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Original Research Article

Assessing Correlation between Platelet Indices and C-Reactive Protein in Infants Admitted with Acute Febrile Illness: An Observational Study

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Abstract

Aim: The aim of the present study was to assess the correlation between platelet indices and C-reactive protein in infants admitted with acute febrile illness.

Methods: This hospital based descriptive study was conducted in Department of Paediatrics . As per sample size calculation 2500 patients were included in the study.

Results: Sex distribution i.e. 1050 male and 950 female was not statistically significant. Maximum and minimum age in months for male and female subjects, the maximum age was 12 months for both the groups the minimum age for males was 1.2 months and for females was 1.4 months. There was no significant difference in height and weight between male and female. The laboratory characteristics were not statistically significant in males and females. The results were statistically significant in males for platelets, CRP (p value <0.001), PCT and CR while and MPV, PDW and WBC were not statistically significant. The results were statistically significant in females for platelets and CRP (p value <0.001) and PCT while MPV, PDW, PCT and WBC were not statistically significant. The optimum cut off value of platelets and WBC showed statistically significant difference.

Conclusion: CRP and platelet levels decreased dramatically as the patient's health improved. Furthermore, our findings revealed a strong link between CRP and platelet counts in patients. Platelet count, PDW, MPV, and PCT were all influenced. Only MPV was replaced on the third day of the fever.

Keywords: Platelet count, Mean platelet volume, Platelet distribution width, CRP

Introduction

Fever is not an illness, but rather a clinical condition associated with numerous diseases in childhood. The causes of fever can be divided into four main groups: infectious, inflammatory, neoplastic, and miscellaneous. [1] Infectious causes are the most common during childhood. Fever prevents bacterial and viral proliferation. It also affects neutrophil and lymphocyte counts, as well as acute phase reactions. [1-3] Platelets, which are central to both hemostasis and thrombosis, are one variety of blood cell. Recent studies have shown that platelets play an important role in the immune system. [4,5] Platelet count, mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT) are all parameters routinely evaluated during complete blood count (CBC). Changes can occur in these platelet parameters during bacterial and viral infections, vascular inflammatory diseases, and malignant diseases, as well as in some specific patient groups (intensive care unit patients, newborn sepsis patients, etc.). [5-9]

Platelet count is unaffected by fever duration (based on the incidence of both thrombocytopenia and thrombocytosis). The average size and manufacturing rate of platelets are shown by the mean platelet volume (MPV). MPV levels are not affected by age or gender. Infectious disorders such rotavirus gastroenteritis, respiratory syncytial virus infection, hepatitis B and C virus infection, brucellosis, and pulmonary tuberculosis, and also medical and non-medical situations, might impact MPV readings. CRP belongs to the short pentraxin family of plasma proteins, which consists of five identical non-glycosylated peptide subunits that join to form a cyclic pentamer structure. CRP is created as a result of neutrophil and monocyte-mediated pro-inflammatory cytokine signaling. CRP plasma concentration changes depending on the pace of

CRP production and the degree of infection. CRP plasma concentration changes during infection or inflammation as part of the innate immune response. CRP has a half-life of 19 hours in plasma and is excreted by the urinary system.

The aim of the present study was to assess the correlation between platelet indices and C-reactive protein in infants admitted with acute febrile illness.

Materials and Methods

This hospital based descriptive study was conducted in Department of Paediatrics, NMCH, Patna, Bihar, India for the period of 20 months. As per sample size calculation 2500 patients were included in the study.

Patients of either sex, age from 1 month to 1 year of age with fever admitted in hospital were included in the study. Age less than 1 month and more than 1 year, children with hematological diseases affecting platelets, not consenting, and children receiving iv antibiotics prior to admission in the Hospital were excluded in the study. All children presenting to the hospital with fever, fulfilling the inclusion and exclusion criteria were enrolled in the study. An informed consent was taken from the parents or guardian of the patients.

Children admitted with fever between 1 month and 1 year of age, whose hemogram and CRP was done by the treating physician, were included in the study. Children with any hematological disorders affecting platelets, those who received antibiotic therapy or other medications affecting platelet count were excluded from the study. Data was collected from blood investigation reports of 3000 patients fitting inclusion criteria. Serial complete blood count (CBC) and CRP were done on days 1, 3 and 7 of admission. Each of the platelet indices were compared with CRP to find out the correlation between the two using Pearson correlation. By receiver operating characteristic (ROC) curve the cut off value for all platelet indices were found out.

Statistical Analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft excel) and then exported to data editor of statistical package for the social sciences (SPSS) version 23.0 (SPSS Inc., Chicago, Illinois, USA). Statistical software SPSS and Microsoft excel were used to carry out the statistical analysis of data. Descriptive statistics of data including percentages and means were reported. Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean±standard deviation (SD) and median. Graphically, the data was presented by bar and pie diagrams. A p value of less than 0.05 was considered statistically significant.

Results

Table 1: Age distribution

Gender		**Number of patients**
Male		1050
Female		950
Total		1000
Age (in months)	**Male**	**Female**
Maximum	13	13
Minimum	1.2	1.4
Mean±SD	7.3±2.4	6.4±2.5
Height	55.5±15	54.6±12
Weight	64±1.6	56±1.4

Sex distribution i.e. 1050 male and 950 female was not statistically significant. Maximum and minimum age in months for male and female subjects, the maximum age was 12 months for both the groups the minimum age for males was 1.2 months and for females was 1.4 months. The mean±SD for males was 7.3±2.4 and for females was 6.4±2.5. The difference was not statistically significant. There was no significant difference in height and weight between male and female.

Table 2: Laboratory characteristics of the study subjects

Variable (mean±SD)	**Males**	**Females**	**P value**
WBC (mm^3)	7840.00±2125.85	7921.59±1950.36	0.750
Hemoglobin (g/dl)	12.18±1.36	11.89±1.50	0.645
PLT (1.40-4.40×109/l)	$3.32x10^9$±$153×10^9$	$3.02±1.80×10^9$	0.934
MPV (8.5-12.5 fl)	8.32±0.98	8.72±0.84	0.947
PCT (0.21-0.23%)	0.24±0.14	0.23±0.16	0.242
PDW (10-17 fl)	9.84±1.48	10.34±1.38	0.520
CRP (mg/dl)	22.56±0.86	2.48±0.82	0.540

The laboratory characteristics were not statistically significant in males and females.

Table 3: Correlation of platelet indices with quantitative and qualitative variables

Variables	P value	R correlation
PLT and CRP	0.02	0.245
MPV and CRP	0.02	-0.25
PDW and CRP	0.05	-0.196
PCT and CRP	0.04	-0.24

There was a significantly positive correlation between PLT and CRP. However, all of the platelet indices had significantly negative correlation with CRP.

Table 4: Data on the 1st, 3rd and 7th day after admission for males

Variable (mean±SD)	Day 1	Day 2	Day 3	P value
WBC (mm^3)	7840.00±2125.85	7528.52±1927.36	7225.55±1925.38	0.780
Hemoglobin (mg/dl)	12.18±1.36	11.87±1.54	11.96±1.56	0.649
PLT (1.4-4.4×10^9/l)	3.20x10^9±153×10^9	3.12×10^9±1.80×10^9	3.04×10^9±1.80×10^9	<0.001
MPV (8.5-12.5 fl)	8.32±0.98	8.42±0.84	8.42±0.84	0.965
PDW (10-17 fl)	0.24±0.14	10.35±1.36	10.24±1.36	0.740
PCT (0.21-0.23%)	9.84±1.48	0.23±0.07	0.24±0.070	0.118
CRP (mg/dl)	22.56±0.86	12.48±1.94	2.49±0.86	<0.001

The results were statistically significant in males for platelets, CRP (p value <0.001), PCT and CR while and MPV, PDW and WBC were not statistically significant.

Table 5: Data on the 1st, 3rd and 7th day after admission for females

Variable (mean±SD)	Day 1	Day 2	Day 3	P value
WBC (mm^3)	7921.59±1950.36	7728.55±1925.38	7289.55±1950.38	0.777
Hemoglobin (mg/dl)	11.89±1.50	11.36±1.54	11.55±1.56	0.645
PLT (1.4-4.4×10^9/l)	3.14±1.80×10^9	3.10x10^9±180×10^9	3.02x10^9±180×10^9	<0.001
MPV (8.5-12.5 fl)	8.72±0.84	8.48±0.88	8.46±0.84	0.957
PCT (0.21-0.21%)	0.23±0.16	0.26±0.24	0.25±0.15	0.118
PDW (10-17 fl)	10.34±1.38	10.36±1.37	10.28±1.32	0.744
CRP (mg/dl)	2.48±0.82	12.52±1.98	2.44±0.84	<0.001

The results were statistically significant in females for platelets and CRP (p value <0.001) and PCT while MPV, PDW, PCT and WBC were not statistically significant.

Table 6: Sensitivity, specificity and accuracy of PLT and platelet indices

Variables	Cut-off point	Sensitivity	Specificity	AUC	95% CI	SE	P value
PLT	>252000	95.65	30.73	0.629	0.551-0.697	0.0419	<0.001
MPV	≤7.7	34.96	93.27	0.644	0.575-0.719	0.0409	0.984
PDW	≤8.9	38.32	84.36	0.624	0.547-0.693	0.0417	0.550
WBC	>10400	97.3	94.6	0.996	0.971-1.00	0.00251	<0.001
PCT	≤0.17	94.76	78.02	0.888	0.100-0.150	0.0101	0.965

The optimum cut off value of platelets and WBC showed statistically significant difference.

Discussion

Fever, often known as pyrexia, is a condition in which the normal body temperature is elevated above homeostasis.1 Infectious, inflammatory, neoplastic, and other causes of fever can be categorized into four categories. Fever in the paediatric population is usually grouped into 4 categories: fever in the neonate, fever with localizing signs, fever without source (FWS) and fever of unknown origin (FUO). Fever is a condition in which the body temperature increases over normal levels, and according to Saladin's great scientific text, it is a good condition as long as it does not last or reach 44°C to 46°C, at which point it might be fatal or cause irreversible brain damage. [10,11] The thermoregulatory centre, located in the preoptic portion of the anterior hypothalamus, regulates temperature. The hypothalamic set point keeps body temperature about 37°C in most people,

but there can be significant fluctuation. Normal daytime temperatures range from 36 to 37.8°C, with a high in the afternoon (5-7 p.m.) and a trough in the early morning (2-6 a.m.).

Sex distribution i.e. 1050 male and 950 female was not statistically significant. Maximum and minimum age in months for male and female subjects, the maximum age was 12 months for both the groups the minimum age for males was 1.2 months and for females was 1.4 months. The mean±SD for males was 7.3±2.4 and for females was 6.4±2.5. The difference was not statistically significant. There was no significant difference in height and weight between male and female. The laboratory characteristics were not statistically significant in males and females.

However, all of the platelet indices had significantly negative correlation with CRP. The results were statistically significant for platelets and CRP (p value <0.001) and PCT while as they were not statistically significant for MPV, PDW, PCT and WBC for male and females. The results were statistically significant in females for platelets and CRP (p value <0.001) and PCT while MPV, PDW, PCT and WBC were not statistically significant. The sensitivity was highest for platelets at 95.65 and lowest for MPV 34.96 while as specificity was highest for WBC at 94.6 for MPV was 93.27 and lowest for PLT 30.73. However, when it comes to MPV as an acute phase reactant, the same cannot be said. Some research found greater MPV values, while others found lower MPV values. Tekin et al found that the MPV's sensitivity and specificity were 81.4 percent and 86.3 percent, respectively, while utilizing a cut-off value of 8.2 fl. [12] Various investigations on MPV in patients with infectious and inflammatory disorders produced inconsistent results. MPV had a substantial negative connection with CRP in our study, with a significant cut off value of MPV was ≤7.7 fl. Patients with lower PLT count and PCT (p=0.001 and 0.001, respectively), increased MPV and PDW (p=0.014 and 0.004, respectively) had a significantly higher risk of mortality than those with normal platelet indices, according to Samuel et al [13] According to Makwana et al, increased MPV, PDW, and PCT were related with a longer hospital stay and a longer fluid therapy requirement. [14] According to Srinivasa et al, MPV and PDW levels were greater in patients with culture-proven sepsis, particularly with gram-positive organisms. PDW had a negative connection with CRP in our study. [15]

Platelets are one variety of blood cell. However, they have no nucleus, and some authors do not therefore regard them as cells.[16,17] Nevertheless, platelets act like cells in many ways. Researchers agree on the role of platelets in hemostasis. Some tumor cells are also protected against the immune system by platelets. [18] At the same time, platelets are also involved in the immune system response of host defenses. [19] Platelet-leukocyte interactions have been shown in atherothrombosis, inflammatory lung disease, inflammatory bowel disease, and inflammatory skin disease. [20]

Conclusion

CRP and platelet levels decreased dramatically as the patient's health improved. Furthermore, our findings revealed a strong link between CRP and platelet counts in patients. Platelet count, PDW, MPV, and PCT were all influenced. Only MPV was replaced on the third day of the fever.

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