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Relationship between severity of pneumonia with anemia and its outcome in children younger than 10 years who were admitted in PICU in a tertiary care centre

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Abstract
Introduction: Lower respiratory tract infections are the leading cause of mortality among children in developing countries, and anemia frequently coexists as a significant contributing factor [1,2]. This study aimed to investigate the association between lower respiratory tract infections and anemia in children.
Objectives: This study is to assess the severity of Pneumonia and its association with anemia and its outcome in children less than 10years admitted in PICU.
Methodology: A Retrospective study done over 6 months period in department of paediatrics, SIMS&RC in PICU, from September 2023 till February 2024. 100 children were admitted and their Hb levels and severity of Pneumonia were evaluated. Children admitted with symptoms of fever, cough, tachypnea, chest retractions, and rhonchi or crackles on chest auscultation, as per the WHO criteria [3] were included.
Investigations included were hemoglobin, peripheral smear and chest X-ray. Hemoglobin < 11 gm% was taken as anemia as per WHO criteria. Data collection was done, data were analysed. Statistical tests were used to determine the association between Pneumonia and Anemia.
Results: Out of 124 children, 100 eligible children were taken for the study and showed that there is significant association between Pneumonia and Anemia and its severity is inversely proportional. Male to females with a ratio of 1.6:1, and 44% of the children were between the age of 1 to 5 years, and that 74% of children were diagnosed to have some form of respiratory distress with moderate levels of anemia. Which also showed 91.6% and 72.72% of children were between 1 to 12 months and 1 to 5years of age.
Conclusion: Anemia is a significant risk factor for Lower Respiratory Tract Infection. Prevention via supplementation and adequate nutrition and early diagnosis of anemia is important to reduce the incidence of lower respiratory tract infection and significantly reduce the morbidity and mortality.

Keywords: Anemia, respiratory distress (Pneumonia) under 5 morbidity and mortality

Introduction
Lower respiratory tract infection (LRTI) is defined as a spectrum of illness, which is basically the inflammation of airways and pulmonary tissue below the level of larynx [1, 2]. Pneumonia is one of the major causes of death in children accounting for 16% of all deaths in children under 5 years of age worldwide [3.6]. Pneumonia, though a lethal disease, is the major cause of morbidity and mortality in children under the age of five in developing countries [4, 7]. Which is preventable in many aspects. Around 150 million childhood pneumonia are reported every year from the world, accounting for 3 million deaths, and of these deaths 90-95% is in the developing countries [5, 7].
Anemia is a clinical condition which occurs, when there is decrease in the level of hemoglobin below the level insufficient to meet the body's physiologic need. Anemia is a major problem in all age groups, but the prevalence is higher in children and pregnant women. Global prevalence of anemia in children is around 47 percent [5]. Anemia, especially iron deficiency anemia, is also a common health issue among children and is associated with

increased morbidity and mortality [5]. Identifying risk factors and implementing preventive measures has always been a mainstay for a long-term disease management and control. In view of this background, this study is aimed to determine association between pneumonia and anemia in children.

Materials and Methods

Objectives: To determine Relationship between severity of Pneumonia with Anemia and its outcome in children younger than 10 years who were admitted in PICU in a tertiary care centre.

Study design: Retrospective Study

Place of study: Sapthagiri Institute of Medical Sciences And Research Centre.

Study period: 6 months (September 2023 to February 2024).

Sample size: 100.

Inclusion criteria

All children who were admitted to SIMS & RC, aged </=10 years, with clinical signs of respiratory distress (fever, cough, tachypnea, chest retractions, and rhonchi or crackles on chest auscultation), as per the WHO criteria [2]. and laboratory-confirmed low hemoglobin levels.

Exclusion criteria: Children without any respiratory problems, Children with prematurity, congenital chest deformity, chronic diseases, severe systemic illness, children with PEM>grade III as per IAP guidelines, pulmonary tuberculosis and immune-compromised children were excluded.

Methodology

The study was conducted in children, meeting inclusion criteria, admitted in SIMS & RC. Each child's demographics were collected. A total of 100 children admitted in the Paediatric PICU from September 2023 to February 2024, were included in the study. Children under 10 years of age admitted with the diagnosis of Lower Respiratory Tract Infection with symptoms of fever, cough, tachypnea, chest retractions, and rhonchi or crackles on chest auscultation, as per the WHO criteria [3]. were included in the study. The cases with incomplete data were excluded from the study. Age and sex appropriate children without any respiratory problems were taken as controls. Children with prematurity, congenital chest deformity, chronic diseases, severe systemic illness, children with PEM > grade III as per IAP guidelines, pulmonary tuberculosis and immune-compromised children were excluded from the study. Investigations included were hemoglobin, peripheral smear and a chest X-ray. Hemoglobin < 11 gm % was taken as anemia as per WHO criteria [3]. Data entry was done using SPSS 21. Statistical analysis was done.

Results

There were total of 124 children who were admitted in PICU below 10 years of age and diagnosed with Pneumonia and lab confirmed Anemia present. 100 children under 10 years met the inclusion and exclusion criteria, and 24 children were within the exclusion criteria.

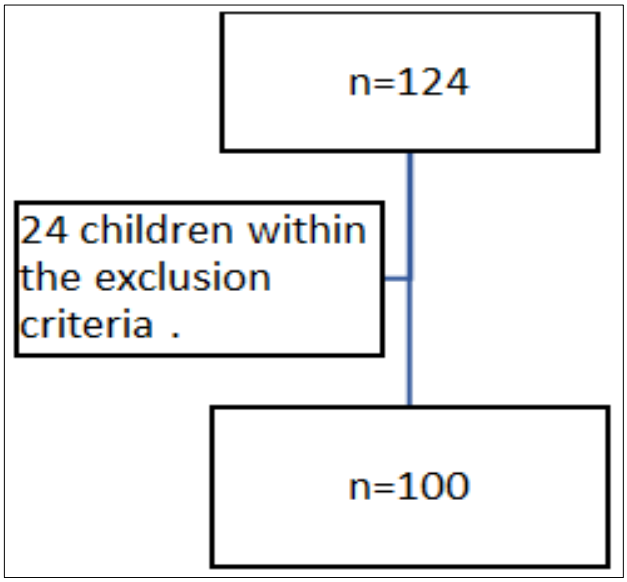

Fig 1: Age distribution

Table 1: Age distribution

Sl. No.	AGE	N
1.	1month to 12 Months	24 (24%)
2.	1year to 5 Years	44 (44%)
3.	6years to 10 Years	32 (32%)
Total		100

Among the 100 children, majority presented with respiratory distress was noticed between the age of 1 to 5 years of age (44%), 1 to 12 months and 6 to 10 years was 24% and 32% respectively. (Table no 1).

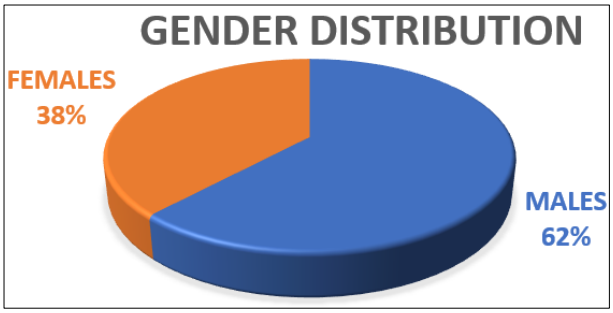

Fig 2: Gender based Distribution

The study showed 62% of the children were males and 38% of the children were females. Male to female ratio being 1.6:1. (fig no 1).

Table 2: Age and Gender based Distribution

Sl. No.	Age	Gender		N
		Male	Female	
1.	1month to 12 Months	14 (58.3%)	10 (41.6%)	24
2.	1year to 5 Years	28 (63.6%)	16 (36.4%)	44
3.	6years to 10 Years	20 (62.5%)	12 (37.5%)	32
Total		62 (62%)	38 (38%)	100

In our study with majority children 44% were within 1 to 5 years of age, in which 63.6% were males and 36.4% were females. (Table no 2).

Table 3: Mild Anemia and Respiratory distress (Pneumonia) severity distribution

Sl. No.	Age	Respiratory Distress (Pneumonia)			N
		Mild	Moderate	Severe	
1.	1month to 12 Months	0	0	0	0
2.	1year to 5 Years	0	4 (66.6%)	2 (33.33%)	6(13.63%)
3.	6years to 10 Years	6(18%)	0	0	6(18.75%)

Table 4: Moderate Anemia and Respiratory distress (Pneumonia) severity distribution

Sl. No.	Age	Respiratory distress (pneumonia)			N
		Mild	Moderate	Severe	
1.	1month to 12 Months	0	12 (54.5%)	10 (45.45%)	22 (91.6%)
2.	1year to 5 Years	6 (19%)	8 (25%)	18 (56%)	32 (72.72%)
3.	6years to 10 Years	4 (20%)	6 (30%)	10 (50%)	20 (62.5%)

Table 5: Severe Anemia and Respiratory distress (Pneumonia) severity distribution.

Sl. No.	Age	Respiratory Distress (Pneumonia)			N
		Mild	Moderate	Severe	
1.	1month to 12 Months	0	1 (50%)	1 (50%)	2 (8.33%)
2.	1year to 5 Years	0	2 (33.33%)	4 (66.66%)	6 (13.63%)
3.	6years to 10 Years	0	2 (33.33%)	4 (66.66%)	6 (18.75%)

In our study we found that 12% of the children had respiratory distress with mild anemia in which 13.63% were children between 1 to 5 years of age. And 18.75% of the children were between 6 to 10 years of age. (Table no 3).
74% of the children diagnosed with respiratory distress with moderate anemia with majority of the children between 1 to 12 months (91.6%) with respect to age groups. 72.72%, n= 32 children between 1 to 5 years of age. (Table no 4).
14% of the children were diagnosed with severe respiratory distress with severe anemia. With majority of the children between 1 to 5 years of age. (Table no 5).

Discussion

Acute lower respiratory tract infection (Pneumonia) is considered as one of the leading causes of mortality in the children under 5 years of age worldwide, accounting to 16% of deaths under 5 years of age, which showed the highest rate of incidence among other age groups with increasing prevalence in developing countries. Several risk factors like low birth weight, poor socioeconomic status, unsanitary living conditions, poor nutrition, lack of exclusive breast feeding have been identified.
Anemia potentiates the weakening of the natural defences of the body. The most common affected age group was 1 to 5 years of age, this age group showed significant association with prevalence of both LRTI and anemia. This is comparable with other studies conducted by Malla T *et al*. and Ashraf M *et al*. [10]. The common involvement of this age groups could be because of low haemoglobin levels which is usually seen with poor or inadequate complementary feeding practices.
In our study it was found that children with mild Anemia <11 gm%, majority were seen between 1 to 5 years n=6 (13.63%) and 6 to 10 years n=6 (18%) of age, of which 66.6% of the children were between 1 to 5 years with moderate respiratory distress and 33.33% with severe respiratory distress. 18% of the children were with mild anemia and respiratory distress were among 6 to 10 years of age. (Table no 3).
Among the 74% (n=74) of children with moderate anemia, 91.6% (n=22) of the children between 1 to 12 months of age were diagnosed to have some form of respiratory distress, among which 54.5% (n=12) had moderate respiratory distress and 45.45% (n=10) of the children with, severe respiratory distress. 72.72% of children with respiratory distress were between 1 to 5 years, majority of the children 56% (n=18) had severe respiratory distress. (Table no 4).
Among 14% (n=14) children with severe anemia, 18.75% and 13.63% were children between 6 to 10 years and 1 to 5 years respectively, with both age groups showing 66.66% and 66.66% with severe and moderate respiratory distress respectively. (Table no 5). Similar results were seen in a study done by Henish S, Singh S, Ashish L *et al* [4]. which compared the relationship between anemia and acute lower respiratory tract infections below 5 years of age, which showed majority of the children were males and children between the age groups of 1 to 5 years showed higher risk.
A study done by Chisti, M.J., Kawser, C.A., Rahman, A.S.M.M.H. *et al*. showed males between the age group of 1 to 5 years were affected with severe respiratory distress and was associated with anemia [9].
Our study showed that there is significant association between children with anemia and pneumonia and its severity is inversely proportional, which was similar to a study done by Chisti, M.J., Kawser, C.A., Rahman, A.S.M.M.H. *et al* [9].
Thus, prevention of anemia and early diagnosis of anemia can play an important role to reduce the incidence of lower respiratory tract infection and its severity. Interventions like exclusive breastfeeding up to 6 months of age, boosting overall nutrition, timely vaccination and early management have played a pivotal role in decreasing both mortality and morbidity [2].

Conclusion

Anemia poses a substantial risk for Lower Respiratory Tract Infections (LRTIs). It is crucial to address this risk through supplementation, ensuring adequate nutrition, and early detection of anemia. These measures are pivotal in lowering the incidence of LRTIs. By focusing on preventive strategies such as nutritional supplementation and timely identification of anemia, we can effectively mitigate the likelihood of developing lower respiratory infections. Therefore, proactive steps like ensuring sufficient iron intake and monitoring hemoglobin levels play a pivotal role in reducing susceptibility to LRTIs [8]. Early intervention through regular health screenings and nutritional support is vital for minimizing the risk associated with anemia and its

impact on respiratory health. Hence, emphasizing the importance of early diagnosis and appropriate management of anemia can significantly contribute to reducing the burden of lower respiratory infections.

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