

Correlation between Length of Hospital Stay and Gait Speed in Patients Submitted to Cardiac Surgery

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Abstract

Background: Cardiovascular diseases have been increasing worldwide in recent decades due to the increased occurrence of triggering factors. In the postoperative period of cardiovascular surgery, patients experience a functional decline, which may be potentiated by the length of hospital stay. Therefore, it is important to evaluate these patients' functional capacity.

Objective: To compare the length of hospital stay with the gait speed in patients undergoing cardiac surgery.

Method: Prospective, cohort study carried out at the *Instituto Nobre de Cardiologia* (Incardio) at *Santa Casa de Misericórdia* (Feira de Santana, Bahia). Upon discharge, all patients were evaluated with the 6-minute walk test (6MWT). The length of hospital stay in the postoperative period was also recorded at the same time and correlate with the gait speed. We used the Kolmogorov-Smirnov test to evaluate the assumption of normality, and Spearman's correlation to correlate the gait velocity with age, length of hospital stay, and duration of cardiopulmonary bypass (CPB) and invasive mechanical ventilation (IMV). All conclusions were based on a significance level of 5%.

Results: In all, 64 patients were included (33 males [51.5%], mean age 57.2 ± 14.06 years). The mean distance walked by the patients was 375.8 ± 197.6 meters, the mean gait speed was 0.98 ± 0.53 m/s, and the mean hospital stay was 8.2 ± 2.3 days. A weak correlation was observed between the length of hospital stay and gait speed ($r = 0.27$ and $p = 0.02$).

Conclusion: The length of hospital stay correlated weakly with the gait speed upon hospital discharge in a sample of patients undergoing cardiac surgery. (Int J Cardiovasc Sci. 2017;30(2):123-127)

Trial registration: Registered at CAAE (41151214.5.0000.5654) on June 26, 2015.

Keywords: Cardiovascular Diseases / surgery; Thoracic Surgery; Hospitalization; Walking; Physiotherapy; Velocity Measurement.

Introduction

Cardiovascular diseases have been increasing considerably worldwide, with genetic predisposition, poor diet, and sedentary lifestyle emerging as major triggering factors.¹ Thus, an increasing number of highly complex procedures such as cardiac surgery has emerged,

and the presence of complications arising from these procedures may increase the length of hospital stay.^{1,2}

Despite technological advances, postoperative complications are common and may affect a patient's lung function and peripheral muscle strength. Factors such as age, duration of extracorporeal circulation (ECC), and respiratory complications

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(including atelectasis, pleural effusion, and respiratory failure) may increase the length of hospital stay in patients undergoing invasive mechanical ventilation (IMV)³ which, in turn, is associated with prolonged hospital stay.^{3,4} The main complications affecting the musculoskeletal system are respiratory and peripheral muscle weakness and decreased functional capacity,⁴ whereas the pulmonary changes include atelectasis, respiratory infection, and hypoxemia.⁵

Therefore, it becomes necessary to evaluate the functional capacity of these patients during the postoperative period because of the potential decline in their activities after surgery. The 6-minute walk test (6MWT) is a practical and inexpensive method that has been used to evaluate treatment responses and functional capacity, in addition to being used as a morbidity and mortality predictor in patients with cardiovascular and respiratory diseases.⁶

Considering that increased hospital stay may worsen an individual's ability to perform exercises, as assessed with the 6MWT, the aim of this study was to evaluate the correlation between the duration of hospital stay and walking speed in patients undergoing cardiac surgery.

Methods

This was a prospective cohort study conducted at the *Instituto Nobre de Cardiologia* (Incardio) at *Santa Casa de Misericórdia* (Feira de Santana, Bahia) from July to October 2015. The inclusion criteria were patients aged over 18 years, of both genders, and undergoing cardiac surgery (coronary-artery bypass grafting [CABG], aortic and/or mitral valve procedures, or correction of atrial septal defect) via sternotomy and cardiopulmonary bypass (CPB).

We excluded patients who were unable to understand the techniques proposed in the study or who had uncontrolled arrhythmia, hemodynamic instability before or during the 6MWT (systolic blood pressure above 150 mmHg or below 90 mmHg), history of pulmonary disease, neurological and/or motor deficits, and musculoskeletal limitations that prevented the completion of the protocol, in addition to those who were readmitted to the intensive care unit (ICU), had died, or refused to sign the consent form. The study was approved

by the Research Ethics Committee of the [omitted] under the protocol number 796,580.

The information collected included the age of the participants and duration of CPB and IMV. Upon discharge, all patients underwent the 6MWT following recommendations by the American Thoracic Society.⁷ During the test, the patients were instructed to walk 30 meters as fast as they could without running. The path was marked every 3 meters, with the turnaround point marked with a cone, and the total distance covered by the patient was measured. To determine the patient's gait speed, we divided the distance walked during the test by 360, which corresponds to the number of seconds in 6 minutes. At the same time of the 6MWT, we recorded the length of hospital stay in the postoperative period to correlate this variable with the gait speed.

Statistical analysis

We used the Kolmogorov-Smirnov test to analyze the normality of the sample. As the distribution of the sample was deemed normal, we expressed continuous and categorical variables as mean and standard deviation. In order to correlate the gait velocity with the variables age, length of hospital stay, and duration of CPB and IMV, we used Spearman's correlation. An $\alpha < 5\%$ was adopted as statistically significant.

Results

A total of 64 patients with a mean age of 57.2 ± 14.06 years were included in the study, of whom 33 were males (51.5%). All participants had been admitted to the *Instituto Nobre de Cardiologia, Santa Casa de Misericórdia* (Feira de Santana, Bahia – Brazil). Table 1 shows the characteristics of the patients included in the study.

The mean length of hospital stay was 8.2 ± 2.3 days, and the mean gait speed was 0.98 ± 0.53 m/s. The length of hospital stay correlated significantly with the gait speed ($p = 0.02$), but this correlation was weak ($r = 0.27$). The duration of IMV (7.7 ± 2.9 hours) also showed no correlation with the gait speed ($r = -0.007$, $p = 0.96$). Other correlations are shown in Table 2.

Table 1 – Characteristics of the sample of patients included in the study

Variable	
Gender (n)	
Male	33 (51.5%)
Female	31 (48.5%)
Age (years)	57.2 ± 14.06
Type of surgery (n)	
CABG	44
Valvular	16
Correction of atrial septal defect	4
Duration of CPB (minutes)	71.3 ± 21.4
Duration of IMV (hours)	7.7 ± 2.9
Walk distance (meters)	375.8 ± 197.6
Walking speed (m/s)	0.98 ± 0.53
Duration of hospital stay (days)	8.2 ± 2.3

CABG: coronary-artery bypass grafting; CPB: cardiopulmonary bypass; IMV: invasive mechanical ventilation; m/s: meters per second.

Table 2 – Correlation between gait speed and the study variables

Variables	Gait speed (m/s)	
	r ^a	p value
Age (years)	-0.17	0.16
Length of hospital stay (days)	0.27	0.02
Duration of cardiopulmonary bypass (minutes)	-0.22	0.07
Duration of mechanical ventilation (hours)	-0.007	0.96

^aSpearman's correlation coefficient.

Discussion

This study demonstrated that the length of hospital stay correlated weakly with the gait speed upon hospital discharge in a sample of patients undergoing cardiac surgery.

These findings are supported by the results of another prospective cohort with a smaller sample size that aimed to evaluate the influence of the pulmonary function,

assessed by spirometry before and after surgery, on the walking ability of patients undergoing CABG and/or valvular replacement. The authors demonstrated a significant correlation between the duration of hospital stay and the distance in the 6MWT, forced vital capacity (FVC), and forced expiratory volume in 1 second (FEV1).⁸

The mean distance walked after surgery in the present study was 375.8 ± 197.6 meters, which is similar (albeit with a higher standard deviation) to that found by Oliveira et al.⁸ of 375.78 ± 50.66 meters. Our findings are also similar to those of another cohort study with a 2-year follow-up that included 215 patients undergoing CABG, in which the sedentary participants walked 375.53 ± 210.92 meters after 2 years.⁹ The 6MWT is a test well tolerated by adults and elderly patients after cardiac surgery without complications,¹⁰ and the findings of this study suggest that early mobilization and ambulation have an important role in reducing the length of hospitalization. Therefore, the implementation of early mobilization as soon as possible is of paramount importance, and the physiotherapist has a major role in this approach after cardiac surgery.^{10,11}

A retrospective survey of women undergoing CABG found a lower complication rate in those operated on without CPB compared with those who underwent the procedure with CPB.¹² Although the study has a larger sample of women and the fact that women have a higher operative mortality, the gender factor had no independent prognostic impact.¹³ Another study has suggested that an ECC duration longer than 75 minutes increased the mortality rate by 3.2 times in patients over the age of 70 years.¹⁴⁻¹⁶ In the study by Nogueira et al.,¹⁷ the results suggested that on-pump (*versus* off-pump) CABG was negatively associated with the patients' functional capacity.

Age above 60 years was an important predictor of death in this study, resulting in two score points. The EuroSCORE determines that there is an increased risk of death above the age of 60 years, with an additional point for each 5 years after this age.¹⁸ Age above 85 years is a risk that must be taken into account in patients undergoing CABG.^{15,16,19} In our study, age showed no significant correlation with gait speed.

On statistical analysis, the duration of IMV showed a poor correlation with the gait speed, which may be justified by a short time on the mechanical ventilator. A prospective study has reported that patients requiring IMV had a mean duration of ventilatory support of 7 days

and mean length of ICU stay of 13 days. This study found that half of the patients who were not extubated within 24 hours remained in the ICU for more than one week.²⁰

One of the hypotheses to explain the weak correlation between the variables in the present study is the fact that often, clinical factors such as international normalized ratio (INR) value and echocardiographic alterations may increase the length of hospital stay, but these variables do not correlate with the patient's functional capacity. Therefore, a longer length of hospitalization may be sufficient to help the patients return to their preoperative functionality and perform well during the tests.

The limitations of this study include the small sample size and the lack of information regarding the patients' pulmonary function and body mass index, which can have an impact on the completion of the 6MWT. Moreover, the study did not include a preoperative evaluation to demonstrate the progression of the gait speed during hospital stay.

Conclusion

We conclude that the length of hospital stay correlated weakly with the gait speed upon hospital

discharge in a sample of patients undergoing cardiac surgery.

Author contributions

Conception and design of the research: Cordeiro ALL. Acquisition of data: Cordeiro ALL, Peruna MP, Guimarães AR. Analysis and interpretation of the data: Borges DL, Cacau LA. Statistical analysis: Borges DL, Cacau LA. Writing of the manuscript: Cordeiro ALL, Peruna MP, Guimarães AR. Critical revision of the manuscript for intellectual content: Cordeiro ALL, Borges DL, Cacau LA.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

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