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Abstract

Introduction: Due to importance of surgeries for treatment of heart diseases, it is necessary to recognize surgical site infection and other Healthcare-Related Infections as the main post-surgical complications. **Objective:** To analyze the association and correlation between clinical and propaedeutic variables with the prevalence of wound infection in patients undergoing cardiac surgery **Methodology:** Quantitative, analytical study with a retrospective approach. Data collection was performed in the Medical Archive Sector of the Clinical Hospital of Uberlandia (HCU), using a previously structured instrument. **Results:** A total of 453 medical records were evaluated, mainly masculine gender (n=313; 69.1%). A time patient hospital stays had a mean of 36.47±28.7days, surgical indication of myocardial revascularization (n=278; 61.4%). The rate of surgical wound infection (SWI) found was 19%. Correlation and clinical associations were: Time of surgery and left ventricle ejection fraction (LVEF) (r=0,10; p<0,05); time hospital stay and almost all echocardiographic variables, weight and height (p=0.01); Systolic blood pressure (SBP) and left ventricle posterior wall (LVPW) (r=0.16), LVEF (r=0.12) and intraventricular septum (r=0.13), (p<0.01); Diastolic blood pressure (DBP) and left ventricle posterior wall (LVPW) (r= 0.10; p<0.01). **Conclusion**: The study has hight potential to increase scientific evidences and improving cardiovascular care, cardiovascular surgery field and prevention of healthcare-associated infections.

Keyword: Cardiac surgery; Hospital infection; Health care

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Clinical Data, Echocardiography and Surgical Wound Infection of Patients Undergoing Cardiac Surgery

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ABSTRACT

Introduction: *Due to importance of surgeries for treatment of heart diseases, it is necessary to recognize surgical site infection and other Healthcare-Related Infections as the main post-surgical complications.* ***Objective:*** *To analyze the association and correlation between clinical and propaedeutic variables with the prevalence of wound infection in patients undergoing cardiac surgery* ***Methodology:*** *Quantitative, analytical study with a retrospective approach. Data collection was performed in the Medical Archive Sector of the Clinical Hospital of Uberlandia (HCU), using a previously structured instrument.* ***Results:*** *A total of 453 medical records were evaluated, mainly masculine gender (n=313; 69.1%). A time patient hospital stays had a mean of 36.47±28.7days, surgical indication of myocardial revascularization (n=278; 61.4%). The rate of surgical wound infection (SWI) found was 19%. Correlation and clinical associations were: Time of surgery and left ventricle ejection fraction (LVEF) (r=0,10; p<0,05); time hospital stay and almost all echocardiographic variables, weight and height (p=0.01); Systolic blood pressure (SBP) and left ventricle posterior wall (LVPW) (r=0.16), LVEF (r=0.12) and intraventricular septum (r=0.13), (p<0.01); Diastolic blood pressure (DBP) and left ventricle posterior wall (LVPW) (r= 0.10; p<0.01).* ***Conclusion****: The study has hight potential to increase scientific evidences and improving cardiovascular care, cardiovascular surgery field and prevention of healthcare-associated infections.*

Keywords: Cardiac surgery; Hospital infection; Health care

INTRODUCTION

Currently, heart diseases represent one of the main causes of hospital admissions, as well as morbidity and mortality, both worldwide and nationally (BRANT et al, 2017). According to data from the World Health Organization (WHO), the estimate of annual deaths caused by cardiovascular diseases from the year 2030 is about 23 million (BARREIROS et al, 2016).

Despite the great benefit of cardiovascular surgeries, the possibilities of postoperative complications in this treatment are directly related to their complexity. Among the main postoperative complications, the most prominent are infections, with emphasis on surgical site infections and Health Care-Related Infections (BRAZ et al, 2018).

Such infections allow the prolongation of the patient's hospitalization, which favors the exposure of the patient to other possible complications. Furthermore, infections directly influence morbidity and mortality rates, besides increasing the cost of treatment (VIEIRA et al, 2018).

In view of the aforementioned panorama related to the control of microorganisms causing infection, as well as the impact of postoperative infections of cardiac surgeries on public health, scientific and technological investments are necessary to adoption of measures to prevent and control infection, since the hospital context itself threatens patient safety (LEMOS et al, 2018).

In addition, care based on scientific knowledge and through results and research are essential to reduce THE RIS. As well as, such care has an impact on the reduction of morbidity and mortality of patients undergoing cardiac surgery (RODRIGUES, FERRETTI-REBUSTINI & POVEDA, 2016).

However, surgeries can evolve postoperatively with several complications, and currently the focus, both nationally and internationally, is directed to postoperative infections, with emphasis on surgical site infections (BECCARIA et al, 2015). There is a scarcity of research and publications that address the proposed theme.

It is then perceived the need for studies that can observe and correlate the preoperative clinical aspects with the development of complications, as well as to evidence the main microbiological agents involved in these infections.

This study seeks to analyze associations and correlations between clinical and propaedeutic variables with the prevalence of wound infection in patients undergoing cardiac surgery, as well as correlate the echocardiographic profile with the prevalence of surgical wound infection in patients undergoing cardiac surgery in a high complexity hospital.

Methodology

Design

Quantitative, analytical study of retrospective approach of the documental analysis.

Site and Population

Data were collected from the documentary clinical records contained in the medical records, by the researchers, in the Medical Archive Service (SAME) of the Clinical Hospital of the Federal University of Uberlandia (HCU). The population consists of patients who underwent cardiac surgery in the HCU from January 2014 to January 2019, according to data provided by the statistics department of the locus institution, 453 cardiac surgeries were performed within the given period.

Data Collection

The HCU statistics department provided a survey of cardiac surgical procedures from January 2014 to January 2019. Thus, the researchers performed the full reading of all medical records so that the data collection instrument was later completed, which was structured according to the classical literature in the area of cardiovascular nursing and surgical cardiology (RODRIGUES, FERRETTI-REBUSTINI & POVEDA, 2016).

Data Collection Instrument

The data collection instrument was semi-structured from a broad bibliographic review, containing admission data, clinical data (reason for surgery, categorized in myocardial revascularization, valve replacement, abdominal aortic aneurysm and other, weight and height, obtained from the medical records, vital signs, obtained by the shock sheet present in medical records, presence of dyspnea, edema and atrial fibrillation, obtained by the nursing note) propaedeutic data (echocardiography and coronary angiography), data related to surgical wound (infectious signs, dressings and microorganisms isolated), medications used and occurrence of surgical reproach.

Inclusion, exclusion and ethical aspects.

Patients who underwent cardiac surgery during the period determined were included, with age equal to or greater than 18 years and who were not hospitalized during the time of data collection. We excluded patients with the diagnosis of infection prior to the surgical procedure and those with data incomplete fillings. This study has approved by the local ethics committee under no. 1,715,990.

Statistical analysis

The data were entered in the Excel program® in double typing and later perform validation between the two worksheets. Then, the data were imported into the Statistical Package for the Social Science (SPSS) Program, version 21.0, where descriptive statistical analysis and simple frequency were performed, as well as chi-square test for data with categorical outcomes and Pearson correlation test for continuous quantitative data.

Results

Table 1 refers to quantitative variables about the clinical profile of patients. Regarding the time that the surgery had been performed, it is possible to notice the mean of 2.79±1.4 years, while the length of hospitalization was approximately 36.47±28.7days.

Table 1 - Descriptive analysis of continuous quantitative variables about the clinical profile of patients undergoing cardiac surgery, Clinical Hospital of Uberlandia, 2020

VARIABLE	MINIMUM	MAXIMUM	MEAN±SD
Surgery time (years)	1	5	2,79±1,4
Length of stay (days)	2	190	36,47±28,7
Age (years)	19	97	59,93±12,2
Weight (kg)	35	127	73,38±14,0
Height (cm)	133	201	166,1±8,4
Axillary temperature (ºC)	33	97	36,08±2,9
Respiratory Rate (rpm)	10	77	19,37±5,1
Sat O2% (%)	51	100	95,18±3,6
Heart Rate (bpm)	16	149	76,98±16,8
Systolic Blood Pressure (mmHg)	62	212	129,7±22,8
Diastolic Blood Pressure (mmHg)	38	120	76,19±14,3

Source: the author. **Sat O2%:** Peripheral oxygen saturation.

Table 2 shows the categorical quantitative variables related to the sociodemographic profile of the analyzed sample alone. It is possible to visualize a higher proportion in male patients (n=313; 69.1%). Regarding the self-reported color, a predominance of white color (n=280; 61.8%), followed by brown color (n=148; 32.7%).%).

Table 2 - Simple frequency analysis of categorical quantitative variables about the sociodemographic profile of patients undergoing cardiac surgery, Clinical Hospital of Uberlandia, 2020

VARIABLE	n	%
Gender		
Male	313	69,1
Female	140	30,9
Self-reported color		
White	280	61,8
Brown skin	148	32,7
Black skin	22	4,9
Other	3	0,7
Civil Status		
Single	160	35,3
Married	253	55,8
divorced	24	5,3
Widower	16	3,5
TOTAL	453	100

Source: The author.

The surgical indication is shown in Table 3. Myocardial revascularization (n=278; 61.4%), valve change (n=93; 20.5%) and abdominal aortic aneurysm (n=50; 11%) were the most prevalent. It should be noted that the same patient could have more than one reason for surgical indication.

Table 3 - Simple frequency analysis of categorical quantitative variables regarding the surgical indication of patients undergoing cardiac surgery, Clinical Hospital of Uberlandia, 2020

SURGICAL INDICATION	n	%
Myocardial Revascularization	278	61,4
Valve change	93	20,5
Abdominal Aortic Aneurysm	50	11,0
Pericardial Stroke	8	1,8
Interatrial Communication	12	2,6
Valve prosthesis implant	6	1,3
Angioplasty	16	3,5
Pacemaker implant	21	4,6
TOTAL	453	100

Source: The author.

Regarding the prevalence of infection, the surgical wound infection (SWI) (n=86; 19%), respiratory system infection (n=48; 10.6%), and subsequently infection of the cardiovascular system and infection in the genitourinary system, both with statistically equal proportions (n=30; 6.6%),as shown in Table 4, stands out.

Table 4 - Simple frequency analysis of the prevalence of infection in patients undergoing cardiac surgery, Clinical Hospital of Uberlandia, 2020

VARIABLE	n	%
Surgical Wound Infection	86	19,0
Respiratory System Infection	48	10,6
Cardiovascular System Infection	30	6,6
Digestive System Infection	4	0,9
Osteoarticular System Infection	8	1,8
Genitourinary System Infection	30	6,6
Tegumental System Infection	17	3,8
Idiopathic Infection	20	4,4
TOTAL	453	100

Source: The author.

Table 5 shows correlations between clinical data and pre-surgical echocardiographic. The time of surgery had a positive, strong (r=0.10) and significant (p<0.05) correlation with the left ventricle ejection fraction (LVEF). The length of hospitalization established a positive, strong and significant correlation (p=0.01) with most of echocardiographic variables, as well as the variables weight and height. Systolic blood pressure (SBP) was positively, strongly and significantly correlated (p<0.01) with the variables left ventricle posterior wall (LVPW) (r=0.16), LVEF (r=0.12) and intraventricular septum (r=0.13). Diastolic blood pressure (DBP) was correlated with LVPW (r= 0.10; p<0.01)

Table 5 –Correlations between clinical data and echocardiographic variables of patients undergoing cardiac surgery, Clinical Hospital of Uberlandia, 2020

VARIABLE	AO. Diam. (mm)	LA. Diam (mm)	DLV. Diam (mm)	SLV. Diam (mm)	LVPW (mm)	LVEF (%)	IV.SEP (mm)
Surgery time (years)	- 0,04	0,07	0,05	0,01	0,02	0,10*	- 0,05
Hospital stay (days)	0,06	0,16**	0,14**	0,14**	0,13**	- 0,12**	0,09
Age	0,03	- 0,01	0,03	0,03	0,13**	- 0,07	0,15**
Weight (kg)	0,25**	0,20**	0,16**	0,11**	0,17**	0,00	0,14**
Height (cm)	0,35**	0,13**	0,20**	0,18**	0,12**	- 0,07	0,11**

Ax. T (ºC)	0,01	- 0,00	- 0,06	- 0,02	0,03	0,05	0,02
R.R. (rpm)	- 0,02	0,02	- 0,05	- 0,04	0,06	0,04	0,08
O_2 Sat (%)	0,03	- 0,03	0,01	0,00	- 0,03	0,00	- 0,05
C.R (bpm)	0,03	0,02	- 0,00	0,03	0,03	- 0,11	0,00
SBP (mmHg)	0,06	- 0,07	- 0,00	- 0,05	0,16**	0,12**	0,13**
DBP (mmHg)	0,08	- 0,05	- 0,07	- 0,08	0,10*	0,05	0,06

Source: The author**. Ax. T:** axillary temperature; **R.R**: respiratory rate; **O_2 Sat**.: oxygen saturation; **C.R**: cardiac rate; **SBP**: systolic blood pressure; **DBP**: diastolic blood pressure**. AO. Diam**: Diameter aortic; **LA Diam**: diameter left atrium; **DLV. Diam**: diastolic diameter left ventricle; **SLV. Diam**: systolic diameter left ventricle; **LVPW**: left ventricular posterior wall; **LVEF**: left ventricle ejection fraction; **IV. SEP**: intraventricular septum

***p<0,05; ****p<0,01

Association tests demonstrate clinical and propaedeutic data with the prevalence of Surgical Wound Infection (SWI)demonstrates an association with longer hospital stay (p=0.00), and higher RATES of SWI in patients with an older age (p=0.00). As for the association between the dependent variable (SWI) and the R.A diameter realizes that the higher the L.A diameter higher infection rates (p=0.02), as shown in Table 6.

Table 6 - Association between clinical and propaedeutic profile with the prevalence of Surgical Wound Infection in patients undergoing cardiac surgery, Clinical Hospital of Uberlandia, 2019.

	SWI		
VARIABLES	Yes	No	p
Surgery Time (years)	2,56	2,85	0,08
Hospital Stay (days)	52,55	32,70	0,00**
Age (years)	63,34	59,13	0,00**
Weight (kg)	74,12	73,20	0,59
Height (cm)	165,07	166,36	0,23
Ax.T (ºC)	35,91	36,12	0,28
R.R (rpm)	20,69	19,06	0,09
O_2 Sat(%)	94,88	95,25	0,38
C. R (bpm)	79,09	76,48	0,24
SBP (mmHg)	132,43	129,05	0,22
DBP (mmHg)	77,90	75,78	0,21

Diameter R.A (mm)	35,08	34,99	0,88
Diameter L.A (mm)	43,80	41,79	0,02*
DLV. Diameter (mm)	53,38	51,31	0,16
SLV. Diameter (mm)	36,57	35,19	0,31
LVPW (mm)	10,23	10,03	0,34
LVEF (%)	54,27	56,36	0,22
Intraventricular Septum (mm)	10,64	10,50	0,55

Ax. T: axillary temperature; **R.R**: respiratory rate; **O_2 Sat**.: oxygen saturation; **C.R**: cardiac rate; **SBP**: systolic blood pressure; **DBP**: diastolic blood pressure**. R.A:** right atrium; **L.A**: left atrium; **DLV.** diastolic left ventricle; **SLV:** systolic left ventricle; **LVPW**: left ventricular posterior wall; **LVEF**: left ventricle ejection fraction;

***p<0,05; ****p<0,01

DISCUSSION

Clinical and sociodemographic profile

The length of hospitalization of the patient is intrinsically related to the occurrence of infectious processes in view of the high exposure of invasive procedures and microbiological exposure in the hospital context. A previous study conducted in 2019 showed that the mean length of hospital stay of patients after cardiac surgery was about 31.8 days, a result that is similar to the present study (KANASIRO, TURRINI & POVEDA, 2019).

On the other hand, other studies show lower means, also leading to lower mortality rates and hospital costs (KOERICH, LANZONI & ERDMANN, 2016; SILVEIRA et al., 2016). The individual clinical picture, presence of comorbidities and type of procedure should be taken into account in the analysis of length of hospitalization.

The age group of patients in this study is in line with several recently published investigations, demonstrating greater involvement in patients over 50 years of age (KANASIRO, TURRINI & POVEDA, 2019; DORDETTO, PINTO & ROSA, 2016; SILVA et al., 2019; BRAZ et al., 2018; SILVEIRA et al., 2016).

With regard to the gender variable, it is perceived that the predominance in male patients observed as a result of this study corroborates with data available in the literature. Men have a lower tendency of self-care when compared to women (SILVA et al., 2019; SILVEIRA, et al., 2016; VELLONE et al., 2017; NORDGREN, SÖDERLUND, 2017; DORDETTO, PINTO & ROSA, 2016; (MOREIRA, GOMES; RIBEIRO, 2016). Although research indicates black populations genetically vulnerable to heart disease, the findings in the present study contradict this statistic. This result can be hypothetically explained by two reasons: self-declaration of ethnicity and spontaneous demand of white participants to be included in the study. White and married marital patients were predominantly found in other investigations (DORDETTO,

PINTO & ROSA, 2016; DE ALMEIDA NETO, et al. 2016; KOERICH, LANZONI & ERDMANN, 2016; BRAZ et al., 2018; SHUBERT et al., 2018).

Surgical Indication

Procedures such as myocardial revascularization, valve replacement and aortic aneurysm found in this study are in line with the literature (DORDETTO, PINTO & ROSA, 2016; SILVA et al.,2019; BRAZ et al.,2018). Other studies also describe other procedures (aortic reconstruction and angioplasty) as highly prevalent (SILVEIRA et al.2016; MURAKAMI et al., 2017). It is noted that the higher prevalence of revascularization in the present study may result from another previous cardiac event, the most common being acute myocardial infarction (SILVA et al., 2018).

Regarding the non-modifiable factors that are closely linked to the risk for the development of heart disease, it is worth noting age, gender, race and/or ethnicity and family history. As previously presented, male patients have a greater predisposition to heart diseases, especially with regard to AMI, even older age increases this risk (OLIVEIRA et al., 2018). In relation to modifiable factors, it is of paramount importance to cite chronic diseases as factors directly linked to cardiac involvement, the main ones pointed out by an integrative review of systemic arterial hypertension, dyslipidemia, and diabetes mellitus caused by life habits such as sedentary lifestyle, smoking and alcohol consumption (COSTA et al., 2018; ANDRADE et al., 2019; OLIVEIRA et al. 2018; FREIRE et al. 2017).

Prevalence of Body Site Infection

The present study shows an incidence rate of surgical wound infections of 19%, given this is consistent with a previous study, where the infection rate was 18.6% (BRAZ et al., 2018; TAUFFER et al., 2019). Other studies that investigated factors associated with mortality in the postoperative period of cardiac surgery, there was a higher prevalence of respiratory tract infections, which also includes the analysis performed (KOERICH, LANZONI & ERDMANN, 2016; TAUFFER et al., 2019). Infectious rates in the cardiovascular and urinary tract systems also corroborate the literature, with similar statistics resulting from invasive procedures, health care-related infection, long-stay invasive devices and the patient's clinical picture (TAUFFER et al., 2019; SOUSA, OLIVEIRA & MOURA, 2016; RODRIGUES et al., 2019).

Correlations between clinical and echocardiographic data

Correlations between surgery time and LVEF suggests an improvement in cardiac function over the years following surgical correction (TOMÉ, 2018).

With regard to age, it is known that aging promotes several both anatomical and physiological changes in the body, with regard to changes in the cardiovascular system we can perceive the increase in cardiac muscle mass due to the increase in greater peripheral arterial resistance, changes that prove the significant correlation between age and thickness of the LVPW and the Intraventricular Septum (ANDRADE et al., 2016; AMBROSIM, 2019).

Also, it is possible to perceive the correlation between anthropometric variables, weight and height, and echocardiographic data, this, as a function of body composition. Patients with a larger body surface have a

deviation from the normality of echocardiographic findings due to the need for the cardiac system to adapt to promote adequate blood supply (FARIA et al., 2018; DORDETTO, PINTO & ROSA, 2016).

Regarding SBP, it is perceived that due to the aging process the aorta acquires a greater rigidity, thus causing the increase of this vital sign to occur (ANDRADE et al. 2016). This increase promotes hypertrophy of the cardiac muscles of the left ventricle, which explains the correlation between this variable and the increase in LVPW and intraventricular septum (BERTOLUCI et al., 2019; ALBUQUERQUE et al., 2017; BRAZILIAN SOCIETY OF CARDIOLOGY, 2016).

Associations between clinical and echocardiographic data and SWI rate

Significant associations were established between length of hospital stay and wound infection. As already mentioned, patient exposure in the hospital context increases the risk for the development of infections. The SWI are mainly related to the surgical procedure, but also to the care provided to the client during his hospitalization. In addition, it is dependently related to the clinical status of patients before the procedure (RODRIGUES et al., 2019). It is also worth noting the two-way association that the length of hospitalization has with the rates of SWI and other infections (SILVA et al., 2016).

Another variable that is significantly associated with SWI indices is age. The mean age of patients who underwent cardiac surgery in the period analyzed, as stated above, was around 60 years. It is at this stage of life that the imuno senescence process begins, thus leaving the individual more exposed and prone to acquiring infections and developing other types of comorbidities (ZONTA et al.,2018).

Conclusions

The study has achieved all proposed objectives, showing clinical and sociodemographic profile of patients undergoing cardiac surgery in a high complex hospital . Furthermore, a rate of surgical wound infection has found (19%) as well as the mainly procedures (myocardial revascularization, valve change and abdominal aortic aneurysm). Important statistical clinical outcomes were stablished, for instance, correlations between echocardiographic parameters and clinical profile. Moreover, association tests demonstrate clinical and propaedeutic data with the prevalence of Surgical Wound Infection.

Limitations need to be appointed, such as uncompleted medical archives leading to data collected limitations and reduction in the sample. In other hand, that study has potential to show scientific evidences in the cardiovascular care, cardiovascular surgery field and prevention of healthcare-associated infections. Other kind of studies, methodologies and statistical approaches must be developing in order to provide new data and improving that scientific field.

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