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Original Research Paper

Paediatrics

SPO2/FIO2 RATIO AND TRIAGE SCORE IN PREDICTING OUTCOME OF CRITICALLY ILL CHILDREN

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ABSTRACT

Introduction: Non-invasive nature of pulse oximetry allows much affordable, rapid assessment of degree of hypoxemia and helps in identification of the patients at risk. Mortality in a pediatric intensive care unit (PICU) depends on the severity of illness. A good scoring system for identifying the severity of illness can help to prioritize care. Triage is sorting out of patients, the main objective of which is early patient assessment to obviate harmful delay in the management.

Aims And Objectives: To predict the outcome of critically ill children in pediatric ICU by using the Triage scoring system and Spo2/Fio2(SF) ratio.

Materials And Methods: A hospital based prospective observational study done at Navodaya Medical College Hospital & Research Centre during January 2020 to June 2021 for a period of 18 months. A total of 125 children were studied. Data is described in terms of mean (+SD), frequencies (number of cases) and percentages. Statistical analysis was done using SPSS software version 26.

Results: Out of 125 children studied, 8 died. Except temperature, all other variables showed significant association with mortality ($p < 0.001$). Mortality was 0%, 4.88%, 28.57%, 75%, 25% and 50% for scores of 0, 1, 2, 3, 4 and 5 respectively. Children of score 3 or more had significant high mortality. Among the 113 subjects who survived, mean SpO2/FiO2 ratio is 340 and among 12 subjects who died, SpO2/FiO2 ratio is 184. SpO2/FiO2 ratio is less among the children who died and can predict mortality.

Conclusions: Many deaths in under five children occurring in hospitals can be prevented if triage is followed, if any sick children are identified soon on their arrival and treatment is started immediately. SpO2/FiO2 ratio is a non-invasive and reliable tool for hypoxemia screening and predicting outcome among patients admitted to the ED.

KEYWORDS : Critically ill, Hypoxemia, Mortality, SpO2/FiO2 ratio, Triage score

INTRODUCTION

Non-invasive nature of pulse oximetry allows a much affordable, rapid assessment of the degree of hypoxemia and helps in identification of the patients at risk[1]. In many pediatric studies, the role of SpO2/FiO2 ratio has been proved to be of great importance in intensive care monitoring but so far only one study including adults suggests that they can be used in place of PaO2/FiO2 ratio[2]. Triage is sorting out of patients[3], 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.[4] Deaths of children in hospital often occur within the first 24 hours of admission. Many of these deaths could be prevented if very sick children were identified early and appropriate treatment started immediately upon their arrival at the health facility.

Aim And Objective

To assess the outcome by using the Triage scoring system and SpO2/FiO2 ratio (SF ratio) in critically ill children in pediatric ICU.

Materials And Methods

A hospital based prospective observational study done at Navodaya Medical College Hospital & Research Centre during January 2020 to June 2021 for a period of 18 months. Data is described in terms of mean (+SD), frequencies (number of cases) and percentages. Statistical analysis was done using SPSS software version 26.

Inclusion Criteria:

1. All children more than one month of age requiring admission to pediatric ward and pediatric intensive care unit.
2. All children who needs oxygen supplementation and requiring respiratory support – either invasive, non-invasive mechanical ventilation or high flow nasal cannula therapy.

Exclusion Criteria:

1. Children with suspected or probable Congenital heart disease
2. Children with Chronic Lung disease
3. Children (parents) who decline to give consent to participate in the study.

RESULTS

The study was a hospital based prospective observational study conducted on children of age group 1 month to 18 years admitted to Department of Pediatrics, Navodaya Medical College Hospital and Research Centre, Raichur. A total number of 125 children were included in the study.

Table I: Temperature Outcome

Outcome	Survived		Died		Total	
Temp	No.	%	No.	%	No.	%
Normal	97	90.7	10	9.35	107	100
Abnormal	16	88.9	2	11.1	18	100
Total	113	90.4	12	9.6	125	100

Chi-square: 0.055; P value: 0.81

Table I shows temperature outcome in 125 study subjects.

Among the107 subjects with normal temperature 97(90.7%) survived and 10 (9.35%) died. Among 18 subjects with abnormal temperature range 16(88.9%) survived and 2 (11.11%) died.

Table II: Heart Rate Outcome

Outcome	Survived		Died		Total	
Heart rate	No.	%	No.	%	No.	%
Normal	108	93.9	7	6.09	115	100
Abnormal	5	50	5	50	10	100
Total	113	90.4	12	9.6	125	100

Chi-square: 20.443; P value: 0.00

Table II shows out of 125 subjects in the study group, 115 had normal heart rate whereas 10 had abnormal heart rate. Among 115 subjects with normal heart rate 108 (93.91%) survived and 7 (6.09%) died. Among 10 subjects with abnormal heart rate, 5 (50%) survived and 5 (50%) died. P value <0.000

Table III: Respiratory Rate Outcome

Outcome	Survived		Died		Total	
Resp.rate	No.	%	No.	%	No.	%
Normal	98	94.2	6	5.77	104	100
Abnormal	15	71.4	6	28.6	21	100
Total	113	90.4	12	9.6	125	100

Chi-square: 10.468; P value: 0.001

Table III shows among 125 subjects in the study group 104 had normal respiratory rate and 21 had abnormal respiratory rate. Among the 104 subjects with normal respiratory rate 98 (94.23%) survived and 6 (5.77%) died. Of the 21 subjects with abnormal respiratory rate 15 (71.43%) survived and 6 (28.57%) died. P value <0.001

Table IV: Blood Pressure Outcome

Outcome	Survived		Died		Total	
B.P	No.	%	No.	%	No.	%
Normal	112	91.8	10	8.2	122	100
Abnormal	1	33.3	2	66.7	3	100
Total	113	90.4	12	9.6	125	100

Chi-square: 11.534; P value: 0.001

Table IV shows among 125 subjects, 122 had normal blood pressure and 3 had abnormal blood pressure. Among this 122 with normal blood pressure, 112 (91.80%) survived and 10 (8.2%) died. Among 3 subjects with abnormal blood pressure 1 (33.33%) survived and 2 (66.7%) died. The p value is 0.001.

Table V: Capillary Filling Time Outcome

Outcome	Survived		Died		Total	
C F T	No.	%	No.	%	No.	%
Normal	111	91.7	10	8.26	121	100
Abnormal	2	50	2	50	4	100
Total	113	90.4	12	9.6	125	100

Chi-square: 7.772; P value: 0.005

Table V shows among the 125 subjects in the study group, 121 had normal capillary refill time and 4 had abnormal capillary refill time. Among the 121 subjects with normal capillary refill time 111 (91.74%) survived and 10 (8.26%) died. Among the 4 subjects with abnormal capillary refill time 2 (50%) survived and 2 (50%) died. The p value is 0.005.

Table VI: SpO2 Outcome

Outcome	Survived		Died		Total	
SpO2	No.	%	No.	%	No.	%
Normal	104	95.4	5	4.59	109	100
Abnormal	9	56.3	7	43.8	16	100
Total	113	90.4	12	9.6	125	100

Chi-square: 24.657; P value: 0.000

Table VI shows among the 125 subjects in the study group 109 had normal SpO2 and 16 had abnormal SpO2. Among these 109 subjects with normal SpO2 104 (95.41%) survived and 5 (4.59%) died. Of the 16 subjects with abnormal SpO2 9 (56.25%) survived and 7 (43.75%) died. The p value is 0.000

Table VII: AVPU Outcome

Outcome	Survived		Died		Total	
AVPU	No.	%	No.	%	No.	%
Normal	79	95.2	4	4.82	83	100
Abnormal	34	81	8	19.1	42	100
Total	113	90.4	12	9.6	125	100

Chi-square: 6.506; P value: 0.011

Table VII shows among the 125 subjects in the study group, 83 children were normal, and 42 children were abnormal. Among the 83 children with normal value 79 (95.18%) survived and 4 died (4.82%). Among the 42 children with abnormal value 34 (80.95%) survived and 8 (19.05%) died. The p value is 0.011.

Table VIII: Total Score Outcome

		Outcome				Total
		Survived		Died		
		No.	%	No.	%	No.
Total score	0	58	100	0	0	58
	1	39	95.12	2	4.88	41
	2	10	71.43	4	28.57	14
	3	1	25	3	75	4
	4	3	75	1	25	4
	5	2	50	2	50	4
Total		113	90.4	12	9.6	125

Chi-square: 41.349; P value: 0.000

This table VIII shows, mortality of 0%, 4.88%, 28.57%, 75%, 25%, 50% was noted with scores of 0,1,2,3,4,5 respectively. The p value is 0.000. In this study score 3 and more has highest mortality.

Table IX: SpO2/FiO2 Ratio and Outcome

SPO2/FiO2		N			Mean	Std. Deviation
			MIN	MAX		
Out come	Survived	113	90	466	340	1.092
	Died	12	80	447	184	1.256

't' value: 4.64900; P value: 0.000

Table IX shows among the 113 subjects who survived, mean SpO2/FiO2 ratio is 340 and among 12 subjects who died, SpO2/FiO2 ratio is 184. From the above table it is evident that SpO2/FiO2 ratio is less among the children who died and can predict mortality. The p value is 0.000.

DISCUSSION

A total of 125 children were included in the study group. On univariate analysis, temperature was not significantly associated with mortality. Remaining all other parameters i.e., heart rate, respiratory rate, blood pressure, capillary filling time, oxygen saturation (SpO2) and AVPU[5] were significantly associated with mortality.

A study done by N Kumar et al showed that the mortality increased with increase in the number of abnormal variables: 0.4% 2.2% 6.1% 15.3% 19.4% and 29.4%for scores of 0,1,2,3,4 and 5 respectively and the linear trend was significant (P < 0.01)[4]. But in our study mortality was 0%, 4.88%, 28.57%, 75%, 25% and 50% for scores of 0, 1, 2, 3, 4 and 5 respectively.

And children with a score of 3 or more had significantly higher mortality as compared to those with no abnormal clinical variables (score=0) (P <0.000). This could possibly be due to less sample size of this study. In our study, SpO2/FiO2 ratio of >/= 340 is associated with good prognosis and SpO2/FiO2 ratio of </=184 is associated with mortality. Among 125 study subjects 113 children who survived had SF ratio >/=340 and 12 children who died had SF ratio of </= 184. And SpO2/FiO2 ratio as an individual variable has statistical significance in our study to predict outcome. (P<0.000). P Catoire et al[6] studied that without other signs of respiratory distress (including increased work of breathing and/or altered mental status), SpO2/FiO2 superior to 450 could be used as a decision threshold for outpatient management, whereas SpO2/FiO2 inferior to 370 could require referral to intensive care units. An SpO2/FiO2 between 370 and 450 would require further clinical evaluation and possibly arterial blood gas.

CONCLUSION

Many deaths in under five children occurring in hospitals can be prevented if triage is followed, if any sick children are identified soon on their arrival and treatment is started immediately. It has been our hope that a triage scoring at first contact of patient is tested to prioritize care and identify patients who would benefit from transfer urgently to ICU. SpO2/FiO2 ratio is a non-invasive and reliable tool for hypoxemia screening and predicting outcome among patients admitted to the ED. SpO2/FiO2 could be a useful index for triage upon admission of patients and would identify patients who could be managed on an outpatient basis and patients requiring admission to the intensive care unit.

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