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Characteristics of Pediatric Emergency and Risk Factors for Life-saving Interventions

Phatthranit Phattharapornjaroen, MD[1], Yuwares Sittichanbuncha, MD[1], Pongsakorn Atiksawedparit, MD, PhD[2], and Kittisak Sawanyawisuth, MD, PhD[3]

Abstract

Pediatric emergency patients are vulnerable population and require special care or interventions. Nevertheless, there is limited data on the prevalence and risk factors for life-saving interventions. This study is a retrospective analytical study. The inclusion criteria were children aged 15 years or under who were triaged as level 1 or 2 and treated at the resuscitation room. Factors associated with LSI were executed by logistic regression analysis. During the study period, there were 22 759 ER visits by 14 066 pediatric patients. Of those, 346 patients (2.46%) met the study criteria. Triage level 1 accounted for 16.18% (56 patients) with 29 patients (8.38%) with LSI. Trauma was an independent factor for LSI with adjusted odds ratio (95% CI) of 4.37 (1.49, 12.76). In conclusion, approximately 8.38% of these patients required LSI. Trauma cause was an independent predictor for LSI.

Keywords

prevalent, trauma, mortality

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Introduction

Approximately 25% to 30% of emergency department (ED) visits are pediatric patients.[1] Of those, 1% to 5% of patients are triaged to resuscitation room. ED visits of pediatric patients are increasing over the years. In addition, there is a variety of attending physicians for pediatric ED visits including pediatricians, critical care pediatrics, and emergency physicians.[2,3] Awareness of the whole emergency care system for pediatric ED care is needed particularly for life-threatening conditions.[4] Clinical guidelines and management including clinical data are crucial. The common pediatric emergency conditions are respiratory insufficiency, hypovolemic shock, and seizures.[5,6]

There are several emergency procedures required for pediatric patients at the emergency room (ER) including endotracheal tube intubation.[7] A report from a national trauma center found that life-saving interventions (LSI) in pediatric trauma patients have variable outcomes.[8] The mortality of patients who underwent emergent airway procedures had mortality rate up to 66.7% and varied by age groups. One factor associated with mortality at the ED was delayed LSI.[9,10] Time to first medication for critically ill pediatric patients was found to be delayed by 15.3 minutes.[10] There is limited data on the prevalence and risk factors for LSI in both trauma and non-traumatic pediatric patients.

Methods

This was a retrospective analytical study conducted at ED University Hospital, Mahidol University, Thailand. This university hospital has 1500 beds with approximately

[1]Mahidol University, Bangkok, Thailand
[2]Chakri Naruebodindra Medical Institute, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Samut Prakan, Thailand
[3]Khon Kaen University, Khon Kaen, Thailand

Corresponding Author:
Kittisak Sawanyawisuth, Department of Medicine, Faculty of Medicine, Khon Kaen University, Sleep Apnea Research Group, 123 Mitraparp road, Khon Kaen 40002, Thailand.
Email: kittisak@kku.ac.th

16 000 ED visits per year. The inclusion criteria were children aged 15 years or under who were triaged as level 1 or 2[11] and treated at the resuscitation room. The study period was between January 1st, 2010 and June 30th, 2016. The study protocol was approved by the Ethics Committee of the Faculty of Medicine, Mahidol University, Thailand.

Medical records of eligible patients were reviewed. Baseline characteristics, triage level, vital signs, oxygen saturations, diagnosis, procedures, disposition, and length of stay in resuscitation room were recorded. A LSI was defined by one of the following interventions: endotracheal tube intubation, intravenous fluid resuscitation, inotropic drug administration, cardioversion, or cardiopulmonary resuscitation (CPR).

Statistical analyses

Sample size calculation. The previous study found that there were 19.5% of pediatric patients who had hemodynamic instability and required LSI.[2] Based on one proportion estimation equation, the required sample size was 242 by d of 5%, alpha error of 5%, and beta error of 20%.

Descriptive statistics were used to calculate studied variables. Numerical variables with normal distribution were presented as mean (SD), while variables that were not normally distributed were reported as median (range). Categorical variables were reported as numbers (percentage). Factors associated with LSI were executed by logistic regression analysis. A univariate logistic regression analysis was used to compute unadjusted odds ratio (95 confidence interval: CI) and p values. Those factors with a p value of less than 0.20 were potential factors for multivariate logistic regression analysis. The remaining factors in the final model were reported with adjusted odds ratio (95% CI). Statistical analyses were performed by STATA software, version 14.0 (College Station, TX, USA).

Ethical Approval and Informed Consent

The study protocol was approved by the Institutional Review Board (ID2559/208). An informed consent was not required as data collection was retrospective.

Results

During the study period, there were 22 759 ER visits by 14 066 pediatric patients. Of those, 346 patients (2.46%) met the study criteria. Male patients accounted for 65.03% The median age of total patients was 3 years as shown in Table 1. The median systolic and diastolic blood pressure values were in normal range at 108/61 mmHg, while pulse rate, respiratory rate, and oxygen saturation were abnormal (126.8 times/minute, 31.16 times/minute, and 89.57%). Top 5 diagnosis were related to respiratory system (191 patients; 55.2%), epilepsy (36 patients; 10.4%), trauma (21 patients; 6.07%), infection (14 patients; 3.76%), and GI system (13 patients; 3.76%).

Table 1. Baseline Characteristics and Outcomes of Pediatric Patients Presenting with Emergency Conditions (n = 346).

Factors	Number (%) or median (min, max) or mean (SD)
Age, years	3 (0, 15)
Male sex	225 (65.03)
Shift	
Morning	117 (33.82)
Afternoon	163 (47.11)
Night	66 (19.08)
Triage level	
1	56 (16.18)
2	290 (83.82)
Systolic blood pressure, mmHg	108 (53, 182)
Diastolic blood pressure, mmHg	64 (21, 106)
Pulse rate, times/min	126.8 (37.73)
Respiratory rate, times/min	31.16 (13.68)
Temperature, °C	36.16 (6.51)
Oxygen saturation, %	89.57 (20.78)
Life-saving intervention (LSI)	29 (8.38)
Types of LSI	
Endotracheal tube insertion	10 (2.89)
Intravenous fluid loading	24 (6.94)
Inotropic drug administration	2 (0.58)
Cardioversion	1 (0.29)
Cardiopulmonary resuscitation	3 (0.87)
Disposition	
Admission to ward	115 (33.42)
Admission to intensive care unit	73 (21.10)
Death	5 (1.45)
Referred	5 (1.16)
Discharge	150 (43.06)
Waiting time for admission, hours	1.78 (0.12, 11.73)

Triage level 1 accounted for 16.18% (56 patients) with 29 patients (8.38%) with LSI (Table 1). The 2 most common LSI were intravenous fluid loading (6.94%) and endotracheal tube insertion (2.89%). There were 188 patients (54.34%) admitted: to ward (115 patients; 33.42%) and ICU (73 patients; 21.10%). The mortality rate was 1.45% (5 patients). There were 9 factors with a *P* value by univariate logistic regression analysis for LSI (Table 2). The 2 remaining factors for the LSI in multivariate final model included age and trauma. The adjusted odds ratios (95% CI) for both factors were 1.06 (0.99, 1.15) and 4.37 (1.49, 12.76), respectively.

Table 2. Unadjusted Odds Ratios, 95%CI, and *P* Values of Studied Variables Associated with Life-Saving Interventions.

Factors		Odds ratio	(95%CI)	*P* value
Gender	Male	1		
	Female	1.01	(0.46, 2.26)	.973
Age (years)		1.08	(1.01, 1.17)	.034
Shift	Night	1		
	Noon	1.54	(0.39, 6.02)	.534
	Morning	2.57	(0.73, 9.04)	.141
Triage level	Level 2			
	Level 1	1.75	(0.71, 4.33)	.223
SBP (mmHg)		0.98	(0.97, 1.00)	.089
DBP (mmHg)		0.98	(0.96, 1.00)	.196
PR (times/minute)		0.99	(0.98, 1.00)	.078
RR (breaths/minute)		0.95	(0.90, 1.00)	.097
Temperature (°C)		0.95	(0.90, 1.00)	.051
Oxygen saturation (%)		0.98	(0.96, 1.00)	.098
Diagnosis	Non trauma	1		
	Trauma	5.29	(1.87, 14.92)	.002

Discussion

This study shows that almost one-fifth (16.18%) of pediatric visits at the ED were categorized as triage 1. These results may raise concerns and needs for pediatric care at the ED as pediatric patients require specific narrow doses and therapeutic ranges of medication.[9,12] Regarding pediatric resuscitation, the causes were different among centers. In this study, respiratory disease was the leading cause as in Germany.[13] However, in France and Swiss, cardiocirculartory disorder and epilepsy were the top diagnosis. Meanwhile, respiratory disease was ranked as the third most common disease at the pediatric ED for both countries.[5,6] It is worthy to note that the time spent in the resuscitation room in this study was longer than that in the Swiss study (1.78 hour vs 46 minutes).[6] These findings may be explained by limited resources, such as medical personnel and available beds in this study.

The previous study found that age of below 2 years and respiratory insufficiency were risk factors for mortality in children admitted from resuscitation room.[5] However, no predictor for LSI was studied. The LSI was performed for 16 out of 361 patients (4.4%), which was slightly lower than that in this study (8.38%). This study added a new predictor for LSI, which is trauma with risk of 4.37 times. Even though age was related to mortality in critically ill children patients, it was not associated with LSI after adjustment for other factors. In this study, trauma accounted for only 6.07%, but it was an indicator of LSI. In other words, trauma may cause more severe conditions than others. As previously reported, frequency of LSI in traumatic pediatric patients was uncommon (0.2%) by national trauma database.[8] However, the types of procedures were related to mortality indicating the severity of traumatic cases with LSI. For example, mortality was 28.3% in those with airway procedures. The mortality rate was also higher in the young population in this study with the median age of 3 years (Table 1).

There are some limitations in this study. First, this study was conducted in only 1 university hospital, even though the sample size was relatively large compared with previous studies.[9,10] Second, some factors were not studied, such as trauma prevention or trauma mechanism.[14-17]

In conclusion, approximately 8.38% of these patients required LSI. Trauma cause was an independent predictor for LSI.

Author Contributions

Phatthranit Phattharapornjaroen: Desinged the study; collected data; interpreted data; and wrote a manuscript draft.
Yuwares Sittichanbuncha: Participated in study design; interperted data; and reviewed the manuscript.
Pongsakorn Atiksawedparit: Performed statistical analysis and reviewed the manuscript.
Kittisak Sawanyawisuth: Interpreted data; wrote the manuscript; and reviewed the manuscript.
All authors approved the final manuscript.

Declaration of Conflicting Interests

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ORCID iDs

Phatthranit Phattharapornjaroen https://orcid.org/0000-0002-4391-2929
Kittisak Sawanyawisuth https://orcid.org/0000-0003-3570-8474

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