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Original Research Article

Outcome of Children with Severe Pneumonia Assessed on PRISM III Scoring System

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ABSTRACT

Objective: To determine the outcome of children with "Severe Pneumonia" having PRISM III score ≥ 10 admitted at Pediatrics Intensive Care Unit (PICU).

Study Design: Case Series study performed in National Institute of Child Health (NICH), Karachi from 15th May 2013 to 14th November 2013.

Material and Methods: Total 97 patients of either sex with age 2 months to 5 years diagnosed with severe pneumonia having PRISM Score ≥10 were included in the study. Patients PRISM score calculated within 24 hours of PICU admission. Patients were followed for maximum 7 days and outcome was measured in terms of alive or death. SPSS version 20 was used for data entry and analysis.

Results: There were 53.6% male and 46.4% female patients. The mean weight was 13.74±5.95 Kg and length of hospital stay was 6.93±1.05 days. Mean PRISM III score was 12.06±1.51 with range of 6 (10 – 16). At the 7th day of hospital stay the final outcome (alive/death) was observed and it was found that severe pneumonia with PRISM score ≥10, 69.1% patients were alive and 30.9% patients were dead. 69 patients had PRISM III score ≤12 out of them 53(76.8%) were alive and 16(23.2%) were dead. 28 patients had PRISM III score >12 of which 14 were alive and 14 were dead. There was a significant association was observed between PRISM III score and outcome (alive/dead) at p<0.01 level.

Keywords: Pneumonia, Severe Pneumonia, PRISM III Score, Pediatrics Intensive Care Unit.

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INTRODUCTION

Pneumonia has been identified as the major "forgotten killer of children" by the United Nations Children's Fund (UNICEF) and WHO. The World Health Organization defines pneumonia as an acute disease episode with cough combined with fast breathing with age specific cut-values for increased respiratory rate, used as an entry criteria or endpoint in different intervention and disease burden studies.[1,2] Pneumonia is caused by infection of lungs, thus reduces oxygen exchange and leading to cough and breathlessness. It's the leading cause of mortality among children less than five years of age, despite effective vaccines and nutritional and environmental interventions.[3]

Pneumonia accounts for almost one in five deaths in children under the age of five years worldwide. Hospital stay is long especially among severe pneumonia cases requiring advanced life support measures. Pneumonia currently accounts for 18% of annual deaths in children under five worldwide, 20% in low income countries compared to only 4.3% in high income countries. Therefore many clinicians are concerned about the severity of pneumonia and its associated complications and mortality.[4-6]

The main bacterial causes of childhood pneumonia are Streptococcus pneumonia (pneumococcus) and Haemophilus influenza. Pneumococcal disease is the most common cause of vaccine preventable deaths. In general, management of severe pneumonia is based on clinical and radiological findings without culture. This often requires expensive antibiotics, the cost of which must be met by the family.[7,8]

PICU plays a very important role in the care of critically ill children, where advances techniques resulted to a more sophisticated care

for children, thus making these units prepared to treat cases of high complexity at a high cost. It is necessary to characterize the disease severity at admission, assessing its prognosis.[9,10]

For pediatric intensive care, various methods are available for mortality prediction; including the Pediatric Risk of Mortality (PRISM, PRISM III) and the Pediatric Index of Mortality (PIM and PIM2).There have been efforts at validating these scores all over the world. However, in view of the paucity of such data in developing countries, there is a need to assess the validity of existing scoring systems through field testing of these scoring systems in our setup.[11-13]

The ideal probability model/scoring system would be institution independent and population independent. The purpose of their usage varies, and may include comparison of severity of illness between different treatment arms in clinical trials and comparison of quality of care between PICUs using standardized (that is, severity of illness adjusted) mortality rates. Both the PRISM and PIM scoring system have been developed and carefully validated in tertiary PICUs.[14-16]

PRISM scoring system is a physiologic stability index that predicts mortality through normal physiological disturbances during the period of disease. With good care in PICU, physicians may save lives of one million children in developing countries such as Pakistan. Now PRISM III scoring system is used to evaluate the severity of the disease after 12 and 24 hours of admission in PICU. Lacroix et al pointed out that PRISM score may be used in neonates, infants, children and adolescents with severe disease, but may not be used in preterm neonates and adults.[17-19]

Although various studies have been done but as they included all children admitted to PICU; therefore results cannot be generalized. The present study was designed as a first step to assess the magnitude of outcome of a specific disease at a specific PRISM III 24 score in terms of discharge alive or death. If the magnitude founds to be high than further studies could be undertaken to assess its complete validity thereby it could be used as a tool to assess the severity of patients and its outcome.

MATERIALS & METHODS

This case series study was performed at National Institute of Child Health (NICH), Karachi from 15th May 2013 to 14th November 2013.

In patients with PRISM score between10-19. 16%[20] had mortality, confidence interval taken as 95%, absolute precision taken as 6% and the sample size came out to be 97 children with severe pneumonia, sampling technique was non-probability consecutive.

Inclusion Criterion

Age 2 months to 5 years, either gender; Severe Pneumonia and PRISM III score ≥10.

Exclusion Criteria

Children with congenital malformations, less than one month of age, less than one hour of hospital stay, patients left against medical advice and Expired within 8 hours.

Data Collection and Analysis: Children with severe Pneumonia having PRISM III score 10 and above meeting the inclusion criteria admitted in PICU, NICH were enrolled in the study. Informed consent was taken from the parents for inclusion in the study and for procedure after explaining the pros and cons, purpose and procedure of the study. Patients PRISM III score calculated within 24 hours of PICU admission. Patients were followed for maximum 7 days and outcome was measured in terms of alive or death. Demographics and the final outcome on 7th day were entered. SPSS version 20 was used for data entry and analysis. Mean ± SD were calculated for age, duration of PICU stay, weight and PRISM III score of the patient.

Figure 1: Histogram presenting Age distribution.

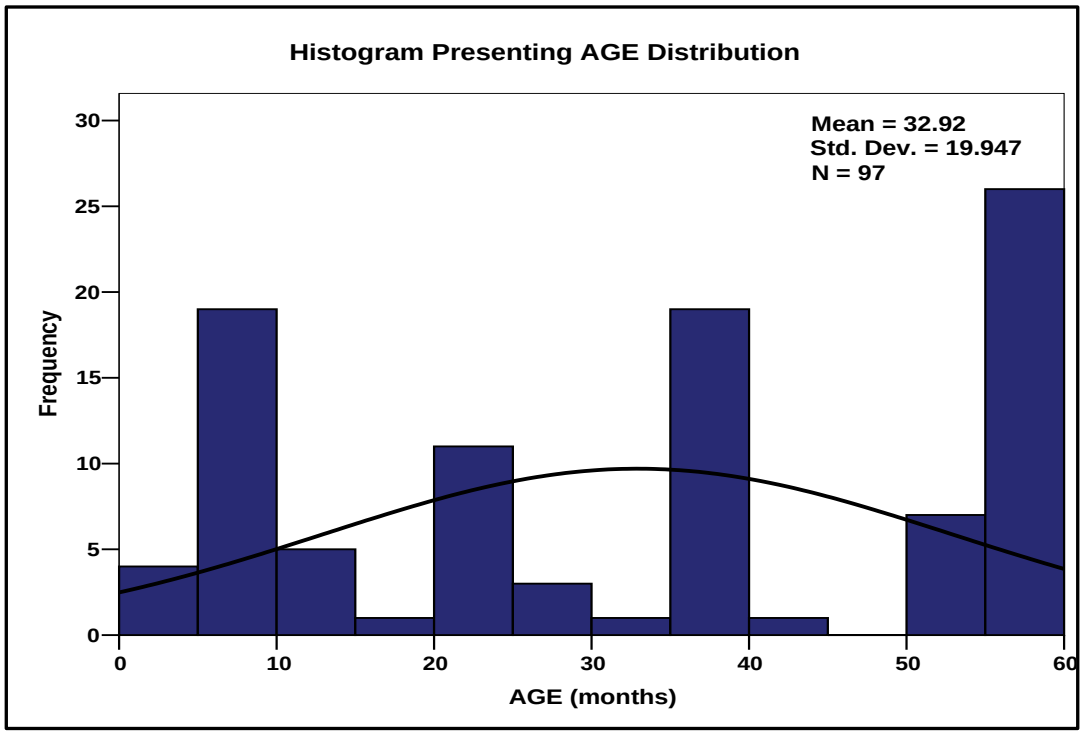

Table 1: Frequency and Association of outcome according to PRISM III Score

	Children alive 67 (100%)	Children death 30 (100%)	P value
Age ≤ 30 months	38 (56.7%)	6 (20%)	0.001**
Age > 30 months	29(43.2%)	24 (80%)	
Weight ≤ 20 Kg	62 (92.5%)	26 (86.6%)	0.357
Weight > 20 Kg	5 (7.4%)	4 (13.3%)	
Length of Stay ≤ 7 Days	42 (62.6%)	30 (100%)	0.000**
Length of Stay > 7 Days	25 (37.3%)	0 (0%)	
PRISM III Score ≤ 12	53 (79.1%)	16 (53.3%)	0.010**
PRISM III Score > 12	14 (20.8%)	14 (46.6%)	

Table 2: Frequency Distribution of PRISM III SCORE

	Frequency (n)	Percentage (%)
10	14	14.4%
11	24	24.7%
12	31	32.0%
13	9	9.3%
14	9	9.3%
15	9	9.3%
16	1	1.0%

RESULTS

There were 53.6% male and 46.4% female patients. The overall mean age of study subjects were 32.92±19.9 months, with range of 58 (2 – 60) months. The age distribution is presented in Figure-1. The age was stratified in groups. 44 patients were in group of ≤30 months and 53 patients were in group of >30 months of age. The weight of children was from 3.1kg to 32kg with range of 28.9 and mean weight was 13.74±5.95 Kg. The patients were in group of ≤20 Kg and 9 patients were in group of >20 Kg of weight. The overall mean length of hospital stay was 6.93±1.05 days, with range of 4 (5 – 9) days. The patients length of stay less than seven days were 72 and 25 patients were in group of >7 days of length of hospital, results are also presented in table 1.

The overall mean PRISM III score was 12.06±1.51 with range of 6 (10 – 16). It was found that 14 patients had score 10, 24 patients had score 11, 31 patients had score 12, 9 patients had score 13, 14, and 15 each and only 1 patient had score of 16. The results are also presented in table 2.

At the 7th day of hospital stay the final outcome (alive/death) was observed and it was found that out of total 97 included patients of severe pneumonia with PRISM score ≥10, 69.1% patients were alive and 30.9% patients were not survived (dead).

The PRISM III score was further divided into groups. 69 patients had PRISM III score ≤12 out of them 53(76.8%) were alive and 16(23.2%) were dead. 28 patients had PRISM III score >12 of which 14 were alive and 14 were dead. Chi square test was used to see association between PRISM III score and outcome (alive/dead) considered p≤0.05 as significant. There was a significant association was observed between PRISM III score and outcome (alive/dead) at p<0.01 level. These results are also presented in table 2

Post stratification it was observed that out of 52 male patients 36 were alive and 16 were dead. Among 45 female patients 31 were alive and 14 were dead. There was no significant association found between gender and outcome (alive/death) with p>0.05. It was found that out of 44 patients of age ≤30 months, 38 were alive and 6 were dead. Among 53 patients of age >30 months 29 were alive and 24 were dead. There was a significant association found between age groups and outcome (alive/death) with p<0.01. The detailed results are presented in table 1.

It was observed that out of 88 patients of weight ≤ 20 Kg, 62 were alive and 26 were dead. Among 9 patients of weight >20 Kg, 5 were alive and 4 were dead. There was no significant association found between weight groups and outcome (alive/death) with p>0.05. It was observed that out of 72 patients of length of hospital stay ≤7 days, 42 were alive and 30 were dead. Among 25 patients of length of hospital stay >7 days, all 25 were alive and no one dead. There was a very strong significant association found between length of hospital stay and outcome (alive/death) with p<0.01. (Table3)

Table 3: Descriptive status of age, weight and length of stay at hospital

Description	Mean	SD	Range	Minimum	Maximum
Overall Age (month)	32.92	19.94	58	2	60
≤ 30 (months)	13.68	8.47	28	2	30
> 30 (months)	48.89	10.11	25	35	60
Weight (Kg)	13.74	5.95	28.9	3.1	32.0
Length of Stay (Days)	6.93	1.05	4	5	9

DISCUSSION

Pneumonia affects all pediatric age groups, though the highest incidence is among those under- 5 years particularly in the first year of life,[20] which is in agreement with the findings of the present study where about half of the subjects are aged ≤30 months. The percent of males admitted to the pediatric Intensive Unit in the current study is higher than the females, consistent with sex specific data for pneumonia incidence which is higher in boys than in girls,[22] but these differences in sex between survivors and non survivors are statistically insignificant except for age that showed significant difference between survivors and non-survivors.[21,22]

High mortalities (30.9%) in the present study could be attributed to delayed referral of needy cases to the intensive care as beds in the later setting are nearly 100% occupied all year round and this is a permanent complaint in PICUs. Further research is required to reveal factors of increased mortality among children with pneumonia admitted to the Pediatric intensive care units particularly the long waiting time for referral to the intensive care.

In-hospital mortality due to pneumonia is often related to associate co-existing illnesses. Longer Length of stay in the PICU and a higher PRISM scoring were independently associated with mortality in the current study.[23,24]

Improvement of care for critically ill patients is a goal in all countries. Different care systems have been created to increase the quality of care for children who need special care. Efforts to decrease children's mortality led to PICU establishment. It is necessary to develop models which predict the mortality risk in PICU in order to monitor the effectiveness of the cares carried out. They enable us to compare different units and evaluate the associations between the severity of diseases, hospitalization duration and the costs.[25]

Given the improvement in pediatric care in the Pediatric Intensive Care Unit, it is imperative that there be strict quality control to identify groups at greatest risk of death and to ensure the adequacy of treatment and the planning and rational use of resources. Differences in mortality rates within the PICU can be explained by the severity of illness of patients treated in each service. The use of prognostic indicators is an essential quality criterion in the care of critically ill patients.[26]

A study among children admitted to the Pediatric Intensive Care Unit (PICU) in Alexandria, Egypt, have reported that a shorter length of stay was independently associated with risk of mortality, while in the current study the opposite was found. This might be due to dissimilarities in included subjects and study settings as El-Nawawy, 2003 included all admitted patients to the PICU with various diagnoses while in our study we included only pneumonia children less than 5 years of age admitted to the PICU.[27]

The PRISM Score was developed from the Physiologic Stability Index (PSI), a pediatric severity of illness measure used to predict mortality. The PRISM Score was developed and validated in intensive care setting by Pollack et al. The score describes the severity of illness according to physiological derangement detected on clinical examination and standard laboratory tests. It has been observed that accuracy or reliability of PRISM score is unlikely to be influenced by measurement frequency to the overall variability. Our observation that increase in PRISM Score is associated with an increase in the mortality was similar to previous workers.[28,29] Since mortality rises with increase in PRISM score at the time of admission, PRISM score can be taken as an indicator of the initial severity of illness which has a great relevance in clinical epidemiology. For example the PRISM score can be used as inclusion/exclusion criteria, or as a stratification variable in clinical trials. Risk adjusted mortality remains the commonest benchmark for neonatal,[30] paediatric,[31] and adult ICU performance. However, the validity of a scoring system for calculation of mortality risk depends on several factors.[30,31]

Qureshi et al[32] indicate that by use of statistical Analyses PRISM scoring system is a good predictor of mortality rate in PICU. Another study demonstrated that PRISM scoring system can predict mortality in children admitted to PICU. These findings are similar to present study. Martha VF et al[33] observed that PRISM scoring system had good validity to predict mortality. Gemek et al[34] stated that PRISM and PRISM III scores are good scales to estimate the mortality rate in PICU which is in harmony with our study.[32-34]

Authors suggest that the PRISM score can be used as an inclusion/exclusion criterion, or as a stratification variable in clinical trials. The probability of death in the ICU from studies like this can serve as a basis for comparison of the experience of other ICUs/hospitals, beside our own center over a period of time.[35] We studied 97 PICU admissions, of which 30.9% died before discharge. Our study sample had 28 of the subjects with a score greater than to 12 and had only 14 events (deaths). Since the predictions for children with high scores are based on a few numbers, they should be viewed continuously, keeping the numbers in mind.

The prediction of possibility of death using PRISM score in our study showed the probability of death increases significantly with increase in PRISM score, suggesting PRISM score to be a sensitive predictor of outcome comparable to other studies.[27,36]

LIMITATIONS

Our study has a number of potential limitations. Patients were scored mostly by physicians who were not specifically trained for scoring, small sample size. Regular use of scoring systems in PICU provides an opportunity not only to predict the outcome but also helps in improvement of the quality of care within the limited resources available.

CONCLUSION

The pneumonia causes fatality rate of under-five year children is quite high. PRISM scoring is accurate scoring in predicting mortality among pneumonia pediatric. The PRISM score is a useful tool for the assessment of prognosis for pediatric patients admitted to a tertiary PICU. Presently PRISM III is the best and latest scores available for PICU mortality prediction.

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