

Rapid Transfer to the Pediatric Intensive Care Unit after Admission from the Emergency Department: Role of the Pediatric Early Warning Score

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ABSTRACT

Background: Admission decisions in the emergency department (ED) can be challenging. Admitting a patient to a general inpatient unit who then quickly requires transfer to an intensive care unit (ICU) generates stress and safety concerns for staff, patient and family.

Objective: Our study sought to identify predictors via the PEWS at the time of admission from the ED of patients likely to require rapid transfer to the ICU. Pediatric Early Warning Scores (PEWS) can predict patients at risk for clinical deterioration. We hypothesized that PEWS obtained prior to admission could be predictive of need for transfer, and that PEWS would increase in patients requiring ICU transfer.

Design/Methods: We retrospectively reviewed charts of patients requiring transfer to the ICU within 10 hours of admission. 73 case patients were identified, control patients were matched by age and diagnosis and PEWS were calculated. Scores were compared between the case and control groups.

Results: The PEWS for case patients in the ED were higher than those for controls ($p=0.026$). PEWS on admission remained higher for cases than controls. On transfer to the ICU, PEWS for the case group had increased to a median of 4 with IQR of 5.

Conclusion: This review demonstrates that elevated PEWS do correlate with need for ICU transfer, however, the level of the score is less than might be expected. With patients requiring rapid transfer to the ICU having a median PEWS of only 2 in the ED, it is likely not practical to use this as a tool to request ICU evaluation while still in the ED.

Keywords: Pews- pediatric early warning scores

INTRODUCTION

Determining disposition for patients in the emergency department (ED) can be challenging. Once the decision is made to admit a patient to the hospital, there often still remains uncertainty about their appropriate destination within the hospital. In many instances, it is difficult to assess the level of inpatient care a patient will require. From the ED, decisions to predict the level of care required are made based on limited information and only a small amount of time to observe the trajectory of the patient's illness. Admitting a patient to a general inpatient unit who then quickly requires transfer to an intensive care unit (ICU) generates stress and safety concerns for both the hospital staff and for the patients

and their families. In critically ill children at risk for deterioration, early recognition is critical for improving outcomes. Likewise, admitting a patient to an ICU who does not require this level of care creates anxiety for patients and families as well as staffing and financial concerns [1].

The Pediatric Early Warning Signs (PEWS) scoring system was designed using expert opinion in an effort to create a reliable, objective scoring system to identify children at risk of clinical deterioration that might result in need for cardiopulmonary resuscitation [1]. Multiple studies have sought to validate this scoring [2]. This scoring system can identify children at risk for need for acute intervention or ICU admission with at least one hour notice.

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The score evaluates patients and gives a score of zero to three in three categories: cardiovascular, respiratory and behavioral. Patients also receive additional points if they are receiving continuous nebulized albuterol or have persistent post-operative vomiting. The PEWS has been validated for use in inpatients, but there is limited literature on its use in the ED prior to admission. One study found that PEWS in the ED could predict level of care required⁴, but did not study the outcome of these patients after admission [3].

In this study, we sought to identify predictors via the PEWS at the time of admission from the ED of patients likely to require rapid transfer to the ICU. We hypothesized that PEWS obtained prior to admission could be predictive of need for transfer, and that PEWS would increase in patients requiring ICU transfer.

LITERATURE REVIEW

This study focused on pediatric patients transferred to the ICU within 10 hours of admission to a general inpatient unit from a single pediatric ED. Nemours/AI duPont Hospital for Children is a suburban, tertiary care children's hospital with an annual ED census of approximately 50,000. Patients having a rapid transfer to the ICU were identified electronically via EPIC electronic medical records (EMR) and tracking system (Epic Systems Corporation, Verona Wisconsin) and QlikView (Qlik Tech International, Radnor, PA).

We extracted these patients via retrospective chart review from a consecutive 54 month period. Patients were excluded if they were direct admissions and did not go through the ED. We extracted patient data including age, sex, admitting diagnosis, discharge diagnosis, date of admission, date of discharge from the hospital, vitals at presentation to the ER, time of last vitals at transfer from the ER to the floor, and time of vitals prior to discharge. From the EMR, 73 patients were identified and then matched by age and diagnosis with 73 control patients who were admitted from the ED and did not require an ICU transfer. Controls were selected from the EMR as next age-matched patient (within 10% of age of case) admitted from the ED to the general inpatient unit with the same diagnosis. A retrospective PEW score was given to each patient prior to ED departure, on admission to the floor, and for the case group, at time of ICU transfer. Scores were compared between the case and control groups at each time point. We analyzed collected vital signs at three separate points of hospital stay: presentation to the ED, admission to the floor, and transfer to the PICU. We evaluated the data to look for missing or abnormal vital signs in both the case and control groups. Vital sign measurements of each patient included temperature, heart rate, respiratory rate, pulse oximetry saturation, oxygen therapy (if applicable) and blood pressure. Vital sign abnormalities were identified by American Heart Association normal vital signs as a reference. In order to measure inter-rater reliability, a subset of 10 patients (25 total PEWS scores) were chosen and assigned a PEWS score by a second reviewer. These results were analyzed via Spearman's rho.

RESULTS

There were a total of 73 case patients and 73 control patients (table 1) that ranged from 3 weeks of age until 20 years of age. The PEWS for case patients in the ED were increased when compared to our controls ($p = 0.026$). Using statistical dispersion, we compared case patient PEWS in the ED to control patients. In the ED, case patients had median PEWS of 2 with interquartile range (IQR)

of 4 (Figure 1). Control patients had a median of 0 and an IQR of 3 (Figure 1). Inter-rater reliability was excellent. Spearman's correlation coefficient was 0.996 ($p < 0.001$).

Demographic Characteristics N = 73			
Patient Information		N	(%)
Patient Sex			
Male		46	63
Female		27	37
Patient Age			
Less than 1 y/o		20	27
1 - 5 y/o		30	41
6- 10 y/o		5	7
Greater than 10 y/o		18	25
Duration on the General Floor Prior to PICU transfer			
Less than 1 hour		5	7
1 to 2 hours		10	14
2 to 5 hours		27	37
Greater than 5 hours		31	42
Duration of Stay in the PICU			
1 day		17	23
2 days		25	34
3 days		11	15
4 days		3	4
> 5 days		17	23
Deceased in the PICU			
Yes		2	3
No		71	97

Figure 1: This represents the demographic characteristics for the 73 case patients in our study.

Respiratory status including Respiratory rate as well as oxygen support was the most predictive of unplanned transfer when evaluating the data. Many valuable vital signs were also missing in both study groups. Interestingly, in both case patients and control patients there was a paucity of blood pressure measurements obtained at presentation to the ED and prior to admission in the ED [4].

DISCUSSION

Our study sought to identify predictors at the time of admission from the ED of patients likely to require rapid transfer to the ICU. Pediatric Early Warning Scores (PEWS) rate patients on a scale of 0-13 and can predict patients at risk for clinical deterioration. We hypothesized that PEWS obtained prior to admission could be predictive of need for transfer, and that PEWS would increase in patients requiring ICU transfer [5].

Our review demonstrates that as expected, for patients requiring ICU transfer within hours of admission from the ED, PEWS increased from the ED to admission. The PEWS also increased for our case patients at the time of ICU transfer. At the time of ICU transfer, median PEWS were only 4, which is typically the lowest level that would predict increased risk for a critical event. When comparing cases to controls, PEWS were higher at each time point. This review demonstrates that elevated PEWS do correlate with need for ICU transfer, however, the level of the score is less than might be expected. Typically, a rapid response at our hospital for ICU intervention would not be called until a PEWS of 6. With patients requiring rapid transfer to the ICU having a median PEWS of only 2 in the ED, it is likely not practical to use this as a tool to request ICU evaluation while still in the ED.

In a study it shows that, adult patients over 18 years of age

with unplanned ICU transfers were more likely to have respiratory conditions, myocardial infarction or sepsis. Given our pediatric patient population, we extracted that respiratory conditions may also be a risk factor for unplanned transfers. We predicted that vital signs, including their completeness and timing, level of respiratory support and Pediatric Early Warning Scores (PEWS) may have an effect on likelihood of rapid transfer.

CONCLUSION

However, the study was able to identify vital signs as a predictive risk for unplanned transfers. Patients with increased oxygen support in the case patients were more likely to be transferred when compared to the controls. However, many of the other vital signs including blood pressure were not as helpful given that this was the most likely vital sign to be missing. Other key findings of our research were the extended time between last vital signs in the ED and those taken once the case patients were admitted. This finding alone may be contributory to why these patients are being admitted to the floor and then rapidly transferred to the ICU.

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