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**ORIGINAL RESEARCH**

# Utility of Platelet Indices as Prognostic Markers in Paediatrics' Critically Ill Patients

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**ABSTRACT**

**Background**: Advances in therapeutic protocols have highlighted the importance of accurate risk prediction models in paediatric intensive care[1]. In settings with limited resources, like India, these tools are crucial for early detection, prioritization, and resource allocation. This study explores the utility of platelet indices as prognostic markers in the critically ill patients, comparing them with the widely used PIM II score[2]. **Aims**: To study the role of platelet indices (PLT, MPV, PDW, PCT) as prognostic markers in predicting mortality in paediatric critically ill patients. **Methods**: A prospective study was conducted at MGM Medical College from February 2023 to March 2024. The medical records of 150 paediatric patients admitted to the PICU were analysed. Platelet indices were obtained from routine CBC results and compared with PIM II scores. Statistical analyses were performed using SPSS software, version 22. **Results**: Significant correlations were observed between platelet indices and patient outcomes. Platelet count (PLT) and mean platelet volume (MPV) were significantly lower in non-survivors, while MPV/PLT and MPV/PCT ratios had significant associations with mortality ($p < 0.001$). The PIM II score also correlated with platelet indices, especially in non-survivors. **Conclusions**: Platelet indices, particularly MPV and its ratios, may serve as reliable prognostic markers in paediatric intensive care, especially when used alongside the PIM II score.

**Keywords**: Paediatric Critically Ill Patients, Platelet Indices, PIM II score, Prognostic Markers, Mortality



## INTRODUCTION

Recent advancements in paediatric intensive care have emphasized the need for effective risk prediction models to optimize patient care[3]. In these settings, a reliable, easy-to-use risk assessment tool such as the Paediatric Index of Mortality II (PIM II), is crucial for patient prioritization and resource management in PICUs. The PIM II score, though widely used, was developed in the West and requires validation in Indian settings[4]. Platelet indices, such as platelet count (PLT), mean platelet volume (MPV), platelet distribution width (PDW), and platelet-crit (PCT), are easily accessible and inexpensive markers that may provide insights into the severity of illness and prognosis in critically ill children[5]. Recent studies suggest abnormal platelet indices correlate with higher mortality correlate with more severe illness and higher mortality in ICU patients, though findings on MPV remain inconsistent[6]. There is a lack of Indian research on the relationship between platelet indices, mortality, and PICU scoring systems like the PIM II score[7]. Therefore, we conducted a prospective study to explore the utility of platelet indices as prognostic markers in our PICU and compare them with the PIM II score. This study aims to evaluate the utility of platelet indices in predicting outcomes in paediatric critical patients and compare them with the PIM II score.

## METHODS

This study aims to evaluate the utility of platelet indices as prognostic markers in pediatric critical patients. The primary objective is to assess the correlation between platelet indices and mortality or morbidity. Additionally, the study seeks to compare platelet indices with the PIM II score as a prognostic tool and analyze differences in platelet indices between patients with sepsis and non-sepsis.

A prospective observational study was conducted at the Paediatric Intensive Care Unit (PICU) of MGM

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Medical College and its associated hospital between February 2023 and March 2024. Paediatric patients aged 1 month to 18 years who were admitted to the PICU during the study period were included. Data included demographic details (age, gender, and place of residence), underlying conditions (such as chronic illnesses, congenital anomalies, and comorbidities), sources of infection (e.g., respiratory infections, sepsis, gastrointestinal infections), and laboratory results were properly recorded in the pre-structured proforma. Severity of illness was assessed using the Paediatric Index of Mortality II (PIM II) score, calculated within 24 hours of admission. Platelet indices (platelet count, mean platelet volume, platelet distribution width, and platelet-crit) were obtained from routine complete blood count (CBC) results within one hour of PICU admission. Statistical Analysis**.** Descriptive statistics were used to summarize baseline data. Fisher's Exact test, Chi-square test, Mann-Whitney U test, andSpearman's correlation test were employed to analyse relationships between variables. A p-value of $< 0.05$ was considered statistically significant.

The PIM II score comprises ten variables, with responses scored as 1 or 0. These responses are inputted into the system (accessible at www.sfar.org/scores2/pim22.html) to calculate the predicted mortality rate[8].

**PIM II SCORE MODEL (Paediatric Index Of Mortality)**

- Systolic Blood Pressure
- Pupils
- PaO2
- FiO2
- Base Excess in arterial or capillary blood (ABG)
- Mechanical ventilation at first hour in ICU- Yes/No
- Elective Admission to ICU- Yes/No
- Recovery after surgical procedure as the main reason for PICU admission- Yes/No
- Admitted following cardiac bypass- Yes/No
- High risk diagnosis
- Low risk diagnosis

## RESULTS AND DISCUSSION

A total of 150 paediatric patients were enrolled in the study over the course of one year. The socio-demographic analysis revealed no significant association between gender, age, or residence and mortality, as the p-values for these factors were greater than 0.05, indicating no notable impact on patient outcomes. When examining system-wise disease distribution, it was found that the most common system affected was the respiratory system, which accounted for 29.3% of the cases, followed by miscellaneous diseases, contributing to 20.7% of the patients. Sepsis, however, was found to be significantly associated with higher mortality, with a p-value of less than 0.0001, highlighting its critical role in patient outcomes. Moreover, therapeutic interventions such as the requirement for oxygen, blood transfusions, use of inotropes, mechanical ventilation, and the need for surgical interventions were all found to be significantly correlated with mortality, with p-values less than 0.05, suggesting that these factors are strongly linked to patient prognosis and survival.

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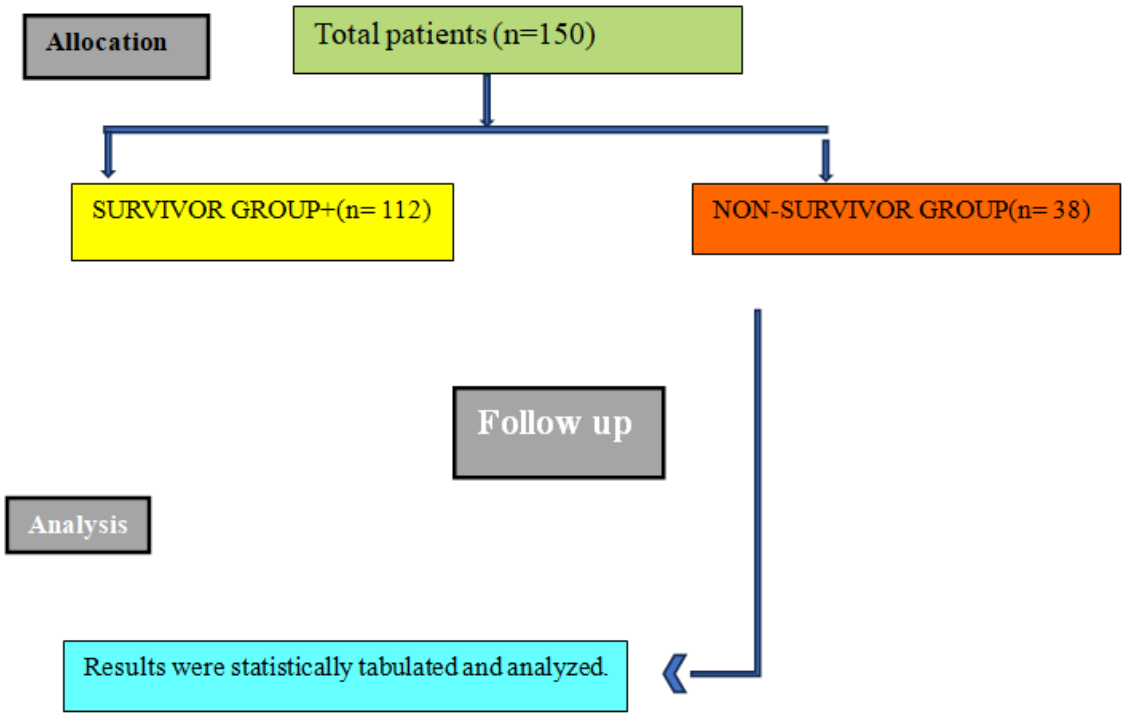


**Figure 3: Flow-chart of the process of study.**

**Table 1. Baseline Socio-demographic data.**

| Baseline Socio-demographic data | | Survivors (n=112, 74.6%) | Non- survivors (n=38, 25.3%) | Total (n=150) | P value |
|---|---|---|---|---|---|
| Gender | Male | 60 (71.4%) | 24 (29.6%) | 84(56.0%) | 0.485 |
| | Female | 52 (78.8%) | 14 (21.2%) | 66 (44.0%) | |
| Age | <1 year | 32 (80%) | 8 (20%) | 40 (26.7%) | 0.326 |
| | 1-5 years | 34 (66.7%) | 17 (33.3%) | 51 (34.0%) | |
| | 5-10 years | 22 (70.9%) | 9 (29.1%) | 31(20.7%) | |
| | >10 years | 24 (85.7%) | 4 (14.3%) | 28 (18.7%) | |
| Residence | Rural | 66 (70.2%) | 28 (29.8%) | 94 (62.7%) | 0.189 |
| | Urban | 46 (82.1%) | 10 (27.9%) | 56 (37.3%) | |

**Table 2. Comparison between survivors and non-survivors.**

| Observed variable | | Survivors (n=112) | Non- survivors (n=38) | Total (n=150) | P value |
|---|---|---|---|---|---|
| SEPSIS | Yes | 40 (64.5%) | 22 (35.5%%) | 62 (41.3%) | <0.0001 |
| | No | 72 (81.8%) | 16 (18.2%) | 88 (58.7%) | |
| **Therapeutic parameter** | | Survivors | Non-survivors | Total | p value |
| Oxygen requirement | Yes | 77 (70.6%) | 32 (29.4%) | 109 (72.7%) | 0.01 |
| | No | 35 (85.4%) | 6 (14.6%) | 41 (27.3%) | |
| Blood transfusion | Yes | 24 (57.1%) | 18 (42.9%) | 42 (28.0%) | 0.003 |
| | No | 88 (81.5%) | 20 (18.5%) | 108 (72.0%) | |
| Inotropes | Yes | 39 (50.6%) | 38 (49.3%) | 77 (50.7%) | <0.001 |
| | No | 73 (98.6%) | 0 (0%) | 73 (49.3%) | |
| Mechanical ventilation | Yes | 32 (51.6%) | 38 (48.4%) | 62 (41.3%) | <0.001 |
| | No | 80 (100%) | 0 (0%) | 88 (58.7%) | |
| Surgical intervention | Yes | 6 (60%) | 4 (40%) | 10 (6.7%) | <0.001 |
| | No | 106 (75.7%) | 34 (24.3%) | 140 (93.3%) | |

Table 2 shows that out patients with sepsis, 64.5% survived, while the mortality rate was 35.5%. Among patients without sepsis, 81.8% survived and 18.2% died, highlighting a significant association between sepsis and poor prognosis (p<0.0001). Additionally, requirement of therapeutic intervention like oxygen, blood transfusion, inotropes, mechanical ventilation and surgical intervention demonstrated a significant association mortality risk (p<0.001).

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**Table 3. Co-relation of Platelet indices, its ratios and PIM II score between Survivors and Non-Survivors**

| Variable | | Survivors (n=112) | Non- survivors (n=38) | Mann-Whitney U test | P value |
|---|---|---|---|---|---|
| **Platelet Indices** (Mean±SD) | **PLT** | 2.69±1.03 | 2.33±1.11 | 1453.00 | 0.030 |
| | **PCT** | 0.37±0.37 | 0.38±0.11 | 1529.00 | 0.010 |
| | **MPV** | 9.35±2.13 | 19.08±4.26 | 221.00 | <0.001 |
| | **PDW** | 12.35±5.34 | 11.23±3.05 | 1980.00 | 0.522 |
| **Platelet Indices ratio** (Mean±SD) | **MPV/PLT** | 4.52±3.72 | 10.74±8.48 | 524.00 | <0.0001 |
| | **MPV/PCT** | 37.83±34.10 | 65.59±93.22 | 730.00 | <0.0001 |
| | **PDW/PLT** | 5.70±5.42 | 8.02±14.80 | 1881.50 | 0.287 |
| | **PDW/PCT** | 46.37±40.92 | 69.59±240.45 | 1501.00 | 0.007 |
| **PIM II score** | | 4.37±5.46 | 13.76±2.68 | 414.00 | <0.001 |

The table highlights the correlation of platelet indices between survivors and non-survivors. The comparison of platelet count on admission showed a significant difference, with survivors having a platelet count of 2.69±1.03, while non-survivors had 2.33±1.11 (p=0.03). The PCT in survivors was 0.37±0.37 and in non-survivors was 0.38±0.11, suggesting a significant correlation of PCT with mortality (p=0.010). MPV on admission was significantly higher in non-survivors (19.08±4.26) compared to survivors (9.35±2.13) (p<0.001). PDW in survivors was 12.35±5.34 and in non-survivors was 11.23±3.05, showing no significant correlation with mortality (p=0.522). The ratio of MPV/PLT in survivors was 4.52±3.72 and in non-survivors was 10.74±8.48, indicating a significant correlation with mortality (p<0.001). The ratio of MPV/PCT in survivors was 37.83±34.10 and in non-survivors was 65.59±93.22, also showing a significant correlation with mortality (p<0.0001). The table also shows a statistically non-significant result for PDW/PLT with values of 5.70±5.42 in survivors and 8.02±14.80 in non-survivors (p=0.287). Lastly, the ratio of PDW/PCT in survivors was 46.37±40.92 and in non-survivors was 69.59±240.45, with a significant correlation to mortality (p=0.007).

**Table 4. Correlation of platelet indices and platelet indices ratios with PIM II Score in survivor and non-survivor.**

| Variables | | PIM II score | | | |
|---|---|---|---|---|---|
| | | Survivor | | Non-survivor | |
| | | Rho (ρ) | P value | Rho (ρ) | P value |
| Platelet indices | PLT | -0.200 | 0.058 | -0.345 | 0.045 |
| | PCT | -0.088 | 0.354 | 0.047 | 0.777 |
| | MPV | 0.115 | 0.229 | 0.360 | 0.028 |
| | PDW | -0.169 | 0.075 | 0.330 | 0.043 |
| Platelet indices ratios | PDW/PLT | 0.031 | 0.888 | 0.383 | 0.018 |
| | PDW/PCT | -0.131 | 0.169 | 0.365 | 0.024 |
| | MPV/PCT | 0.031 | 0.743 | 0.113 | 0.499 |
| | MPV/PLT | 0.252 | 0.007 | 0.228 | 0.168 |

Spearman's correlation test

The table interprets the relationship between platelet indices and the PIM II score as follows: There is a weak negative correlation between platelet count (PLT) and PIM II score in both survivors and non-survivors, with statistical significance ($p < 0.035$) only in non-survivors. No significant correlation is observed between platelet crit (PCT) and PIM II score in either group. For mean platelet volume (MPV), a weak positive correlation is seen in survivors ($p = 0.229$), but a moderate positive and statistically significant correlation ($p = 0.028$) exists in non-survivors, indicating higher MPV values correlate with higher PIM II scores in non-survivors. Platelet distribution width (PDW) shows a weak negative correlation in survivors ($\rho = -0.169$, $p = 0.075$), but a moderate positive and significant correlation in non-survivors ($\rho = 0.330$, $p = 0.043$), suggesting higher PDW values are linked with higher PIM II scores in non-survivors. For PDW/PLT ratio, a very weak positive correlation is found in survivors ($\rho = 0.031$, $p = 0.888$), but in non-survivors, it is a moderate positive and significant correlation ($\rho = 0.383$, $p = 0.018$). Similarly, the PDW/PCT ratio shows a weak negative correlation in survivors ($\rho = -0.131$, $p = 0.169$), but a moderate positive and significant correlation in non-survivors ($\rho = 0.365$, $p = 0.024$). The MPV/PCT ratio shows very weak correlations in both groups, with no statistical significance. Lastly, the MPV/PLT ratio demonstrates a weak positive correlation in both survivors and non-survivors, significant in survivors ($p = 0.007$) but not in non-survivors ($p = 0.168$). These results suggest that certain platelet indices and ratios, particularly in non-survivors, are significantly correlated with higher PIM II scores.

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**Table 5. Comparison of platelet indices between sepsis and non-sepsis**

| Variable | | Sepsis (n=62) | Non- sepsis (n=88) | Mann-Whitney U test | P value |
|---|---|---|---|---|---|
| **Platelet Indices** (Mean±SD) | **PLT** | 2.59±1.13 | 1.60±1.51 | 2140.50 | **0.034** |
| | **PCT** | 0.36±1.87 | 0.38±0.40 | 2684.00 | 0.867 |
| | **MPV** | 12.85±5.57 | 11.09±4.63 | 2203.50 | **0.045** |
| | **PDW** | 11.22±3.02 | 12.66±5.78 | 2475.50 | 0.335 |
| **Platelet Indices ratios** (Mean±SD) | **MPV/PLT** | 6.71±7.12 | 5.65±4.98 | 2343.50 | 0.142 |
| | **MPV/PCT** | 51.48±76.19 | 41.50±37.10 | 2230.50 | 0.058 |
| | **PDW/PLT** | 6.35±11.68 | 6.24±6.10 | 2498.50 | 0.381 |
| | **PDW/PCT** | 60.40±188.26 | 46.51±44.38 | 2476.00 | 0.336 |

Table 5. Comparison of platelet indices was made between sepsis and non-sepsis participants wherein PLT was found to have a **significant** association with sepsis. (p=0.034)

MPV was also slightly higher in patients with sepsis (p=0.045) suggesting that MPV has a **significant** association between sepsis and non-sepsis.

PCT and PDW showed **no significant** association with sepsis (p=0.867 and 0.335 respectively) shows all the platelet indices ratios made between sepsis and non-sepsis**. No significance** wasobservedbetween all the platelet ratios were seen in sepsis and non-sepsis.

**Platelet Indices and Mortality**

- Platelet count (PLT) was significantly lower in non-survivors compared to survivors ($p = 0.03$).
- MPV was significantly higher in non-survivors ($p < 0.001$).
- MPV/PLT and MPV/PCT ratios had a significant correlation with mortality ($p < 0.001$).

This study aimed to explore the role of platelet indices in predicting mortality and morbidity in paediatric ICU patients, comparing their effectiveness with the PIM II score. The results demonstrated that platelet indices, especially MPV, were significantly correlated with patient outcomes. Higher MPV values were found in non-survivors, supporting the hypothesis that platelet dysfunction, as reflected by MPV, may be a useful prognostic marker. Additionally, MPV/PLT and MPV/PCT ratios showed significant associations with mortality, indicating their potential utility in early risk stratification.

While the PIM II score remains a valuable tool for predicting mortality, our findings suggest that platelet indices could be used as supplementary markers, particularly in resource-limited settings where rapid assessment is needed. Further studies are required to validate these findings in different populations and settings.

## CONCLUSION

Platelet indices, particularly MPV and its ratios, may serve as reliable prognostic markers in paediatric ICU patients, with significant correlations observed with mortality outcomes. These indices, when used alongside the PIM II score, can improve the accuracy of risk prediction and aid in better resource management in paediatric intensive care settings.

**Limitations**

1. The study was conducted at a single centre, and results may not be generalizable to other regions or hospitals.
2. The sample size was limited to 150 patients, which may not fully capture the variability of platelet indices in different paediatric populations.

## REFERENCES

1. Admission platelet count and indices as predictors of outcome in children with severe Sepsis: a prospective hospital-based study - PMC
2. https://doi.org/10.3889/oamjms.2020.4448
3. https://doi:10.1001/jamanetworkopen.2024.59684
4. Pediatric index of mortality 2 score as an outcome predictor in pediatric Intensive Care Unit in India - PMC
5. Admission platelet count and indices as predictors of outcome in children with severe Sepsis: a prospective hospital-based study - PubMed
6. The Impact of Various Platelet Indices as Prognostic Markers of Septic Shock | PLOS One
7. Pediatric index of mortality 2 score as an outcome predictor in pediatric Intensive Care Unit in India - PMC
8. Performance of Pediatric Risk of Mortality (PRISM), Pediatric Index of Mortality (PIM), and PIM2 in a pediatric intensive care unit in a developing country - PubMed