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Application of different scoring systems and their value in pediatric intensive care unit

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KEYWORDS

Scoring systems;
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Abstract *Background:* Little is known on the impact of risk factors that may complicate the course of critical illness. Scoring systems in ICUs allow assessment of the severity of diseases and predicting mortality.

Objectives: Apply commonly used scores for assessment of illness severity and identify the combination of factors predicting patient's outcome.

Methods: We included 231 patients admitted to PICU of Cairo University, Pediatric Hospital. PRISM III, PIM2, PEMOD, PELOD, TISS and SOFA scores were applied on the day of admission. Follow up was done using SOFA score and TISS.

Results: There were positive correlations between PRISM III, PIM2, PELOD, PEMOD, SOFA and TISS on the day of admission, and the mortality rate ($p < 0.0001$). TISS and SOFA score had the highest discrimination ability (AUC: 0.81, 0.765, respectively). Significant positive correlations were found between SOFA score and TISS scores on days 1, 3 and 7 and PICU mortality rate ($p < 0.0001$). TISS had more ability of discrimination than SOFA score on day 1 (AUC: 0.843, 0.787, respectively).

Conclusion: Scoring systems applied in PICU had good discrimination ability. TISS was a good tool for follow up. LOS, mechanical ventilation and inotropes were risk factors of mortality.

Introduction

Mortality rate in the intensive care unit (ICU) depends on the severity of illness and the patient population analyzed, and 6.4–10.3% of critically ill patients were reported to die.[1]

Although the total number of hospital beds in the United States decreased by 26.4% from the year 1985 to 2000; the ICU beds increased by 26.2% during the same period.[2]

As a fact, we know little on the exact causes of death and the impact of risk factors that may complicate the course of critical illness irrespective of the underlying disease.[3]

The work was performed at the Pediatric Intensive Care Unit (PICU) of Cairo University Children Hospital, Cairo, Egypt.

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Knowledge of such determinants of outcome in critically ill would not only help improve prognostic evaluation of patients, but also indicate what therapy and research should focus on to improve the short and long term outcomes of those patients.[4]

Scoring systems for use in ICU patients have been introduced over the last 30 years. They allow assessment of the severity of disease and provide an estimate of in-hospital mortality by gathering routinely measured data specific to a patient.[5]

The aim of this study was to apply commonly used scores, in adults and children, for assessment of illness severity and determine their relation to patient's outcome in a developing country.

Patients and methods

This is a prospective study including all patients admitted to pediatric ICU (PICU) in Cairo University Mounira Pediatric Hospital, over one year.

Inclusion criteria

All patients must be from the age of 1 month to the age of 14 years (As pubertal children are referred to adult ICU).

Exclusion criteria

Patients who died in the first 24 h.

Intervention

Clinical examination and full investigations including: complete blood count (CBC), arterial blood gases (ABG), full chemistry, coagulation profile, cerebrospinal fluid (CSF) if needed, cultures (blood culture, urine culture, others if needed), Radiology (X-ray, CT scan, others if needed).

Assessment of the severity of illness and mortality risk adjustment on admission of the patient using the parameters of the following scores:

- Pediatric risk of mortality (PRISM) III.[6]
- PEdiatric Multiple Organ Dysfunction (PEMOD) scoring system.[7]
- PEdiatric Logistic Organ Dysfunction (PELOD) scoring system.[7]
- Pediatric Index of Mortality2 (PIM2).[8]

Follow up of the patient progression and level of intervention using:

- Sepsis-related Organ Failure Assessment (SOFA) score.[9] SOFA score was previously been used in children.[10,11]
- Therapeutic Intervention Scoring System (TISS).[9] Although TISS score was used only in adults, we found its parameters not assessed in other scores and we were interested in its parameters.

Assessments of the outcome of the patients at the end of PICU stay, regarding length of stay (LOS) and survival to discharge.

Statistical analysis

Results were tabulated and statistical significance was tested using the student-*t* test for quantitative values and chi square test was used for qualitative values, other tests of significance were used depending on results.

Results

Two hundred thirty one patients admitted to PICU in Mounira Pediatric Hospital, over 1 year, were enrolled in a prospective observational study.

One hundred and eleven (48.1%) were females and 120 (51.9%) were males, deaths in both sexes were almost equal (26.1% and 25.8% respectively).

The mortality rate was 25.9% (60 patients). Mortality rate was higher in infants (< 1 year) than in children (27%, 23% respectively).

Respiratory problems were the highest admission diagnoses (40.6%), followed by central nervous system (CNS) (15.1%) and cardiovascular system (CVS) (10.8%), but the highest percentage of mortalities was in patients with septicemia and multiple organ dysfunction syndrome (MODS) (66.7%) and neurological disease (51.4%).

Table 1 Scores done for the patients on admission.

	Outcome	Mean	SD	95% CI	*p* value	AUC
PRISM III	Died	12.9	±9.27	10.55–15.24	$p < 0.0001$	0.751
	Survived	5.73	±4.86	5.00–6.46		
PIM2	Died	0.22	±0.29	0.15–0.3	$p < 0.0001$	0.747
	Survived	0.06	±0.10	0.04–0.07		
PEMOD	Died	7.05	±3.88	6.07–8.03	$p < 0.0001$	0.732
	Survived	4.13	±2.82	3.70–4.55		
PELOD	Died	15.17	±14.25	11.56–18.77	$p < 0.0001$	0.762
	Survived	4.96	±8.31	3.71–6.20		
SOFA	Died	10.55	±4.50	9.41–11.69	$p < 0.0001$	0.765
	Survived	6.34	±3.47	5.82–6.86		
TISS	Died	23.62	±8.52	21.46–25.77	$p < 0.0001$	0.811
	Survived	14.94	±5.16	14.17–15.72		

AUC: area under the curve, PELOD: PEdiatric Logistic Organ Dysfunction scoring system, PEMOD: PEdiatric Multiple Organ Dysfunction scoring system, PIM2: revised Pediatric Index of Mortality score, PRISM III: pediatric risk of mortality score, SOFA: Sepsis-related Organ Failure Assessment, TISS: Therapeutic Intervention Scoring System.