

Analysis of steps adapted protocol in cardiac rehabilitation in the hospital phase

Análise do protocolo adaptado de steps na reabilitação cardíaca na fase hospitalar

Eliane Roseli Winkelmann¹, PhD; Fernanda Dallazen², Angela Beerbaum Steinke Bronzatti³, Juliara Cristina Werner Lorenzoni⁴, Pollyana Windmöller⁵

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Abstract

Objective: To analyze a cardiac rehabilitation adapted protocol in physical therapy during the postoperative hospital phase of cardiac surgery in a service of high complexity, in aspects regarded to complications and mortality prevalence and hospitalization days.

Methods: This is an observational cross-sectional, retrospective and analytical study performed by investigating 99 patients who underwent cardiac surgery for coronary artery bypass graft, heart valve replacement or a combination of both. Step program adapted for rehabilitation after cardiac surgery was analyzed under the command of the physiotherapy professional team.

Results: In average, a patient stays for two days in the Intensive Care Unit and three to four days in the hospital room, totalizing six days of hospitalization. Fatalities occurred in a higher percentage during hospitalization (5.1%) and up to two years period (8.6%) when compared to 30 days after hospital discharge (1.1%). Among the postoperative complications, the hemodynamic (63.4%) and respiratory (42.6%) were the most prevalent. 36-42% of complications occurred between the immediate postoperative period and the second postoperative day. The hospital discharge started from the fifth postoperative day. We can observe that in each following day, the patients are

evolving in achieving the Steps, where Step 3 was the most used during the rehabilitation phase I.

Conclusion: This evolution program by steps can to guide the physical rehabilitation at the hospital in patients after cardiac surgery.

Descriptors: Thoracic Surgery. Rehabilitation. Hospital Service of Physiotherapy.

Resumo

Objetivo: Analisar o protocolo adaptado de reabilitação cardíaca na fisioterapia durante a fase hospitalar pós-operatória de cirurgia cardíaca em um serviço de alta complexidade, nos aspectos complicações e prevalência de mortalidade e dias de internação.

Métodos: Estudo observacional transversal, retrospectivo, analítico. Realizado por meio da investigação de 99 prontuários de pacientes submetidos à cirurgia cardíaca de revascularização do miocárdio, troca de valva cardíaca ou associadas. Foi analisado um programa de *step* adaptado para reabilitação pós-operatória de cirurgia cardíaca executado pela equipe de Fisioterapia.

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Correspondence address:

Eliane Roseli Winkelmann

DCVida/ UNIJUI

Rua do Comércio 3000 - Bairro Universitário - Ijuí, RS, Brazil - Zip Code:

98700-000 - PO Box 383

E-mail: elianew@unijui.edu.br

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¹Physiotherapist, in Health Sciences: Cardiovascular Sciences, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil, Master of Biological Sciences: Physiology, UFRGS, Specialist in Cardiorespiratory Physiotherapy and Acupuncture, Teacher of Physiotherapy Course at Universidade Regional do Noroeste do Estado do Rio Grande do Sul (UNIJUI), Master in Comprehensive Health Care Serictu Sensu Program (UNIJUI/ UNICRUZ). Ijuí, RS, Brazil.

²Physiotherapist, Master Degree in Gerontology from the Federal University of Santa Maria (UFSM), Post graduate in Physiotherapy in Intensive Care Faculty Inspire - Porto Alegre. Member of the Cardiology Institute of Hospital de Caridade de Ijuí, Ijuí, RS, Brazil.

³Physical Therapy Student from UNIJUI, Ijuí, RS, Brazil.

⁴Physiotherapist and Specialist Hospital Physiotherapy by UNIJUI, Ijuí, RS, Brazil.

⁵Physiotherapist and Specialist Hospital Physiotherapy by UNIJUI. Member of the Cardiology Institute of Hospital de Caridade de Ijuí, Ijuí, RS, Brazil.

Abbreviations, acronyms & symbols	
AMI	Acute myocardial infarction
CABG	Coronary artery bypass graft
CCU	Coronary care unit
COPD	Chronic obstructive pulmonary disease
CVD	Cardiovascular disease
DM	Diabetes mellitus
HVR	Heart valve replacement
PO	Postoperative
SAH	Systemic Arterial Hypertension
WHO	World Health Organization

Resultados: Em média, o paciente permanece dois dias na Unidade de Terapia Intensiva e de três a quatro dias no quarto, ficando, em média, seis dias internado no hospital. O óbito ocorreu em maior percentual no período hospitalar (5,1%) e até dois

anos (8,6%) quando comparado ao período de 30 dias pós-alta hospitalar (1,1%). Dentre as complicações no pós-operatório, as hemodinâmicas (63,4%) e respiratórias (42,6%) foram as mais predominantes. De 36% a 42% das complicações ocorreram entre o pós-operatório imediato e o segundo dia pós-operatório. A alta hospitalar teve início a partir do quinto dia pós-operatório. Podemos observar que, com o passar dos dias, os pacientes vão evoluindo na realização dos *steps*, sendo que o mais utilizado durante a reabilitação na fase I foi o *Step 3*.

Conclusão: Este programa de evolução por *steps* pode nortear a reabilitação fisioterapêutica nos pacientes no pós-operatório de cirurgia cardíaca na fase hospitalar.

Descritores: Cirurgia Torácica. Reabilitação. Serviço Hospitalar de Fisioterapia.

INTRODUCTION

Currently cardiovascular disease (CVD) is a public health problem. According to the World Health Organization (WHO), about 17 million people die annually from cardiovascular diseases^[1]. Coronary artery bypass grafting is an effective alternative for the treatment of CVD, optimizing the prevention of acute myocardial infarction (AMI), improved quality of life and delay death. Likewise, surgical intervention is the treatment of degenerative rheumatic valvular heart disease^[2,3]. However, cardiac surgery is a complex procedure that carries significant implications, both organic, and changes the patient's physiological mechanism, resulting in a higher incidence of complications that tend to significantly decrease the potential for recovery^[4]. Moreover, physiotherapy participates in the process of cardiac rehabilitation, pre and postoperative cardiac surgery, to contribute significantly to better prognosis, acting in the preoperative period with techniques aimed at the prevention and minimization of pulmonary complications, and in the postoperative period, with hygiene maneuvers and pulmonary expansion, to contribute on reducing the effects of time spent in bed and decrease the length of hospital stay^[5,6].

Thus, cardiac surgery requires the work of a multidisciplinary team, and the physiotherapist is one of the professionals involved and of great importance in the rehabilitation process. According to the Guidelines for Cardiopulmonary and Metabolic Rehabilitation^[7] cardiac rehabilitation should take place in phases. Phase 1 applies to inpatients, being the first step toward an active and productive life, which should predominate the combination of low-intensity exercise, techniques for stress management and education programs in relation to risk factors.

The program aims at this stage that the patient is discharged with the best possible physical and psychological conditions, with all the possible information regarding healthy lifestyle.

Phase 2 starts after discharge and lasts three to six months, during this period the exercise program is individualized in terms of intensity, duration, frequency, type of training and progression, as well as constant monitoring, aiming to return to social and professional activities. The third phase lasts 6 to 24 months and may or may not be following the previous phase. The improvement of the physical condition is the main purpose, as well as improved quality of life. The phase 4, following long-term programs, with the main objective of increasing and maintaining physical fitness. Activities are not necessarily supervised and should adequate time availability for the maintenance of physical exercise program and preference for recreational sporting activities. In this study, we discuss the phase I of cardiac rehabilitation in patients in the postoperative period (PO) of cardiac surgery.

In the Literature it becomes clear protocols for cardiac rehabilitation during hospitalization deficit. There are protocols that demonstrate a progression in which individuals go through stages (steps) that evolve according to their recovery^[8,9] and others as a daily rehabilitation, adopting different therapeutic strategies in PO, both in cardiac rehabilitation after acute myocardial infarction as in the postoperative period of cardiac surgery^[10,11]. An example for postoperative care of cardiac surgery is proposed by Umeda^[8] protocol that works as developing global Steps exercises, daily progression involving large muscle groups and stretches developed in 5 days.

Other authors have also highlighted in phase I cardiac rehabilitation in other cardiac pathologies and similar to

the postoperative cardiac surgical actions. The protocol Babu et al.^[11] worked with three levels of evolution and with lower intensity exercise during five days. In rehabilitation in post-AMI, Regenga^[9] adapted its protocol from the Emory University School of Medicine, occurring progression of 7 Steps to simultaneous work of motor and respiratory therapy.

Currently, studies bring the effectiveness of physiotherapy techniques in phase I in the Literature, cardiac rehabilitation individualized^[10] having so few studies that are directed to protocols with progression to hospital discharge in cardiac rehabilitation in postoperative cardiac surgery^[8,9]. Thus, the physiotherapy team, along with staff health professionals of the Heart Institute of the Hospital de Caridade de Ijuí (General Hospital of IV status), cardiology reference in the countryside of the State of Rio Grande do Sul, by the occasion of the opening service of cardiac surgery and cardiac rehabilitation process chose to adapt the Regenga^[9] protocol. This protocol is intended for patients after acute myocardial infarction^[9] and adapted by the team to be performed in patients in the postoperative period of cardiac surgery. The adoption of a protocol ensured that the team could standardize care among professionals and conduct the registration of a comprehensive and systematic way activity. Therefore, the aim of this study was to analyze the adapted protocol for cardiac rehabilitation in physical therapy during the postoperative hospital stay (PO) of cardiac surgery in a service of high complexity, prevalence and complications in aspects of mortality and hospitalization days.

METHODS

Study of cross observational, retrospective and analytical form, approved by the Ethics Research Committee of the Regional University of the Northwestern of Rio Grande do Sul, - UNIJUÍ under Opinion No. 201 602, and it is in accordance with the Guidelines and Standards Regulating Research Involving Human beings, according to the Resolution of the National Health Council (CNS) No. 466/2012.

Data collection was conducted through research into patient charts, so it does not have any risk of damage, being subject to the secrecy of information. A total of 111 records analyzed, 12 were eliminated from the sample because they belonged to individuals who died more than a year before the data collection, and they were in a position to inactive file or by not reporting on the program of Steps in hospital rehabilitation. It is the sample of 99 patients undergoing heart bypass surgery (CABG) or heart valve replacement (HVR), in the Cardiology Institute of Hospital de Caridade de Ijuí, Brazil (General Hospital of status IV from the Northwest of Rio Grande do Sul). Data were analyzed from April to September 2012.

Through an analysis of patient records, data collection was performed using a specifically designed form for this purpose, containing the variables for identifying individuals, clinical variables: family history of cardiovascular disease (CVD), hypertension (SAH) diabetes mellitus (DM), dyslipidemia, smoking, physical inactivity and stress and comorbid conditions: acute myocardial infarction (AMI), chronic obstructive pulmonary disease (COPD) and surgical history. The analyzed variables were intraoperative time of surgical procedure, duration of cardiopulmonary bypass (CPB) time, aortic clamping, recovery rate (spontaneous or shock) and type of drain used. In the postoperative period, the variables analyzed were duration of mechanical ventilation (MV), length of stay in the coronary care unit (CCU), days of hospital stay and total hospital days.

The Cardiology Institute of Hospital de Caridade de Ijuí opened its cardiology unit in 2010 and since its inception, the physiotherapy team entered in the cardiac rehabilitation in order to prevent and minimize pulmonary complications, reduce the effects of time spent in bed and shorten hospitalization. Thus, physical therapy along with the team of professionals, adopted and adapted a cardiac rehabilitation program through steps (Chart 1) from the protocol of cardiac rehabilitation after myocardial infarction^[9]. The protocol is composed of seven progressive stages, with low intensity activities starting at 2 METs and reaching around 4 METs in the last step. It begins with early mobilization, followed by sedestation and active assisted or free standing position.

The progression of the intensity is made individually, following the program steps in which each Step is equivalent to a set of exercises at an intensity and repetition, wherein the energy consumption of each group are related in accordance with oxygen consumption required by the body for the task. The physiotherapist opted by Step after performing the assessment to the bedside, observing the general condition of the patient and performed the medical record entries. By the time the analysis was performed physiotherapy twice a day. The adoption of this protocol by physiotherapy was performed at the time the service began and professionals performed the standardization of care, as well as a detailed record of the protocol in the medical record. This allowed the holding of a protocol analysis of cardiac rehabilitation, as well as it was possible to verify the postoperative complications, mortality and length of hospital stay in postoperative cardiac surgery. It is noted that the present study performed the analysis for a range of time of application.

Data were stored and analyzed using the Statistical Package for Social Sciences (SPSS, version 18.0) software. The variables were presented as absolute and relative, average, standard deviation and percentage frequencies.

Chart 1. Cardiac Rehabilitation Program consists of Steps adapted to postoperative cardiac surgery for patients in hospital phase I.

STEP 1 - Calories = 2 METs

Patient lying
Diaphragmatic breathing exercises + ventilatory patterns
Active exercises of the extremities
Active assisted exercises - elbow and knees
Milking drains

STEP 2 - Calories 2 METs

Patient sitting
Diaphragmatic breathing exercises + ventilatory pattern
Exercises with ventilatory incentive + Flutter
Active exercises of the extremities
Active exercises of the lower limbs (quadriceps)
Milking drains

STEP 3 - Calories 3-4 METs

Patient standing
Active exercises of the elbow and ends
Active stretching of lower limbs (quadriceps, adductors, hamstrings and triceps)
Mark steps with knee
Ambulation: 35 meters
Exercises with ventilatory incentive

STEP 4 - Calories 3-4 METs

Patient standing
Passive stretching of active upper and lower limbs
Active exercises of the extremities
Active exercises of the lower limbs (flexion/extension and abduction/adduction)
Exercises with incentive spirometry
Ambulation: 60 meters
Walking downstairs training (1st floor)

STEP 5 Calories = 3-4 METs

Patient standing
Passive stretching and active upper and lower limb
Active exercises of the extremities
Active exercises of the lower limbs (flexion/extension and abduction/adduction)
Exercises with incentive spirometry
Ambulation: 100 meters
Walking downstairs training (1st floor)

STEP 6 Calories = 3-4 METs

Patient standing
Passive stretching of upper and lower limb active
Active exercises of the extremities
Active exercises of the lower limbs (flexion / extension and abduction / adduction)
Breathing exercises encouraged
Ambulation: 160 meters
Walking downstairs training (2 floors)

STEP 7 Calories = 3-4 METs

Patient standing
Passive stretching of upper and lower limb active
Active exercises of the extremities
Active exercises of the lower limbs (flexion / extension and abduction / adduction)
Exercises with incentive spirometry
Ambulation: 200 meters
Walking downstairs training (3 floors)

Steps program adapted to patients in the postoperative period of cardiac surgery in phase I or hospital adapted from the Steps of Regenga program^[9]

RESULTS

The study consisted of 99 patients undergoing cardiac surgery, with an average age of 59.7±10.3 years, 60 (60.6%) were male and 39 (39.4%) were female. The predominant type of surgery was CABG (53.5%), followed by aortic valve replacement (22.2%), mitral valve replacement (11.1%), exchange of pulmonary valve (1.0%), CRM associated with aortic valve replacement (3.0%), CRM associated with mitral valve replacement (1.0) and aortic valve replacement associated with mitral valve (7.1%), aortic valve replacement associated with pulmonary (1.0%).

The presence of cardiovascular risk factors and comorbidities have a high prevalence of cardiac patients. Thus, it is observed that family history (67.7%), hypertension (65.7%), physical inactivity (55.6%) and history of smoking (49.5%) are the most occurring in this sample. Among the comorbidities, AMI (32.3%) was more prevalent followed by several surgical history (23.2%) and chronic obstructive pulmonary disease (4.0%).

Table 1 shows the analysis of intraoperative and postoperative factors of patients undergoing cardiac surgery. It is observed in most patients that the recovery rate was spontaneous, ejection fraction was above 55%, average duration of mechanical ventilation was three times greater than the time of cardiac surgery, most did not require blood transfusion and when it did, it was through erythrocytes. On average it is two days in the ICU and three to four days in the room, with an average of six days in hospital. The PO mortality had a higher percentage in hospital and two years compared to 30 days after hospital discharge.

To facilitate analysis, the complications of PO were divided into seven groups, they are the neurological complications (psychomotor agitation, confusion and syncope), cardiovascular complications (hypotension, tachycardia and cardiogenic shock), respiratory (hemoptysis, pleural effusion, pleural fistula, pneumothorax, atelectasis, and reintubation), vascular complications (ischemia and bleeding); hemodynamic complications (bleeding and thrombocytopenia), gastrointestinal complications (nausea and vomiting), renal (aerodynamics evaluation and oliguria).

Respiratory complications such as atelectasis and pleural effusion in small proportions were found in 100% of patients after surgery. Table 2 shows all the complications that occurred in each PO, and hemodynamic and respiratory complications were the most prevalent. Complications occur in about 36-42 % between the immediate postoperative periods, until the second postoperative day. The discharge started from the fifth to the seventh postoperative day, 80.2% of patients were sent home, while 17 still remaining hospitalized (17.7%).

Table 3 describes the steps performed on each postoperative day. It is observed that by each passing day, the patients were progressing in achieving Steps, and the step most used during the rehabilitation phase I, it was the Step 3. In the

analysis of the implementation of the step, at each postoperative day, most of the time: the PO immediately was step 1, on the first postoperative day step 1 and 2, in the second and third PO the step 2 and 3, the fourth, fifth, sixth and seventh PO the step 3 and 4; and some patients already managed to evolve step 5 and 6 from the fourth postoperative day. Most patients were discharged on postoperative day 5. Each postoperative day, starting from the first postoperative day, on average 3.4% of patients did not undergo physiotherapy for being unable or refusing to perform such activity. Seventeen patients remained hospitalized.

Seventeen patients were hospitalized for a prolonged period of eight days or more, and of these, ten were male and seven females. We performed a comparison between the overall average values of the sample (99 patients) with the values of these patients (17 patients) who were hospitalized for eight days or longer. The results were respectively for the following variables: duration of MV (654.46±312.48 and 734.53±313.611 min); hospitalization time in CCU (61.69±26.86 and 97.47±41.25 hours), stay in the room (90.43±50.08 and 139.76±65.85 hours), and total length of stay of patients (151.23±51.73 and 238.59±63.19 hours). The death rate of the patients who remained for a long time was 2 patients (11.8%) from 30 days to a year after the PO.

Table 1. Description of intraoperative and postoperative factors of patients undergoing cardiac surgery.

Intraoperative factors	±/n (%)
Aortic clamping (min)	73.77±26.38
CPB time (min)	92.33±29.86
Heartbeat Recovery (n/%)	
Spontaneous	60 (60.6)
Shock	37 (37.4)
Cardiogenic shock	2 (2.0)
V M Time (min)	654.46±312.48
Surgical Time (min)	222.55±83.65
Ejection Fraction (%)	64.78±11.07
Blood Transfusion (n/%)	
Erythrocytes (mlions/mm ³)	26 (26.5)
Plasma (ml/kg)	2 (2.0)
Erythrocytes (millions/mm ³)+ plasma (ml/kg)	6 (6.1)
Bleeding (ml/kg)	8 (8.2)
Bleeding + RBCs	1 (1.0)
Not Blood Transfusion	56 (56.6)
UCOR Stay (hs)	61.69±26.86
Room Stay (hs)	90.43±50.08
Hospital Stay (hs)	151.23±51.73
In-Hospital Death (n/%)	5 (5.1)
30 day Death (n/%)	1 (1.1)
Death within 2 years (n/%)	5 (8.6)
Total patients	99

Data presented as median and minimum-maximum or absolute and relative frequency, CPB=cardiopulmonary bypass; VM=Mechanical ventilation; CCU=Coronary Care Unit; n=number of subjects analyzed

Table 2. Characterization of postoperative complications in cardiac surgery according to the days of hospitalization (n = 96).

Postoperative complications	PO I n (%)	1° PO n (%)	2° PO n (%)	3° PO n (%)	4° PO n (%)	5° PO n (%)	6° PO n (%)	7° PO n (%)	Total n (%)
Neurological	4 (4.2)	3 (3.1)	3 (3.2)	1 (1.1)	1 (1.1)	0 (0)	0 (0)	0 (0)	12 (12.7)
Cardiac	3 (3.1)	2 (2.1)	2 (2.1)	1 (1.1)	1 (1.1)	1 (1.1)	1 (1.9)	1 (3.6)	12 (16.1)
Respiratory	11 (11.5)	6 (6.3)	5 (5.3)	6 (6.3)	2 (2.1)	2 (2.1)	1 (1.9)	2 (7.1)	35 (42.6)
Vascular	2 (2.1)	0 (0)	3 (3.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (5.3)
Hemodynamic	13 (13.5)	16 (16.7)	17 (17.9)	5 (5.3)	4 (4.3)	2 (2.1)	0 (0)	1 (3.6)	58 (63.4)
Digestive	1 (1.0)	2 (2.1)	1 (1.1)	0 (0)	2 (2.1)	0 (0)	0 (0)	0 (0)	6 (6.3)
Renal	0(0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.9)	0 (0)	1 (1.9)
Resp. + Hemod.	1 (1.0)	4 (4.2)	3 (3.2)	1 (1.1)	1 (1.1)	1 (1.1)	1 (1.9)	1 (3.6)	13 (17.2)
Vasc + Hemod.	2 (2.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2.1)
Neurol+ Hemod.	2 (2.1)	1 (1.0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (3.1)
Neurol + Resp.	1 (1.0)	0 (0)	0 (0)	1 (1.1)	0 (0)	0(0)	0 (0)	0 (0)	2 (2.1)
Hemod. + Digestive	0 (0)	0 (0)	1 (1.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.1)
Hemod. + Card.	0 (0)	0 (0)	1 (1.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.1)
Hemod+Neurol+Resp.	0 (0)	0 (0)	1 (1.1)	1 (1.1)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2.2)
Hed+Cardio+Resp+Renal	0 (0)	0 (0)	0 (0)	1 (1.1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.1)
Digestive + Resp	0 (0)	1 (1.0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.0)
Resp + Card	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.1)	0 (0)	0 (0)	0 (0)	1 (1.1)
FO Deficiency	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2.1)	0 (0)	0 (0)	2 (2.1)
Total patients with complications	40 (41.6)	35 (36.4)	37 (39.3)	17 (17.9)	12 (12.9)	8 (8.6)	4 (7.6)	5 (19.2)	
Total patients without complications	56 (58.4)	60 (62.5)	58 (60.7)	77 (81.1)	82 (87.1)	43 (45.7)	22 (44.3)	12(46.1)	
Discharge	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	43 (45.7)	25 (48.1)	9 (34.6)	77 (80.2)
Death	0 (0)	1 (1.1)	0 (0)	1 (1.0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2.1)
Total	96	96	95	95	94	94	51	26	

Data are presented as absolute and relative frequencies. Resp=respiratory; Hemod=hemodynamic; Card=heart; n=number of patients with postoperative complications; POI=immediate postoperative; PO=postoperatively discharge

Table 3. Description of the Steps program used in the postoperative period of cardiac surgery (n = 96).

Step used	IPO n (%)	1° PO n (%)	2° PO n (%)	3° PO n (%)	4° PO n (%)	5° PO n (%)	6° PO n (%)	7° PO n (%)
Step 1	92 (95.8)	29 (30.2)	13 (13.7)	4 (4.2)	2 (2.1)	1 (1.1)	1 (1.9)	1 (3.2)
Step 2	0 (0)	61 (63.5)	42 (44.2)	21 (22.1)	10 (10.6)	5 (5.4)	2 (3.8)	0 (0)
Step 3	0 (0)	3 (3.1)	35 (36.8)	46 (48.4)	31 (33.0)	19 (20.4)	12 (23.1)	3 (9.7)
Step 4	0 (0)	0 (0)	1 (1.1)	18 (18.9)	34 (36.2)	14 (15.1)	10 (19.2)	6 (19.4)
Step 5	0 (0)	0 (0)	0 (0)	1 (1.1)	12 (12.8)	8 (8.6)	2 (3.8)	4 (12.9)
Step 6	0 (0)	0 (0)	0 (0)	0 (0)	2 (2.1)	3 (3.2)	2 (3.8)	3 (9.7)
Do not PST	4 (4.2)	2 (2.1)	4 (4.2)	4 (4.2)	2 (2.1)	3 (3.2)	2 (3.8)	0 (0)
Discharge	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.1)	40 (43.0)	22 (40.6)	14 (45.1)
Death	0 (0)	1 (1.1)	0 (0)	1 (1.1)	0 (0)	0 (0)	0 (0)	0 (0)
Inpatient	96	95	95	94	93	53	31	17
Total	96	96	95	95	94	93	53	31

Data are presented as absolute and relative frequencies; IPO=immediate post-operative; PO=Postoperatively discharge; Do not PST=do not undergo physiotherapy

DISCUSSION

Over the years, cardiac rehabilitation programs have been evolving and gaining in importance as a result of their social relevance and effectiveness in the rehabilitation of patients^[12]. Although the benefits of cardiac rehabilitation for patients who underwent CABG, HVR are known^[13], still require larger scale studies, especially in phase I.

The cardiac rehabilitation programs aim at physical, social and psychological improvement of the individuals, and studies show the reduction of anxiety and depression^[14], beyond patients expressing who believe in physical therapy as a possibility of improved health status^[15]. At this hospital physiotherapy rehabilitation phase aims to avoid the negative effects of prolonged bed rest, stimulates a fast return to daily activities, maintains functional capacity, develops the

patient's confidence, reduces the psychological impact (such as anxiety and depression), maximizes chance of early discharge and provides the basis for a home program^[9]. In the hospital, physiotherapy also acts preoperatively, aiding the team in the instruction and guidance of ventilatory physiotherapy exercises and pre-operative hospital routines, which leads to reduced levels of anxiety in these patients^[16].

Several studies have been done showing the effectiveness of cardiac rehabilitation as Herdy et al.^[6], adopted the procedures of Phase I with breathing exercises, Stein et al.^[17] using EPAP mask, bronchial hygiene, progressive walking and calistemic exercises. Hirschhorn et al.^[18] with physiotherapy and moderate walking and Ferreira et al.^[19] with incentive therapy associated with expiratory positive airway pressure. Although the therapy is effective, there is still need for more studies showing the scientific evidence for most physiotherapy techniques^[20]. There are questions about the cardiac rehabilitation protocols applied during the in-hospital phase (phase I) presenting subjectiveness, and its results were contested when evaluated considering that they must follow the three basic principles of exercise prescription: specificity, overload and reversibility^[21].

This study performed an analysis of a protocol for cardiac rehabilitation AMI^[9] patients, it was adapted for patients in postoperative cardiac surgery which proposes the progression to exercise through stages, individualized treatment because selection step is performed and executed after evaluating the bedside. They follow a pattern of evolution 2-4 MET from the beginning of rehabilitation until discharge. The use of specific protocols for patients receiving postoperative cardiac surgery physiotherapy services, since there is a standardization of the adoption of procedures for patients and also their attention to evaluate the effectiveness of their procedures. A simple evolution of the physical therapy procedures that are performed in the records does not guarantee this, as well as the loss of information, they are not standardized and there is an adoption of the techniques performed in ways of measuring the same qualification. But unfortunately this is the adoption by most physical therapy services during hospitalization.

The role of physiotherapy in rehabilitation Phase I, according Herdy et al.^[6] leads to a reduced rate of postoperative complications (reducing the incidence of pleural effusion, atelectasis, pneumonia, and atrial fibrillation). The analysis of this study revealed that the most frequent complications were also hemodynamic and respiratory, and these were also the complications that increased the length of stay in the intensive care unit due to cardiac surgery, according to Lazio et al.^[22]. It is noteworthy that most of these complications occurred until the third postoperative day. Physiotherapy also provides a shorter hospital stay^[6]. The hospitalization was 151.23 hours, in other words, the majority was discharged on the fifth postoperative day, and this average hospital stay was lower than that found

in other studies as Fernandes et al.^[23]. This analysis of hospital stay shows that the role of physiotherapy is important in the health service for these patients while minimizing the costs of hospitalization. A literature review^[5] showed that the preoperative therapy reduces postoperative pulmonary complications (atelectasis and pneumonia) and decreases the length of hospitalization in patients after elective cardiac surgery. But it also noted that there is a gap of evidence on the role of physiotherapy in reducing preoperative pneumothorax, prolonged mechanical ventilation or mortality from all causes.

During the protocol analysis, we found out that by each passing day, patients are evolving in achieving the Steps, and the most used during the rehabilitation phase I was the Step 3. Cardiac rehabilitation through the introduction of standardized exercise protocol reduces the deleterious effects of immobility during hospitalization, allowing the professional physiotherapist inserted in the multidisciplinary team, take care of the functional health of the patient immediately after surgery. That is, the therapist guides and monitors the physical and hemodynamic parameters of the patient that is undergoing exercises after surgery. This helps to prevent the perpetuation of the myth experienced by many patients bedrest after surgery.

In our study, two sessions of physical therapy were held daily, which is consistent with the literature in which the supervised exercise sessions are recommended at least twice a day, with an average duration of 15 to 20 minutes, including time for education and informal conversation^[9]. It is worth noting that the work of therapy should be initiated in the preoperative period^[24], with patient education about the work of breathing and motor to be performed before and after surgery. The protocol of this study did not include these activities, but they should be included in physiotherapy routine. Physical therapy provides early rehabilitation which allows the patient to have a social inclusion and reduced costs for the healthcare system. But still, there is need for further studies and therapeutic proposals that seek to shorten the period of hospitalization, provide the patient with early and safe social inclusion and hence lower costs for the healthcare system.

CONCLUSION

This study investigated an adapted protocol of cardiac rehabilitation in the postoperative period of cardiac surgery during hospitalization in a service of high complexity checking postoperative complications, mortality and length of hospitalization. It was observed that the most common complications were respiratory and hemodynamic, with the most of these complications occurring until the third postoperative day. Regarding the type of surgical procedure performed was the predominance of CRM and hospitalization time was 151.23 hours, and death during hospital stay was 5.1%. The step program was an important to guide the work of therapy, and the steps have

been evolving over the days postoperatively until hospital discharge and the most used step during the rehabilitation phase I was the Step 3. Therefore, this program can guide evolution by physical therapy rehabilitation in patients after cardiac surgery during hospitalization. The limitation of this study lies in being a retrospective study. We suggest further studies with a prospective design and randomized clinical trials in order to show the effectiveness of cardiac rehabilitation program in postoperative cardiac surgery.

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Authors' roles & responsibilities	
ERW	Analysis and/or interpretation of data; statistical analysis; final approval of the manuscript; conception and design of the study; completion of experiments; drafting and review of the manuscript
FD	Data collection, analysis and interpretation of data, manuscript draft
ABSB	Data collection, analysis and interpretation of data, manuscript draft
JCWL	Study design, data collection
PW	Study design, data collection

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