Original Article

Correlation of sociodemographic and clinical factors with changes in functionality in hospitalized children

Correlação dos fatores sociodemográficos e clínicos com alterações da funcionalidade em crianças hospitalizadas

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ABSTRACT | INTRODUCTION: The development of functional changes is common in children who have been in intensive care conditions. The Functional Status Scale (FSS) is a scale that aims to assess the functionality of hospitalized pediatric patients. **OBJECTIVE:** To verify the correlation of sociodemographic and clinical factors with the functional changes of children submitted to PICU admission. **MATERIALS AND METHODS:** A cohort study with children admitted to a PICU. The FSS assessed functionality on admission and discharge from the unit. New disability was defined as a change in FSS ≥ 1 and severe disability as a FSS ≥ 3. Data were evaluated using the SPSS version 17.0 program. Pearson and Spearman's test was used for correlation analysis. The level of statistical significance adopted was p <0.05. **RESULTS:** 43 children participated in the study; 51.2% were male, with a median age of 15 (1-144) months. The main reason for hospitalization was respiratory discomfort 12 (27.9%), and the most frequent previous comorbidity was neurological (37.3%), followed by cardiovascular (11.8%). Significant correlations were observed between new disability and previous vascular disease (p <0.000), new disability and hospitalization due to vascular changes (p <0.000), and severe disability and previous cardiovascular disease (p = 0.005). **CONCLUSION:** The development of functional changes can occur in children after admission to the PICU. The previous presence of vascular disease and heart disease, and hospitalization due to vascular changes are associated with a functional worsening at hospital discharge.

KEYWORDS: Intensive care units pediatric. Child hospitalized. Functional performance. Morbidity.

RESUMO | INTRODUÇÃO: O desenvolvimento de alterações funcionais é comum em crianças que estiveram em condições de terapia intensiva. A *Functional Status Scale* (FSS) é uma escala que tem por objetivo avaliar a funcionalidade de pacientes pediátricos hospitalizados. **OBJETIVO:** Verificar a possível correlação de fatores sociodemográficos e clínicos com as alterações funcionais de crianças submetidas à internação na UTIP. **MATERIAIS E MÉTODOS:** Estudo coorte com crianças admitidas em uma UTIP. A funcionalidade foi avaliada pelo FSS na admissão e na alta da unidade. Nova incapacidade foi definida como mudança no FSS ≥ 1 e incapacidade grave como mudança no FSS ≥ 3. Os dados foram avaliados pelo programa SPSS versão 17.0. O teste de Pearson e Spearman foi empregado para análise de correlação. O nível de significância estatística adotada foi de p < 0,05. **RESULTADOS:** Participaram do estudo 43 crianças, sendo 51,2% do sexo masculino, com mediana de idade de 15 (1-144) meses. O principal motivo de internação foi desconforto respiratório 12 (27,9%) e a comorbidade prévia mais frequente foi a neurológica (37,3%), seguida de cardiovascular (11,8%). Foram observadas correlações significativas entre nova incapacidade e doença vascular prévia (p<0,000); nova incapacidade e internamento por alteração vascular (p<0,000) e incapacidade grave e doença cardiovascular prévia (p=0,005). **CONCLUSÃO:** O desenvolvimento de alterações funcionais pode ocorrer em crianças após internação na UTIP. A presença prévia de doença vascular e doença cardíaca, além do internamento por alteração vascular, estão associados a uma piora funcional na alta hospitalar.

PALAVRAS-CHAVE: Unidade de Terapia Intensiva Pediátrica. Criança hospitalizada. Desempenho funcional. Morbidade.

Submitted 03/23/2021, Accepted 10/05/2021, Published 05/26/2021
J. Physiother. Res., Salvador, 2021 May;11(2):361-367
http://dx.doi.org/10.17267/2238-2704rpf.v11i2.3741 | ISSN: 2238-2704
Designated editors: Kátia Sá e Cristiane Dias

How to cite this article: Jesus LG, Andrade MCB. Correlation of sociodemographic and clinical factors with changes in functionality in hospitalized children. J Physiother Res. 2021;11(2):361-367. http://dx.doi.org/10.17267/2238-2704rpf.v11i2.3741

Introduction

Assistance in Pediatric Intensive Care Units (PICUs) has undergone several transformations over the years.[1-3] With technological advances and improved care, there was a reduction in mortality rates in most PICUs, but in contrast, recent studies have shown an increase in morbidity rates after hospitalization in these units.[1-3] Due to these changes and assessing survival, researchers are increasingly interested in functional outcomes after admission to the ICU.[2,3] Given this information, it is known that the objective of the care teams in the PICUs is not restricted to saving lives but also to carry out actions to prevent morbidities and preserve function.[2]

The hospital is an environment that offers a certain deprivation to the fundamental stimuli for child development.[4,5] Prolonged hospital stay generally leads to reduced functionality, and this change may be related to the underlying disease or associated with other factors, such as the care administered in the PICU.[4,5] The literature reports that the decline in functionality, including physical, psychosocial, and neuro-cognitive deficits, is common in children who were in intensive care conditions.[2-4] After discharge from the PICU, the disabilities and limitations presented by children affect their performance and overall development, whether in the physical, cognitive, emotional and / or social dimension.[4,5]

Therefore, it is of great importance to use instruments that assess the functionality of hospitalized children.6-8 The application of these instruments allows the early identification of children most likely to develop changes in functionality, which favors more consistent treatment and rehabilitation strategies.[6,7] Most of these instruments are not yet available in Brazil, as they are not validated for the Portuguese language.

Recently, a specific instrument for assessing functionality, the Functional Status Scale (FSS), has gone through the validation process in the Brazilian population and has since been widely used.[6,9,10] This instrument was developed on a conceptual basis in scales of activities of daily living and adaptive behavior, and its objective is to assess the functional outcomes of hospitalized pediatric patients.6,9,10 The FSS is an appropriate instrument for a wide age group, considered easy to apply, low cost, and reliable.[6,8,9]

Given the importance of a better understanding of changes in functionality during the child's hospitalization process, this study aimed to verify the correlation of sociodemographic and clinical factors with the functional changes, measured by the FSS, of children submitted to PICU admission.

Materials and methods

This is an observational, prospective cohort study whose population was composed of children admitted to a PICU. Children of both sexes, aged between 29 days and 15 years of age, on spontaneous ventilation and who were not under continuous use of sedatives or anticonvulsants in doses higher than usual, were included in the study, and children readmitted to hospital were excluded from the study. PICU in a period ≤ 24 hours after discharge from the unit. The sample was constituted by convenience.

Primary data related to the functional aspect were collected through the investigation form, and secondary data, sociodemographic and clinical, came from the patients' medical records. Data collection was carried out at the PICU between February and April 2020 by previously trained physiotherapists from the service. Upon admission to the PICU, the research was presented to the person in charge, in case of agreement with the purposes of the study and after signing the Informed Consent Form (ICF), a form was filled out with the medical record baseline data. Then, the FSS was applied to identify the child's level of functionality when admission to the PICU. The FSS was also applied when the unit was discharged.

As sociodemographic variables, gender was included, categorized as female and male and age in months. Clinical variables refer to previous comorbidities, described in: neurological, cardiac, renal, vascular disease, previous abdominal surgery and multiple comorbidities (in the presence of two or more comorbidities) and the reason for hospitalization in the PICU as respiratory discomfort, postoperatively general pediatric surgery, post-operative neurosurgery, lowering the level of consciousness and vascular changes.

The FSS was developed to assess the functional status of hospitalized patients, it is composed of six domains: mental status, sensory functioning, communication, motor functioning, food and respiratory status, the score per domain ranges from 1 (normal) to 5 (very dysfunction) serious). Therefore, its overall score can vary from 6 to 30 points, the higher the score the worse the functionality.The global score can still be categorized as follows: adequate functionality, in scores ranging from 6 to 7; mild dysfunction of 8 to 9 points; moderate dysfunction between 10 and 15 points; severe dysfunction of 16 to 21 points and above 21 will be considered very severe dysfunction.[6,9,10] According to the study by Williams et al.[11], new disability was defined as a change in the FSS ≥ 1 and severe disability as a change in the FSS ≥ 3, this variable aimed to show the individuals who had functional changes by the FSS, regarding it concerns the score of admission and discharge.

The Statistical Package for the Social Sciences (SPSS) version 17.0, was used to structure the data spreadsheet and statistical analysis. The numerical variables were presented in median and interquartile range and the categorical variables were presented in absolute terms and relative frequency. For this study, a Pearson correlation was performed between sociodemographic and clinical variables with the functional changes assessed by the FSS. P <0.05 was considered statistically significant.

This study is part of a parent project and is approved by the Ethics and Research Committee. According to Resolution 466/12 of research involving human beings, all participants or responsible family member signed the informed consent form.

Results

The study included 43 children admitted to the PICU in Salvador, Bahia, 51.2% of whom were male, with a median age of 15 (1-144) months. The median length of stay was 6 (1-27) days. Regarding the main reasons for hospitalization, 12 (27.9%) participants had respiratory distress, 8 (18.6%) after pediatric surgery, and 6 (14%) after neurosurgery. The most frequent previous comorbidity was neurological disease (37.3%), followed by heart disease (11.8%) and kidney disease (9.8%) (Table 1).

Regarding the global FSS score, on admission, the sample had a median of 14 (6-26) points, indicating then moderate dysfunction. At hospital discharge, the median of the global score decreased to 9 (6-24) points, characterizing the sample as mild dysfunction (Table 1). Upon admission, the researchers showed that most participants had severe dysfunction 14 (32.6%), on the other hand, at the time of hospital discharge, the majority, 19 (44.2%), had adequate functionality, thus showing an increase in the number of children with improved functionality at discharge from the unit (Table 2). Concerning functional changes, the present study showed that 9.3% of the children had a functional worsening at discharge, and among these, 1 (2.3%) presented a new disability (change in the FSS ≥ 1), and 3 (7%) had a severe disability (change in FSS ≥ 3) (Table 1).

When correlating sociodemographic and clinical variables with functional changes, significant associations were observed between new disability and previous vascular disease (p <0.000); new disability and hospitalization due to vascular changes (p <0.000); and severe disability and previous cardiovascular disease (p = 0.005) (Table 3).

Table 1. Sociodemographic, clinical and functional characteristics of children admitted to a PICU, 2020

Variables	Total population (n = 43)
Male, n (%)	22 (51,2)
Age (months), median (IR)	15 (1-144)
Length of ICU stay (days), median (IR)	6 (1-27)
Reason for hospitalization, n (%)	
Respiratory discomfort	12 (27,9)
Postoperative pediatric surgery	8 (18,6)
Neurosurgery postoperative	6 (14)
Lowering the Level of Consciousness	5 (11,6)
Shock and sepsis	4 (9,3)
Vascular changes	2 (4,7)
Others	6 (14)
Previous comorbidities, n (%)	
Neurological Disease	19 (37,3)
Heart disease	6 (11,8)
Kidney disease	5 (9,8)
Vascular disease	3 (5,9)
Previous abdominal surgery	2 (3,9)
Respiratory disease	1 (2)
Others	4 (7,8)
Multiple comorbidities	4 (7,8)
No previous comorbidity	7 (13,7)
Global FSS score on admission, median (IR)	14 (6- 26)
Global FSS score at discharge, median (IR)	9 (6- 24)
Functional changes (change in FSS)**,** n (%)	4 (9,3)
≥ 1	1 (2,3)
≥ 3	3 (7)

Table 2. Classification of FSS on admission and discharge from a PICU, 2020

FSS Classification	Admission (n=43)	discharge (n=43)
6-7 proper functionality, n (%)	6 (14)	19 (44,2)
8-9 mild dysfunction, n (%)	8 (18,6)	3 (7)
10-15 moderate dysfunction, n (%)	11 (25,6)	11 (25,6)
16-21 severe dysfunction, n (%)	14 (32,6)	8 (18,6)
> 21 very serious dysfunction, n (%)	4 (9,3)	2 (4,7)

Table 3. Correlation between sociodemographic and clinical variables with the functional changes of children hospitalized in a PICU, 2020

Variables		p-value
New disability	Previous vascular disease	p<0,000
	Hospitalization due to vascular alteration	p<0,000
Severe disability	Previous heart disease	p=0,005

Discussion

The present study results suggest that the development of new disability and severe disability can occur in children who have been admitted to the ICU. A similar result was found in the multicenter study by Pollack et al.[3], whose objective was to investigate the development of new disability (increase in FSS ≥ 3) associated with pediatric intensive care through the application of FSS the incidence of new disability was 4.8%.

The literature reports higher rates of acute illness after discharge from the PICU, such as the study in the study by Williams et al.[11], where a presentation of new disability (change in FSS ≥ 1) and severe disability (change in FSS ≥ 3) were commonplace in pediatric patients with primary neurological diagnosis, affecting 35% and 13% of its population, respectively, upon discharge from the PICU. When compared to the number of changes found in the present study, this high frequency may be related to existing differences concerning the PICU specialty, technological support, and the profile of the patients obtained, which changes according to the specificity of each region.

Recent studies show that some variables such as the reason for admission to the PICU and previous comorbidity can significantly influence the functional status of patients admitted to these units.[3,10-13] Pollack et al.[3], reported that the presence of new disability (FSS ≥ 3) at discharge from the PICU occurred more frequently in children with primary neurological diagnosis (7.3%), acquired cardiovascular disease (5.9%), and disease congenital cardiovascular disease (4.9%), rates were significantly different between groups (p = 0.003). In the present study, a similar result was observed with the literature, since a significant association was found between the presence of previous vascular disease, hospitalization due to vascular alteration, and the development of new disability, as well as the presence of previous heart disease and the development of severe disability. In the study by Typpo et al.[14], the researchers found that children with chronic heart disease have a higher incidence of multiple organ deficiency syndromes during ICU stay when compared to children with other chronic diseases and children without chronic diseases; this clinical finding may justify the worst functional outcome presented for this patient profile at discharge from the unit.

In the present study, although most of the sample had neurological diseases as the previous comorbidity, there was no statistically significant association of this category with the development of a new disability or severe disability. That can be explained by the study by Mestrovic et al.[12], which aimed to assess the functional outcome of patients treated in a PICU using the Pediatric Overall Performance Category. The researchers found that children with previous neurodevelopmental changes had a significantly worse pre-admission functional score and therefore did not suffer as much functional deterioration during hospitalization compared to children without chronic diseases and children with other not-so-serious chronic diseases.

Regarding the time of exposure in the PICU, the literature reports that this variable presents a probability with the necessary losses at the time of discharge, indicating that the longer the period of exposure to this environment, the greater will be, according to the necessary losses.[3,10-13] The median number of days of hospitalization found in the present study is similar to that reported in the study by Danneberg[13], who in turn had a median of 5 (3-10) days, in addition to finding a limit of this with a variable with corrected losses at discharge from the unit in all patients (p = 0.000). Despite this finding, the length of hospital stay with changes in functionality was not likely to be observed in the present study. The child's age is also pointed out as a factor that interferes with functionality. Pollack et al.[3] reported the presence of a new disability in all age categories, being more frequent in children younger than 12 months, with a statistically significant difference between groups (p <0.0001). No association was found between new disability and age; this may be due to fewer participants.

Finally, the present study results suggest that although there are functional changes in this profile of children, admission to the PICU does not determine a worsening of functionality since there was a reduction in the number of children with functional worsening at discharge. This finding differs from that found in the literature, which points to a worse functional status at the time of discharge from the PICU compared to the functionality assessed by the FSS on admission.[3,13] This mismatch may have occurred because most studies had assessed the child's functional level before hospital admission, unlike the present study, which assessed the functional state at the time of admission, where the child could already have functional changes resulting from the acute condition that motivated his hospitalization. In addition, in the studies mentioned above, the assessment and classification of functional conditions before admission to the PICU was obtained through the report of parents and caregivers, which may contain a tendency to overestimate the children's conditions.

As a limitation of the present study, the sample comes from a single service and is selected in a non-probabilistic way, and may not reflect other regions' real-life and health conditions. In addition, the FSS was not classified by domains, which would allow a more detailed assessment of the functional profile of these children. It is also necessary to consider the sample size and that the significant association found in the present study concerning the new disability represents the condition of only one child.

Conclusion

In the present study, we identified that the development of functional changes can occur in children who have been admitted to the PICU and that there is a statistically significant association between new disability and previous vascular disease; new disability and hospitalization due to vascular changes; and severe disability and previous heart disease. Identifying and understanding the subtle changes in the FSS is important to detect the profile of patients at risk for developing functional problems, thus providing better recovery and rehabilitation strategies. Therefore, it is necessary to develop multicenter studies with a larger number of participants, prioritizing probabilistic sampling to investigate in more detail and the long-term functional changes developed by children during hospitalization.

Authors 'contributions

Jesus LG participated in data collection, search and statistical analysis of research data, interpretation of results, and scientific article writing. Andrade MCB participated in the design, data collection, interpretation of results, and guidance in writing the scientific article.

Conflicts of interest

No financial, legal, or political conflicts involving third parties (government, companies and private foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to grants and funding, participation in advisory council, study design, preparation manuscript, statistical analysis, etc.).

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