IMMEDIATE POSTOPERATIVE COMPLICATIONS OF MYOCARDIO REVASCULARIZATION

Complicações no pós-operatório imediato de revascularização do miocárdio

Complicaciones en el postoperatorio inmediato de revascularización miocárdica

Alessandra Yuri Takehana de Andrade[1]*, Patricia Sayuri de Lima Tanaka[2], Vanessa de Brito Poveda[3], Ruth Natalia Teresa Turrini[4]

ABSTRACT: Objective: To verify the main complications of myocardial revascularization (MR) with cardiopulmonary bypass (CPB) and its association with modifiable and non-modifiable risk factors, nursing diagnoses, CPB time and nursing workload. **Method:** Retrospective cohort through analysis of 50 medical records of adult patients undergoing MR with CPB between 2012 and 2017. Project approved by the Research Ethics Committee Report No. 1969823. **Results:** The sample was predominantly male (70%), with a mean age of 62.1 years (standard deviation - SD ± 9.98). The mean CPB time was 124 minutes (SD ± 0.46). Postoperative complications occurred in 52% of the 50 patients analyzed, with bleeding being the most frequent (16%). The most frequent nursing diagnosis was risk of infection (92%). It was found that nursing staff care was most needed by patients with postoperative hypotension (p = 0.003) and arrhythmia (p = 0.000). **Conclusion:** Knowledge of postoperative complications associated with the patients helps develop more appropriate care plans.
Keywords: Nursing. Thoracic surgery. Nursing care.

RESUMO: Objetivo: Verificar as principais complicações da cirurgia de revascularização do miocárdio (RM) com circulação extracorpórea (CEC) e sua associação com os fatores de risco modificáveis e não modificáveis, diagnósticos de enfermagem, tempo de CEC e carga horária de enfermagem. **Método:** Coorte retrospectiva por meio da análise de 50 prontuários de pacientes adultos submetidos à RM com CEC, entre 2012 e 2017. Projeto aprovado pelo Comitê de Ética em Pesquisa parecer nº 1969823. **Resultados:** A amostra foi predominantemente masculina (70%), com idade média de 62,1 anos (desvio padrão — DP±9,98). O tempo médio de CEC foi de 124 minutos (DP±0,46). Complicações pós-operatórias ocorreram em 52% dos 50 pacientes analisados, sendo a mais frequente o sangramento (16%). O diagnóstico de enfermagem mais frequente foi risco de infecção (92%). Constatou-se que os cuidados pela equipe de enfermagem foram mais requeridos por pacientes que apresentaram hipotensão (p=0,003) e arritmia (p=0,000) no pós-operatório. **Conclusão:** O conhecimento das complicações pós-operatórias associadas ao perfil dos pacientes atendidos colabora para a elaboração de planos de cuidados mais adequados.
Palavras-chave: Enfermagem. Cirurgia torácica. Cuidados de enfermagem.

RESUMEN: Objetivo: Verificar las principales complicaciones de la cirugía de revascularización miocárdica (RM) con *bypass* cardiopulmonar (BCP) y su asociación con factores de riesgo modificables y no modificables, diagnósticos de enfermería, tiempo de BCP y carga de trabajo de enfermería. **Método:** Cohorte retrospectiva mediante el análisis de 50 registros médicos de pacientes adultos sometidos a RM con BCP entre 2012 y 2017. Proyecto aprobado por el Comité de Ética de Investigación Opinión 1969823. **Resultados:** La muestra fue predominantemente masculina (70%), con edad media de 62,1 años (DE±9,98). El tiempo medio de BCP fue de 124 minutos (DE±0,46). Las complicaciones postoperatorias ocurrieron en el 52% de los 50 pacientes analizados, siendo el sangrado el más frecuente (16%). El diagnóstico de enfermería más frecuente fue el riesgo de infección (92%). Se encontró que la atención por parte del personal de enfermería era más necesaria para los pacientes que presentaban hipotensión (p=0,003) y arritmia (p=0,000) después de la operación. **Conclusión:** El conocimiento de las complicaciones postoperatorias asociadas con el perfil de los pacientes ayudó en la elaboración de planes de atención más apropriados.
Palabras clave: Enfermería. Cirugía torácica. Atención de enfermería.

[1]Technical Nurse in charge of the Pró-Saúde Associação Beneficente Assistência Social e Hospitalar (ABASH) of the Centro de Atenção Psicossocial em Álcool e outras Drogas (CAPS AD). Undergraduate degree in nursing from the School of Nursing of the Universidade de São Paulo (USP) – São Paulo (SP), Brazil.
[2]Undergraduate degree in nursing; specialization in auditing from the Instituto Brasileiro de Extensão Educacional. Care nurse of the Sarah Network of the Hospitais de Reabilitação Associação das Pioneiras Sociais – Brasília (DF), Brazil.
[3]Post-doctoral scholar in Sciences from the Ribeirão Preto Nursing School of USP. Professor associated with the Department of Medical-Surgical Nursing of the School of Nursing of USP – São Paulo (SP), Brazil.
[4]Ph.D in Public Health through the School of Public Health of USP. Professor associated with the Department of Medical-Surgical Nursing of the School of Nursing of USP – São Paulo (SP), Brazil.
*Corresponding author: alessandra.yuri.andrade@usp.br
Received on: 09/04/2018 - Approved on: 09/15/2019
DOI: 10.5327/Z1414-4425201900040008

INTRODUCTION

Nowadays, noncommunicable chronic diseases (NCDs) are responsible for high morbidity and mortality rates in Brazil[1]. Among them, cardiovascular diseases stand out[2]. The occurrence of cardiovascular diseases is related to several risk factors for illness caused by these diseases, such as harmful lifestyle habits, like smoking, inadequate diet, physical inactivity and alcohol consumption[3].

Thus, the treatment of these cardiac disorders can occur either pharmacologically, percutaneously or surgically, through myocardial revascularization (MR)[4].

MR is often performed through cardiopulmonary bypass (CPB). This technique, applied to heart surgeries, provided a clean and safe surgical field for the team, and preserved the functional characteristics of the cardiac apparatus[5].

However, despite the benefits of performing CPB, its use may also be related to potential immediate postoperative period (IPO) in elderly patients and infants younger than 3 months old, especially over prolonged periods of time[5].

Complications related to the use of CPB are associated with the induction of the organic systemic inflammatory response, with impairment of coagulation and immune response; increased venous tone; increased catecholamine release; changes in electrolyte state; myocardial cell dysfunction, injury or necrosis; and mild pulmonary dysfunction, which causes complications in the cardiovascular, respiratory, renal, gastrointestinal, and nervous systems[5].

Considering that nurses are some of the main care takes, they need to be aware of the risks and problems that affect the patients under their care, so that they can provide quality, and whenever possible, risk-free care[4]. From the nursing history survey to the treatment of possible postoperative complications, it is important to know how these personal antecedents are related to the main complications in the IPO of patients who underwent the MR procedure with CPB.

As such, following through with nursing diagnoses is essential, since they provide care that meet the individual needs of each patient, by choosing an ideal intervention and allowing for it to be further evaluated.

OBJECTIVE

To verify the main complications of MR with CPB and its association with modifiable and non-modifiable risk factors, nursing diagnoses, time performing the cardiopulmonary bypass, and the nurses' workload.

METHOD

Descriptive and exploratory retrospective study developed by analyzing medical records of patients undergoing cardiac surgery performed between 2012 and 2017.

For this purpose, a convenience sample consisting of 50 medical records of patients older than 18 years old, who had undergone cardiopulmonary bypass surgery and had survived the first 72 postoperative hours was used. Patients who had undergone other surgical procedures of any nature, performed within 30 days prior to the MR procedure, those undergoing hemodialysis treatment prior to the surgical procedure analyzed, MR surgeries without CPB, and urgent and emergency surgeries were excluded.

Data collection was performed by one of the researchers using an instrument that contained sociodemographic identification data, clinical and surgical personal history, continuous use medications, vital signs, invasive devices used before and after surgery, the duration of the surgery, CPB time, length of stay in the intensive care unit (ICU), surgical complications, nursing diagnoses and number of procedures performed or assisted by the nursing staff during the IPO.

The list of patients undergoing MR procedures between 2012 and 2017 was provided by the medical records service of the hospital selected for the study. Based on this list and by applying the inclusion and exclusion criteria, the medical records were read in full.

For this study, we followed the guidelines and regulatory standards for research involving human beings, emanating from Resolution No. 466 of 2012 of the National Health Council[6]. The project was submitted to the Research Ethics Committee of the School of Nursing at the Universidade de São Paulo and received approval under protocol number 1969823.

The results were analyzed using the Statistical Package for Social Sciences (SPSS) program, utilizing the Yates-corrected χ^2 tests or Fisher's exact test for dichotomous variables. For continuous variables, Student's t or Mann-Whitney's tests were performed. The delimited significance level was $\alpha=0.05$.

To estimate the workload spent by the nursing staff, we used the nursing activities score (NAS), which considers basic activities, ventilatory, cardiovascular, renal, neurological and metabolic supports, and specific interventions. Each item

has a score, and the patient score is the sum of all of the items' scores. This percentage represents, in percentage, how much time of assistance the patient required within 24 hours, with a maximum total of 176.8%. According to the definition, 100 NAS points equals 100% of a nursing professional's time within 24 hours, and each NAS point corresponds to 14.4 minutes[7].

RESULTS

The sample consisted of 50 records of patients aged between 32 and 77 years old, with a mean of 62.1 years (SD±9.98), mostly male (70%), smokers (20%) or former smokers (32%) and with a varied personal history (100%) (Table 1).

Among the 50 patients, 70% were taking medication at home, especially antihypertensive drugs (56%), statins (46%), antiplatelet drugs (38%) and oral hypoglycemic drugs (18%).

Eight (16%) had undergone some previous surgery, primarily surgeries for partial or total (75%), orthopedic (25%), vascular (25%) and abdominal (25%) organ removal. There were no records of complications from these procedures.

Regarding medications, 20% received vasoactive drugs in the preoperative period, mainly nitroglycerin (12%) and dobutamine (6%), and 40% of the patients had a preoperative device, especially a delayed bladder catheter (84%) and peripheral venous accesses (36%).

Surgical time ranged from 4 to 16 hours, with an average of 9 hours and 20 minutes (standard deviation - SD±2.52h). The mean CPB time of the procedures performed was 2 hours and 4 minutes (SD ± 0.46h), with a minimum and maximum of 39 minutes and 3 hours and 40 minutes, respectively. Regarding the aortic clamping time, the average was 1 hour and 17 minutes (SD ± 0.41h), ranging from 25 minutes to 2 hours and 23 minutes.

During the procedure, 20% of the patients received packed red blood cells and 24% exhibited surgical complications. The main complication described was the difficulty in removing the patient from CPB (50%), followed by bleeding (40%) and hemodynamic instability (30%).

POI complications occurred in 26 (52%) patients, but only one (2%) required surgical reoperation due to hemorrhage, and two (4%) died, one due to cardiogenic shock and the other due to unspecified cardiac problems (Table 2).

The most frequent postoperative complications were heart related, represented by arrhythmias (14%), hypotension (10%), atrial fibrillation (6%), low cardiac output syndrome (4%) and cardiopulmonary arrest (2%); hematologic, represented by bleeding (8.16%) and hemodynamic instability (4%); and the respiratory system, especially hypoxemia (2%) and pneumothorax (2%).

Postoperatively, more invasive devices (96%) and new devices were required, including invasive blood pressure monitoring (90%), a pacemaker wire (80%), a Swan-Ganz catheter (12%) and an intra-aortic balloon (6%).

Table 3 describes the nursing diagnoses found according to the North American Nursing Diagnosis Association (NANDA)[8] taxonomy.

Postoperative complications that showed a significant statistical relationship with modifiable and non-modifiable risk factors included: family history of heart disease, correlated with cardiac complications ($p = 0.050$); and dyslipidemia, linked to impaired skin integrity ($p = 0.029$).

There was an association between CPB time ($p = 0.035$) and aortic clamping time ($p=0.039$), with the probability that the patient exhibited postoperative bleeding, and an association between anesthesia time and the risk of decreased cardiac output ($p = 0.013$).

The CPB time is also pertinent with regard to the onset of atrial fibrillation during the POI ($p = 0.011$), to the risk of a bleeding diagnosis regarding hematological

Table 1. Clinical and sociodemographic variables of the patients included in the investigation.

Variables	n	%
Unmodifiable Risk Factors		
Sex		
Male	35	70
Female	15	30
Family history of heart disease	17	34
Modifiable Risk Factors		
Smoking		
Smoker	10	20
Former smoker	16	32
Alcoholism		
Alcoholic	2	4
Former Alcoholic	2	4
Systemic arterial hypertension	36	72
Dyslipidemia	20	40
Coronary Artery Disease	16	32
Obesity	2	4

Table 2. Distribution of clinical and surgical variables of patients included in the investigation.

Variables	n	%
Physical State		
ASA 2	1	2
ASA 3	28	49
ASA 4	21	42
Surgical complications		
Intraoperative Complications		
Difficulty in removing the patient from CPB	6	12
Bleeding	4	8
Hemodynamic instability	3	3
Postoperative complications		
Heart	17	34
Hematological	10	20
Respiratory	2	4
Renal	2	4
Neurological	2	4
Surgical approach	1	2
Death	2	4

ASA: American Society of Anesthesiologists; CPB: cardiopulmonary bypass.

Table 3. Distribution of the nursing diagnoses of patients included in the investigation.

Nursing diagnoses*	n	%
Risk of infection	46	92
Risk of decreased cardiac tissue perfusion	30	60
Decreased cardiac output	25	50
Shock risk	18	36
Bleeding risk	17	34
Sharp pain	15	30
Risk of unstable blood glucose	11	22
Impaired skin integrity	10	20
Anxiety	9	18
Risk of slipping, tripping or falling	8	16
Ineffective breathing pattern	6	12
Unable to bathe themselves	5	10
Impaired Physical Mobility	5	10
Ineffective peripheral tissue perfusion	5	10
Risk of constipation	4	8
Imbalanced nutrition; less than needed	2	4

*The number of nursing diagnoses is higher than the number of patients, as each patient had several diagnoses.

complications (p=0.025) and to the occurrence of bleeding (p = 0.038). The use of a pacemaker wire was associated with a diagnosis of acute pain (p = 0.026). The other statistically significant correlations identified in this study are described in Chart 1.

Regarding the average workload spent by the nursing staff in the care of postoperative patients, the average values were 28.7 (SD±6.0), with a minimum of 25.7 and a maximum of 42.5. That is, on average each patient required 28.7% of the time of the nursing staff or 7 hours and 28 minutes. Patients who presented hypotension (p=0.003) and arrhythmia (p=0.000) postoperatively needed more care provided by the nursing staff.

Chart 1. Correlation between nursing diagnoses, postoperative complications and personal and clinical-surgical antecedents.

Nursing diagnoses	Variables	p*
Bleeding risk	CPB time	0.035
	Aortic clamping time	0.039
	Hematologic complication	0.025
	Bleeding in the immediate postoperative period	0.038
Impaired skin integrity	Vasoactive drug	0.029
	Respiratory frequency	0.038
	Dyslipidemia	0.029
	Cardiopathies	0.023
Unable to bathe themselves	CPB time	0.028
	Anesthesia time	0.006
Risk of unstable blood glucose	Diabetes *mellitus*	0.004
	ASA 3	0.029
	ASA 4	0.014
Decreased cardiac output	Anesthesia time	0.013
Sharp pain	Diabetes *mellitus*	0.052
Ineffective breathing pattern	Length of hospitalization	0.032
Imbalanced nutrition; less than needed	Angina	0.043
Acute confusion	Neoplasms	0.043
Risk of slipping, tripping or falling	Diastolic blood pressure	0.046
Shock risk	Diastolic blood pressure	0.034

*Fisher's exact test; CPB: cardiopulmonary bypass; ASA: American Society of Anesthesiologists.

DISCUSSION

The scientific literature indicates that the main risk factors for the appearance of changes in the postoperative period of cardiac surgeries are associated with the patient's age, sex, hypertension, diabetes, high cholesterol levels, low density lipoproteins (LDL) and low cholesterol high density lipoprotein (HDL) cholesterol, smoking, obesity, physical inactivity, family history[2], type of preoperative medication, and intraoperative risk factors (type of surgery, length of time in CPB, length of stay in the hospital and the use of a specific medication)[9]. However, in the present study,[10] the main complications identified in the POI were of cardiac or hematologic origin. Only the unmodifiable risk factor family history of heart disease showed a statistical correlation with cardiologic complications, and the modifiable risk factor dyslipidemia, with the nursing diagnosis of impaired skin integrity.

Systemic arterial hypertension (SAH) is considered to be the main risk factor for coronary artery disease and is markedly related to heredity[10,11] and death in patients undergoing MR[3]. However, although hypertension was the most recurrent personal antecedent in the present study, there was no statistical correlation with death and postoperative complications.

Currently, MR has survival rates of 97% in one year and 81% after ten years postoperatively[12]. Such prognosis can be attributed to the technique employed for aortic clamping and CPB time[12].

Nevertheless, it is believed that the use of CPB causes the body to undergo a systemic inflammatory response caused by blood circulation through the extracorporeal circuit and the formation of microemboli[13]. However, the pathophysiological mechanism of organ damage after CPB remains unclear[14].

The use of CPB can lead to complications, including: renal dysfunction, acute myocardial infarction, neurological impairment, cognitive dysfunction, atrial fibrillation and ventricular dysfunction[11], risk of intraoperative stroke associated with the manipulation of the ascending aorta and arrhythmias. Additionally, it is also related to the risk of postoperative hemorrhage, low cardiac output, pleural effusion, cardiac tamponade, and coagulopathy.[2,10].

The present prospective study analyzed the medical records of 72 patients who had undergone MR and identified that the largest number of complications was linked to hydroelectrolytic (61%), acidobasic (35%), glycemic (32%), cardiac (13%) and pulmonary disorders (10%). Other complications were renal (7%), neurological (6%), infectious (3%) and hepatic (1%) in nature.[11]

Another analysis of 145 adult patients undergoing cardiac surgery (45% MR, 26% valve surgery, 18% combined surgery and 11% other types of cardiac surgery) found that the main postoperative complications within the first 24 hours included loss of blood (58%), pulmonary dysfunction (34%), arrhythmias (6%) and need for reintubation (3%)[15].

In contrast, the present study identified the main hematological complications, represented by bleeding and hemodynamic instability, followed by cardiac complications, such as arrhythmias, hypotension, atrial fibrillation and low cardiac output syndrome. It was also identified that insufficient nutrient intake is a risk factor for angina incidence in the MR POI.

Low diastolic pressure increases the risk of shock, as insufficient perfusion induces cell and tissue hypoxia and may eventually lead to organ and system failure. It is also worth noting that the risk of falling is increased in patients with orthostatic hypotension[16].

Another aspect that deserves attention in the postoperative period of cardiac surgery is the fact that patients have impaired physical mobility for prolonged periods, hampering the action of calf muscles and therefore impairing venous return. In addition, anesthetic agents interfere with vasodilation and normal constriction, reducing perfusion to bony prominences and regions under pressure. Thus, the nursing diagnosis of impaired skin integrity is frequent and may be the result of intense and/or prolonged pressure in combination with shearing, which result from mechanical actions like the surgical incision itself, and factors such as microclimate, nutrition, perfusion, comorbidities, and clinical condition[17,18].

Therefore, due to the metabolic change caused by MR surgeries[14], patients who perform the procedure and who have a family history of heart disease and comorbidities, such as dyslipidemia, are more likely to develop cardiac complications and present skin lesions, increasing the work of the nursing staff.

Nursing diagnoses indicated statistically significant associations with several clinical variables and associations related to the anesthetic-surgical procedure. Thus, this complexity attributed to the care of patients undergoing cardiac surgery requires special attention throughout the perioperative period, especially the postoperative period.

Currently, in the ICU, the degree of patient dependence, the complexity of the disease, the characteristics of the institution, the work processes, the physical plan and the profile of the team professionals determine the nursing workload[19]. Estimating care demand is necessary to ensure quality of care and to subsidize staff size in different hospital units, since too

many staff people entails high costs, and a reduced staff can lead to a decline in patients' quality of care[7].

Thus, there are instruments that contribute to this evaluation, among them the therapeutic intervention scoring system-28 (TISS-28) and the NAS. For the development of the present study, the NAS indicator was chosen. Although the TISS-28 has an extensive approach in the scientific literature, its practical application showed structural flaws for the total measurement of nursing workload, since activities concerning indirect patient care, such as organizational tasks, were not included in the study[7].

NAS, in turn, has been increasingly used in the ICU and takes into account basic activities, ventilatory support, cardiovascular support, renal support, neurological support, metabolic support and specific interventions. In this study, it was found that, on average, each patient required 28.7% of the nursing staff time or 7 hours and 28 minutes.

However, it is believed that this number may be underestimated, given the characteristic associated with the retrospective collection of information, which may have been impaired by the absence of adequate records. Thus, for a better estimate, professionals should be advised on how the instrument works so that the activities are recorded correctly. In the future, further studies will be able to more accurately determine the workload associated with postoperative care in patients undergoing cardiac surgery.

CONCLUSION

In the present study, it was found that the main postoperative complications were heart-related and connected to a family history of heart disease. The CPB time was associated with the appearance of atrial fibrillation in the IPO, the nursing diagnoses, the risk of bleeding and the self-care deficit.

Finally, the most frequent nursing diagnosis was the risk of infection. Patients with postoperative hypotension ($p = 0.003$) and arrhythmia ($p = 0.000$) required the most care from the nursing staff postoperatively.

REFERENCES

1. Nascimento LS, Dias RM, Dutra CDT, Silva LMC, Pedrosa LN, Araújo JS, et al. Fatores de risco para doenças crônicas não transmissíveis e variáveis sociodemográficas de servidores públicos. Rev Bras Promo Saúde [Internet]. 2015 [acessado em 3 mar. 2018];28(2):230-9. Disponível em: http://periodicos.unifor.br/RBPS/article/view/3570/pdf

2. Colósimo FC, Sousa AG, Silva GS, Piotto RF, Pierin AMG. Hipertensão arterial e fatores associados em pessoas submetidas à cirurgia de revascularização do miocárdio. Rev Esc Enferm USP. 2015;49(2):200-1. http://dx.doi.org/10.1590/S0080-623420150000200003

3. Koerich C, Lanzoni GMM, Erdmann AL. Factors associated with mortality in patients undergoing coronary artery bypass grafting. Rev Latino-Am Enfermagem. 2016;24:1-9. https://doi.org/10.1590/1518-8345.0708.2748

4. Carvalho ARS, Matsuda LM, Carvalho MSS, Almeida RMSSA, Schneider DSLG. Complicações no pós-operatório de revascularização miocárdica. Ciênc Cuid Saúde [Internet]. 2006 [acessado em 21 mar. 2018];5(1):50-9. Disponível em: https://pesquisa.bvsalud.org/portal/resource/pt/bde-12303

5. Torrati FG, Dantas RAS. Extracorporeal circulation and complications during the immediate postoperative period for cardiac surgery. Acta Paul Enferm. 2012;25(3):340-5. http://dx.doi.org/10.1590/S0103-21002012000300004

6. Brasil. Conselho Nacional de Saúde. Resolução nº 466, de 12 de dezembro de 2012. Aprova as diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos [Internet]. Brasília, 2012 [acessado em 5 abr. 2018]. Disponível em: https://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf

7. Queijo AF, Padilha KG. Nursing Activities Score (NAS): adaptação transcultural e validação para a língua portuguesa. Rev Esc Enferm USP. 2009;43(Núm. Esp.):1-8. http://dx.doi.org/10.1590/S0080-62342009000500004

8. North American Nursing Diagnosis Association. Diagnósticos de enfermagem da NANDA; definições e classificação 2011-2014. Porto Alegre: North American Nursing Diagnosis Association; 2013.

9. Soares GMT, Ferreira DCS, Gonçalves MPC, Alves TGSA, David FL, Henriques KMC, et al. Prevalência das principais complicações pós-operatórias em cirurgias cardíacas. Rev Bras Cardiologia [Internet]. 2011 [acessado em 7 maio 2018];24(3):139-46. Disponível em: http://sociedades.cardiol.br/socerj/revista/2011_03/a_2011_v24_n03_01prevalencia.pdf

10. Quadros FF, Gutierrez LLP, Ribeiro JL. Obesidade e fatores de risco cardiovascular em filhos de obesos: uma revisão. Scientia Medica [Internet]. 2013 [acessado em 8 abr. 2018];23(2):119-26. Disponível em: http://revistaseletronicas.pucrs.br/ojs/index.php/scientiamedica/article/viewFile/11675/9653

11. Oliveira JLM, Hirata MH, Sousa AGMR, Gabriel FS, Hirata TDC, Tavares IS, et al. Sexo masculino e hipertensão arterial são preditores de placa à angiotomografia das coronárias. Arq Bras Cardiol [Internet]. 2015 [acessado em 10 mar. 2018];104(5):409-16. Disponível em: http://www.scielo.br/pdf/abc/v104n5/pt_0066-782X-abc-20150028.pdf http://doi.org/10.5935/abc.20150028

12. Sobral MLP, Santos Jr. SF, Sá JC, Terrazas AS, Trompieri DFM, Sousa TAN, et al. Aperfeiçoamento em técnica de perfusão cardioplégica no pinçamento único de aorta: resultados iniciais. Rev Bras Cir Cardiovasc [Internet]. 2014 [acessado em 10 mar. 2018];29(2):229-34. Disponível em: http://www.scielo.br/pdf/rbccv/v29n2/0102-7638-rbccv-29-02-0229.pdf http://doi.org/10.5935/1678-9741.20140026

13. Henriques LS, Forte WC. Alterações imunológicas pós circulação extracorpórea. Rev Bras Alerg Imunopatol [Internet]. 2000 [acessado em 12 jun. 2018];23(4):143-150. Disponível em: http://www.sbai.org.br/revistas/Vol234/alt.htm

14. Christensen MC, Krapf S, Kempel A, Heyman CV. Costs of excessive postoperative hemorrhage in cardiac surgery. J Thorac Cardiovasc Surg [Internet]. 2009 [acessado em 13 abr. 2018];138(3):687-93. Disponível em: https://www.jtcvs.org/article/S0022-5223(09)00324-9/fulltext https://doi.org/10.1016/j.jtcvs.2009.02.021

15. Oliveira JMA, Silva AMF, Cardoso AB, Lima FF, Zierer MS, Carvalho ML. Complicações no pós-operatório de cirurgia cardiovascular com circulação extracorpórea. Rev Interd [Internet]. 2015 [acessado em 14 maio 2018];8(1):9-15. Disponível em: https://revistainterdisciplinar.uninovafapi.edu.br/index.php/revinter/article/view/584/pdf_177

16. Kapadohos T, Angelopoulos E, Vasileiadis I, Nanas S, Kotanidou A, Karabinis A, et al. Determinants of prolonged intensive care unit stay in patients after cardiac surgery: a prospective observational study. J Thorac Dis [Internet]. 2017 [acessado em 2 abr. 2018];9(1):70-9. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5303108/
https://dx.doi.org/10.21037%2Fjtd.2017.01.18

17. Associação Brasileira de Estomaterapia. Classificação das lesões por pressão. Consenso NPUAP 2016 [Internet]. Associação Brasileira de Estomaterapia; 2016 [acessado em 21 abr. 2018]. Disponível em: http://www.sobest.org.br/textod/35

18. Rocha LA, Maia TF, Silva LF. Diagnósticos de enfermagem em pacientes submetidos à cirurgia cardíaca. Rev Bras Enferm. 2006;59(3):321-6. http://dx.doi.org/10.1590/S0034-71672006000300013

19. Altafin JAM, Grion CMC, Tanita MT, Festti J, Cardoso LTQ, Veiga CFF, et al. Nursing Activities Score e carga de trabalho em unidade de terapia intensiva de hospital universitário. Rev Bras Ter Intensiva [Internet]. 2014 [acessado em 12 mar. 2018];26(3):292-8. Disponível em: http://www.scielo.br/pdf/rbti/v26n3/0103-507X-rbti-26-03-0292.pdf http://dx.doi.org/10.5935/0103-507X.20140041