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Triaging in Acutely Ill Child

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Abstract

Objective: To assess the triage scoring system evolved by N. Kumar et al. For severity of illness and outcome based on clinical variables related to systemic inflammatory response syndrome (SIRS) and advanced pediatric life support. *Design*: Prospective studyconducted in a tertiary-care hospital. *Methods*: A Prospective observational study was done at tertiary care center of Navodaya Medical College and Hospital during the period of October 2013 to October 20015. All children admitted during this period in pediatric ward and pediatric ICU were included in the study and a triage score would be applied to each child at the time of first contact. The triage score consisted of temperature, heart rate, respiratory rate, blood pressure, capillary filling time, oxygen saturation (SpO2) based on systemic inflammatory response syndrome and sensorium level was assessed on AVPU score. Each study variable was scored as 0 or 1 (normal or abnormal) and a total score for each child obtained. The outcome at discharge was correlated with the study variables and the total score. ROC curve analysis was performed to see the overall predictive ability of the score as well as a cut off at which maximum discrimination occurred. *Results*: Of 252 children studied 36 died. Of the 7 variables 6 variables were abnormal in the study subjects. Except temperature all other variables showed significant association with mortality ($p<0.05$). Mortality increased with increase in the number of abnormal variables; 1%, 8.1%, 22.9%, 45.5%, 62.5%, 64.3% and 100% for scores of 0, 1, 2,3,4,5 and 6 respectively. Children with a score of 2 or more had significant higher mortality. The area under the ROC curve was 0.900, indicating that overall 90% of the subject could be predicted correctly. *Conclusion*: Our study concluded that for triage scoring, any child with 2 or more abnormal clinical variables at the time of first contact should be taken as serious that might lead to death.

Keywords: Intensive Care; Systemic Inflammatory Response Syndrome; Triage Score; Acutely Ill Child.

Introduction

Triage is sorting out of patients [1] - the main objective of which is early patient assessment to obviate harmful delay in the management. The early identification of severity of illness is important for prioritizing treatment to reduce mortality and allow proper utilization of limited resources in the developing world [2]. Most of the triage work has been done mainly in the field of disaster management, so the patient assessment and management can be done without delay. Few of the standard scoring system like PIM and PRISM overestimated the risk of mortality [3,4,5]. The initial triage of sick children arriving at hospital in developing countries in often deficient, with severely ill children experiencing delays in the institution of life saving emergency treatment [6]. Mortality in an intensive care unit depends on the severity of illness. A good scoring system for identifying the severity of illness can help to prioritize care. More sick children need to be admitted and those at the end of the spectrum would benefit from intensive care management [2].

The existing scoring systems presently available have been developed to predict mortality in ICU admissions. However the existing scoring systems depends on both physical and laboratory variables and are inappropriate for primary triage [2]. So if a scoring system using physical criteria alone is developed than it would be appropriate for primary triage. this scoring system hypothesized only using

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physical criteria to identify severity of illness. This can be used to triage patients for management and predict outcome. this triage score is related directly or indirectly to the abnormal physical variables of systemic inflammatory response syndrome (SIRS) [7,8] and physical signs, utilized in the Advanced Pediatric Life Support [9].

Materials and Methods

A Prospective observational study was done at tertiary care centre of Navodaya medical college during the period of October 2013 to October 2015. All children admitted during this period in pediatric ward and pediatric ICU were included in the study and a triage score would be applied to each child at the time of first contact. The triage score consisted of temperature, heart rate, respiratory rate, blood pressure, capillary filling time, oxygen saturation (SpO2) based on systemic inflammatory response syndrome and sensorium level was assessed on AVPU score. Each study variable was scored as 0 or 1 (normal or abnormal) and a total score for each child obtained. The outcome at discharge was correlated with the study variables and the total score.

Blood Pressure, SpO2 & temperature was measured according to the norms. Abnormal values for heart rate, respiratory rate, temperature and blood pressure were according to standard SIRS criteria [7,8]. Consciousness was noted using the AVPU score. Except alert (A) of AVPU, all other states of consciousness were taken as abnormal. AVPU was taken for rapid assessment of sensorium because it requires only 4 observations for its assessment. The abnormal value for SpO2, CFT and AVPU were as per Advanced Pediatric Life Support [9] the hospital discharge status (death / survival) was the primary outcome of all variables.

Scoring of Abnormal Clinical Variables (Based on SIRS and APLS [7,8,9]

Heart rate >2 SD above normal for age; or for children <1 yr old, OR<10th percentile for age.

Temperature>38.5 or < 36.0°C.

Mean respiratory rate >2 SD above normal for age.

BP; <5th percentile for age

SpO2 <90%,

Capillary refill time, ≥3 seconds,

AVPU (Alert, Responds to voice, Responds to pain, Unresponsive), anyone except A

The data was subjected to statistical analysis.

Results

Out of the 252 children in our study 216 survived and 36died. The mean age of the study group was 51.39 months. In the survived group it was 52.6 months and of expired group it was 44.14 months which suggested that younger the age was at risk (Table 1). Of the 252 subjects in the study group males contributed 64.3 % ie 162 children (133 survived and 29 died) as compared to females who contributed 35.7% ie 90 children (83 survived and 7 died) (Table 2). Each study variable i.e temperature, heart rate, respiratory rate, blood pressure, capillary filling time, oxygen saturation (SpO2) and sensorium level was assessed on AVPU score wasstatistically analyzed (Table 3). From our study it is evident that as the total number of abnormal variables increases mortality also increases. Mortality of 1%, 8.1%, 22.9%, 45.5%, 62.5%, 64.3% and 100% was noted with scores of 0, 1, 2, 3 ,4, 5 and 6 respectively (Table 4). Considering the system wise involvement number of cases are maximum among the diseases involving respiratory system followed by central nervous system. Among the 82 cases involving respiratory system, 9(11%) died. Among 70 cases involving central nervous system 9 cases (12.9%) died There were totally 5 cases involving CVS of which 3 cases (60%) died. Per abdomen out of 28 cases 3cases (10.7%) died. Cases, which did not fit into four main systemic groups, were considered as other system, which included 67 cases of which 12 cases (17.9%) died (Table 5).

At a score of 2 it has a sensitivity of 80 and specificity of 84%. Area under the ROC curve is 0.900 (Figure 1).

Over all irrespective of the system involved it is evident from above statistical analysis that a score of 2 or more has high risk of mortality.

Fig. 1: Area under the ROC curve for predictive ability of the score is 0.900. *At a score of 2 it has a sensitivity of 80 and specificity of 84%.*

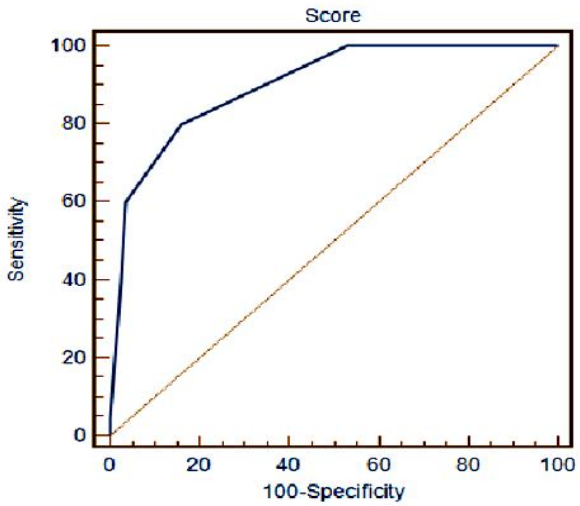

Table 1: Age in months

	N	Mean age in months	Std. Deviation	Min	Max	't' value	'p' value
Survived	216	52.60	49.30	1	180	0.868	0.352
Died	36	44.14	57.01	1	180		

Table 2: Statistical table for gender

Sex	Outcome Survived	Total Died	
Male	133	29	162
	61.6%	80.6%	64.3%
Female	83	7	90
	38.4%	19.4%	35.7%
Total	216	36	252
	100.0%	100.0%	100.0%
Chi-Square Value	Df	P value	
4.842	1	.028	

Table 3: Association of study variables with mortality*

Variable	Normal		Abnormal		Total	Odd's Ratio & 95% Confidence Interval	Cohort Outcome & 95% Confidence Interval		Pearson Chi-Square Value	P Value
	Survived	Died	Survived	Died			Survived	Died		
Temp	183	30	33	6	252	1.109	1.015	0.915	0.046	0.831
	85.9%	14.1%	84.6%	15.4%	100%	(0.428-2.873)	(0.879-1.173)	(0.408-2.052)		
HR	205	21	11	15	252	13.312	2.144	0.161	44.609	0.000
	90.7%	9.3%	42.3%	57.7%	100%	(5.421-32.687)	(1.366-3.365)	(0.95-0.272)		
RR	180	16	36	20	252	6.250	1.429	0.229	27.00	0.000
	91.8%	8.20%	64.3%	35.7%	100%	(2.957-13.211)	(1.170-1.744)	(0.127-0.411)		
BP	208	29	8	7	252	6.276	1.646	0.262	13.657	0.000
	87.8%	12.2%	53.3%	46.7%	100%	(2.118-18.596)	(1.023-2.648)	(0.138-0.497)		
CFT	210	22	6	14	252	22.273	3.017	0.135	55.071	0.000
	90.5%	9.50%	30.0%	70.0%	100%	(7.775-63.8)	(1.543-5.901)	(0.83-0.221)		
SPO2	194	16	22	20	252	11.023	1.764	0.160	45.733	0.000
	92.4%	7.6%	52.4%	47.6%	100%	(4.995-24.326)	(1.318-2.359)	(0.091-0.282)		
AVPU	149	10	67	26	252	5.782	1.301	0.225	22.498	0.000
	93.7%	6.3%	72%	28%	100%	(2.639-12.667)	(1.139-1.486)	(0.114-0.445)		

** Based on univariate analysis*

Table 4: Outcome at different scores

Score	Survived No. %		Died No. %	
0	96	99	1	1.00
1	79	91.9	7	8.1
2	27	77.1	8	22.9
3	6	54.5	5	45.5
4	3	37.5	5	62.5
5	5	35.7	9	64.3
6	-	-	1	1
7	-	-	-	-

* Derived from a multiple logistic regression analysis

Table 5: System involved outcome

System Involved	Outcome		
	Survived	Died	Total
CNS	61	9	70
	87.1%	12.9%	100.0%
CVS	2	3	5
	40.0%	60.0%	100.0%
Other	55	12	67
	82.1%	17.9%	100.0%
PA	25	3	28
	89.3%	10.7%	100.0%
RS	73	9	82
	89.0%	11.0%	100.0%
Total	216	36	252
	85.7%	14.3%	100.0%

Discussion

The early identification of severity of illness is important for prioritizing treatment to reduce mortality and allow proper utilization of limited resources in the developing world (10). Various scoring systems have been proposed to assess the severity of illness which predict mortality e.g., PRISM

[11]. Most of the scoring systems are for ICU patients, and these scoring systems rely on a large number of physical and laboratory variables and require prolonged observation. This makes it unsuitable for practice in developing countries.

WHO developed guidelines for emergency triage, assessment and treatment for sick children presenting to hospitals in the developing world. It prioritized the treatment of sick children depending upon the emergency signs related to airway, breathing, circulation, coma, convulsion, confusion and dehydration to decrease the mortality. The limitation of emergency triage, assessment and treatment is that it requires reorganizing of the existing health care system and special training of both staff and doctor [12]. In view of the drawbacks of the existing system we developed a score based on physical criteria alone. The SIRS is the host response to presence of an insult regardless of the presence of infection. SIRS is diagnosed when a patient has two or more of the following criteria (i) temperature (ii) heart rate (iii) respiratory rate, and (iv) white blood cell count, as abnormal [7,8]. The children with SIRS may go on to develop multiple organ dysfunction syndromes. We thus took physical variables of SIRS and pediatric advanced life support and excluded the biochemical and laboratory parameters and tested if the score thus developed could predict mortality. We hypothesized that prediction of mortality based entirely on physical criteria could perhaps be helpful to triage patients.

In thisunivariate analysis, temperature was not significantly associated with survival status. Since temperature may show significant association with mortality if larger samples are studied, we have retained these parameters in our scoring system.

The study done by N. Kumar et.al did not show any significant association of respiratory rate with heart rate (P=0.18) (P=0.10) respectively did not show significant association with mortality. Where as temperature instability showed significant association with mortality (P<0.01)[2].

In this study we have found on ROC curve analysis that the scores based on regression could predict 90% subjects correctly. Further, a score of 2 showed maximum discrimination with 80% sensitivity and 84% specificity. We found that two or more abnormal physical variables out of seven were significantly associated with mortality and may be used to assess the severity of illness.

Our study has certain limitations. We took only patients which were admitted in our hospital. If children who were sent back on the opd were also studied, then the results could have been generalized. The mortality would be less among children who were sent home on opd basis because they were apparently well.

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