

Unplanned transfer of pediatric patients from the general ward to the intensive care unit

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ABSTRACT

Introduction. During hospitalization, patients may develop significant clinical deterioration and require unplanned admission to the pediatric intensive care unit (PICU). This may result in increased morbidity and mortality. These events are often preceded by a deterioration phase that may go unnoticed.

Objective. To determine the frequency, analyze the causes, and describe the clinical characteristics and outcomes of unplanned transfers of hospitalized pediatric patients from the general pediatric ward (GPW) to the PICU, and analyze the differences between urgent and emergent transfers.

Population and methods. Prospective, descriptive study; all unplanned transfers from the GPW to the PICU occurring between January 1st, 2014 and December 31st, 2019 were analyzed.

Results. There were 212 unplanned transfers (21 transfers per 1000 admissions). An associated comorbidity was present in 76% of transferred patients –being cancer the most frequent one (36%)– and they had been hospitalized for more than 24 hours in the GPW. The most frequent causes of transfer were respiratory distress (43%), sepsis (20%), and neurological/neurosurgical complications (20%). The overall mortality rate was 8.96% (19 patients).

Conclusions. The analysis of unplanned transfers is a critical component in the assessment of the quality of care and patient safety of an area, and should be an indicator integrated into the control panel. The interpretation of unplanned transfers as a preventable event is a key paradigm shift.

Key words: patient transfer; pediatrics; indicators of health care quality.

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INTRODUCTION

During hospitalization, patients may develop significant clinical deterioration and require unplanned admission to the pediatric intensive care unit (PICU). This may result in increased morbidity and mortality.¹ These events are often preceded by a deterioration phase that may go unnoticed² and be a precursor to cardiac arrest. According to different publications, mortality due to in-hospital cardiac arrest in the pediatric population outside the PICU may reach 50–67%.^{1,2}

Miles et al. found that almost one-third of all unplanned transfers to the PICU were associated with adverse events, and 35% of these were considered preventable.³ Thus, the analysis of such transfers is a measure of patient safety and an indicator of quality.^{4,5}

Few studies have analyzed unplanned transfers to a higher level of care due to clinical deterioration, their causes, and the clinical profile of these pediatric patients.

OBJECTIVE

To determine the frequency, analyze the causes, and describe the clinical characteristics and outcomes of an unplanned transfer of hospitalized children, from the general pediatric ward (GPW) to the PICU, and analyze the differences between urgent and emergent transfers.

POPULATION AND METHODS

This was a prospective, descriptive study that analyzed all unplanned transfers that occurred between January 1st, 2014 and December 31st, 2019 at Hospital Universitario Austral, from the GPW to the PICU (that offers the highest level of care).

Unplanned transfer was defined as an episode of unexpected clinical deterioration of a patient admitted to the GPW that required to be transferred to the PICU, as opposed to a transfer planned in advance, whether preventive or elective, following a procedure.

Inclusion criteria: patients aged 18 years or younger admitted to the GPW who were transferred to the PICU on an unplanned basis.

Definition of emergent transfer: a patient transferred to the PICU who required inotropic agents and/or mechanical ventilation (MV) within 60 minutes of the transfer.

Definition of urgent transfer: an unplanned transfer that was not emergent.

Definition of associated comorbidity or

morbidity: presence of 2 or more disorders or diseases occurring in the same person, with potential interaction, that may worsen their course.

Analyzed data included demographic variables, comorbidities, reason for transfer, length of stay in the GPW before transfer, length of stay in the PICU from the transfer event to discharge from the PICU, length of stay from the transfer event to hospital discharge, critical interventions performed, and mortality. To estimate mortality, the Pediatric Index of Mortality 2 (PIM2) was used, which takes into account aspects related to the patient's condition prior to admission to the PICU and is not affected by the treatment received during the first 24 hours after admission to the unit. An overall analysis and an analysis of the differences in results in the group of patients who required urgent or emergent transfer were done.

Categorical variables were expressed as percentage and rate, and the χ^2 test was used to analyze the statistical association. Continuous variables were expressed as absolute numbers and analyzed using the t test. A multivariate analysis of survival was also performed applying the Cox regression model, and the different hazard ratios (HR) were estimated.

The data were anonymized, and the study was approved by the Institutional Review Board.

RESULTS

The total of 9877 admissions to the GPW during the study period were analyzed, and 212 unplanned transfers to the PICU were found, with a rate of 21 transfers per 1000 admissions. The median age of transferred patients was 2 years (8 days to 18 years), with a similar distribution between sexes (50.94% were male and 49.06%, female). There were 29 (14%) emergent transfers and 183 (86%) urgent transfers. *Table 1* shows the overall and detailed analysis of emergent and urgent transfers.

An associated comorbidity was present in 76% of the patients requiring an unplanned transfer (*Figure 1*); the most frequent one was cancer (36%).

Of the patients transferred on an unplanned basis, 76.88% had been hospitalized in the GPW for more than 24 hours, and the average length of stay in the PICU was 10.77 days.

Overall and most frequently, the causes of transfer were respiratory distress (43%), sepsis (20%), and neurological/neurosurgical

TABLE 1. Overall analysis of patients transferred on an unplanned basis

Sex M/F (%)	50.94/49.06
Age, median (range)	24 months (8 days–224 months)
Total unplanned transfers, n (%)*	212 (2.14)
Unplanned emergent transfers, n (%)	29 (14)
Unplanned urgent transfers, n (%)	183 (86)
Length of stay in the PICU, mean (SD)	10.77 days (12.5)
Overall mortality, n (%)	19 (8.96)
Mortality among emergent transfers, n (%)	8 (27.6)
Mortality among urgent transfers, n (%)	11 (6)
Presence of associated comorbidities (%)	75.95
Length of hospitalization before transfer, n (%)	
< 12 hours	16 (7.54)
≥ 12 and ≤ 24 hours	33 (15.56)
> 24 hours	163 (76.88)
Length of stay in days between transfer and hospital discharge, median (range)	13 (1–145)
PIM2/Probability of mortality	
Overall	-3.86/5.93
Emergent transfers	-2.39/17.35
Urgent transfers	-4.09/4.12
Survival (HR/95% CI)	
Unplanned emergent transfers	6.48/2.18–19.20
Patients with cancer	6.72/2.02–22.26

*: percentage of total admissions for the study period.

SD: standard deviation.

PIM2: Pediatric Index of Mortality 2.

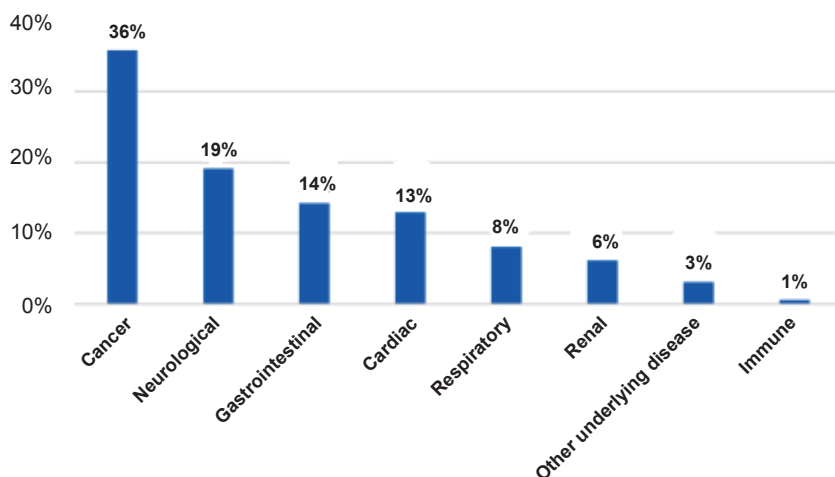
HR: hazard ratio.

CI: confidence interval.

complications (20%). The differential analysis based on the type of transfer shows that, in the case of urgent transfers, respiratory causes accounted for 46%; neurological/neurosurgical causes, for 21%; and sepsis, for 14%. In the case of emergent transfers, sepsis was the leading cause with 59%; respiratory causes accounted

for 21%; and neurological/neurosurgical causes, for 14%.

The overall mortality rate of transferred patients was 8.96% (19 patients), but a significant difference ($p = 0.006$) was observed when mortality was analyzed in the group of patients who required an emergent transfer (27.6%)

FIGURE 1. Percent distribution of patients with an underlying disease

versus an urgent transfer (6%). The difference in the PIM2 value according to the type of transfer was not statistically significant.

The main overall causes of transfer among patients who died were sepsis (42%), respiratory failure (21%), and heart failure (16%). In the group of patients requiring an emergent transfer, the main cause was sepsis (75%); whereas, in the group of urgent transfers, the main cause was respiratory failure (36%). In relation to their underlying diseases, overall and most frequently, the patients who died had cancer (53%), followed by congenital heart disease (21%).

In the survival analysis (*Table 1*), patients who required an emergent transfer had a higher risk of mortality (HR: 6.48, 95% CI: 2.18–19.2), as did those with underlying cancer (HR: 6.72, 95% CI: 2.02–22.26).

DISCUSSION

Although it is difficult to predict a patient's clinical course, the analysis of transfers helps to identify those at a greater risk for deterioration, allowing the health care team to implement a better approach, with a higher level of alertness.

Patients transferred to the PICU on an unplanned basis show a rapid disease progression and deterioration. Previous studies have demonstrated that they are associated with worse outcomes, an increased mortality, and a longer length of hospital stay.^{3,6,7} According to Odetola et al.,⁷ the mortality rate of patients transferred to the PICU from the GPW was 9.8% versus 3.7% in those transferred directly from the pediatric emergency department and 2.2% in those admitted from the operating room following an elective surgery. They also found that patients transferred from the GPW to the PICU had almost twice the risk of mortality compared to those transferred from the pediatric emergency department (odds ratio [OR]: 1.65, 95% CI: 1.08–2.51; after adjustment for disease severity) and that the length of stay in the PICU was 3.6 days for patients transferred from the emergency department versus 6.2 days for those transferred from the GPW.⁷

In our study, the overall mortality in the PICU was 3.73% in the study period and is similar to that published by the United States Society of Critical Care Medicine (2–6%).⁸ However, the overall mortality in the group of patients that needed an unplanned transfer was higher (8.96%), which is consistent with the findings of other authors,^{3,6,7} thus demonstrating a significant

difference between the group of patients who required an emergent versus an urgent transfer. This contrasts to the findings of Nadeau et al.,⁹ and Mansel et al.,¹⁰ who did not observe an increased mortality in patients requiring an unplanned transfer.

It is also worth highlighting that, in our population, the group of transferred patients who had underlying cancer had the highest risk of mortality.

Although no differences were observed in the average length of stay in the PICU in both groups of transferred patients (10.77 days), it was slightly longer than the overall average length of stay of 8.09 days for all patients hospitalized in the same period in the unit.

In relation to the reasons for transfer, overall, the most common was for respiratory causes (43%), similar to what has been observed by other authors.⁴ However, respiratory causes were not associated with the highest mortality rate; sepsis was the first overall cause of death in our patients. The latter is probably related to the fact that 36% of transferred patients had underlying cancer.

Most transferred patients had been hospitalized for more than 24 hours in the GPW. Although they had a non-preventable underlying condition, most likely, their clinical deterioration was not adequately perceived. Considering an unplanned transfer as a preventable event is a key paradigm shift.

In relation to the PIM score, the probability of mortality was 17.35% among the patients who required an emergent transfer and 4.12% among those who required an urgent transfer. For the same period, the PIM score of all patients admitted to the PICU was -4.76 and the probability of mortality was 3.24%. This should alert the intensive care team about patients coming from the GPW, in view of what has been observed by us and by other authors in relation to a higher mortality risk in this group of patients.

Bapoje et al., assessed 152 patients with unplanned transfer to the ICU and found that errors in care accounted for 19% of these transfers and that most were due to inadequate categorization upon admission (triage).^{11,12} In our hospital, 24% of emergent transfers (7 patients) between 2014 and 2016 occurred at ≤12 hours of admission to the GPW. We believe that this subgroup of patients could have implied a clinical evaluation error in the Emergency Department that led to their subsequent assignment of their wrong place of hospitalization; i.e., these patients

arrived to the GPW with a critical illness and should have been assigned from the beginning to the PICU as the most appropriate place of hospitalization. Since 2014, the analysis of patients who underwent unplanned transfers has been included in the GPW control panel and is considered a quality indicator analyzed on an ongoing basis. Since 2017, no emergent transfers with less than 12 hours of stay in the GPW have been recorded; therefore, it is possible that this was related to the joint analysis of cases and the better recognition and intervention in the Emergency Department.¹³ In any of the health care areas, this concept of early recognition must be implicit in situational awareness, which is defined as “the perception of environmental elements with respect to time and space, the comprehension of their meaning, and the projection of their future status.”^{2,14}

The analysis of unplanned transfers is a critical, triggering component in the assessment of an area’s quality of care and patient safety, which allows to identify adverse events and should be an indicator integrated into the control panel.^{3,15,16} It has also been pointed out that the transition of care from one area to another exposes patients to greater risks (delays in medication administration, oxygen supply, loss of venous access, extubations, failure of battery-powered medical equipment, etc.);¹⁷ and there is also an intense use of resources (especially health care staff) in both the GPW and the PICU, which results in “collateral damage” to the rest of the patients hospitalized in the same area, due to relative neglect, with a greater risk of deterioration of the patients in the same ward, as well as a delay in hospital discharge for patients who were in a position to be discharged.^{10,18} The latter, although beyond the scope of analysis of our study, exposes additional considerations that should be taken into account in relation to unplanned transfers. To decrease these events outside the PICU, different strategies have been designed, such as rapid response teams, early warning scores,^{19,26} and bedside nursing observations, which are essential because they are the first step to identify signs of clinical deterioration.

This study has some weaknesses. Unplanned transfers to the PICU are an uncommon event that occurred in 2.1% of all admissions. This restricted our study population to 212 patients over the course of 6 years and, therefore, may have limited our ability to detect a difference, if actually

present. Since this study was conducted at a single site, it is not clear whether other hospitals have the same thresholds for unplanned transfers to the PICU, so further studies are required to better assess which unplanned transfers to the PICU may be potentially predictable and/or preventable.

CONCLUSIONS

The analysis of unplanned transfers is a critical component in the assessment of the quality of care and patient safety of an area, and should be an indicator integrated into the control panel. The interpretation of unplanned transfers as a preventable event is a key paradigm shift. ■

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