



ANALYSIS OF PLATELET PARAMETERS IN CHILDREN WITH PNEUMONIA -A PEDIATRIC TERTIARY CARE HOSPITAL.

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ABSTRACT Pneumonia is the inflammation of lung tissue in the alveoli and interstitium due to infectious and non-infectious factors, and is one of the primary causes of child mortality in developing countries, resulting each year in death of 1.1-1.4 million children worldwide¹. In many pediatric patients, the diagnosis of pneumonia is based on clinical symptoms such as coughing, wheezing, fever, cyanosis and difficulty in breathing. A radiological examination is performed to make a differentiation between lobar pneumonia and broncho-pneumonia. Revised guidelines of WHO classified pneumonia into two categories A) pneumonia which can be treated at home with the oral dose of amoxicillin and, B) severe pneumonia is treated with injectable antibiotics.² Despite advances in its management over the last few decades, severe pneumonia (SP) remains a primary cause of death from infection across the globe, with a mortality rate ranging from 20% to more than 50% . 3, 4 Patients with SP are seriously ill and will progress to shock and even multiple organ dysfunction quickly if not treated properly in time.⁵ Platelets are conventionally considered to have a role in hemostasis and thrombosis, but have received increasing attention for their role in inflammation and immune responses.⁶⁻⁹ **Methods:** A prospective study was conducted in the Upgraded Department of Pathology, Osmania government general hospital , Hyderabad during July 2019 to July 2022. In present study 100 patients were evaluated fulfilling the criteria of pneumonia in pediatric age group. Detailed history, thorough clinical examination, complete hemogram through automated Hematology analyzer and peripheral smear examination was performed in all the 100 patients. Platelet indices have been evaluated in all 100 patients. **Result:** A total of 100 cases were studied and compared to controls with same mean age. All cases admitted with pneumonia were included. The age range was 1 to 12 years with mean age being 2.77 years. Male preponderance was noted with a male: female= 2.1 : 1 .Majority of cases were seen in the age group of 1.5years.Total leucocyte count, Platelet count and Platelet Indices such as Mean platelet Volume, platelet distribution width and plateletcrit were compared between cases and controls. The mean total leucocyte count was found be higher (10.9) in the cases when compared to controls(8.34) with a statistically significant P value (<0.0000001).The mean Platelet count and plateletcrit was found to be higher (4.21,000 and 0.68) in cases when compared to controls (3,29,000 and 0.32) respectively. Mean platelet volume was found to be lower (9.2) in cases when compared to controls(9.4) though the p value is insignificant(0.31).The mean Platelet distribution width was found to be increased in cases (11.1) when compared to controls(10.8) though the p value is insignificant(0.44). **Conclusion:** Pneumonia is the leading cause of mortality in children less than 5 years in the developing countries such as India. Platelets play a major role in antimicrobial host defense, the induction of inflammation and tissue repair. Activation of platelets stimulates platelet interactions with complement proteins and humoral immune components. Platelets are capable of binding, aggregating and internalizing microorganisms, which enhances the clearance of pathogens from bloodstream. Thrombocytosis was commonly associated with pneumonia in children. Children with thrombocytosis usually develop severe illness and complications resulting in prolonged hospital stay. Degree of thrombocytosis directly correlated with severity of illness. Hence the variations in platelet count and platelet indices such as platelet distribution width (PDW), plateletcrit (PCT), Mean platelet volume (MPV) in children with pneumonia may be used to assess the severity of pneumonia, prevent complications and reduce the duration of hospitalization.

KEYWORDS : Pneumonia, Platelet, Mean platelet volume, Plateletcrit.

INTRODUCTION

Platelets are produced predominantly by the bone marrow megakaryocytes as a result of budding of the cytoplasmic membrane. Megakaryocytes are derived from the hematopoietic stem cell, which was stimulated to differentiate to mature megakaryocytes under the influence of various cytokines, including thrombopoietin.

The mean platelet diameter is 1-2µm and the normal range for cell volume (MPV) is 8-11 fl. Although platelets are non-nucleated cells, those that have recently been released from the bone marrow contain RNA and are known as reticulated platelets. They normally represent 16% of the total count and they indirectly indicate the state of marrow production.¹⁰

Platelet Indices:

Complete blood count (CBC) tests with automated hematology analyzers are one of the most commonly ordered tests in clinical laboratories. Among them Platelet counts, Mean Platelet Volume (MPV) and Platelet Distribution Width are important parameters.¹¹Modern hematology analyzers in routine diagnostic use, which measure platelet Indices (PIs), use impedance counting or optical light scatter counting techniques..

Investigations focusing on the diagnostic and prognostic values in a

variety of Settings without bringing extra costs. The platelet indices (PI) are: Mean platelet volume (MPV), Platelet distribution width (PDW) and Plateletcrit.

Platelet Parameters In Pneumonia:

Platelet Count: Secondary thrombocytosis is a common finding in pediatric Patients with infections.^{12,13,14}

Platelets and leukocytes are activated in response to microbial infections, and the response of platelets shows similarities to the response mediated by leukocytes. Leukocytes ingest bacteria, while platelets encapsulate microorganisms in phagosome-like vacuoles, which allow the rapid clearance of pathogens. Thrombocytosis is more common in bone, joint and pleural cavity infections, and although it is known to occur more often in bacterial infections with a more severe clinical progression, elevated platelet counts are also reported in bronchiolitis with Viral etiology, as well as pneumonia^{15,16,17}

Prina et al conducted a study in which they revealed that complicated pleural effusion and empyema were more common in patients with thrombocytosis, while Severe sepsis, septic shock and intensive care unit hospitalization were seen more in patients with thrombocytopenia, to a significant degree.¹⁸ Patients with abnormal platelet counts had longer hospital stays and higher mortality and

rehospitalization rates. Mirsaedi et al. reported a significant correlation between thrombocytopenia and thrombocytosis and mortality, and thrombocytosis was shown to be independently correlated with the length of hospital stay in patients with community acquired pneumonia (CAP)¹⁹

MATERIALS AND METHODS

The present study was conducted in the Upgraded Department of pathology, Osmania Medical College and Niloufer Hospital, Hyderabad...

Study Design: Prospective study.

Study Period: The present study was conducted during July 2019 to July 2022.

Method Of Collection Of Data

Source of Data: Clinically diagnosed cases of pneumonia in pediatric age group in the Niloufer hospital, Hyderabad.

Sample Size: 100 Pediatric cases of pneumonia

Sampling Procedure

Data collected from the records of Niloufer hospital, Hyderabad.

NUMBER OF GROUPS TO BE STUDIED: Two groups. (cases - group I and controls - group II)

Inclusion Criteria

All children admitted with Pneumonia.

Exclusion Criteria

Children who were admitted to the hospital for other reasons and were believed to have Pneumonia as a hospital-acquired infection at least 48 hours after admission were excluded from the study

Procedure

The study was approved by the Ethical committee of Niloufer Hospital, Hyderabad. During the study period, all pediatric cases of pneumonia fulfilling the inclusion criterion were included in this study after obtaining informed written consent.

All patients underwent complete hemogram. These patients were subjected to routine hematological investigations.

The peripheral smear was studied after staining with Leishman's stain. The samples of both cases and controls were analyzed through automated hematology analyzer and results tabulated in excel sheet.

RESULTS

Total data collected had been classified in to study group (group I) and control (group II).

Group I comprised 100 children with pneumonia and group II comprised 100 children without pneumonia.

Of total 100 cases studied 42% of cases are below the age of 1.5 years. Of total 100 cases studied the minimum cases reported were in the age group between 8 to 12 years – 5%.

Group I (patient group) comprised 100 patients with pneumonia, of which 32 (32%) were female and 68(68%) were male. Mean age among patient group is 2.77. Group II (control group) comprised 100 children without pneumonia of which 31(31%) were female and 69(69%) were male. The most common symptom is fever which is present in 82% of cases followed by tachypnea which is present in 74% of cases.

Most common clinical symptom in severe pneumonia patients-100%. There are 90 cases of bronchopneumonia and 10 cases of lobar pneumonia in the study group. The minimum platelet count in study group was found to be 95 with maximum value of 1711 with mean of 421 and standard deviation of 207. The minimum platelet count in control group was found to be 200 with maximum value of 534 with mean of 329 and standard deviation of 79. The P value is 0.00005 (P value is significant). The minimum Platelet distribution width (PDW) in study group was found to be 7 with maximum value of 22.4 with mean of 11.1 and standard deviation of 2.5

The minimum Platelet distribution width (PDW) in control group was found to be 7.1 with Maximum value of 15.6 with mean of 10.8 and standard deviation of 1.7. The P value is 0.44 (P value is insignificant). The minimum Mean platelet volume (MPV) in study group was found to be 6.4 with maximum value of 14.3 with mean of 9.2 and standard

deviation of 1.0. The minimum Mean platelet volume (MPV) in control group was found to be 7.5 with maximum value of 13.1 with mean of 9.4 and standard deviation of .89. The P value is 0.31 (P value is insignificant). The minimum plateletcrit in study group was found to be 0.19 with maximum value of 1.1 with mean of 0.68 and standard deviation of .15. The minimum plateletcrit in control group was found to be 0.15 with maximum value of 0.53 with mean of 0.32 and standard deviation of 0.07. The P value is <0.005 (P value is significant)

In our present study 2% of cases were with complications. On Comparison of mean platelet count in cases with and without complications was 1367×10^3 and 402.27×10^3 respectively. P value was 0.0001 and found to be significant.

DISCUSSION

The present study is carried over in the Department of Pathology, Niloufer hospital, Hyderabad. Analysis of platelet parameters in children with pneumonia was done.

Pneumonia is the inflammation of lung tissue in the alveoli and interstitium due to infectious and non-infectious factors, and is one of the primary causes of child mortality in developing countries, resulting each year in death of 1.1-1.4 million children worldwide¹

WBC count, ESR (erythrocyte sedimentation rate), CRP (C-reactive protein) are the most commonly used acute phase reactants. Although platelet parameters, including platelet count, mean platelet volume and platelet distribution width, can also act as acute phase reactants in inflammatory diseases.

Various studies were made in this perspective to evaluate the significance of platelet parameters in acute inflammatory conditions.

Musa Sahin et al in 2017 has studied the platelet parameters in children with pneumonia.²⁰

Ashraf A. ELMaraghy et al studied platelet count as a possible marker for predicting the severity and outcome of community acquired pneumonia in 2016.²¹

Anubha Jain et al in 2018 studied about the low platelet count as a predictor of mortality in severe community acquired pneumonia in less than five children.²²

The present study aims to correlate platelet parameters with pediatric patients admitted in to the hospital versus control population of similar age group.

Age And Sex Distribution Of Cases And Controls

In our study, Group I comprised 100 patients with pneumonia, of which 32(32%) were female and 68(68%) were male. The minimum and maximum age of the patients was 1 year and 12 years respectively. The mean age of the patients was 2.77±2.23 years. 45% of cases are under the age of 2 years. This was found to be concordant with the study done by Jayashree Gothankar et al, done on pediatric pneumonias of 5 years of age a south East Asia study done in the state of Maharashtra, India, indicating that the risk of acquiring pneumonia is higher among young infants, malnourished children, non-exclusively breastfed children and those with exposure to solid fuel use.²³ Group II comprised 100 children without pneumonia, of which 31 (31%) were female and 69(69%) were male. Groups I and II were similar in terms of age.

Most Common Clinical Symptoms

For Group I the diagnosis of pneumonia was made according to the presence of fever, cough, respiratory distress and detection of tachypnea, cyanosis and apnea, detection of rale and rhonchus with auscultation during physical examination. Anterior and posterior chest x rays and laboratory findings. Several studies have evaluated the use of various clinical symptoms and signs in children with pneumonia. Studies done by Campbell H et al²⁴, noticed that tachypnea has been the most sensitive indicator in pediatric pneumonias.

In our study Tachypnea was found to be present in 74% of the cases and it was the clinical parameter to classify as pneumonia.

Rapid breathing/ respiratory distress (100%), cough (100%) and fever (99%) were the most common symptoms. Tachypnea (100%), chest retractions (100%) and crepitations (82%) were the most common

signs in the study done by Prabhakar et al.

In our study of all cases, 82% of cases presented with fever making it commonest symptom of presentation in pediatric age group for pneumonia followed by tachypnea, which is present in 74% of cases, cough is present in 62% of cases, chest wall indrawing is present in 26% of cases and wheeze is present in 24% of cases, which were nearly comparable to study done by Prabhakar et al.²⁵

In this study we have compared platelet parameters such as PLT, PCT, MPV and PDW between group I and II

Platelet Count (PLT)

The minimum and maximum value of Platelet count for the age group of 1 to 12 years is 150000 and 450000. In our study Group I which constitutes patients the Platelet count is found to be 95000 and 1711000 as the minimum and maximum range with a mean of 421000. In our study Group II which constitutes controls the Platelet count is found to be 200000 and 534000 as the minimum and maximum range with a mean of 329000.

The incidence of Thrombocytopenia(<150000) in Group I is 3% and increased platelet count of >450000 is 30% when compared to controls – Group II 0% and 6% respectively indicating the incidence of increased platelet count in children with pneumonia, Correlated with significant P value of 0.00005

The incidence of thrombocytopenia and with increased platelet count (>4.5 lakhs) in patients staying < 14 days in hospital was 3.3% and 33.7% respectively.

Mean Platelet Volume (MPV)

The minimum and maximum value of Mean platelet volume for the age group of 1 to 12 years is 8 and 11. In our study Group I which constitutes patients the Mean platelet volume is found to be 6.4 and 14.3 as the minimum and maximum range with a mean of 9.2. In our study Group II which constitutes the control group Mean platelet volume is found to be 7.5 and 13.1 as the minimum and maximum range with a mean of 9.4. Though the MPV when compared to control group was not statistically significant (.31) but it was high (9.4) in control group. This observation is in near correlation with Musa sahin et al study where they found statistical significance.²⁰

Platelet Distribution Width

The minimum and maximum value of Platelet distribution width for the age group of 1 to 12 years is 10 and 17. In our study Group I which constitutes patients the Platelet distribution width is found to be 7 and 22.4 as the minimum and maximum range with a mean of 11. In our study Group II which constitutes the control group Platelet distribution width is found to be 7.1 and 15.6 as the minimum and maximum range with a mean of 10.8.

When we compare cases versus controls the PDW was found to be high (11.1) in patients when compared to controls (10.8) with insignificant P value (0.44). This observation was similar to Ayşe Betül Ergül et al study conducted on children with Acute pneumonia.²⁶

Plateletcrit (PCT)

The minimum and maximum value of Plateletcrit for the age group of 1 to 12 years is 0.17% and 0.34%

In our study Group I which constitutes patients the Plateletcrit is found to be 0.19 and 1.1 as the minimum and maximum range with a mean of 0.68.

In our study Group II which constitutes control group the Plateletcrit is found to be 0.15 and 0.53 as the minimum and maximum range with a mean of 0.32

When we compare both Group I and Group II in relation to Plateletcrit the P value was found to be significant(<0.005) suggesting that in pneumonia due to increased platelet count the plateletcrit(0.68) also increases. This observation was consistent with the study done by Musa Sahin et al in 2017 has studied the platelet parameters in children with pneumonia.²⁰

Platelet Count And Complications

In our study 2 patients had complications such as pleural effusion. When we compared platelet count (13, 67,000) of these patients to

those who doesn't have any complications (4, 02,000), the platelet count was much higher in patients with Complications with a significant p value (0.0001).

This observation was consistent with the study done by Prina et al 24, where they revealed that pleural effusion and empyema were more common in patients with thrombocytosis. Mirsaedi et al. reported a significant correlation between thrombocytopenia and thrombocytosis and mortality, and thrombocytosis was shown to be independently Correlated with the length of hospital stay in patients with community acquired pneumonia (CAP)¹⁹

CONCLUSION

Pneumonia is the leading cause of mortality in children less than 5 years in the developing countries such as India. Platelets play a major role in antimicrobial host defense, the induction of inflammation and tissue repair. Activation of platelets stimulates platelet interactions with complement proteins and humoral immune components. Platelets are capable of binding, aggregating and internalizing microorganisms, which enhances the clearance of pathogens from blood stream. Thrombocytosis was commonly associated with pneumonia in children. Children with thrombocytosis usually develop severe illness and complications resulting in prolonged Hospital stay. Degree of thrombocytosis directly correlated with severity of illness.

Hence the variations in platelet count and platelet indices such as platelet distribution width (PDW), plateletcrit (PCT), Mean platelet volume (MPV) in children with pneumonia may be used to assess the severity of pneumonia, prevent complications

And reduce the duration of hospitalization.

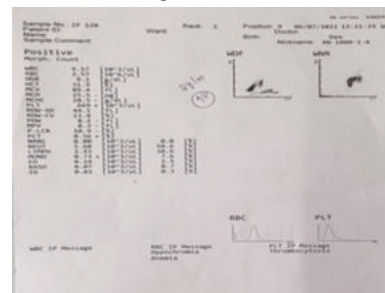


Figure.1 Automated Hematology Analyzer Showing Increased Platelet Count And Plateletcrit.

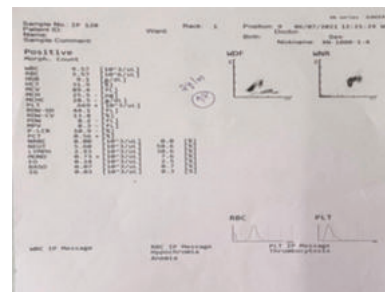


Figure .2 Automated Haematology Analyser Showing Thrombocytosis

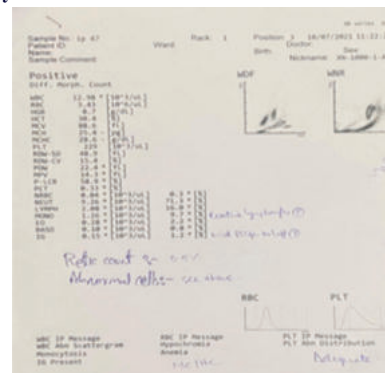


Figure 3: Automated Hematology Analyzer Showing Increased Pdw

Table No. 1: Comparision Of Platelet Count (PLT) In Group I And Group II

PLT	MINIMUM	MAXIMUM	MEAN	Std. Deviation	P value
Group I	95	1711	421.56	207.932	0.00005
Group II	200	534	329.26	79.758	

Table 2. : Comparision Of PDW In Group I And Group II

PDW	MINIMUM	MAXIMUM	MEAN	Std. Deviation	P value
Group I	7	22.4	11.1080	2.54589	0.44
Group II	7.1	15.6	10.8760	1.74351	

Table 3. Comparision Of MPV In Group I And Group II

MPV	MINIMUM	MAXIMUM	MEAN	Std. Deviation	P value
Group I	6.4	14.3	9.2630	1.07240	0.31
Group II	7.5	13.1	9.4040	.89012	

Table 4. Comparision Of Plateletcrit In Group I And Group II

PCT	MINIMUM	MAXIMUM	MEAN	Std. Deviation	P value
Group I	0.19	1.1	0.6818	.15246	<0.001
Group II	0.15	0.53	0.3254	.07493	

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