Population consisted of patients undergoing cardiac surgery from July 2005 to July 2010, who met the inclusion criteria: age 18 years or older and who underwent cardiac surgery by longitudinal median sternotomy. Patients whose medical record numbers have not been located or identified, and those who died intraoperatively or within 48 hours after surgery, were excluded.

Data were collected from hospital infection reporting forms, provided by the Hospital Infection Control Commission (CCIH) of the hospital mentioned and from the medical records of patients undergoing cardiac surgery.

Respiratory infections were considered both those notified by CCIH and those diagnosed and recorded in the records by the medical team responsible for the patient.

For data collecting, we used an instrument elaborated for this purpose, consisting of socio-demographic data, such as gender, age, origin and clinical aspects, such as body mass index (BMI), according to World Health Organization; the Physical Status Classification System of the American Society of Anesthesiologists (ASA), type of surgery performed, surgery association and classification; data relating to perioperative, such as time of postoperative at ICU, total time of postoperative hospitalization, intubation time, reintubation, complications, receiving blood transfusion, isolated microorganisms, antibiotic use and patient outcomes.

Data were entered into a spreadsheet to Excel® for Windows® subsequently validated and exported to the Statistical Package for the Social Sciences (SPSS) version 19 for Windows, for processing and analysis.

Qualitative variables were analyzed using descriptive statistics through the
distribution of absolute and percentage frequency, while for quantitative variables descriptive measures of centrality (mean) and dispersion (standard deviation, minimum and maximum values) were used.

In order to identify the risk factors associated with respiratory infection it was initially done bivariate analysis using the chi-square test (χ²) and measures of association (relative risk and odds ratio). Statistically significant associations were considered, with <p 0.05 level of significance. Subsequently, multivariate analysis by logistic regression was used. To do so, variables that presented p<0.01 in the bivariate analysis were considered. In multivariate analysis, the statistical significance level adopted was 0.05.

This study is part of a larger project entitled "Analysis of hospital infections in patients undergoing cardiac surgery." The development of the study met national and international standards of ethics in research involving human subjects; it was observed the approval of the protocol nº.1611 / 2010 of the Ethics Committee for Human Research of the Federal University of Triângulo Mineiro.

RESULTS

Of the 460 patients who underwent cardiac surgery 280 (60.9%) were male, the mean age was 55.6 (± 12.9), ranging from 18 to 81 years and the majority came from the city of Uberaba – MG, 304 (66.1%).

Among the patients evaluated, 95 (20.7%) had respiratory infections and 41 (8.9%) had undergone previous heart surgery.

Concerning the clinical classification of patients according to the American Society of Anesthesiologists (ASA), it was observed that most patients, 248 (53.9%), did not have this information in their medical record. For the remaining patients, 115 (25%) had severe systemic disease, with P3 classification. It is noteworthy that the classification P1, healthy patient and classification P4, patients with severe systemic disease, that is a constant threat to life, were found in ten (2.2%) patients, respectively.

Regarding the comorbidities, 325 (70.7%) had systemic arterial hypertension (SAH); 105 (22.8%) Diabetes Mellitus, 52 (11.3%) suffered from Chronic Obstructive Pulmonary Disease (COPD), seven (1.5%) of Congestive Heart Failure (CHF).

The Body Mass Index (BMI) was found to be 25.6 kg / m² (+/- 4.2) with a minimum of 14.9 and a maximum of 40.3 kg / m². According to the BMI classification proposed by the World Health Organization (WHO), it was observed that 122 (26.5%) were
overweight and 114 (24.8%) were normal. It was not possible to calculate the BMI on 171 (37.2%) records due to lack of information.

When talking about tobacco, 141 (30.7%) patients were smoking, 146 (31.7%) had never smoked and 106 (23%) were former smokers.

Coronary artery bypass graft (CABG) was the most performed surgical specialty, 218 (47.8%), followed by mitral valve replacement (MVR), 83 (18%), and aortic valve replacement (AVR) in 69 (15%) patients.

Among the patients, 426 (92.6%) had no complications in the intraoperative period.

Previous focus of infection was found in 37 (8%) patients, with 30 (6.5%) having received preoperative antibiotics. Regarding the use of Extracorporeal circulation (ECC), most surgical procedures were performed using this mechanism, 449 (97.6%).

Mean duration of the surgeries was 3.8 hours (±1.0), with a minimum of 1.8 hours and a maximum of nine hours, with an average CEC duration of 78 minutes (±33.1), with variation from ten to 260 minutes.

Regarding the classification of the surgeries, most of them was elective (452 to 98.3%), with eight (1.7%) being classified as urgent.

As regards the aspects related to the postoperative period, it is found that the average length of ICU stay was 7.6 days (±7.8), ranging from two to 70 days. The mean total postoperative hospital stay was 11.9 days (±10.3), ranging from three to 76 days.

Patients had a mean time of endotracheal intubation of 26.1 hours (±43.9), ranging from four to 469 hours. Of these, 62 (13.5%) patients underwent reintubation.

With respect to the use of a nasogastric tube, the majority used this device in the postoperative period, 319 (69.3%).

Regarding the evolution of the patients evaluated in this study, it was found that 407 (88.5%) progressed to hospital discharge, 52 (11.3%) died and one (0.2%) patient was referred to another hospital institution.

In the bivariate analysis, the variables that had a statistically significant association (p <0.01) were intubation time (p <0.001), use of nasogastric tube (p = 0.005), age group (p = 0.006), previous cardiac surgery (p = 0.002), duration of surgery (p = 0.001), COPD (p <0.001) and surgery classification (p = 0.001), according to data in table 1.

Table 1. Association between risk factors for respiratory infection and the occurrence

<table>
<thead>
<tr>
<th>RESPIRATORY INFECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VARIABLES</strong></td>
</tr>
<tr>
<td>Admissio</td>
</tr>
<tr>
<td>n time</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Intubatio</td>
</tr>
<tr>
<td>n time</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Use of nasogras</td>
</tr>
<tr>
<td>tric tube</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Age group</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Previous heart</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Duration of the</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>COPD</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>CHF</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

Surgery rate

| Urgency | 6 | 75.02 | 25.03 | 80(2.4512.23 | 0.0 | | |
| | 9 | 5.92 | (2.43-0.1 | 01 | | | |
| Elective | 89 | 19.736380.3 | 61.64 | | | | |


In multivariate logistic regression analysis, intubation time, use of nasogastric tube, previous cardiac surgery, duration of surgery and COPD continued to show statistically significant association (p <0.05), according to data in table 2.

**Table 2. Logistic regression analysis of risk factors to the occurrence of respiratory infection in patients undergoing cardiac surgery. Uberaba-MG, 2005-2010**

<table>
<thead>
<tr>
<th>RESPIRATORY INFECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VARIABLES</strong></td>
</tr>
<tr>
<td>Intubation time</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Use of nasogastric</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Age group</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Previous heart</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

The incidence of respiratory infection cases among patients with COPD was 23 (44.2%), while incidence for patients without the disease was 72 (17.6%). Incidence of infection was found in 59 (39.3%) patients with intubation time of 24 hours or more.

Among the factors related to occurrence of respiratory infection, patients who used a nasogastric tube, 77 (24.1%) developed this type of infection. Among the elderly, 50 (27%) were affected with the same clinical picture. Of the patients who were in second heart surgery procedure, 16 (39.1%) developed respiratory infectious process.

Of all cases of infection, 85 (24.2%) underwent surgery with a time longer than three hours (180 minutes).

**DISCUSSION**

It was found that most of the patients were male (60.9%) with a mean age of 55.6 years. Other studies have found similar data related to gender and age.\(^2,3\)

Studies indicate that with an age over 65 ± 11.3 the duration of MV, ICU stay and hospitalization are risk factors for mortality in the population undergoing cardiac surgery.\(^1,3,5-6\)

The incidence of respiratory infection in the sample studied was (20.7%), with similar results identified in a study with a sample of 1,628 patients, in which (14.4%) presented pulmonary complications.\(^2\) However, these values are lower in another study that evaluated 5,582 patients undergoing cardiac surgery, and of these (3.1%) developed respiratory infection.\(^1\)

The mean duration of endotracheal intubation of this study was 26.1 hours. We observed a lower time in a study that evaluated 116 heart surgery patients, in which all of them remained under VM postoperatively, for a time of 15.5 hours.\(^3\)

With regard to comorbidities, it was found that most of the patients had hypertension. It is observed that this condition was more prevalent in the elderly population conducted in the city under this
This disease is associated with other chronic diseases, such as obesity, diabetes, congestive heart failure and COPD, with similar results found in other studies.\textsuperscript{1,6,8}

The average BMI of the population studied was 25.6 kg/m\(^2\). However, there was a greater proportion of overweight patients according to BMI classification proposed by WHO.\textsuperscript{9} Overweight is associated with intraoperative variables, which may impact on the appearance of pulmonary complications, such as respiratory infections.\textsuperscript{10}

In this study the most frequently performed surgery was MRI (47.8%). This surgery was the most performed in (77.1\%) among 8,112 patients\textsuperscript{5} and (52\%, 6) among 116 patients.\textsuperscript{3} Coronary artery bypass surgery is considered a safe procedure performed worldwide with low rates of mortality and morbidity in the general population.\textsuperscript{10}

In the studied population, most patients (97.6\%) used CEC, with an average time of 228 minutes of surgery. One study linked the CEC time with the relative risk of death in 209\% higher when it is above 115 minutes.\textsuperscript{2}

In this study it was found that (11.3\%) patients died, comparing this result with countries like the United States (2.9\%) and Canada (1.7\%).\textsuperscript{11} In a hospital in Brazil (4.7\%), in patients undergoing on-pump CABG\textsuperscript{12}, mortality is higher in the population of this study.

Risk of mortality has been associated with factors such as age > 65 years, use of cardiopulmonary bypass surgery.\textsuperscript{1,2}

Lung infection was significantly associated with 2.1 times increased likelihood of death within 30 days after cardiac surgery when compared to patients without lung infection.\textsuperscript{6} A review study shows that the most frequent infection related to health care was pneumonia (38.3\%) and was associated with hospitalization, comorbidities, invasive procedures, nutritional conditions, decline in immune response as contributing factors for the occurrence of infections in the elderly.\textsuperscript{13}

**CONCLUSION**

Results of this study suggest that patients who underwent surgery time longer than 180 minutes have 1.73 more chances of developing respiratory infection compared to surgeries with time less than 180 minutes. It showed a high prevalence of respiratory infections in the postoperative period of cardiac surgery. It was also identified variables such as long intubation time (higher than 24 hours), use of nasogastric tube, age group (older than 60), history of previous heart surgery, duration of surgery (> 180 min), and history of disease Chronic Obstructive
pulmonary disease (COPD) as factors associated with respiratory infection.

It is expected that the results shown in this study may support actions to prevent the occurrence of respiratory infection in this population, considering the risk factors identified.

As possible limitations of this research it can be considered the constraints of the group assessed in relation to the sample size, since it has been held in a single institution.

Studies like are suggested to be developed on an enlarged scope, preferably in a multicentric perspective.

REFERENCES

11. Oliveira EL, Westphal GA, Mastroeni MF. Características clínico-demográficas de pacientes submetidos a cirurgia de revascularização do miocárdio e sua relação com a mortalidade. Rev Bras Cir

Received: 12/04/2016
Approved: 20/06/2016
Published: 31/07/2016