Saúde e Pesquisa

Promoção da Saúde
DOI: 10.17765/2176-9206.2023v16n4.e11413

Effects of physical therapy assistance on the length of hospitalization and ambulation of revascularized cardiac patients

Effects of physiotherapy care on time of hospitalization and deambulation of revascular heart patients

Mariama Ribeiro de Carvalho[1], Dyego Anderson de Farias[2], Danyelle Nobrega de Farias[2], Weslley Barbosa Sales[3]*, Renata Ramos Tomaz[2]

[1]Physiotherapist and is linked to the Multidisciplinary Residency in Hospital Health at Hospital Nova Esperança (FACENE);
[2]Professor, Faculdade Nova Esperança (FACENE), João Pessoa (PB), Brazil;
[3]Master's student in Physical Therapy, Federal University of Rio Grande do Norte, Natal (RN), Brazil.

***Corresponding author**: Weslley Barbosa Sales – *E-mail*: weslleysaless8@gmail.com

Received in december 28, 2022
Accepted on april 06, 2023

ABSTRACT
This research aimed to analyze the impacts of physical therapy care on the length of hospitalization and walking capacity of patients undergoing coronary artery bypass grafting (CABG), between the years 2019 to 2020. This is a retrospective and documentary cohort study that was conducted at the Nova Esperança University Hospital (HUNE). The sample consisted of 273 medical records accepted after the exclusion and loss criteria. The regression analysis showed that motor deficit, tone change and aspiration procedure were responsible for 25% of the variation in hospitalization time. A second regression analysis was performed with the outcome of ambulation at hospital discharge, and revealed that the conducts of bipedalization, cycle ergometer, positioning and sedation at hospital discharge were responsible for 67% of variation of this outcome. Physical therapy was associated with shorter hospitalization time and walking capacity.

Keywords: Acute Myocardial Infarction. Rehabilitation. Physiotherapy.

RESUMO
Essa pesquisa teve como objetivo analisar os impactos da assistência fisioterapêutica no tempo de hospitalização e capacidade de deambulação de pacientes submetidos à cirurgia de revascularização do miocárdio (CRVM), entre os anos de 2019 a 2020. Trata-se de um estudo de coorte, retrospectivo e de caráter documental, que foi realizado no Hospital Universitário Nova Esperança (HUNE). A amostra foi composta por 273 prontuários aceitos após os critérios de exclusão e perdas. A análise de regressão demonstrou que o déficit motor, alteração de tônus e procedimento de aspiração foram responsáveis por 25% da variação do tempo de hospitalização. Uma segunda análise de regressão foi realizada com o desfecho deambulação na alta hospitalar, e revelou que as condutas de bipedestação, cicloergometro, posicionamento e sedestação na alta hospitalar foram responsáveis por 67% de variação deste desfecho. A atuação da fisioterapia esteve associada a um menor tempo de hospitalização e capacidade de deambulação.

Palavras-chave: Infarto Agudo do Miocárdio. Reabilitação. Fisioterapia.

INTRODUCTION

Coronary artery disease (CAD) is characterized by insufficient blood supply to the heart through the coronary arteries.[1] It is directly related to the degree of obstruction of blood flow by atherosclerotic plaques, resulting in narrowing of the coronary arteries (stenosis), which, due to reduced coronary blood flow, decreases the arrival of oxygen to the heart.[1]

CAD has some forms of manifestation, one of them is Acute Coronary Syndrome (ACS).[1-2] Acute coronary syndromes (ACS) are caused by coronary obstruction resulting from the interaction between thrombosis and vasospasm phenomena, resulting in a set of clinical symptoms that are compatible with myocardial ischemia, including unstable angina (UA) and acute myocardial infarction (AMI), with or without ST-segment elevation (AMI with or without TSS).[2]

AMI, which is caused by rupture or erosion of the atherosclerotic plaque, leading to decreased or absent perfusion to the cardiac tissue, causes imbalance between oxygen supply and demand and results in irreversible cellular involvement and cardiac muscle necrosis.[3] In Brazil, CAD was responsible for more than 100,000 deaths in 2011. The prevalence of CAD in the adult population is estimated at 5 to 8%.[4] Spontaneous AMI and recurrent AMI represent about 93,495 deaths in the Brazilian population and, in Paraíba, 2,391 deaths occurred in 2018.[5]

According to the third classification of universal redefinition of the Brazilian Cardiology Guideline, AMI is classified into five subtypes: type 1- Spontaneous myocardial infarction (plaque rupture, erosion or dissection); 2- Secondary myocardial infarction due to ischemic imbalance (spasm, embolism, tachyarrhythmia, hypertension and anemia); 3- Myocardial infarction resulting in death, without biomarkers collected; 4a- Myocardial infarction related to percutaneous coronary intervention; 4b- Myocardial infarction related to stent thrombosis; 5- Myocardial infarction related to coronary artery bypass graft surgery.[6]

Regarding the fifth type of AMI, where elective surgical revascularization is necessary, it is generally considered in patients with: lesion of the left main coronary artery, three-vessel disease, biarterial disease with proximal stenosis of the anterior interventricular branch, or biarterial disease not amenable to treatment by Percutaneous Coronary Intervention (PCI) and significant impairment of ventricular function.[6]

After the event of AMI and surgical treatment, the cardiovascular rehabilitation (CVR) phase begins, where according to the World Health Organization, cardiac rehabilitation is the sum of the activities necessary to guarantee patients with heart disease the best physical, mental

and social conditions, so that they can, by their own effort, regain a normal position in the community and lead an active and productive life.[7]

The main objective of CVR with emphasis on physical exercises is to provide an improvement of the components of physical fitness, both aerobic and non-aerobic (muscle strength/power, flexibility, balance), something that requires the combination of different training modalities. Thus, CVR should provide the highest levels of physical fitness that can be obtained, in order to reduce the risk of cardiovascular events culminating in a reduction in overall mortality.[8]

Traditionally, CVR is divided into temporal phases, with phase 1 being in-hospital and phases 2 to 4 outpatient. Phase 1 will include hospitalized patients undergoing percutaneous coronary interventions (PCI), valve surgeries, surgeries for congenital heart disease and heart transplantation (CT), as well as patients with heart failure (HF), coronary artery disease (CAD), diabetics, hypertensive patients, lung disease and chronic nephropaths, as soon as clinically stabilized. Therefore, CVR should be initiated immediately after the patient has been considered clinically compensated as a result of clinical and/or interventional treatment.[8]

In phase I of the CVR, Physical Therapy acts in the prescription of low intensity activities, such as early mobilization exercise, section, orthostatism, ambulation, ascent and descent of steps, assisted and active exercise free of MMSS and LL, breathing exercises, light resistance exercises, relaxation and stretching. Such exercises are distributed in daily and/or weekly sessions with varied durations and non-standardized protocols, and the application of the protocols is proportional to the conditions and clinical phases of the patients with heart disease.[9]

Cardiac surgeries promote considerable systemic changes affecting the functionality of people who undergo them.[9-10] Thus, the literature shows that the introduction of a standardized exercise protocol in patients in the postoperative period (PO) of cardiac surgery has significant effects on length of stay and mortality, reducing the deleterious effects of immobility during hospitalization.[9-10]

Considering the high prevalence of cardiovascular diseases in the Brazilian population, the limited number of studies that involve the description of protocols and routines in cardiac rehabilitation services in the hospital phase and the changes generated by the surgical procedure, one of the concerns is to provide that the patient has an improvement in quality of life, as well as that their functional independence is guaranteed, allowing you to return to the activities of daily living.

This research becomes relevant due to the need to know the epidemiological profile and the evaluation and conduct resources used by the physiotherapy team during the hospital phase of Cardiovascular Rehabilitation of a reference hospital in the Cardiology Service in the State of Paraíba. Thus, this study aimed to analyze the impacts of physical therapy assistance on the length of hospitalization and walking capacity of patients undergoing coronary artery bypass grafting (CABG).

METHODS

This is a retrospective cohort study of documentary character. The study was conducted at the Nova Esperança University Hospital (HUNE), located in the city of João Pessoa-PB. The location was chosen because this hospital is considered a reference center for cardiac surgeries in the state of Paraíba.

The study sample was composed of patients undergoing CABG at HUNE between the years 2019 to 2020. The electronic system *Wareline*, which manages and stores the medical records of patients assisted at the HUNE, was used for data collection.

Electronic medical records of patients undergoing cardiac surgery due to valve replacement and other heart failure factors that are not related to the CABG procedure were excluded from the analysis. The following information was collected: age, gender, education, level of occupation, physical examination, physiotherapeutic procedures, length of hospitalization, type of discharge and ability to walk at hospital discharge.

To calculate the sample size, the following statistical values were considered: quantitative of surgical procedures performed at the HUNE between the years 2019 to 2020 (134 procedures), probabilities of type I error of 5% and 20% for type II error, 10% of losses in follow-up, resulting in a value of 300 medical records.

The data were plotted and analyzed by the SPSS program, version 23.0 for Windows. Categorical variables were described in relative and absolute frequencies. The quantitative variables were initially submitted to the Kolmogorov-Sminorv normality test, and the variables that presented parametric distribution were described as means and standard deviation. In turn, the nonparametric variables were described in medians and interquartile range.

Two linear regression analyses (Stepwise model) were performed to answer which variables influence the length of hospitalization and the walking capacity of patients after hospital discharge. A significance level or p-value <0.05 and 95% confidence intervals were

used for all analyses. The research was approved under the CAAE: 44814021.7.0000.5179, of the Research Ethics Committee of the Nova Esperança School of Nursing and Medicine/FACENE/PB, under Opinion number: 4,638,206.

RESULTS

A total of 285 medical records were recruited, but after applying the eligibility criteria, 273 were considered for analysis. Detailed information can be found in Figure 1.

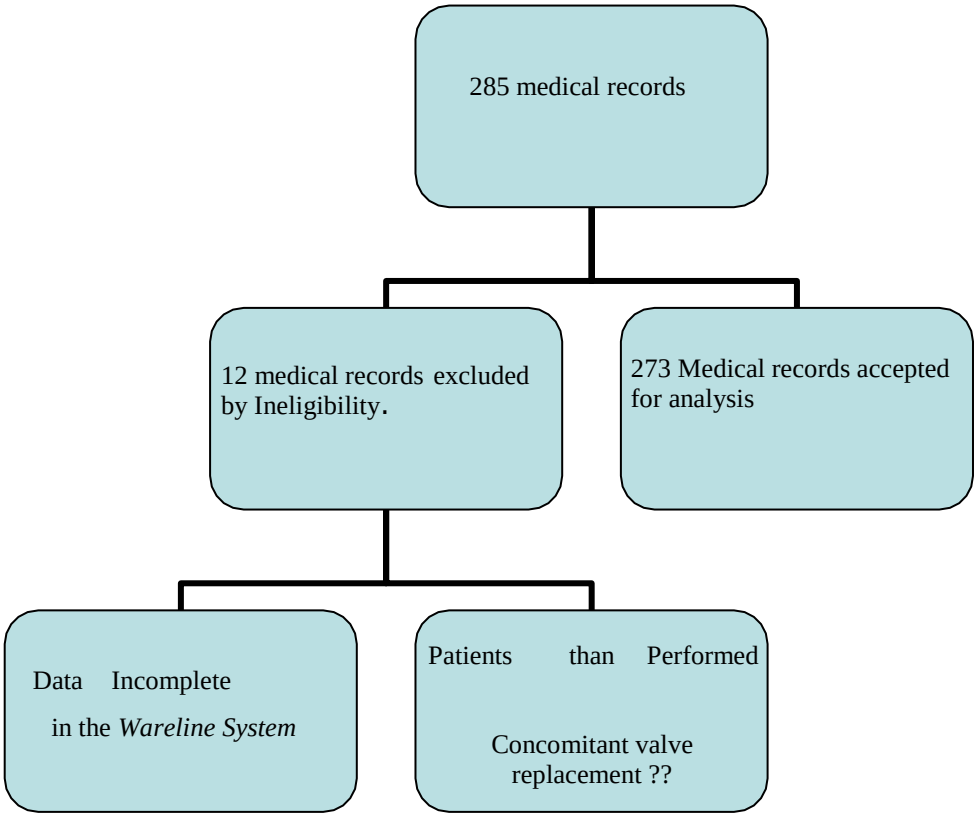

Figure 1. Sample Flowchart

The descriptive characteristics of the study participants according to age, sex and marital status can be seen in Table 1. There was a higher prevalence of married men aged 61-70 years.

Table 1. Sample characterization

Variables	N /%
N	273
Age group	
30-40 years	5/ 1,8
41-50years	12/ 4,4
51-60years	68/ 24,9
61-70years	112/ 41,0
71-80years	65/ 23,8
81-90years	11/ 4,0
Sex	
Male	182/ 66,7
Female	91/ 33,3
Marital status	
Single	50/ 18,3
Married	168/61,5
Divorced	16/5,9
Stable union	8/ 2,9
Widower	21/7,7
Not informed	10/3,7

Source: Survey data, 2019-2020.

Diabetes and associated systemic arterial hypertension were the main comorbidities found in the research participants. The prevalent clinical outcome was hospital discharge, with a mean length of stay of 15.09 days, as shown in Table 2.

Table 2. Description of comorbidities, clinical outcome and mean length of stay of study participants

Variables	N/ %
Comorbidities	
Hypertension	105/38,5
Diabetes	9/3,3
Hypertension and Diabetes	121/ 44,3
No	26/9,5
Other	12/4,4
Denouement	
Discharge	246/ 90,1
Death	27/ 9,9
Length of hospital stay (md ±dp)	15.09± 9.126

Table 3 describes the frequency of respiratory interventions performed at admission (PO) and hospital discharge (BP), among which higher frequencies were observed in the use of respiratory monitoring, lip frenum technique, fractional inspiration, active pulmonary expansion therapy and use of Noninvasive Ventilation.

Table 3. frequency of respiratory interventions performed at admission (p0) and hospital discharge (BP)

Variable	AFTER		«PA	
Respiratory Monitoring	**N**	**%**	**N**	**%**
Yes	240	87,9	236	86,4
No	6	2,2	10	3,7
Lip brake				
Yes	159	58,2	160	58,6
No	87	31,9	86	31,5
Fractional Inspiration				
Yes	149	54,6	160	58,6
No	97	35,5	86	31,5
pansion Therapy				
Yes	186	68,1	199	72,9
No	60	22	47	17,2
Noninvasive Ventilation				
Yes	79	28,9	43	15,8
No	167	61,2	203	74,4
Respiron				
Yes	52	19,0	101	37,0
No	194	71,1	145	53,1
Bronchial Hygiene Therapy				
Yes	45	16,5	49	72,2
No	201	73,6	197	17,9
Diaphragmatic Stimulation				
Yes	55	20,1	48	17,6
No	191	70,0	198	72,5
Cough Stimulus				
Yes	10	3,7	4	1,5
No	236	86,4	242	88,6
Aspiration				
Yes	1	0.4	1	0.4
No	245	89.7	245	89.7
Inhalation Therapy				
Yes	5	1.8	4	1.5
No	241	88.3	242	88.6
Expiratory Flow Acceleration				
Yes	12	4.4	6	2.2
No	234	85.7	239	87.5
Forced Expiration Technique				
Yes	1	0.4	2	0.7
No	245	89.7	244	89.4
Compression and decompression maneuver				
Yes	1	0.4	1	0.4
No	245	89.7	245	89.7

Table 4 describes the frequency of early mobilization interventions performed at admission (PO) and hospital discharge (PA), among which we noticed a higher frequency in

the conducts of general orientations, stretching of extremities, metabolic exercises, sedation and positioning.

Table 4. Frequency of mobilization procedures performed at admission (P0) and hospital discharge (PA)

Variable	**AFTER**		**'PA**	
Elevation of the Headboard	**N**	**%**	**N**	**%**
Yes	144	52,7	127	46,5
No	102	37,4	119	43,6
Extremity Stretching				
Yes	221	81,0	224	82,1
No	25	9,2	22	8,1
Positioning				
Yes	160	58,6	139	50,9
No	86	31,5	107	39,2
Metabolic Exercises				
Yes	194	71,1	205	75,1
No	52	19,0	41	15,0
Sedestação				
Yes	169	61,9	208	76,2
No	77	28,2	38	13,9
Bipedestação				
Yes	83	30,4	132	48,4
No	163	59,7	114	41,8
Ambulation				
Yes	49	17,9	100	36,6
No	197	72,2	146	53,5
Cycle ergometer				
Yes	6	2,2	25	9,2
No	240	87,9	221	81,0
General guidelines				
Yes	243	89,0	239	87,5
No	3	1,1	7	2,6
Weight Transfer				
Yes	2	0.7	3	1.1
No	244	89.4	243	89.0
Proprioceptive Neuromuscular Facilitation				
Yes	0	0	0	0
No	246	90,1	246	90,1
Change of Decubitus				
Yes	19	7.0	6	2.2
No	227	83.2	240	87.9
Massage therapy				
Yes	0	0	2	0.7
No	246	90,1	244	89.4

The linear regression analysis showed that motor deficit, tone alteration and aspiration procedure were responsible for 25% of the variation in the length of stay of the study participants, as shown in Table 5.

Table 5. Multiple linear regression of variables associated with length of stay of study participants

F (5,64) ≤0,01; **p=0,03; R2= 0,25**			
Variable	**ß**	**p- value**	**IC**
Intercept	14,64	≤0,01	13,47 - 15,80
Deficit motor	10,58	≤0,01	4,63- 16,52
Change in tone	-11,02	≤0,01	-19,05 - -2,98
Aspiration	19,35	0,03	1,83- 36,88

Source: Survey data, 2019-2020.

A second multiple linear regression analysis was performed with the outcome of ambulation at hospital discharge, and revealed that the bipedal conducts, cycle ergometer, positioning and sedation at hospital discharge were responsible for 67% of the variation of this outcome, as shown in Table 6.

Table 6. Multiple linear regression of variables associated with walking ability at hospital discharge

F (49.40) = ≤0,01; p=0.041; R2= 0,67			
Variable	**ß**	**p-value**	**IC**
Intercept	-0,14	0,04	-0,28- -0,002
Bipedestação (PA)	0,53	≤0,01	0,43 - 0,64
Cicloergometria (PA)	0,29	≤0,01	0,13- 0,44
Positioning (PA)	0,18	≤0,01	0,08 - 0,27
Sedestação (PA)	0,15	0,04	0,006- 0,29

Source: Survey data, 2019-2020.

This study aimed to analyze the impacts of physical therapy assistance on the length of hospitalization and walking capacity of patients undergoing coronary artery bypass grafting (CABG).

There was a predominance of married men aged 61-70 years. These data corroborate the global epidemiological profile of this condition.[9-10] In addition, a similar study was conducted by Rosier et al.[11], where it was possible to observe that, among the individuals who underwent CABG surgery in a philanthropic hospital in Salvador, 121 (71.6%) were male, 119 (70%) were married and with a mean age of 63.78 ± 9.06 years.

Hypertension and diabetes associated with it were described as the most prevalent comorbidities in the sample, and also corroborate the literature, as for example, in the study by Kaufman et al.[12] who, in their sample of 372 patients, stated that the most prevalent risk factors were systemic arterial hypertension (93.2%), diabetes (29.0%) and smoking (4.3%).

In this scenario, according to Nicolau,14 hypertension is often associated with cardiovascular risk factors, evidencing that this condition results in increased oxidative stress,

accelerated growth of the smooth vascular cell and exaggerated vasoconstriction. That is, myocardial injury caused by hypertension results from an imbalance between oxygen supply/consumption.[14-13] Meanwhile, diabetes predisposes to abnormalities in platelet function, coagulation system and fibrinolytic, which favor the thrombotic process.

The mean length of stay in the study sample was 15.09± 9.126 days, being considered slightly higher than the studies previously described in the literature.[15-16] Maia et al.[15] observed a postoperative hospitalization time of 6.5 (between 5 and 8 days). Whereas, the study by Sousa et al.[16] showed a mean time of postoperative hospitalization of 8.0 ± 1.8 days. It is noteworthy that the previously mentioned authors conducted their studies in the northern and southeastern regions of Brazil, respectively.

The frequency of patients who died in the sample was 9.9%. Going against a recent study conducted by Farias et al.[18], where a relatively similar mortality rate was presented in individuals undergoing thoracic surgery. However, this percentage is above the national average of 8.3%.[18]

Respiratory dysfunctions are among the main postoperative complications of patients undergoing cardiac surgery. These come from the reduction in total lung capacity, caused by a decrease in functional residual capacity, and by the reduction in expiratory reserve volume. Such complications result from the combination of a number of factors, which include anesthetic narcosis, surgical incision, cardiopulmonary bypass (CPB), surgery time, mechanical ventilation time, and pain. [19]

Therefore, an adequate physical therapy evaluation and the titration of physiotherapy procedures have been widely used strategies during care practice in a hospital environment. Among the conducts performed in the study, classified as respiratory physiotherapy, respiratory monitoring and the use of Noninvasive Ventilation (NIV) are relevant.

The clinical evaluation through the values obtained with the vital signs enables health professionals to identify/detect early the occurrence of some and/or other alteration of the clinical picture of the individual and will be able to act, together with the patient, in an immediate and differential way, providing a direct, specific and individualized care.[20] The Brazilian Guidelines for Cardiac Rehabilitation emphasize that monitoring and patient safety is part of Cardiac Rehabilitation.[8]

Another resource described in the study in the treatment of post-surgical pulmonary dysfunctions was NIV. This emerges as a resource that increases alveolar ventilation, reduces respiratory work and improves gas exchange without the need for the institution of invasive

prostheses.[21] It also has an impact on hemodynamics, with a decrease in preload due to reduced venous return and left ventricular afterload due to the reduction of its transmural pressure, which leads to improved cardiac performance and increased cardiac output.[22]

Within the arsenal of resources mentioned in the care of the service in question, the evaluation of preoperative pulmonary function and inspiratory muscle training (IMT) were not observed, both resources already disseminated in the literature as effective in reducing mortality and reducing the length of stay in patients undergoing thoracic surgery.[23]

A study24 using linear load IMT based on 30% of MIP, with progressive increase in the preoperative phase, showed an incidence of pulmonary complications reduced by 50% when compared to studies with patients who underwent physical therapy without inspiratory muscle training. Therefore, the length of postoperative hospital stay was significantly shorter.[24]

With regard to the most frequent motor physiotherapy techniques mentioned in the sample, the general orientations, extremity stretching, metabolic exercises, sectionalization, positioning were detached. General guidelines were given regarding the correct positioning in bed, the exercises performed and the decubitus position.[23-24]

Stretching is considered a useful resource for regaining range of motion, improving body function, and as a warm-up before an exercise program, with the goal of reducing the risk of injury.[25] However, no studies were found that discuss changes and the use of muscle stretching in the rehabilitation protocol in the hospital phase.

According to Meyer et al.[26], metabolic exercise causes increased blood flow through stimulation of the calf muscle pump (BMP), associated with posture in elevation of LLLL, in order to promote the action of gravity, favoring a greater mobility of this flow. Another benefit of active movement of these joints is the improvement of venous hemodynamics, which is maintained for up to 30 minutes after the end of the exercise.[26]

Sedation is part of the proposal of early mobilization, should be present one hour a day, up to twice of 30 minutes. However, it does not significantly interfere in the length of stay of patients in the ICU and hospital, however, the functional improvement at the time of discharge from the ICU and hospital of the patient submitted to this intervention model is evident.[26-27]

The precocity and the establishment of clear goals, with progressive intervention phases, through functional diagnosis, are relevant factors and are directly related to functional independence and ambulation at the time of the patient's discharge,[27] However, aerobic exercises such as walking and the use of the cycle ergometer appear in this study as conducts still little used and muscle strengthening was not clearly mentioned as conduct.

Motor deficit, altered tone and a greater need for aspiration were associated with longer hospital stays of the participants in this study. These data emphasize the need to use tools to stimulate mobility and functional independence even during care in the hospital phase. A previous study reveals that assisted mobilization and coughing may favor an increase in expiratory flows, increasing the effectiveness of coughing and decreasing the need for aspiration.[28]

This is corroborated by the fact that prolonged hospitalization or excessive bed rest can lead to decreased protein synthesis, decreased muscle strength and, in cardiac patients, orthostatic intolerance and reduced cardiac output can worsen physical fitness, generating motor deficit and tone alteration. [29]

The ability to walk at hospital discharge is a relevant factor of strength and functional independence.[30] In this study, the variables associated with walking ability at hospital discharge were bipedal, cycle ergometry, positioning and sectionalization. Of those mentioned, only cycle ergometry was the one that least appeared in the study as a care conduct, and we understand that this needs to be better encouraged.

The study by Trevisan,[30] clarifies that the cycle ergometer seems to be an excellent training equipment for patients who are in the postoperative period of cardiac surgery, because it allows the control of the training intensity during a CR program in phase l, since the performance of the same does not require the patient to support his own body weight during training, stimulating strength[31,32] and maintenance of peripheral muscles.[33]

To our knowledge, this was the first study that listed the rehabilitation resources used in the hospital environment of a reference service in cardiac surgery in northeastern Brazil. We listed the importance of early rehabilitation in these patients, with significant impacts on length of stay and ambulation capacity at hospital discharge.

We highlight as limitations of this study the difficulty of standardization and description of the terms recorded in the medical records analyzed. We believe that the use of electronic medical record systems may have been a barrier in the sense of limiting the description of the procedures applied in a detailed manner.

CONCLUSION

From the present study it was possible to identify the potentialities of the physiotherapy service offered to patients undergoing CABG in a hospital environment. We emphasize the

rehabilitation resources that had a significant impact on the length of stay and functional capacity in the postoperative period. However, it is still necessary that the use of rehabilitation resources in a hospital environment be applied and titrated in greater consonance with the pillars of evidence-based practice.

Thus, these findings may have implications for the determination of ways to construct and standardize cardiac rehabilitation protocols according to current guidelines, with significant impacts on reducing the length of stay and functional capacity of patients undergoing CABG.

REFERENCES

1. Pinho RA, Araújo MC, Ghisi GLM, Benetti M. Doença arterial coronariana, exercício físico e estresse oxidativo. Arq Bras Cardiol. 2010. Apr;94(4).

2. Martins HS. Síndromes coronarianas agudas sem elevação do segmento ST. In: Martins HS, Neto RAB, Neto AS, Velasco IT. Emergências clínicas: abordagem prática. São Paulo: Manole; 2006. p. 547-68.

3. Aehlert B. Síndromes Coronarianas Agudas. In: Aehlert, B (ed.) ACLS: Suporte avançado de vida em cardiologia: emergência em cardiologia. 4° ed. Rio de Janeiro (RJ): Elservier; 2013. p. 211-75.

4. Silva RBS, Castro CM, ISER BPM, CASTILHO LJC. Perfil dos pacientes com síndromes coronarianas agudas em um hospital da Região Sul do Brasil. Rev Soc Bras Clin Med. 2016 jan-mar;14(1):33-7.

5. Brasil, Ministério da Saúde. Banco de dados do Sistema Único de Saúde-DATASUS.

6. Piegas LS, Timerman A, Feitosa GS, Nicolau JC, Mattos L a. P, Andrade MD, et al. V Diretriz da Sociedade Brasileira de Cardiologia sobre Tratamento do Infarto Agudo do Miocárdio com Supradesnível do Segmento ST. observatoriofmuspbr [Internet]. 2015; Available from: https://observatorio.fm.usp.br/handle/OPI/12652

7. Organização Mundial de Saúde (OMS). Global status report on non-communicable diseases 2010. Geneva: World Health Organization [Internet]. 2012 [cited 2017 Oct 15].

8. Carvalho DF, et al. Diretriz Brasileira de Reabilitação Cardiovascular – 2020. Arq Bras Cardiol. 2020; 114(5):943-987.

9. Chagas AM, Silva YM, Alencar AMC. Reabilitação cardíaca fase I: uma revisão sistemática. ASSOBRAFIR Ciência. 2016 Dez;7(3):51-60.

10. Winkelmann ER, Dallazen F, Bronzatti ABS, Lorenzoni JCW, Windmöller P. Analysis of a STEPs adapted protocol in Cardiac Rehabilitation in Phase Hospital. Revista Brasileira de Cirurgia Cardiovascular [Internet]. 2014 [cited 2019 Dec 31]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4389528/

11. Rosier GL, et al. Revascularização Miocárdica e Troca Valvar: Comparação no Perfil dos Indivíduos. Rev Saúde HIS, v. 3, p. 46-50, 2017.

12. Kaufman R, Azevedo VMP, Sá RMG de, Geller M, Xavier RM de A, Chaves RBM, et al. Epidemiological Characteristics and Mortality Predictors in Patients Over 70 Years Submitted to Coronary Artery Bypass Grafting. International Journal of Cardiovascular Sciences [Internet]. 2018 [cited 2022 Jun 29]; Available from: https://www.scielo.br/j/ijcs/a/PySgCcgJngFjwsp4NMxjxLf/?format=pdf&lang=pt

13. Nicolau JC, Filho GSF, Petriz JL, Furtado RH de M, Précoma DB, Lemke W, et al. Diretrizes da Sociedade Brasileira de Cardiologia sobre Angina Instável e Infarto Agudo do Miocárdio sem Supradesnível do Segmento ST – 2021. Diretrizes da Sociedade Brasileira de Cardiologia sobre Angina Instável e Infarto Agudo do Miocárdio sem Supradesnível do Segmento ST – 2021 [Internet]. 2021 Feb 26 [cited 2021 Jul 8];00(00). Available from: https://abccardiol.org/article/diretrizes-da-sociedade-brasileira-de-cardiologia-sobre-angina-instavel-e-infarto-agudo-do-miocardio-sem-supradesnivel-do-segmento-st-2021/

14. Amarante RDM, Castro R, Lage AV, Cisternas JR. Diabetes Mellitus como fator de risco na aterogênese. Arq Med Hosp Fac Cienc Med Santa Casa São Paulo. 2007; 52(3):87-93.

15. Maia GC. Influência do threshold® na capacidade funcional, respiratória e qualidade de vida nos idosos submetidos à cirurgia de revascularização do miocárdio. 2018. Tese de Doutorado. Porto: Faculdade de Ciências da Saúde da Universidade Fernando Pessoa.

16. Sousa AR, et al. Fatores associados a um impacto na qualidade de vida pós-revascularização miocárdica. Revista da Rede de Enfermagem do Nordeste, v. 19, 2018.

17. Farias AC, et al. Mortalidade de pacientes submetidos à cirurgia cardíaca. Research, Society and Development, v. 10, n.5, e12110514610, 2021.

18. Monteiro GM, Moreira DM. Mortalidade em cirurgias cardíacas em hospital terciário do sul do Brasil. Int J Cardiovasc Sci. 2015;28(3):200- 5. https://doi.org/10.5935/2359-4802.20150029

19. Oliveira RS, Lima BP, Oliveira MS, et al. Tempo de hospitalização em pacientes submetidos a fisioterapia pós cirurgia de revascularização do miocárdio. Pesq cuid fundam. online 2011. abr/jun. 3(2):1992-97.

20. Barbas CSV, Ísola AM, Farias AM de C, Cavalcanti AB, Gama AMC, Duarte ACM, et al. Brazilian recommendations of mechanical ventilation 2013. Part I. Revista Brasileira de Terapia Intensiva [Internet]. 2014;26(2). Available from: http://www.sadif.com.br/conteudo/arquivo/Recomendacoes-brasileiras-de-ventilacao-mecanica-2013-Parte-1-1525128139.pdf

21. Meinhardt MY et al. Efeito da ventilação não-invasiva sobre a demanda miocárdica no pós-operatório de cirurgia cardíaca. Revista Saúde e Pesquisa, v. 10, n. 2, p. 301-308.

22. Hermes BM, Cardoso DM, Gomes TJN, Santos TD dos, Vicente MS, Pereira SN, et al. Short-term inspiratory muscle training associated with combined aerobic and resistance

training is benefic in patients undergoing CABG surgery in phase II cardiac rehabilitation program. Revista Brasileira de Cirurgia Cardiovascular. 2015.

23. Miranda RCV, Padulla SAT, Bortolatto CR. Fisioterapia respiratória e sua aplicabilidade no período pré-operatório de cirurgia cardíaca. Rev Bras Cir Cardiov [Internet]. 2011 [cited 2021 Sep 19];26(4):647–52. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-76382011000400022&lang=pt

24. Carolyn C. Exercícios terapêuticos: fundamentos e técnicas. 5. ed. São Paulo: Manole; 2009.

25. Meyer PF, Chacon DA, Lima AC. Estudo piloto dos efeitos da pressoterapia, drenagem linfática manual e cinesioterapia na insuficiência venosa crônica. Reabilitar. 2006;31(8):11-7.

26. Aquim AD, et al. Diretrizes Brasileiras de Mobilização Precoce em Unidade de Terapia Intensiva. Rev Bras Ter Intensiva. 2019;31(4):434-443.

27. Laizo A, Delgado FE, Rocha GM. Complications that increase the time of hospitalization at ICU of patients submitted to cardiac surgery. Rev Bras Cir Cardiovasc. 2010;25(2):166-71.

28. Arruda KA, Cataneo DC, Cataneo AJ. Surgical risk tests related to cardiopulmonary postoperative complications: comparison between upper abdominal and thoracic surgery. Acta Cir Bras. 2013;28(6):458-66.

29. Pereira LVAL, Sales WB, Bovi ACN, Velôso JA de P, Resende NV. Efeitos da fisioterapia intensiva na função motora em pacientes internados com o novo coronavírus: uma revisão integrativa. Research, Society and Development. 2022 Sep 28;11(13):e57111335253.

30. Trevisan MD, et al. Alternative physical therapy protocol using a cycle ergometer during hospital rehabilitation of coronary artery bypass grafting: a clinical trial. Revista Brasileira de Cirurgia Cardiovascular, [s.l.], p.615-619, 2015.

31. Gonçalves JM, Sales WB, Tomaz RR. Estratégias de suporte ventilatório para pacientes com coronavírus: uma revisão integrativa de literatura. Rev Cien Saúde Nova Esperança. 2021 Dec 28;19(3):211–9.

32. Leite DG, Sales WB, Vidal GP, Freitas GD de M, Tomaz RR. Atuação da fisioterapia na unidade de terapia intensiva com ênfase na prevenção da síndrome da imobilidade: uma revisão integrativa. Research, Society and Development. 2020 Mar 29;9(5):e93953196.

33. Francisco LM, Nascimento RB do, Sales WB, Tomaz RR. A intervenção do fisioterapeuta no pré e pós-operatório de cirurgia cardíaca: uma revisão integrativa. Research, Society and Development. 2020 Jun 16;9(7):e890973446.