

# Pulmonary complications in pediatric cardiac surgery at a university hospital

*Complicações pulmonares em crianças submetidas à cirurgia cardíaca em um hospital universitário*

Daniel Lago BORGES<sup>1</sup>, Lícia Raquel Teles SOUSA<sup>2</sup>, Raquel Teixeira SILVA<sup>2</sup>, Holga Cristina da Rocha GOMES<sup>2</sup>, Fernando Mauro Muniz FERREIRA<sup>3</sup>, Willy Leite LIMA<sup>4</sup>, Lívia Christina do Prado Lui BORGES<sup>5</sup>

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## Abstract

**Objective:** To identify the prevalence of pulmonary complications in children subjected to cardiac surgery, as well as demographic and clinical characteristics of the studied population.

**Methods:** The sample comprised 37 children of both genders, subjected to cardiac surgery at the *Hospital Universitário Presidente Dutra*, São Luis (MA), during the year of 2007. Patients who had pre-operative pulmonary disease, patients with neurological disorders, intra-operative death besides lack of data in medical records were not included. The data were obtained from data collection of medical and nursing developments of the respective medical records.

**Results:** The population of the study was predominantly composed by female children, from the countryside and at school age. Pathologies considered as low risk were the majority, highlighting the patent ductus arteriosus, ventricular septal defect and interatrial septal defect. It was observed that most children used cardiopulmonary bypass for over 30 minutes, with a median of 80 minutes, suffered a median sternotomy, using only the mediastinal drain and made use of postoperative mechanical ventilation, with the median of about 6.6 hours. Only 8.1%, in other words, three patients developed pulmonary complications, and of those, two died.

**Conclusion:** Most of the sample children was female, school aged and from the countryside. The low time of cardiopulmonary bypass and mechanical ventilation, in

addition to congenital heart diseases with low risk, may have been factors that contributed to the low rate of postoperative pulmonary complications.

**Descriptors:** Congenital Heart Diseases. Surgery. Postoperative Complications.

## Resumo

**Objetivo:** Identificar a prevalência de complicações pulmonares em crianças submetidas à cirurgia cardíaca, assim como características demográficas e clínicas da população estudada.

**Métodos:** A amostra foi composta por 37 crianças, de ambos os sexos, submetidas à cirurgia cardíaca no Hospital Universitário Presidente Dutra, São Luís (MA), durante o ano de 2007. Não foram incluídos pacientes que apresentaram doença pulmonar pré-cirúrgica, portadores de distúrbios neurológicos, óbito intra-operatório, além de falta de dados no prontuário. Os dados foram obtidos pela coleta nas evoluções médicas e de enfermagem dos respectivos prontuários.

**Resultados:** Quanto às características populacionais, houve predomínio de crianças do sexo feminino, provenientes do interior do estado e na faixa etária escolar. Patologias consideradas de baixo risco foram a maioria, destacando-se a persistência do canal arterial, comunicação interventricular e comunicação interatrial. Observou-se que a maior parcela das crianças fez uso de circulação extracorpórea por mais de 30 minutos, sendo a

1. Expert (HU-UFMA<sup>1</sup> Cardiac Surgery Postoperative Unit Physiotherapist)
2. Physiotherapist
3. Physiotherapist
4. Physiotherapist
5. Expert (HU-UFMA Neonatal ICU Physiotherapist)
6. Master (HU-UFMA Intensive Care Unit Physiotherapist)
7. Expert (Physiotherapist. Faculdade Santa Terezinha – CEST<sup>2</sup> Professor)

Federal do Maranhão<sup>3</sup>, in the city of São Luis, MA<sup>4</sup>, Brazil. Poster presentation at the VII Congresso Norte-Nordeste de Medicina Intensiva<sup>5</sup>, in the city of São Luis – MA, June 3<sup>rd</sup> to 5<sup>th</sup>, 2009.

## Correspondence address:

Daniel Lago Borges, Rua S, Quadra 09, Casa 19, Parque Athenas, CEP: 65072-475. São Luis – MA, Brazil.  
E-mail: dlagofisio83@hotmail.com

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mediana igual a 80 minutos, sofreu esternotomia mediana, utilizou apenas dreno mediastinal e fez uso de ventilação mecânica pós-operatória, sendo a mediana aproximadamente de 6,6 horas. Somente três (8,1%) pacientes apresentaram complicações pulmonares, sendo que destes, dois foram a óbito.

**Conclusão:** A maioria das crianças da amostra era do sexo feminino, na faixa etária escolar e proveniente do

interior do estado. Os baixos tempos de circulação extracorpórea e ventilação mecânica, além de cardiopatias congênitas consideradas de baixo risco, podem ter sido fatores contribuintes para o pequeno índice de complicações pulmonares no pós-operatório.

**Descritores:** Cardiopatias congênitas/cirurgia. Complicações pós-operatórias.

## INTRODUCTION

Congenital heart diseases affect approximately 80 to 10 children in every 1000 children born alive, estimating the appearance of about 28 thousands new cases per year in Brazil, being necessary, approximately 23 thousand surgical procedures per year [1].

The most common causes of morbidity and mortality in cardiac surgeries are pulmonary complications with wide variation of incidence, from 6% to 76% [2]. It is believed that factors such as general anesthesia, surgical incision, cardiopulmonary bypass (CPB), ischemia time, intensity of surgical manipulation and number of drains may predispose patients to pulmonary function changes, which are highly relevant on the onset of respiratory complications in cardiac surgery postoperative [3-7].

Therefore, this research aims at identifying the pulmonary complications and their prevalence in cardiac surgery postoperative in children besides to identifying demographic and clinical characteristics of the studied sample.

## METHODS

This is a retrospective cohort study, executed at *Hospital Universitário Presidente Dutra (HUPD)* in the city of São Luís – state of Maranhão, which treats exclusively patients from the *Single Health System-SUS*.

The study sample consisted of children aged under or equal to 12 years old, of both genders, diagnosed with congenital heart diseases, subjected to cardiac surgery at HUPD, during the year of 2007. Patients who had pulmonary disease in the preoperative, carriers of neurological disorders, intra-surgical deaths, and lack of data in medical records were not included in the study.

Data collection was executed using medical records of the Archives Division, after the number of medical records and names of the subject patients had been provided by the Cardiology and Cardiac Surgery Service. It occurred with the assent of the *Research Ethical Committee* and, as recommended by Resolution 196/96 of the *Health National Council* under protocol number 003236/2008-60.

The data collection instrument approached issues related to: identification, diagnosis, preoperative hospital stay, type of surgery and incision, surgical length of time, cardiopulmonary bypass and postoperative mechanical ventilation, pulmonary and other system complications, postoperative hospital stay and death, being filled with information from medical records only.

Information found in medical developments was considered for pulmonary complications, and other data were taken from the nurses developments. All data were computed using the Microsoft Excel 2007 software and analyzed with EPIINFO software.

## RESULTS

In the year of 2007 381 cardiac surgeries were carried through at HUPD, and 66 (17.3%) of those occurred in individuals under 12 years old. Within the non inclusion criterion, 26 patients fit, and of those, eight had prior respiratory disease, five with neurological diseases and 13 for lack of data from medical records. Therefore, the final study sample comprised 37 children. Of those, five (13.5%) died postoperatively.

The demographic characteristics of the studied patients showed that 18 (48.6%) were male and 19 (51.4%) were female. Most children, 25 (67.6%) was from the countryside, and only 12 (32.4%) lived in the capital. None of the patients fit the age group of neonates, 12 (32.4%) were in the sucking stage, 11 (29.7%) were preschoolers and 14 (37.8%) were students.

Concerning the clinical diagnosis, the most common was the Patent Ductus Arteriosus (27.0%), followed by Ventricular Septal Defect (16.2%), Interatrial Septal Defect (13.5%) and Tetralogy of Fallot (8.1%). There were also cases of associated congenital cardiac diseases, which equaled to 35.2% of the sample. Most surgeries used as access the median sternotomy (70.3%) and isolated mediastinal drain in 64.9% of the cases.

A cardiopulmonary bypass was necessary in 70.3% of surgeries, with duration of use ranging between 25 and 180 minutes, and of those, only 7.6% had pulmonary complications. The median found was 80 minutes.

Mechanical ventilation was required in the

postoperative in 64.9% of patients, with duration of use ranging between 1 and 362 hours, with a median of 6.6 hours. Of those patients, only 8.3% had pulmonary complications.

From the total sample patients, only three (8.1%) had pulmonary complications: one with subcutaneous emphysema, one with pulmonary hemorrhage and one with a pleural effusion, empyema, and atelectasis, whereas the latter two died. Both patients who died showed CPB time above 100 minutes and mechanical ventilation time longer than 24 hours.

## DISCUSSION

Most children in this study were female and came from the countryside. Therefore, it is understood that those diagnoses were made in the capital, a fact consistent with the study of Guitti [8], since it suggests that the diagnosis is made more likely in large urban centers. Also, Miyague et al. [9] showed a large number of patients which were came from the countryside or even other States. As the HUPD is the reference center in the state of Maranhão to the SUS users in the treatment of heart diseases, it is expected that children with heart diseases from the countryside are sent to this health unit for treatment.

Most patients included in this study were in school age (> 5 to 10 years old), different from the work performed by Nina et al. [10], in the same Institution, with 145 patients under the age of 18 years old, with congenital heart diseases and subjected to cardiac surgery in the years of 2001 to 2004, where there was a predominance of lower aged patients, and most of them were between 1 to 5 years old. A study performed by Boethig et al. [11] in a developed country showed a significant percentage for neonates and sucking infants (<1 year old) subjected to cardiac surgery. Those facts show how late the children in this study were diagnosed and treated.

The most common congenital heart diseases in the study of Miyague et al. [9] were acyanotic anomalies such as the ventricular septal defect (30.5%), the atrial septal defect (19.1%), the patent ductus arteriosus (17%), the pulmonary valve stenosis (11.3%) and the aortic banding (6.3%), while the most common cyanotic anomalies were the tetralogy of Fallot (6.9%), the transposition of the great vessels (4.1%), the tricuspid atresia (2.3%) and the total anomalous drainage of pulmonary veins (2%). Those data corroborate the findings of our study, where there was also a predominance of acyanogenic heart diseases.

The largest portion of the sample was subjected to a median sternotomy incision, once, according to Sampaio et al. [12], that incision facilitates a broad access to the heart and great vessels. Lichtenberg et al. [13] claim that the median sternotomy causes changes in mechanical

ventilation by causing pain and instability in the thorax, however, in our findings, it was observed that only two patients subjected to that type of incision progressed with pulmonary complications.

Udern-Sternberg et al. [14] mention that the cardiac surgery associated to the cardiopulmonary bypass causes a number of respiratory complications. Studies by Borghi-Silva et al. [15] and Guizilini et al. [16] also revealed damages to the respiratory mechanics in patients subjected to cardiac surgery with CPB application. Nozawa et al. [17], in another study, with 45 patients, found similar results in which the use of CPB delayed weaning from the mechanical ventilator and still considered as CPB high time periods longer than 120 minutes for adults, however Brown et al. [18], in a specific survey with children found worsening of pulmonary mechanics in those with CPB time longer than 30 minutes. Although the fact that great part of our sample (70.3%) used CPB, the findings were different from those of the mentioned studies, once only 7.6%, that is, two patients developed respiratory complications.

Felcar et al. [19], in a study with 135 children subjected to cardiac surgery, divided into two groups, one subjected to pre and postoperative physiotherapy and the other one only to postoperative, had a median duration of mechanical ventilation equal to 36 hours (8 - 288) and 35.8 hours (7 - 204). In turn, Silva et al. [20], working with 29 children subjected to cardiac surgery found a mechanical ventilation average time of 3.43 days in those who did not require ventilator support after 48 hours of extubation. Those data show important differences compared to our study, where the median duration of mechanical ventilation was only 6.6 hours after surgery.

Felcar et al. [19], in an already mentioned study, found a 34% incidence of pulmonary complications in children subjected to cardiac surgery, and pneumonia was the most common one with 14.8%. Linhua et al. [21], in a survey with 311 children aged up to 1 year old, subjected to congenital heart disease surgical correction, found an incidence of 21.5% for pneumonia. Those findings do not match the data found in our research, since there was no record of pneumonia in any of the cases that developed pulmonary complications.

## CONCLUSION

The results showed that the majority of children were female and from the countryside, showing the importance of this hospital unit for a considerable region of the State. It was found that children aged over six years old at school age, formed the largest portion of the sample, which shows how late those patients are diagnosed and treated.

The low times of cardiopulmonary bypass and mechanical ventilation, besides the congenital heart diseases considered as low risk, may have been

contributing factors to the low rate of pulmonary complications found in the postoperative.

## CONCLUSIONS

Due to the high relevance of the subject, it is necessary to perform further deeper studies with larger sampling to evidence precisely the relation between the pediatric heart surgery and pulmonary complications.

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