Functional assessment of inpatients in the Intensive Care Unit of the University Hospital of Canoas

Avaliação funcional de pacientes internados na Unidade de Terapia Intensiva adulto do Hospital Universitário de Canoas

Evaluación funcional de pacientes internados en la unidad de cuidados intensivos adultos de Hospital Universitario de Canoas

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ABSTRACT | Survival of critically ill patients has increased over time. However, immobility and length of hospital stay contribute to these patient's functional decline and reduction in quality of life. To assess the functional independence of patients admitted to the Intensive Care Unit (ICU) of the University Hospital of Canoas, a prospective cohort study was performed from February to December 2016. Functional capacity, muscle strength, hand grip strength, mobility, balance, and gait were assessed. 90 patients aged on average 59.6±16.1 years old were assessed, with a predominance of male individuals (51.1%). The median of length of stay in the ICU was 5 (3-9) days and the median of hospital stay was 13 (10-20) days. Functional capacity (p<0.001), mobility (p=0.004), and balance (p=0.009) significantly improved. Hospitalized patients showed functional decline (compared to normative values) in all assessments. However, all scores improved after hospital discharge.

Keywords | Physical Therapy Department; Hospital; Intensive Care Units; Disability Evaluation; Patient Discharge.

RESUMO | A sobrevida de pacientes críticos tem aumentado com o tempo. No entanto, a imobilidade e o tempo de internação estão contribuindo para o seu declínio funcional e da sua qualidade de vida. O objetivo do estudo foi avaliar a independência funcional dos pacientes internados na Unidade de Terapia Intensiva (UTI) Adulto do Hospital Universitário de Canoas.

Pesquisa de coorte prospectiva executada de fevereiro a dezembro de 2016. Os pacientes foram avaliados quanto à capacidade funcional, força muscular, força de preensão palmar, mobilidade, equilíbrio e marcha. Foram avaliados 90 pacientes com média de idade de 59,6±16,1 anos, com predominância do gênero masculino (51,1%). A mediana do tempo de internação na UTI foi de 5 (3-9) dias, e de internação hospitalar de 13 (10-20) dias. Houve melhora significativa nos resultados de capacidade funcional (p<0,001), mobilidade (p=0,004) e equilíbrio (p=0,009). Os pacientes internados apresentaram um declínio funcional (com relação à normalidade) nos momentos avaliados. Entretanto, houve melhora nos valores até momento da alta hospitalar.

Descritores | Serviço Hospitalar de Fisioterapia; Unidades de Terapia Intensiva; Avaliação da Deficiência; Alta do Paciente.

RESUMEN | La sobrevida de pacientes críticos ha aumentado con el tiempo. Sin embargo, la inmovilidad y el tiempo de internación están contribuyendo a su declive funcional y su calidad de vida. El objetivo del estudio ha sido evaluar la independencia funcional de los pacientes internados en la Unidad de Cuidados Intensivos (UCI) Adulto de Hospital Universitário de Canoas. Investigación de cohorte prospectiva ejecutada de febrero a diciembre de 2016. Los pacientes han sido evaluados en cuanto a la capacidad funcional, fuerza muscular, fuerza de prensión de mano, movilidad, equilibrio y marcha. Se evaluaron 90 pacientes con una

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media de edad de 59.6±16.1 años, con predominio del género masculino (51.1%). La mediana del tiempo de internación en la UCI ha sido de 5 (3-9) días, y de internación hospitalaria de 13 (10-20) días. Se observó una mejora significativa en los resultados de capacidad funcional (p<0.001), movilidad (p=0.004) y equilibrio (p=0.009). Los pacientes internados presentaron un declive funcional (con relación a la normalidad) en los momentos evaluados. Sin embargo, hubo mejora en los valores hasta el momento del alta hospitalaria.

Palabras clave | Servicio Hospitalario de Fisioterapia; Unidades de Cuidados Intensivos; Evaluación de la Discapacidad; Alta del Paciente.

INTRODUCTION

Technological and scientific evolution, in addition to multidisciplinary interaction, have contributed in the survival of critically ill patients. However, the incidence of complications resulting from deleterious effects of immobility in Intensive Care Units (ICUs) is related to the decline of functional independence, excessive welfare costs, decreased quality of life, and post-discharge survival[1].

The reasons for hospitalization of patients in ICUs include infectious diseases, acute myocardial infarction, unstable angina, acute respiratory insufficiency, and acute pulmonary edema. The polyneuropathies resulted from these patient's comorbidities can increase their time of Mechanical Ventilation (MV) and permanence in the ICU[2].

The prolonged hospitalization is directly associated with physical deconditioning and muscle weakness, affecting patients admitted in the ICU because of immobility[3]. In the first seven days of being confined to bed, 30% decrease in muscle strength may occur, with a 20% increase every week. This restriction results in muscle fiber changes and atrophy of the peripheral and respiratory muscle, what can hinder extubation, prolonging the need for MV[4]. To ensure a better functional status of these individuals, a multidisciplinary approach is performed, with glycemic control, adequate nutrition, care in the use of neuromuscular blockers, and early mobilization[3].

In intensive care, the first 48 hours are crucial for the prognosis of critically ill patients[5]. Early mobilization is a viable and safe procedure that aims to minimize and/or avoid the risks of prolonged hospitalization, as well as future weaknesses, and thus restore the functional capacity and independence for daily life activities, directly associated with the quality of life of patients after hospital discharge[6,7].

This study aimed to analyze the functional evolution, including mobility and muscle strength, of critically ill patients admitted to the ICU of the University Hospital of Canoas during the length of stay, also aiding the identification of the most effective therapy for each phase of hospital rehabilitation.

METHODOLOGY

Prospective cohort research approved by the Ethics and Research Committee of Universidade Luterana do Brasil (Ulbra), performed from February to December 2016 in the Intensive Care Unit of the University Hospital of Canoas, with adults of both genders and minimum stay of 24 hours in the ICU. Patients incapable to interact and/or without person responsible for at the time of the assessment, as well as transferred to other units with neuromuscular disorders, motor deficit, and functional impairment prior to hospitalization were excluded from the study, in addition to the patients which presented death during hospitalization. After signing the Informed Consent Form (ICF), the data of the patients were collected, beginning the assessments.

All patients received conventional physical therapy, being offered 2 to 3 daily sessions with the presence of physical therapists during 18 hours/day in the ICU. When sent to the infirmary, 2 sessions were held per day, during the whole period of hospitalization. Each session covers motor and respiratory physical therapy, i.e., passive and/or active exercises carried out according to the muscular strength of each patient, associated with ventilatory therapy, according to the needs of everyone.

Muscle strength was assessed 24 hours after ICU admission, ICU discharge, and before hospital discharge with the Medical Research Council (MRC). The application followed the rules of the MRC[8], which analyzes the performance of six specific movements (shoulder abduction, flexion of the elbow, wrist extension, hip flexion, extension of the knee and ankle dorsiflexion) and upper and lower limbs, bilaterally. Each muscle

group tested received a score of 0 to 5, being 0 no visible contraction progressing to active movement against gravity and maximum resistance (5 points).

The functionality was assessed 24 hours after ICU admission, ICU discharge, and before hospital discharge with the Functional Independence Measure (FIM), which includes items of self-care, transfers, feeding, locomotion, sphincter control, communication, and cognition. Each activity received a score: 1 (functional dependence), 2 (maximum assistance), 3 (moderate assistance), 4 (minimum assistance), 5 (need of supervision), 6 (moderate independence) or 7 (complete independence). The total score ranged from 18 to 126 points[9].

Hand grip strength was measured by dynamometry. Patients were positioned in supine position with bedside at 45°, holding an electronic dynamometer Camry® brand (EH101 model), and after command they held the palmar closure through a maximum voluntary isometric contraction with maintenance of 3 to 5 seconds. A verbal stimulus was given during each contraction and 3 measures with 20-minute interval were carried out, being considered the highest value as the result of the test[10]. The test occurred 24 hours after ICU admission and before hospital discharge.

Functional capacity was assessed by the six-minute walk test (6MWT) in the ICU discharge and prior to hospital discharge. Patients performed the test on a 30-meter corridor, after checking the vital signs, and oriented to walk the greatest distance possible. It was verified the distance traveled. The data were compared with predicted values that took into consideration height, age, and body weight[11].

Functional mobility was measured with the Timed Up and Go (TUG) in the ICU discharge and prior to hospital discharge. The patients began the test sited, were told to get up and roam in their own pace until a 3-meter distance from the chair, to turn around and return to the chair, sitting again. A timer was activated with the voice command "Go" and locked when the patient returned to sedestation[12].

Mobility and balance were assessed through Tinetti index, or Performance Oriented Mobility Assessment (POMA) Brazil, in the ICU discharge and prior to hospital discharge. Balance was tested and, then, the gait in a 3-meter course was analyzed. The score of each item ranged from 0 to 1 or from 0 to 2; the maximum score was 12 points for gait and 16 for balance, totaling 28 points[13].

The quantitative variables were described by mean and standard deviation or median and interquartile range. Qualitative variables were described by absolute and relative frequencies. To compare the variables over time was applied the Generalized Estimating Equation (GEE) model with Bonferroni correction to get the maximum amount of information available in each moment. This enabled, in addition to the analysis of continuous outcomes, even though the variable would not present normal distribution or sphericity, the inclusion of the full sample and avoided selection bias, even when there was no loss of information of any individual.

We used normal distribution for symmetric variables, and asymmetrical variables were assessed by gamma distribution. The comparison between the observed and predicted values was performed by Student's t-test for paired samples. The significance level adopted was 5% (p<0.05) and the analyses were held in the software SPSS, 21.0 version.

RESULTS

Figure 1 presents the selection of the sample between the period from February to December 2016: 100 patients were selected and 90 were included in the study, the rest were withdrawn following exclusion criteria. Table 1 presents the characteristics of the sample, which showed an average age of 59.6±16.1 years, predominantly composed by male individuals (51.1%). The most frequent hospitalization diagnosis was Acute Myocardial Infarction. The median of the length of stay in ICU was 5 (3-9) days and, in the hospital, 13 (10-20) days.
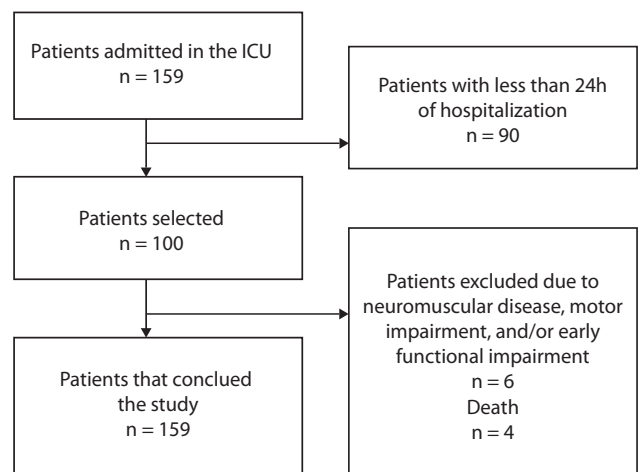

Figure 1. Flowchart of the study

Table 1. Sample characterization

Variables	n=90
Age (years)–mean±SD	59.6±16.1
Gender–n(%)	
Female	44 (48.9)
Male	46 (51.1)
Most frequent diagnoses – n (%)	
Acute myocardial infarction	30 (33.3)
Acute respiratory failure	7 (7.8)
Congestive heart failure	4 (4.4)
Stable angina	4 (4.4)
Tracheoplasty	4 (4.4)
Myocardial Revascularization Surgery	4 (4.4)
Length of stay (days) – md (P25-P75)	13 (10-20)
Duration of MV (days) – md (P25-P75)	0 (0-2)
Period in ICU (days) – md (P25-P75)	5 (3-9)
Type of airway – n(%)	
Orotracheal tube	13 (14.4)
Tracheostomy	1 (1.1)
Physiological	76 (84.4)
Death – n(%)	3 (3.3)

SD: standard deviation; MV: mechanical ventilation; ICU: intensive care unit

Regarding the outcomes of the assessments carried out during the research stages (ICU admission, ICU discharge, and prior to hospital discharge), Table 2 presents the comparison of the results, highlighting significant evolution of functionality in hospital discharge when compared to the ICU discharge. We observe increment of peripheral muscle strength after ICU discharge and functional mobility, with better results in hospital discharge. There was also progress in functional capacity and balance over time. Hand grip strength showed no significant difference in the comparison of the periods.

Results of assessments of hospital discharge were compared with predicted values of normality for the population under study. Tinetti and 6 MW tests presented greatest differences in relation to normality, demonstrating a deficit on functional capacity and balance of the patients during hospitalization. These data are described in Table 3.

Table 2. Comparison of tests at different times

Variables	ICU admission	ICU discharge	Hospital discharge	p
	md (P25-P75)	md (P25-P75)	md (P25-P75)	
TUG (s)	–	14.4 (10-23)	9.9 (8-16)	0.004
6MWT (m)	–	330 (245-390)	450 (382-476)	<0.001
TINNETTI (pts)	–	52 (44-55)	54 (50-57)	0.009
Dynamometry (kgf)	21.8 (14.8-34)	–	23.2 (13.6-32.3)	0.230
FIM (pts)	91 (61-126)[a]	110 (74-125)[a]	126 (116-126)[b]	<0.001
MRC (pts) *	48.7±8.3[a]	51.9±6.9[b]	53.6±7.4[b]	0.002

ICU: intensive care unit; TUG: Timed Up and Go; s: seconds; 6MWT: six-minute walk test; m: meters; pts: points; kgf: kilogram-force; FIM: functional independence measure; MRC: Medical Research Council
* described by mean ± standard deviation; [a,b]the same letters do not differ by Bonferroni test at 5% of significance
* Student's t Test for paired samples

Table 3. Comparison between observed values in the tests at hospital discharge with predicted values

Associations	Observed Mean±SD	Predicted Mean±SD	Difference (CI 95%)	p
6MWT	440.8±62.2	640.4±126.3	199.5 (112.7-286.4)	0.002
Tinetti	53.1±4.4	84.0±0.0	30.9 (26.8-34.9)	0.001
FIM	120.4 ±10.6	126±0.0	5.6 (-2-13.2)	0.128
MRC	54.1±7.3	60±0.0	5.9 (1.7-10.2)	0.010

SD: standard deviation; CI: confidence interval; ICU: intensive care unit; 6MWT: six-minute walk test; FIM: functional independence measure; MRC: Medical Research Council

DISCUSSION

The results showed that most individuals assessed was discharged with functional impairment. However, there was significant improvement in mobility, balance, and functional capacity. There was discreet improvement in functional independence at the time of hospital discharge, when compared to admission and discharge from ICU.

Avci et al.[14] reported the difficulty to perform the tests, such as TUG and 6MWT, in intensive care patients, comparing their application with specific scale for the ICU environment. However, they suggest the tests must be performed when once individuals are able to walk. In this research, the application of TUG produced positive results and pointed the good prognosis of these patients that showed evolution throughout the hospitalization. Denehy et al.[15] showed that the time to perform TUG and 6MWT in 177 patients after ICU discharge (average age of 60 years) has a significant association with their physical domains and, consequently, with the performance of activities of daily life: the shorter the time in the test, the higher the score on functional scales. These data corroborate the outcomes presented in this investigation, since TUG and FIM obtained scores inversely proportional in the final stages.

Functional independence was gradually rescued during hospitalization until hospital discharge. At the time of hospital discharge, most patients had achieved full independence, as in the data of Curzel et al.[9], which described improved functionality after 30 days of hospitalization. Curzel et al. showed no significant difference in the comparison between MV time, length of stay, or pathological complications. The results found by Cordeio et al.[16] proved functional loss of patients undergoing heart surgery in the ICU.

The distance walked in the 6 MWT showed significant difference (p<0.001) between the periods post-ICU and hospital discharge. However, it was possible to observe in this sample that the average distance traveled in the test was significantly lower than the predicted average distance. Considering that the hospital where this research was developed did not have a specific program of mobilization of critically ill patients in its ICU, we can see the importance of the implementation of the 6MWT, which, by measuring functional capacity, can provide the characterization of risk and promote preventive and/or therapeutic strategies. That way, we can prevent future complications and provide adequate and planned treatment. According to Burtin et al.[17], critically ill patients who performed physical therapy with cycle ergometer instead of conventional physical therapy showed a greater distance in the 6MWT prior to hospital discharge, extolling the importance of early therapy. Therefore, the results can act as motivators to therapy in the ICU, so that the benefits be even higher, since the supply of conventional physical therapy demonstrated positive results.

There are current studies in the literature documenting the effectiveness of early mobility, technique used in the intervention group of this study in relation to the best performance in the 6MWT when compared to patients who performed conventional physical therapy. According to a study conducted by Elliott et al.[18], the patients of the intervention group who received early mobilization traveled a greater distance in the 6MWT in all the assessments conducted in comparison with the control group. In general, participants of the intervention group improved the distance of the 6MWT in 27% at 8 weeks and 39% at 26 weeks of the initial assessment.

There are many studies in the literature on the application of balance tests in the elderly population, using the results as predictors of fall risk. There are surveys that seek to identify the applicability of Tinetti index in comparison with other tools of balance and gait, as occurred in a study of Knobe et al.[13], However, few studies assessed critically ill patients, in which there is proven muscle and functional imbalance. It is important to quantify the balance/gait pattern to monitor the evolution of these outcomes against the therapy offered. This study tested the hypothesis that would be decline in relation to gait and balance, verified by Tinetti index POMA Brazil. However, the results presented were considered satisfactory within the score presented by the index, while Al-Momani et al.[19], after checking the good reliability of this assessment, classified their sample by correlating the scores found in the index with

three levels of fall risk (low, moderate, and high), and 52.5% presented high fall potential. Thus, this research suggests, in a subsequent application, the use of data from Tinetti index also in these levels, complementing the use of findings with their classification, aiming at the prevention of aggravations.

Muscular strength presented deficit in the admission, as a study under the influence of early mobilization in patients submitted to prolonged MV, which showed higher risks of mortality in post-discharge follow-up. The trend to recovery in the stages post-ICU and hospital discharge, represented in this study, differs from Parry et al.[20], who achieved average score of 36 points in the assessment of muscle strength in patients admitted to the ICU. As for the review of Hermans et al.[21], about muscle weakness acquired in the ICU, reiterates the existence of loss and/or deterioration of muscle fibers during the period of immobility. Therefore, the use of a viable and secure score as the MRC allows the registry of the comparison of muscle strength of this population over time, allowing quantifying the deleterious effects caused by the intensive therapy.

The decreased hand grip strength was hypothetically expected in this study, however, the results found were not significant. Fernandes et al.[22] proved that the peripheral muscle fatigue may directly interfere on the outcome of the dynamometry, correlating reduced levels of strength to the period of prolonged inactivity. The study of Cottereau et al.[23] associates fatigue with difficult weaning of the MV and prolonged stay in the ICU. Thus, in this research, this instrument that acts as predictor and prognosis assistant relates inversely with the data of the studies cited, in the extent that proves increment not only in this outcome, but also in other assessments, from the reduction of exposure to immobility (UTI), demonstrating the possibility of functional recovery. It is interesting to highlight that patients accompanied in the study received conventional physical therapy monitoring offered by the hospital, which varied from 3 to 2 daily sessions, during stay in the ICU and in the infirmary, respectively.

Among the limitations of this study, we highlight the reduction in the number of beds in the hospital during the period of study, as well as the profile of patients admitted to the ICU: most chronic patients, often suffering from neuromuscular diseases or with previous orthopedic trauma, being excluded from the sample.

CONCLUSION

The study assessed the functional independence of patients admitted to the ICU in the University Hospital of Canoas, who showed functional decline in the moments assessed when compared to normative data. However, there was recovery at the time of hospital discharge, regarding the admission and discharge from the ICU.

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