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Behavior of the functional independence domains in patients submitted to the revascularization of the myocardium during intensive care unit stay

Comportamento dos domínios de independência funcional em pacientes submetidos à revascularização do miocárdio durante a estadia na terapia intensiva

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RESUMO | INTRODUÇÃO: A Mensuração da Independência Funcional (MIF) é utilizada para avaliar a condição funcional dos pacientes sendo dividida em domínios aplicada nos pacientes submetidos a cirurgia cardíaca devido ao seu alto potencial de efeitos deletérios. **OBJETIVO:** Analisar o comportamento dos domínios da MIF em pacientes submetidos a revascularização do miocárdio. **MÉTODOS:** Trata-se de um estudo de coorte. No momento da admissão hospitalar foi avaliada a funcionalidade através da MIF e computado os seis domínios. No dia da alta da Unidade de Terapia Intensiva (UTI) foi novamente aplicada a MIF para comparação com o pré-operatório e correlação com o tempo de permanência na UTI. **RESULTADOS:** Foram analisados 38 pacientes sendo 21 (55,3%) homens, a média de idade 57,3 ± 13,3 anos. O tempo médio de estadia na UTI 2,9 ± 1,3 dias sendo a MIF pré 125,7 ± 0,5 e a pós 87,4 ±16,8 (p <0,001). Em relação aos domínios percebeu-se uma redução em todos com exceção da Comunicação que passou de 14 para 13,1 ± 2,1 (p=0,24) e Cognição 20,9 ± 0,1 para 19,2 ± 4,4 (p=0,24). Porém, percebeu-se uma correlação forte entre o tempo de permanência na UTI com os domínios comunicação (r -0,76 e p < 0,01) e cognição (r -0,77 e p<0,01). **CONCLUSÃO:** Conclui-se que a funcionalidade é reduzida devido a cirurgia cardíaca e que o tempo de permanência na UTI tem relação direta com a piora da comunicação e cognição.

PALAVRAS-CHAVE: Cirurgia cardíaca. Unidade de Terapia Intensiva. Funcionalidade.

ABSTRACT | INTRODUCTION: Functional Independence Measurement (MIF) is used to evaluate the functional status of patients being divided into domains and should be applied in patients undergoing cardiac surgery due to their high potential for deleterious effects. **OBJECTIVE:** To analyze the behavior of MIF domains in patients submitted to myocardial revascularization. **MATERIALS AND METHODS:** This is a cohort study. At the time of hospital admission, the functionality was evaluated through the MIF and computed the six domains. After the surgery on the day of discharge from the Intensive Care Unit (ICU), the MIF was again applied for comparison with the preoperative period and correlation with the length of stay in the ICU. **RESULTS:** A total of 38 patients were analyzed: 21 (55.3%) men, mean age was 57.3 ± 13.3 years. The mean ICU stay was 2.9 ± 1.3 days, with a FIM of 125.7 ± 0.5 and a mean of 87.4 ± 16.8 (p <0.001). In relation to the domains, a reduction was observed in all of them, with the exception of Communication from 14 to 13.1 ± 2.1 (p = 0.24) and Cognition 20.9 ± 0.1 to 19.2 ± 4, 4 (p = 0.24). However, there was a strong correlation between ICU stay time with the communication domains (r -0.76 and p <0.01) and cognition (r -0.77 and p <0.01). **CONCLUSION:** It is concluded that the functionality is reduced due to cardiac surgery and that the time spent in the ICU is directly related to the worsening of communication and cognition.

KEYWORDS: Thoracic surgery. Intensive Care Units. Functionality.

Introduction

Cardiac surgery is associated with a longer life expectancy, but can lead to complications such as respiratory and muscular function impairment[1,2]. In the postoperative period of cardiac surgery, muscular atrophy and prolonged inactivity are factors that can cause the sensation of fatigue and the decline of the functional capacity[3]. Together these changes may compromise the functional independence of patients. Functional independence reflects the level of need for care of third parties that the patient needs to perform motor and cognitive activities[4].

It should be emphasized that the reduction of muscle strength may negatively influence the functionality of hospitalized patients, with a tendency to worsen functional capacity during the time of stay in the Intensive Care Unit (ICU)[5]. Thus, the complications of myocardial revascularization surgery associated with intensive care unit admission may significantly compromise the patients' functional independence. Researchers[6] observed a significant reduction in the degree of functional independence in patients undergoing cardiac surgery when compared to the pre- and post-surgical periods. However, isn't yet known which domain suffers the greatest impact of surgery and length of stay in the ICU.

Studies also suggest that the prolonged duration of mechanical ventilation (MV), cardiopulmonary bypass and stay in the Intensive Care Unit are risk factors for reduction of inspiratory muscle strength, which may be associated with reduced postoperative functional independence[7,8]. Most ICUs present a closed and challenging environment to the patient. Sometimes they become deprived of contact with relatives and are exposed to procedures that create discomfort and pain. All these factors influence the fluctuation of the level of consciousness and may alter your cognition and communication capacity.

Thus, it's necessary to evaluate the functional independence in patients after cardiac surgery seeking the limitations that the patient presents aiming at an optimization of the prescription of the individualized exercise. The objective of this study was to analyze the behavior of the functional independence domains in patients submitted to myocardial revascularization and their correlation with the length of stay in the ICU.

Methods

This is a longitudinal, analytical study performed with patients undergoing cardiac surgery at a referral hospital in the city of Feira de Santana, Bahia, in the period from January to October 2015. The work was approved by the Research Ethics Committee of Faculdade Nobre, opinion number 1.241.433 (CAAE 68968817.7.0000.5654). All participants signed a Free and Informed Consent Form.

As inclusion criteria, patients should be older than 18 years of age, of both genders, and underwent myocardial revascularization surgery via median sternotomy and extracorporeal circulation. As exclusion criteria, patients who were unable to respond to the scale used, with Chronic Obstructive Pulmonary Disease underwent emergency cardiac surgery, ICU stay time of more than 5 days and time of mechanical ventilation over 12 hours or intermittent use of Non-Invasive Ventilation for more than 24 hours.

After meeting the criteria for participation in the research, information related to clinical and surgical aspects of these patients was collected. In addition, one day before cardiac surgery, all patients underwent functional independence assessment through the Functional Independence Measure (FIM). In this instrument already adapted and validated in Brazil, the activities that the patient is able to perform well as the level of assistance to perform the activity. The domains of FIM are: Self-care, sphincter control, transference, locomotion, communication and cognition. There are subdivisions in the domains as, for example, in self-care the capacities that the patient presents for personal hygiene, dressing, feeding and bathing are evaluated. Given scores from 1 (total dependency) to 7 (complete independence) with the maximum FIM value of 1269. Patients were assessed using FIM and the specific values of each domain were calculated one day before surgery and at

discharge from the ICU. The application of FIM was performed by a single evaluator trained for use of the scale. The patient's length of stay in the ICU was also recorded.

Statistical Package for the Social Sciences (SPPS) 20.0 was used to analyze the data. To evaluate the normality of the sample, the Kolmogorov-Smirnov test was used. Continuous variables were expressed as mean and standard deviation. In order to compare MIF and its domains before and after surgery, paired Student's t-test was used and to correlate domains such as ICU stay time with Pearson's correlation coefficient. The level of statistical significance adopted was 5%.

Results

During the study period 45 patients were recruited. Of these, 2 underwent emergency surgery, 2 had lung disease and 3 remained for more than five days in the ICU. Thirty-eight patients with mean age of 57 ± 13 years were evaluated. Other data related to the clinical characteristics of the patients are shown in Table 1. The length of stay in the ICU was 2.9 ± 1.3 days.

Table 1. Clinical data of patients undergoing myocardial revascularization

Variables	n
Genre	
Male	21 (55,3%)
Female	17 (44,7%)
Age (years)	57 ± 13
BMI (kg/m²)	23 ± 2.7
Comorbidities	
SAH	22 (57,9%)
DM	7 (18,4%)
Dyslipidemia	19 (50%)
Obesity	18 (47,4%)
Time MV (hours)	7.9 ± 2.7
Stay in the ICU (days)	2.9 ± 1.3

BMI – Body Mass Index; SAH – Systemic Arterial Hypertension; DM – Diabetes Mellitus; MV – Mechanical Ventilation; ICU – Intensive Care Unit.

Table 2 shows the surgical characteristics of patients undergoing coronary artery bypass grafting.

Table 2. Surgical data of patients undergoing myocardial revascularization

Variables	N
Extracorporeal Circulation Time (min)	88 ±12
Number of bridges	2.5 ± 0.8
Number of drains	1.8 ± 0.4
Surgery time (min)	231 ± 51

Table 3 shows the behavior of the functional independence domains in the preoperative period and on the day of ICU discharge. It was noticed that there was a reduction in the points obtained in the domains, however the communication and cognition domains did not present a decrease with statistical significance (p = 0.24).

Table 3. Analysis of the preoperative and post-discharge FIM domains of the ICU of patients submitted to coronary artery bypass grafting

Variables	Pre	Discharge from ICU	pᵃ
Total FIM	125.7 ± 0.5	87.4 ±16.8	<0.001
Self-care	41.9 ± 0.3	25.8 ± 8.4	<0.001
Sphincter control	13.9 ± 0.1	7.5 ± 0.9	<0.001
Transfers	20.9 ± 0.1	14.6 ± 3.4	<0.001
Locomotion	14 ± 0.1	7.8 ± 3	<0.001
Communication	14 ± 0.1	13.1 ± 2.1	0.24
Cognition	20.9 ± 0.1	19.2 ± 4.4	0,24

FIM – Functional Independence Measure; ICU – Intensive Care Unit. a Paired Student's t-test.

In Figures 1 and 2 we have the FIM motor and cognitive domain variables started with a high score. At the time of ICU discharge, a significant reduction (p <0.001) was observed in the motor category in the domains of self-care, sphincter control, transfer and locomotion. The cognitive category was related to communication and cognition, also statistically reducing a p = 0.03.

Figure 1. Behavior of FIM motor category between admission and discharge from ICU in patients undergoing myocardial revascularization. *p<0,001. Paired Student's t-test.
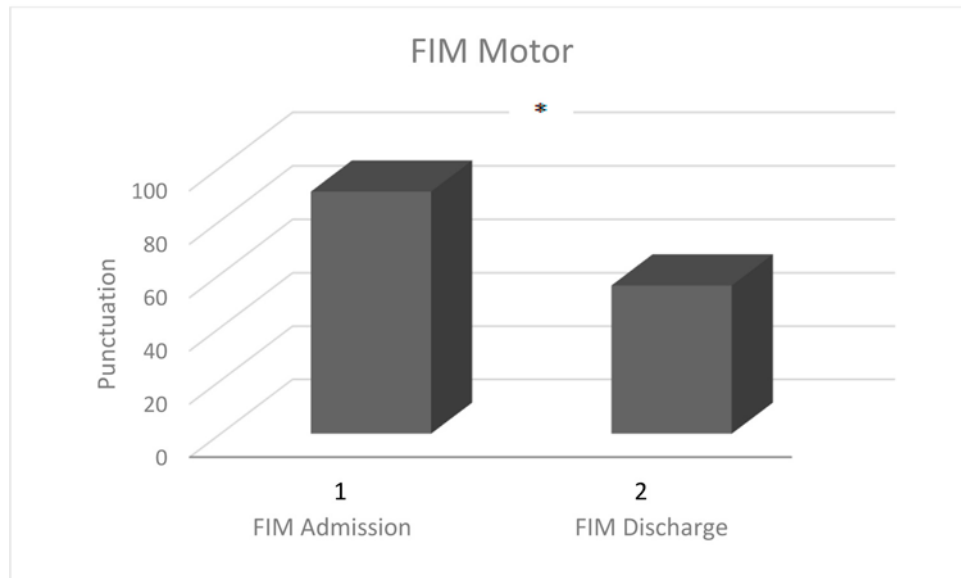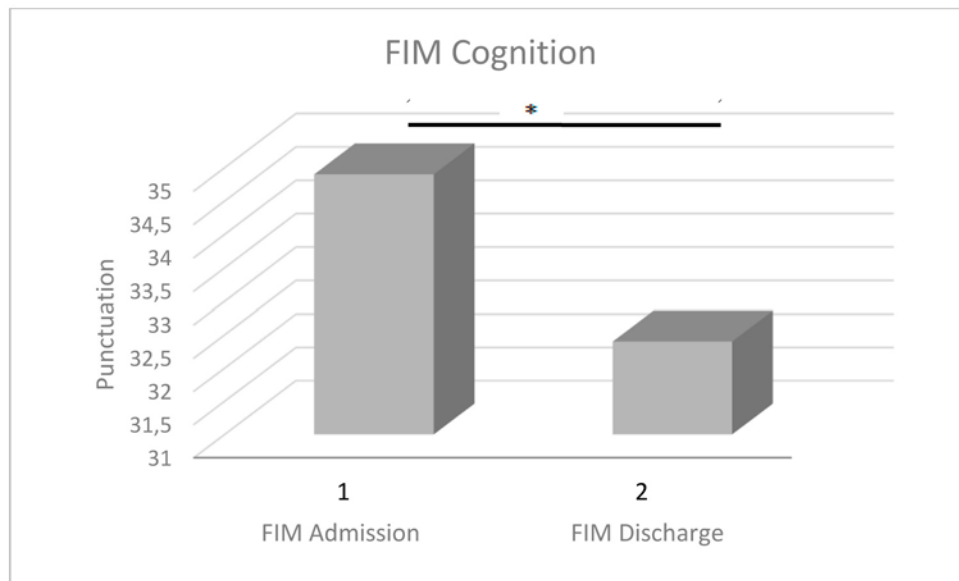
In order to correlate the behavior of the FIM domains with the length of stay in the ICU, the delta of the domain was obtained by subtracting the initial value from the value of the ICU discharge, being represented in Table 4. The delta of the self-care was $16,1 \pm 8,4$, sphincter control $6,5 \pm 0,9$, transfer $6,4 \pm 3,4$, locomotion $6,1 \pm 3$, communication $0,8 \pm 2,1$, cognition $1,7 \pm 4,4$. It was observed that only communication ($r = 0,76$ and $p < 0,01$) and cognition ($r = 0,77$ and $p < 0,01$) presented a negative correlation considered quite expressive. Thus, it was observed that the time spent in the ICU seems to be directly associated to the development of a cognitive-interaction impairment in this population.

Table 4. Correlation between ICU stay time with FIM domains in patients submitted to myocardial revascularization.

FIM Domains	Stay in the ICU	
	r*	p-value
Δ Self-care	0,26	0,11
Δ Sphincter control	0,20	0,23
Δ Transfers	0,22	0,20
Δ Locomotion	0,06	0,73
Δ Communication	- 0,76	<0,01
Δ Cognition	- 0,77	<0,01

ICU – Intensive Care Unit; FIM – Functional Independence Measure. *Pearson's correlation.

In addition, we analyzed whether the time of MV and extracorporeal circulation represented some impact on the behavior of the domains studied. It was noted that the MV had a strong correlation with the cognitive domain variables. On the other hand, extracorporeal circulation had no impact on the behavior of the domains (Table 5).

Table 5. Correlation between MV time with FIM domains in patients submitted to myocardial revascularization.

FIM Domains	Time of MV		Time of ECC	
	r*	p-value	r*	p-value
Δ Self-care	0,32	0,06	0,09	0,60
Δ Sphincter control	0,17	0,32	0,23	0,16
Δ Transfer	0,26	0,12	0,27	0,10
Δ Locomotion	0,14	0,40	0,16	0,34
Δ Communication	- 0,70	<0,01	- 0,03	0,87
Δ Cognition	- 0,73	<0,01	- 0,02	0,91

MV – Mechanical Ventilation; FIM – Functional Independence Measure. *Pearson's correlation.

Discussion

Based on the results demonstrated, it can be seen that reduced functional independence in patients undergoing myocardial revascularization, with the domains of self-care, sphincter control, transference and locomotion being the most affected.

Reduction of functionality has already been observed in other studies[6,10] and possibilities for this reduction have also been discussed. Pain is associated with functional worsening, and in the study by Borges et al[10] verified that pain was present until the seventh postoperative day and had a significant contribution to functional decline. Oliveira et al. pointed out that some factors may contribute to worsening functional performance in this patient profile such as: type of surgery, extracorporeal circulation time, body mass index, and initial FIM value.

For Morais et al.[12] pain has no influence on functionality and there is a reestablishment of the function until the fifth postoperative day. For these authors, what has relation with functional loss is the time of extracorporeal circulation, which was not verified in the present study.

In the present study, comparing the preoperative period with the ICU post, it's possible to observe a reduction in FIM, a result close to that of the study by other researchersl[11] where the pre-FIM was 123 ± 4 and at hospital discharge of 115 ± 10,8. It is worth mentioning that the FIM in these studies were evaluated at different times of ICU discharge and hospital discharge, respectively.

ICU stay may be another contributing factor for functional decline after myocardial revascularization, and this correlation is well established when the respiratory function is analyzed[5]. Permanence in MV is also a factor associated with worsening muscle strength[13] and functionality, the longer the patient goes through the MV the worse its functionality[13-15].

For Myles et al[16] cardiac surgery is associated with impairments in the functionality and abilities of the patient. In the present study, domains such as self-care, transference and locomotion were significantly reduced in agreement with Borges et al[10] who compared the total FIM at the pre, seventh postoperative day and hospital discharge.

A condition that may be associated with the presence of cognitive and communication changes in this population is the time of extracorporeal circulation. In 2012, Selnes and colleagues[17] verified in a review of nine studies that an extracorporeal circulation time greater than 120 minutes was associated with the presence of delirium. And more recently, Rudiger and colleagues[18] have found that intraoperative variables, such as a high extracorporeal circulation time, correlated with the 50 patients who developed delirium after surgery.

In this study, some limitations may be listed: 1) lack of assessment of pulmonary function through spirometry since functional decline can be attributed to functional impairment of the respiratory system; 2) non-assessment of the level of pain since there are reports correlating pain and functionality.

Conclusion

Based on the findings, it's concluded that there is a reduction in the behavior of all domains of functional independence evaluated through the FIM and that there is a correlation between the time of MV and permanence in the ICU with worsening of communication and cognition.

Author contributions

Cordeiro ALL participated in the conception and design of the research, data analysis and interpretation, statistical analysis and critical revision of the manuscript regarding the intellectual content. Petto J, Gomes-Neto M, Guimarães AR, Melo TA and Shannon A participated in writing the manuscript and critically reviewing the manuscript for intellectual content.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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