

Original Research Article

Microalbuminuria as a predictor of patient outcome in pediatric intensive care unit

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ABSTRACT

Background: Critically ill children have disturbed milieu interior and these disturbances can be estimated by measuring how much apart one or many physiologic variables are from the normal range. In critical care units, predicting patients' outcomes is vital to the intensivist. It allows planning early aggressive therapeutic interventions, optimum resource allocation and appropriate family and patient counselling.

Methods: The study was conducted in the post graduate department of pediatrics and neonatology of tertiary care hospital. All patients admitted to our PICU for any critically ill ailment were classified into three groups.

Results: In our study of 250 patients, study groups were divided into three groups. Group 1 patients with sepsis; group 2 patients with SIRS and group 3 patients without sepsis and SIRS. Ninety-four patients belonged to group 1; 78 belonged to group 2 and 78 belonged to group 3. There were 42, 36 and 27 females in group 1, group 2 and group 3, respectively. Most patients resided in district Kupwara. Most cases had respiratory system involvement. The median albumin creatinine ratio within 6 hours of admission (ACR1) and at 24 hours was 148 mg/g and 97 mg/g, respectively, among survivors and 199.2 and 287 among non-survivors. There were 30 deaths in group 1, 11 deaths in group 2 and 5 deaths in group 3.

Conclusions: Microalbuminuria was found in 78.8% of critically ill children at admission. Urine albumin creatinine ratio at 6 and 24 hours of PICU stay was assessed to predict the degree of severity and mortality. It was found to have 88.5% sensitivity and 62.3% specificity.

Keywords: PICU, PRISM3, ACR

INTRODUCTION

A critically ill child is one who is in a clinical state of severe cardio respiratory or neurological compromise, an emergency with very high morbidity and mortality. Causes of this clinical condition may be primary cardiovascular, respiratory, or neurological illnesses or secondary to metabolic disorder, septicemia, trauma, malignancy or poisoning. The goal of the intensivist should be early recognition and administration of treatment of respiratory, circulatory and neurological insufficiency.¹

Critically ill children have disturbed milieu interior and these disturbances can be estimated by measuring how much apart one or many physiologic variables are from the normal range.² Early recognition and appropriate management of these disturbances among the critically ill pediatric population acts as a wonderful tool to turn remorse faces into charming ones. A rapid cardiopulmonary assessment helps a clinician to classify the degree of compromise of the physiologic status. Based on the degree of compromise the patient is managed appropriately. During stabilization, the priority is to address the airway first followed by breathing and

circulation (ABC). All patients with the following conditions are admitted to the PICU.³ Severe respiratory distress, tachypnea and retractions, oxygen requirement on the rise greater than 50% to maintain hemoglobin saturations above 90%, desaturation below 90% on highest flow of oxygen, lethargic or comatose child, arterial blood gas showing hypoxemia, hypercarbia or metabolic acidosis. In summary, all children whom the treating pediatrician think, require constant and intensive monitoring of pulse, blood oxygen, hydration, respiration, blood pressure and conscious state are eligible for PICU admission.

In critical care units, prediction of outcome of patients is of vital importance to the intensivist. It allows planning of early aggressive therapeutic interventions, optimum resource allocation and appropriate counselling of the family and or patient. A number of prognostication tools have been developed for the above purpose. The predictive scores that are frequently used in the PICU are the pediatric risk of mortality (PRISM) scores and the pediatric index of mortality (PIM) scores.⁴⁻⁸ Critical illnesses are characterised by the systemic inflammatory response syndrome (SIRS), which is the host response to an acute insult. SIRS is a common finding in the ICU patients which, when severe, can lead to multiple organ failure and finally death.⁹ Small amounts of albumin in the urine can be found in normal people but it can be excreted in excessive amounts in certain circumstances.¹⁰ Albuminuria is thought to be caused by impaired endothelial function. Levels of albumin in urine can vary from normal, microalbuminuria and macroalbuminuria; hence we studied this as a predictor for outcome in patients admitted in PICU.¹¹

METHODS

This was a prospective observational study conducted in the post graduate department of pediatrics and neonatology Government Medical College Srinagar from September 2019 to August 2021; after obtaining ethical approval from hospital authorities.

Inclusion criteria

Inclusion criteria for current study were patients admitted to our PICU with a duration of stay of more than 24 hours and age 1 month to 18 years.

Exclusion criteria

Exclusion criteria for current study were anuria, failure to collect a urine sample, urological trauma resulting in frank hematuria, urinary infection with significant proteinuria, current renal replacement therapy, chronic renal disease (GFR<30 ml/min), use of nephrotoxic drugs and illness leading to proteinuria.

All patients admitted to our PICU for any critically ill ailment were classified into 3 groups: group-I (SIRS with

proven infection); group-II (SIRS without proven infection); group-III (No-SIRS, no-infection). ACR at admission (within 6 hours) in PICU (ACR₁) and ACR at 24 hours (ACR₂) were estimated. Quantification of albuminuria and urinary albumin creatinine ratio was done using the immunoturbidimetric method.

Statistical analysis

Data were entered in a Microsoft excel spreadsheet. continuous variables were summarized as mean and standard deviation. Continuous variables not normally distributed were summarized as median and IQR. Analyses were performed using SPSS 28.

RESULTS

In our study of 250 patients, study groups were divided into three groups. Group 1 patients with sepsis; group 2 patients with SIRS and group 3 patients without sepsis and SIRS. 94 patients belonged to group 1; 78 belonged to group 2, and 78 belonged to group 3 as shown in (Table 1). In comparison, there were 42, 36, and 27 females in group 1, group 2 and group 3 respectively. Most patients resided in district Kupwara. Most cases had respiratory system involvement. The median albumin creatinine Ratio within 6 hours of admission (ACR₁) and at 24 hours was 148 mg/g and 97 mg/g respectively among survivors and 199.2 and 287 among non-survivors, as is shown in Table 2. There were 30 deaths in group 1, 11 deaths in group 2 and 5 deaths in group 3 respectively.

Table 1: Age distribution of study population.

Age	Group 1	Group 2	Group 3
1 month to 1 year	65	21	25
2-5 years	17	31	29
6-12 years	05	15	12
13-18 years	07	11	12

DISCUSSION

Age group

In our study of 250 patients, study groups were divided into three groups. Group 1 patients with sepsis; group 2 patients with SIRS and group 3 patients without sepsis and SIRS. 94 patients belonged to group 1; 78 belonged to group 2 and 78 belonged to group 3. The median age group of our study population was 1.7 years. Nismath et al in their study “comparative validity of microalbuminuria versus clinical mortality scores to predict pediatric intensive care unit outcomes” with a sample size of eighty four patients over a period of 18 months, between the age group of 1 month to 18 years admitted in PICU; observed that the median age group of the patients was 1.75 years.¹² Sachdev et al did a prospective observational study of patients of varying categories admitted in the PICU with duration of stay

more than 24 hours. All the 138 patients fulfilling the inclusion criteria were enrolled. The median age of the cases was 1.45 years.¹³ Thus with respect to age

distribution among the study population, our observation is similar to the observations made by other researchers.

Table 2: Comparison of ACR1 and ACR2 between survivors and nonsurvivors.

ACR	Survivors	Non survivors	P value
ACR 1	128 (52.4-198.3)	199.2 (109.1-389.5)	0.037
ACR 2	97 (44.3-196.6)	287 (112.4-458.3)	0.004

Table 3: Comparison of median albumin-creatinine ratio within 6 hrs of ICU admission (ACR1) and at 24 hrs (ACR2), median change of albumin-creatinine ratio from admission to 24 hrs (Δ ACR), the median duration of ICU stay and number of survivors and nonsurvivors.

Variables	Survivors	Non survivors	P value
Number of patients	204	46	-
Median PICU stay (IQR), days	5 (2.7-10)	2 (2-7)	0.12
Median ACR1 (IQR), mg/g	128 (52.4-198.3)	199.2 (109.1-389.5)	0.037
Median ACR2 (IQR), mg/g	97 (44.3-196.6)	287 (112.4-458.3)	0.004
Median Δ ACR (IQR), mg/g	31	88	0.017

Gender

In our study of 250 patients, there were 145 (58%) male cases and 105 (42%) female cases. There were 52, 42, and 51 males, respectively, in group 1, group 2, and group 3. In comparison, there were 42, 36, 27 females in group 1, group 2, and group 3, respectively. Nismath et al did a cross sectional study to evaluate the role of microalbuminuria at admission as a prognostic marker in comparison to standard PRISM and pediatric logistic organ dysfunction (PELOD) mortality scores in children admitted to PICU. They observed that out of the 84 cases, 51(60.7%) cases were males; while as 33 (39.3) cases were females.^{12,13} Basu et al conducted a study to evaluate whether microalbuminuria on admission and after 48 hours of admission to intensive care unit predicts outcome. Out of the 238 patients included in the study sample size 143 (60%) cases were males; while as only 95 (40%) cases were females.¹⁴ Thus the observation made by us is similar to the observation made by the two above.

Reasons for PICU admission

In our study of 250 patients, 119 (47.5%) cases had respiratory system involvement, including bronchopneumonia and bronchiolitis. Others were infectious diseases (23%), neurological (12%); cardiovascular (7%); burns (6%) and malignancy (4%). Nismath et al did a cross sectional study between January 2015 to October 2016 to evaluate the role of microalbuminuria at admission as a prognostic marker in children admitted to PICU.¹² They observed that 41 (48.8%) cases were having respiratory system diseases, 21 (25%) infectious cases, 8 (9.5%) cases were having neurological diseases, 5 (5.9%) cases of Cardiovascular, 5 (5.9%) cases of burn and 4 (4.8%) cases of malignancy.

Our study had comparable reasons for admission in PICU as is seen in the literature above.

Albumin creatinine ratio

In our study of 250 patients, there were 204 survivors and 46 non survivors. The median albumin creatinine ratio within 6 hours of admission (ACR1) and at 24 hours was 148mg/g and 97 mg/g respectively among survivors. Sachdev et al in their study observed that the value of albumin creatinine ratio was 124.5 and 198.9 among the survivors and 198 and 213 among the non survivors with a p value of 0.008. The above mentioned study results are similar to the results mentioned in the literature.¹³

Duration of PICU stay

In our study of 250 patients, there were 204 survivors and 46 non survivors. The median stay in the Pediatric intensive care unit was 6 days for the survivors, while it was only 2 days for the non survivors, with a p value of 0.012. Nismath et al did a cross sectional study of 67 enrolled patients admitted to PICU for comparison of urine albumin creatinine ratio with established PICU scores.¹⁵ They observed that median duration of hospital stay among survivors was 6 days. However the median days of stay was only 2 days among non survivors with a p value of 0.012. Sachdev et al in their study observed that the median duration of stay in hospital was 6 days for both survivors and non survivors with a p value of 0.5.¹³ Hence our results are similar to results given in data.

Mortality

In our study of 250 patients, there were 30 deaths in group 1, 11 deaths in group 2 and 5 deaths in group 3. Sachdev et al did a study on the importance of microalbuminuria in predicting patient outcome.¹⁶ There

were 102 patients admitted with 30% mortality. They observed that there were 16 (47%) deaths in group 1, 10 (33.3) in group 2 and 4 (10.5) respectively with a p value of 0.002. Sachdev et al in their study observe that there was 21% mortality among the study group.¹³

CONCLUSION

Microalbuminuria was found in 78.8% of critically ill children at admission. Urine albumin creatine ratio at 6 and 24 hours of PICU stay was assessed for predicting the degree of severity and mortality. It was found to have 88.5 % sensitivity and 62.3% specificity.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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