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Original Article

Validity of Pneumonia Severity Score in Predicting Mortality of Pediatric Patients in a Tertiary Care Hospital

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Abstract

Background: Pneumonia is estimated to kill 410,000 children in India every year. In India, recent estimates in under-fives suggest that 13% of deaths and 24% of the National Burden of Disease is due to pneumonia. Very few studies have evaluated the predictors of mortality in children with pneumonia in developing countries. Hence, this study was planned to study predictors of mortality in children aged 1–59 months based on pneumonia severity score (PSS) in hospitalized patients with severe pneumonia.

Objective: The objective of this study is to assess the factors (clinical and investigational) contributing to the mortality in patients based on PSS in hospitalized patients diagnosed with severe pneumonia.

Materials and Methods: The present observational longitudinal study was carried out in a tertiary care PICU in a Govt. NSCB Medical College, Jabalpur for of 1 years (Ian 2019–December 2019). Children diagnosed as severe pneumonia of either sex between age group 1–59 months admitted in a hospital were enrolled in the study. Demographic data, clinical details, and laboratory parameters of the enrolled cases were recorded in a predesigned pretested pro forma. PSS was calculated and correlated with the outcome of the patients enrolled and followed up till discharge or death.

Results: Mortality was observed in 11 cases, and of them, 4 (36.4%) were males and 7 (63.6%) patients were females. This study showed that among clinical parameters pulse rate and SpO_2 were significantly raised (63.6%) and saturation was significantly <90 (72.7%) in children who succumbed to death ($P < 0.05$). This study observed a statistically highly significant association of PSS with the outcome of children ($P < 0.01$).

Key words: Modified PSI, Outcome, PICU, Pneumonia

INTRODUCTION

Pneumonia is estimated to kill 410,000 children in India every year. In India, recent estimates in under-fives suggest that 13% of deaths and 24% of the National Burden of Disease is due to pneumonia.[1] To reduce mortality, the World Health Organization (WHO) initiated the acute respiratory infection control program in 1983 which led to a decline in the infant mortality rate and under-fives mortality.[2] Case fatality rates in hospitalized children are reported to be between 8.7 and 47%.[2-4]

Although predictors of mortality were studied in developed countries, it cannot be used in developing countries due to differences in etiology and treatment resources available. Very few studies have evaluated the predictors of mortality in children with pneumonia in developing countries.[5-7] More studies are required to analyze the factors predicting mortality in hospitalized children.

There is a need for standardized pneumonia mortality predictive score easy to calculate and should be based on basic bedside parameters; therefore, this study was planned to study predictors of mortality based on pneumonia mortality predictive score (PMPS)in children aged 1–59 months hospitalized with severe pneumonia.

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OBJECTIVE

The objective of this study is to study the predictors of mortality based on pneumonia mortality predictive score (PMPS) in children aged 1–59 months hospitalized with severe pneumonia.

MATERIALS AND METHODS

The present observational longitudinal study was carried out in a tertiary care NICU un a Govt. NSCB Medical College, Jabalpur. The duration of the study was 1 year (Ian 2019 December 2019). Ethical clearance was sought for from the Institutional Ethical Committee before the start of the study. Children who were diagnosed as severe pneumonia 2 of either sex between age group 1 and 59 months admitted in a hospital were enrolled in the study.

For diagnosing the child as tachypneic or rapid respiration, the WHO guidelines followed, that is, for age <2 months is respiratory rate >60/min; age 2–12 months is respiratory rate >50/min, and age >1 year is respiratory rate >40/min. Children diagnosed and were followed up for outcome measurement until their discharge from the hospital or death.

A total of 75 children were enrolled and as per the WHO case definition was diagnosed as severe pneumonia. Demographic data, clinical details, and laboratory parameters of the enrolled cases were recorded in a predesigned pretested pro forma. Variables studied are age, sex, urban slum, any comorbidities present in the form of CNS, CVS, liver, kidney disease, and neoplasm were noted. At admission, altered mental status, pulse rate, temperature, SBP for sex and age, and SpO_2 were noted. The following investigations were noted ABGA pH, PaO_2, and hypoglycemia at admission (random blood sugar level <50 mg/dl), serum sodium, hematocrit, and chest X-ray. A score was calculated based on the following parameters:

1. Comorbities < 2 = 0, ≥ 2 =1.
2. Altered mental status yes = 1, No = 0,
3. SBP abnormal for age and sex = 1, normal = 0,
4. Temperature >100 F = 1,< 100 = 0,
5. PaO_2 < 60 = 1, > 60 = 0,
6. Pulse rate abnormal for age and sex = 1, normal = 0,
7. PaO_2 < 60 = 1, > 60 = 0,
8. ABG ph < 7.3 = 1, > 7.3 = 0,
9. SpO_2 < 90% = 1, > 90% = 0

Based on the above finding, patients were categorized into three groups mild (score <3), moderate (score between 3 and 6), and severe (Score >6). They were treated with appropriate therapy and the outcome recorded was discharge or death. Statistical analysis was conducted using STATA version 10.0. Categorical variables were compared between deaths and discharges by performing the Chi-square test. All tests were two-sided and $P < 0.05$ is considered significant.

RESULTS

Table 1 shows that total of 75 children aged 1–59 months were enrolled. Mortality was observed in 11 cases and of them, 4 (36.4%) were males and 7 (63.6%) patients were females However, the test of significance (Chi-square test) showed no significant association between outcome and gender ($P = 0.89$).

In the present study, <2 comorbidities were observed in 82.7% cases, whereas 17.3% cases had >2 comorbidities. The present study documented no statistically significant association between comorbidities and outcome ($P > 0.05$). Similarly, 12% cases presented with altered mental status; however, no statistically significant association between outcome and altered mental status was observed ($P > 0.05$), pulse rate was significantly raised (63.6%), whereas saturation was significantly <90 (72.7%) in children who succumbed to death ($P < 0.05$). However, no such association of outcome was observed for SBP and temperature ($P > 0.05$).

PaO_2 was < 60 in 100% cases in whom mortality was observed. Similarly, glucose levels were <50 in 36.4% cases. The present study observed statistically highly significant association of outcome with PaO_2 and glucose ($P < 0.01$).

Mild, moderate, and severe pneumonia severity score (PSS) were documented in 82.7%, 14.6%, and 2.7% cases, respectively. The present study documented a statistically highly significant association between PSS and outcome, that is, mortality was higher in cases with moderate and severe PSSs ($P<0.01$) [Tables 2-4].

DISCUSSION

Decreasing pneumonia deaths will significantly contribute to achieving the Millennium Development Goal of reducing under 5-year of mortality. This study was conducted to identify the clinical and laboratory variables

Table 1: Distribution according to outcome

Outcome	Frequency (*n*=75)	Percentage
Discharge	64	85.3
Death	11	14.7

Table 2: Association of clinical features with outcome

Clinical features		Discharge	Death	Total	*P* value
Co morbidities	<2	55 (85.9)	7 (63.6)	62 (82.7)	0.07
	>2	9 (14.1)	4 (36.4)	13 (17.3)	
Altered mental status	Present	8 (12.5)	1 (9.1)	9 (12)	0.75
	Absent	56 (87.5)	10 (90.9)	66 (88)	
SBP for age and sex	Normal	63 (98.4)	10 (90.9)	73 (97.3)	0.15
	Abnormal	1 (1.6)	1 (9.1)	2 (2.7)	
Temperature	<100 F	32 (50)	3 (27.3)	35 (46.7)	0.16
	>100 F	32 (50)	8 (72.7)	40 (53.3)	
Pulse rate	Normal	47 (73.4)	4 (36.4)	51 (68)	0.015
	Raised	17 (26.6)	7 (63.6)	24 (32)	
SpO_2	<90	2 (3.1)	8 (72.7)	10 (13.3)	0.001
	>90	62 (96.9)	3 (27.3)	65 (86.7)	

Table 3: Association between investigation findings and outcome

Investigations		Discharge	Death	Total	*P* value
PaO_2	>60	64 (100)	0 (0)	64 (85.3)	0.001
	<60	0 (0)	11 (100)	11 (14.7)	
ABG pH	<7.3	8 (12.5)	2 (18.2)	10 (13.3)	0.61
	>7.3	56 (87.5)	9 (81.8)	65 (86.7)	
Glucose	<50 mg%	2 (3.1)	4 (36.4)	6 (8.)	0.001
	>50 mg%	62 (96.9)	7 (63.6)	69 (92)	

Table 4: Association between pneumonia severity score and outcome

Pneumonia severity score	Discharge	Death	Total
Mild (<3)	61 (95.3)	1 (9.1)	62 (82.7)
Moderate (3–5)	3 (4.7)	8 (72.7)	11 (14.6)
Severe (≥6)	0 (0)	2 (18.2)	2 (2.7)

P=0.001

associated with deaths in hospitalized children aged 1–59 months with a diagnosis of severe pneumonia.

In the present study, about 33.3% of children had CNS disease, 12% of children presented with altered mental status, liver disease, and CHD was observed in 13.3% cases each. Renal disease and neoplasm was present in 2.7% and 1.3% cases, respectively. However, the present study documented no statistically significant association between outcome and comorbidities ($P > 0.05$).

Our study found that the pulse rate was significantly raised (63.6%), whereas saturation was significantly <90 (72.7%) in children who succumbed to death ($P < 0.05$). However, no such association of outcome was observed for SBP ($P > 0.05$).

PaO_2 was < 60 in 100% cases in whom mortality was observed. The present study observed a statistically highly significant association of outcome with PaO_2, SpO_2, and glucose ($P < 0.01$).

We found overall CFR of 14% compared to 3.9% for all-cause mortality in this age group. CFR of childhood pneumonia in various Indian studies ranges from 8.9% to 47%[3-6] and 3.4% to 12% in other developing countries.[8-10] This can be due to differences in etiology, immunization and treatment resources available.

Mild, moderate, and severe PSS were documented in 82.7%, 14.6%, and 2.7% cases, respectively. The present study documented a statistically highly significant association between modified PSI score and outcome, that is, mortality was higher in cases with moderate and severe PSI scores ($P < 0.01$).

The limitation of the study was that we could not find out the etiology of pneumonia. The study may have referral bias since many enrolled cases were referred from peripheral centers and findings cannot be generalized. The strength of the study was the study period of 1 year preventing the effect of an epidemic outbreak. There is a need to carry out extensive multi-centric studies involving both rural and urban areas to identify the severity of pneumonia based on this simple useful and easy to carry out PSS.

CONCLUSIONS

Mortality was observed in 11 cases, and of them, 4 (36.4%) were males and 7 (63.6%) patients were females. However, test of significance (Chi-square test) showed no significant association between outcome and gender ($P = 0.89$). Pulse rate was significantly raised (63.6%), whereas saturation was significantly <90 (72.7%) in children who succumbed to death ($P < 0.05$). The present study observed a statistically highly significant association of outcome with PaO_2 and glucose ($P < 0.01$).

Mild, moderate, and severe PSS were documented in 82.7%, 14.6%, and 2.7% cases. respectively. The present study documented a statistically highly significant association

between PSS and outcome, that is, mortality was higher in cases with moderate and severe PSI scores ($P < 0.01$).

Recommendation

PSS is a good predictor of mortality in children with severe pneumonia under low-cost settings.

PSS can help to select sick children for PICU admission and optimal utilization of limited PICU resources.

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