

Thrombocytosis in Acute Lower Respiratory Tract Infections among Children

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Abstract

In industrialized and developing nations, the burden of acute respiratory tract infections is equal. Acute start of respiratory system symptoms as coughing, wheezing, rhinorrhea, dyspnea, and tachypnea are considered to be signs of an acute respiratory tract infection. ARI stands for clinically evident respiratory tract inflammation from the nasal passages to the alveoli. Infections of the upper respiratory system and lower respiratory systems are separated. In contrast to developing nations, wealthy nations have a lower incidence of LRTI. Pneumonia, bronchiolitis, bronchitis, laryngitis, and epiglottitis are among the LRTI-related illnesses.

1. Introduction

Globally, 8,00,000 children under the age of five die from pneumonia each year, or around 2000 children per day.

The most prevalent and dangerous infections in children are LRTIs (Lower Respiratory Tract Infections), which are the main causes of mortality and morbidity worldwide. These infections are made worse by environmental factors on a global scale, such as

inadequate nutrition and subpar healthcare systems in developing nations.

Even while the total morbidity is still high in industrialized nations, the results are better thanks to the higher quality of the medical infrastructure.

The most prevalent risk factors for pneumonia are not receiving exclusive breastfeeding, low birth weight (LBW), early age, lack of measles vaccination, undernutrition, anemia, poverty, lack of parental education, overcrowding, excessive air pollution, and congenital heart conditions.

Platelets are vital cells that have a significant impact on tissue healing, inflammation, and antimicrobial activity. Inflammation causes platelets to become more active and interact more with complement proteins, humoral immune cells, endothelial cells, and leucocytes.

Inflammation causes platelet activation and adhesion to white blood cells (WBCs), as well as the release of cytokines such as thrombopoietin, IL-6, IL-1 α , IL-8, and chemokines that are chemotactic for neutrophils and monocytes. Hence, platelets are helpful in directing lymphocytes, neutrophils, and monocytes to the location of the infection. As a result of their ability to aggregate, bind, and engulf pathogens, platelets also contribute to the humoral immune response by producing strong antimicrobial peptides. In some viral, bacterial, and other illnesses, platelets can alter the prognosis.

Increased plasma levels of the inflammatory cytokines IL-1 β , TNF- α , IL-6, and IL-8 (associated with pneumonia) are observed in these individuals' bronchoalveolar lavages as well.

The usual range for healthy children's platelet counts is 1.5 lakh/mm³ to 4.5 lakh/mm³. A peripheral blood platelet count rise of >5.0 lakhs, which affects 3 to 13% of children, is referred to as thrombocytosis. Reactive thrombocytosis in children is brought on by acute or persistent bacterial or viral infection. In children who are admitted, reactive thrombocytosis occurs 6–15% of the time. Respiratory tract infections are the primary cause of 60–80% of reactive thrombocytosis, followed by gastrointestinal and urinary tract infections. This is the typical observation in pediatric LRTI. According to certain research, children with LRTI and thrombocytosis presented severely at entry. This demonstrates how closely tissue infection and increased platelet production are related. Hence, thrombocytosis is a helpful indicator of the severity of LRTI.

2. Objective

To ascertain whether thrombocytosis is connected to

(i)

(ii)

(iii)

The ARI Grading of Pneumonias

Problems and result

The prognostic significance of platelet count in children between the ages of 2 months and 5 years who have acute lower respiratory tract infections.

3. Review of Literature

In a related study, Zheng SY et al. found that ARI patients who had thrombocytosis had a considerably longer hospital stay than those who did not (p value 0.001).

In their study, Jayashree Choudhary et al. (2018) found that there was a strong correlation between thrombocytosis and length of hospital stay (P = 0.0008), indicating increased morbidity in the thrombocytosis-positive group.

Similar results were noticed by Sreenivasa B et al., (2015) who discovered that children admitted with LRTI who had thrombocytosis had longer hospital stays, which imply more severe pneumonia.

According to WHO statement in the year 2017, number of deaths among children under 5 years by causes in the South East Asian Region from 2000 to 2017.

Table 1: Deaths of under four Years Old

Sr. No.	Year	0-4 Years
1	2017	5.2
2	2016	5.5
3	2015	6.0
4	2014	6.7
5	2013	7.3
6	2012	7.9
7	2011	8.5
8	2010	9.1
9	2009	9.8
10	2008	10.4
11	2007	11.1
12	2006	12.4
13	2005	13.1
14	2004	13.7
15	2003	14.5
16	2002	15.2
17	2001	16.0
18	2000	

Source:

<https://www.scielosp.org/article/bwho/2008.v86n5/408-416B/>

There are numerous risk factors, including:

Climatic Circumstances

Housing Issues

Industrialization

- (iv) Socioeconomic Advancements
- (v) The Environment
- (vi) Host-related Factors
 - Removal of danger elements like:
 - (i) Supplying a Balanced Diet
 - (ii) Breastfeeding is required by Law
 - (iii) Pollution Reduction
 - (iv) Preventing crowding is Step
 - (v) Teaching Skills for self-care
 - (vi) Education about Health
 - (vii) The Practices of Referral
 - (viii) Case Management Quality Enhancement and Other Issues

Platelets' Part in Infections

Hewson initially noticed and characterized little, undefinable blood particles in 1780, and numerous other researchers, including Gazzaniga V, Ottini L. (2001), later reported similar findings in the middle of the 19th century. Max Schultze published the first compelling account of platelets in blood in 1865, and Giulio Bizzozzero followed suit in 1882 with a more thorough description of platelets and the beginnings of an explanation of their function in hemostasis.

Thrombocytosis

The range of a normal platelet count is 1,50,000 to 4,50,000/mm³. This description applies to healthy newborns, babies, kids, and teenagers (Dua, Sachdev, Yadav, 2012).

The increase in the peripheral blood platelet count to values >5,00,000/mm³ is known as thrombocytosis. (ii) affects 3 to 13% of kids during infancy and childhood (Sutor, 1995) and is prevalent. Less than 2% of children experience extreme thrombocytosis (platelets > 10,000/mm³), however severely unwell children may experience it more frequently.

Table 2: Classification of Thrombocytosis

Sr. No.	Condition	Platelet Levels
1	Mild	500-700 x 10 ⁹ /L
2	Moderate	701-900 x 10 ⁹ /L
3	Severe	901-1000 x 10 ⁹ /L
4	Extreme	>1000 x 10 ⁹ /L

In a 2006 study by Vlacha et al., (2006) it was discovered that 48% of the 102 pediatric patients hospitalized for lower respiratory tract infections had platelet counts greater than 500 x 10⁹/L. The median age of patients with thrombocytosis was 31 months, compared to 61 months for those without the condition.

According to a 2012 study by Prina E. et al, (2013) 2% of 2423 patients hospitalized with community-acquired pneumonia (CAP) had thrombocytopenia, 8% had thrombocytosis, and the remainder had a normal platelet count. The study came to the conclusion that thrombocytosis in CAP patients is linked to a poor prognosis and is worsened by pleural effusion and empyema.

4. Methodology

Study conducted at a hospital (Analytical study). Children who had lower respiratory tract infections and were being treated in the pediatric ward or pediatric ICU at Krishna Hospital in Karad during the study period were included in our prospective study. From December 2018 to May 2020, the study was carried out. 91 kids with acute lower respiratory infections who were admitted to the pediatric ward and the pediatric intensive care unit made up the sample size.

Criteria for Inclusion:

Children between the ages of 2 months and 5 years who have acute lower respiratory tract infections and meet the criteria for the ARI control program are admitted to Krishna Hospital (WHO)

Criteria for Exclusion:

Children who have neuro-infections, connective tissue illnesses, congenital heart diseases, and platelet disorders are among the first group.

No pneumonia presence

5. Results

According to the age distribution of the participants in the current study, the bulk of the participants were between the ages of 2 and 12 months (45.05%), followed by 13 to 60 months (54.94%). 18.74 + 13.79 months was the average age.

Table 3: Distribution of Patients According to Age

Sr. No.	Age Distribution	Number of Subjects	Percentage
1	2 months to 12 months	41	45.05
2	13 months to 60 months	50	54.94
	Total	90	100.00

The gender breakdown of the study participants. We found that 60.44% of the subjects were men and

39.56% were women. In the current investigation, a M:F ratio of 1.52:1 was noted.

Table 4: Gender Distribution of Patients

Sr. No.	Age Distribution	Number of Subjects	Percentage
1	Male	55	60.44
2	Female	36	39.56
	Total	90	100.00

Depending on the type of pneumonia that was reported among them, the study patients were divided. We found that the majority of the study participants (46.15%) had severe pneumonia, whereas 28.57% also had pneumonia and 25.27% had extremely severe pneumonia.

Table 5: Distribution of Patients as per Clinical Classification of Pneumonia

Sr. No.	Classification of Pneumonia	Number of Subjects	Percentage
1	Pneumonia	26	28.57
2	Severe Pneumonia	42	46.15
3	Very Severe Pneumonia	23	25.27
	Total	91	100.00

According to their socioeconomic level, the majority of the study subjects (56.04%) belonged to the upper lower class, which was followed by the lower middle class (38.46%), the lower class (3.30%), and the upper middle class (2.20%).

Table 6: Distribution of Patients as per Socio-economic Status

Sr. No.	Socio-economic Status	Number of Subjects	Percentage
1	Upper	0	0.00
2	Upper Middle	2	2.20
3	Lower idle	35	38.46
4	Upper Lower	51	56.04
5	Lower	3	3.30
	Total	91	100.00

According to the birth weight, the majority of the subjects (41.76%) had birth weights between 2100 and 2500 grams, whereas 29.67% of the subjects had birth weights beyond 2600 grams. In 23.08% of the individuals, the weight ranged from 1600 to 2000 grams.

Table 7: Distribution of Patients as per Birth Weight

Sr. No.	Birth Weight	Number of Subjects	Percentage
1	Less than 1500 gm	5	5.49
2	1600 to 2000 gm	21	23.08
3	2100 to 2500 gm	38	41.76
4	More than 2600 gm	27	29.67
	Total	91	100.00

All of the study individuals' clinical presentations included chest indrawing, 81.32 percent of them included nasal flare-ups, 39.36% included grunting, and 18.68 percent included stridor.

Table 8: Distribution of Patients as per Clinical Presentation of Pneumonia

Sr. No.	Clinical Presentation	Number of Subjects	Percentage
1	Chest Indrawing	91	100.00
2	Nasal Flaring	74	81.32
3	Grunting	34	37.36
4	Stridor	17	18.68

The average TLC over the trial revealed that it was 27,672.52 on day one, 25,839.5 on day three, and finally 19,045.05 on day five.

Using a student t-test, the change in TLC values on days 1, 3, and 5 revealed that the decrease in TLC values was determined to be statistically significant.

(T has a value of -6.975739. P has a value of .00001. At p 0.05, the outcome is significant. t has a value of -13.038346. P has a value of .00001. At p 0.05, the outcome is significant.)

Table 9: Comparison Between TLC Assessment on Day 1,3,5

Sr. No.	TLC	Number of Subjects	Percentage
1	Day – 1	27,672.52	7682.57
2	Day – 5	25,839.5	7152.34
3	Day – 5	19,045.05	4554.36

The severity of pneumonia was compared to the mean platelet counts. When the pneumonia became more severe, the platelet counts rapidly increased. (Chi-square analysis revealed a value of 21.4873 the value of p is.000253. At p .05., the outcome is noteworthy.).

Table 10: Comparison Between Severity of Pneumonia and Mean Platelet Counts

Sr. No.	Plate Counts Severity of Pneumonia (Number of Subjects)			
	Platelet Counts	Pneumonia	Severe Pneumonia	Very Severe Pneumonia
1	5 to 7	20	21	3
2	7.1 to 9	5	16	12
3	9.1 to 10	1	4	7
4	More than 10 lakhs	0	1	1
5	Total	26	42	23
6	Significance	The Chi-square statistic is 21.4873. the p-value is .000253. The result is significant at $p < .05$.		

6. Discussion

In the current study, we evaluated the age distribution of the research participants. The bulk of the study participants, or 54.94% of them, were between the ages of 2 and 12 months, and 45.5% were between the ages of 13 and 60 months. The median age was 18.74 years and 13.79 months. In their study, Sreenivasa B. et al. (2015) found that out of a total of 220 cases, 70% (154) of the cases were between the ages of 2 months and 12 months, and the remaining 30% (66) of the cases were between the ages of 13 months and 60 months (5 years). In the current study, we evaluated the gender distribution of the research participants. Sixty-four percent of the subjects were men (60.44%), and 39.56% were women. The current investigation found a M:F ratio of 1.52:1.

Similar results were found by Sreenivasa B et al, who found that, out of 220 instances, 63.2% (139) of the cases involved men and 36.8% (81) involved women, with a male to female ratio of 1.7:1.

The individuals in the current study were divided into groups based on the type of pneumonia that each person had. The majority of the study individuals (46.15%) had severe pneumonia, which was followed by pneumonia (28.57%) and very severe pneumonia (25.27%), as we had noticed.

In their analysis of 220 hospitalized patients of LRTI, Sreenivasa B et al. (2015) found that 50% (110) of the cases were pneumonia, 26.4% (58) were very severe pneumonia, and 23.6% (52) were severe pneumonia. Out of 154 cases, the majority of patients were admitted with severe pneumonia (80 children), followed by very severe pneumonia (43 children), in the age range of 2

months to 12 months. In contrast, in the age range of 13 months to 60 months, the majority of patients were admitted with severe pneumonia (30 children) and pneumonia (21 children) 79.

7. Conclusion

The current study looked at the relationship between thrombocytosis and the severity of pneumonias. The WHO ARI classification system was used to rate the severity of pneumonia cases. In our research, we discovered a direct link between thrombocytosis and the severity of pneumonias as well as pneumonia complications. It was statistically significant that the platelet count obtained on Days 1, 3, and 5 showed a decline in counts as the severity of the pneumonia decreased.

In the study, we also saw a clear relationship between thrombocytosis, the length of symptoms, and the length of hospital stay. Based on the results of this study, we can say that platelet count can be employed as a prognostic marker in grading pneumonia severity using the ARI classification.

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