International Journal of Contemporary Pediatrics
Tailor D et al. Int J Contemp Pediatr. 2023 Jul;10(7):1053-1056
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20231841

Original Research Article

Association of anemia with acute lower respiratory tract infection in children aged 2 months to 5 years

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Received: 11 April 2023
Accepted: 31 May 2023

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ABSTRACT

Background: In developing countries lower respiratory tract infection (LRTI) is a major cause of death in children. Various risk factors like low birth weight, malnutrition, vitamin A deficiency, lack of breastfeeding, poor socioeconomic status, large family size, young age and air pollution have been proposed for development of lower respiratory infections. Anemia is one of the commonest cofactor of LRTI.
Methods: A case-control study was conducted among 150 children in the age group of 2 months-5 years who attended the department of paediatrics during February 2021 to July 2022. Accordingly, 75 cases of LRTI and 75 normal controls (age and gender matched) were enrolled. Their parents were interviewed using a semi-structured questionnaire. Blood investigations were done and documented in a proforma.
Results: On studying the age distribution, maximum children were in the age group of 1-3 years. Male preponderance was found with male: female ratio being 1.27:1. Study shows that 74.67% of the cases and 34.67% of the controls were found anemic. Anemia was found to be a significant risk factor for LRTI ($p<0.001$).
Conclusions: Anemia was significantly found in patients with LRTIs and these patients were found to be more susceptible to LRTIs. Prevention of anemia, due to whatever etiology, early diagnosis and treatment is important to reduce the incidence of LRTIs in children.

Keywords: Bronchiolitis, LRTI, Poor socio economic status, Low birth weight, Malnutrition

INTRODUCTION

Lower respiratory tract infection (LRTI) is an inflammation of the airways and pulmonary tissue below the level of larynx. Children below 5 years of age suffer approximately 5 to 6 episodes of LRTI infections per year.[1] LRTI includes all infections of lungs and large airways below the larynx i.e., bronchitis, bronchiolitis, pneumonia and croup syndromes.[2] According to recent studies, 13% of deaths and 24% of national burden of disease is due to pneumonia under 5 years of age in India. Pneumonia affects children across the globe, but is most prevalent in South East Asia and Africa.[3]

Various risk factors have been proposed for development of lower respiratory infections like low birth weight, malnutrition, vitamin A deficiency, lack of breastfeeding, passive smoking, poor socioeconomic status, large family size, family history of bronchitis, advanced birth order, crowding, young age and air pollution.[4]

Anemia is a major global nutritional problem of immense public health significance, affecting people of all ages, sex and economic group of both developing and developed countries.[5] Global prevalence of anemia in preschool children is around 47%. Anemia in children occurs most frequently between 6 months to 3 years, the period of age when repeated respiratory tract infections occur.

The cost-effective prevention of LRTI by correction of anemia may reduce incidence of morbidity and mortality

of under 5 children. Adequate nutritional supplementation and food fortification may also improve the immunity and develop resistance power against infections.

Identifying risk factors and implementing preventive measures has always been a mainstay for a long-term disease management and control. There is little contemporary literature outlining the relationship between anemia and LRTI in children especially in south Rajasthan region. Hence this study is aimed to determine association of anemia with LRTI among children under five years of age.

METHODS

Study design was of case-control study. Duration of the study was of February 2021-July 2022.

Sample size calculation

$$N=\frac{r+1[(Z_a+Z_{1-\beta})^2 P(100-P)]}{r[E]^2}$$

Where, Zα=1.96% at 95% confidence level, $Z_{1-\beta}$=0.8413 at 80% power of study, p=Incidence of LRTI (30%), E=Absolute error=10%

N=150

r= 1:1 (ratio of exposed to non exposed)

Cases=75 and controls=75

All eligible children between 2 months to 5 years of age with acute LRTI who were consecutively admitted in department of pediatrics of Geetanjali medical college and hospital, Udaipur during study period (February 2021-July 2022) were enrolled in this study after taking ethical approval from institutional ethics committee if they satisfy the case definition of acute LRTI.

Acute lower respiratory tract infection

Acute lower respiratory tract infection (ALRTI) is defined as per WHO criteria i.e., presence of fever, cough with fast breathing (>60 per minute in 50 per minute in 2 to 12 month of age and >40 per minute in 12 months to 5 years of age) and duration of illness being <30 days. Children aged 2 months to 5 years who were admitted in pediatrics department with illness other than ALRTI were enrolled as controls. Anemia is defined as hemoglobin level <11 gm% in this study.[6]

Inclusion criteria

All the children aged 2 months to 5 years who admitted in department of pediatrics with diagnosis of ALRTI. Children aged 2 months to 5 years admitted in pediatrics department with illness other than ALRTI were enrolled as controls included in the study.

Exclusion criteria

Congenital malformations of chest wall, having chronic systemic illness [CHD, tuberculosis, bronchial asthma, immunodeficiency disorders etc.], severe acute malnutrition, hemoglobinopathies and H/O of prematurity were excluded from study.

Details of study were explained to each parent and written informed consent was obtained voluntarily from at least, one of the parents, before child enters the study. For both cases and controls demographic data, detailed history, physical assessment was recorded on pre structured Performa. Physical examination including anthropometry, nutritional assessments were recorded.

The investigations included were complete blood count (CBC) with peripheral blood smear (PBS) and chest X-ray in both cases and controls. Based on results of CBC and PBS, other investigations (serum ferritin, TIBC, serum iron, vitamin B12 levels) were done. After that all data were collected and then analysis of collected data was done.

Statistical analysis

Data was entered into MS excel software. Statistical analysis was performed using the statistical packages for social sciences (SPSS) version 21 IBM Corporation. Statistical analysis of categorical variables was compared between patients using the chi-squared test. Odds ratio was calculated for anemia as a risk factor for LRTI. Binary logistic regression analysis was done for predictor variables. A $p<0.05$ is considered to be significant.

RESULTS

Total of 150 children (75 cases and 75 controls) aged 2 months to 5 years were enrolled in this study.

Table 1: Distribution of cases and controls according to various age and gender, (n=75).

Variables	Cases, N (%)	Controls, N (%)	P value
Gender			
Male	42 (56)	39 (52)	0.6230
Female	33 (44)	36 (48)	
Age			
2-12 months	20 (26.67)	15 (20)	0.6038
1-3 years	46 (61.33)	49 (65.33)	
3-5 years	9 (12)	11 (14.67)	

Out of 75 children with ALRTI, males (56%) were affected more than females (44%) with male to female ratio of 1.27:1. Maximum children were noticed between

1-3 years i.e., 61.33% children in case group and 65.33% children in control group. P>0.05 suggests that distribution of cases and controls according to age and gender is statistically insignificant (Table 1).

Table 2: Mean hemoglobin in cases and controls.

Mean Hb (Mean± SD)	Cases	Controls	P value
	9.83±1.78	11.18±1.21	<0.0001

Mean hemoglobin value of case group is 9.83±1.78 while in control group mean hemoglobin is 11.18±1.21 which is statistically significant (p<0.05). This shows that there is a significant difference of mean hemoglobin between case and control group (Table 2).

Table 3: Frequency of anemia in cases and controls, (n=75).

Anemia	Cases, N (%)	Controls, N (%)	P value
Yes	56 (74.67)	24 (34.67)	<0.00001
No	19 (25.33)	51 (65.33)	

Out of 75 children from case group, 56 (74.67%) children had anemia in compare to only 24 (34.67%) children had anemia in control group which is statistically significant (p<0.05) (Table 3).

Table 4: Distribution of cases according to etiology of ALRTI.

Diagnosis of ALRTI	Cases	
	N	%
Bronchiolitis	45	60.00
Bronchopneumonia	22	29.33
Empyema	2	2.67
Lobar pneumonia	6	8.00
Total	75	100

Out of 75 children who had ALRTI, 45 (60%) children had bronchiolitis followed by 22 (29.33%) children had bronchopneumonia, 6 (8%) children has lobar pneumonia while only 2 (2.67%) children has empyema (Table 4).

Table 5: Mean hemoglobin level according to severity of ALRTI.

Severity	Mean hemoglobin	P value
	Mean±SD	
Pneumonia, (n=38)	10.42±1.99	<0.0001
Severe, (n=25)	9.43±1.38	
Very severe, (n=12)	8.7±1.17	

Out of 75 children who had ALRTI, mean hemoglobin level of 38 children who had pneumonia was 10.42±1.99 followed by 25 children who had severe pneumonia was 9.43±1.38 and 12 children who had very severe pneumonia was 8.7±1.17. P<0.05 shows statistically significant association between mean hemoglobin and severity of ALRTI. Table shows that as mean hemoglobin level decreased, severity of ALRTI increased.

DISCUSSION

The study included 75 cases and 75 controls with their age and gender distribution not significantly different and comparable as per Table 1. The magnitude of anemia was 74.67% among the cases and 34.67% among the controls in the present study. Similar results were seen in the study conducted by Gobinath et al, Avhad et al, Gupta et al, Shakya et al and Hussain et al.[7-10]

In our study, mean hemoglobin level was 9.83±1.78 for case group in compare to 11.18±1.21 for control group which is statistically significant. Avhad et al noticed that mean hemoglobin level was 9.99±0.63 in case group while 11.99±0.92 in control group, Gupta et al noticed that mean hemoglobin level was 9.2% in case group while 11.4% in control group, Vashishth et al studied that mean hemoglobin level was 9.1±1.99 in case group while 10.42±1.57 in control group. Gobinath et al studied that mean hemoglobin level was 9.6±0.8 in case group while 11.7±1.1 in control group.[7,8,12]

In present study, children with ALRTI were distributed according to different etiology like bronchiolitis, bronchopneumonia, empyema and lobar pneumonia. In our study, 60% children had bronchiolitis followed by 29.33% children had bronchopneumonia, 2.67% children had empyema and 8% children had lobar pneumonia. In studies done by Badakali et al, Ahmad et al and Saleh et al, they observed that maximum children had bronchopneumonia followed by bronchiolitis and consolidation.[13-15]

In present study, out of 75 children who had ALRTI, mean hemoglobin level of 38 children who had pneumonia was 10.42±1.99 followed by 25 children who had severe pneumonia was 9.43±1.38 and 12 children who had very severe pneumonia was 8.7±1.17 which was statistically significant. As mean hemoglobin level decreased, severity of ALRTI increased.

Limitations

This present study was a hospital-based study and hospitalized cases may not represent full entity of LRTI cases in community as this needs extensive population based research. As sample size was small, a definite conclusion cannot be made on this study alone.

CONCLUSION

Anemia was more common in ALRTI children as compare to non ALRTI children. Mean hemoglobin level was low in children with ALRTI as compare to non

ALRTI children. Most common etiology in children with ALRTI was bronchiolitis followed by bronchopneumonia. Severity of ALRTI is inversely related to mean hemoglobin level. As mean hemoglobin level decreased, severity of ALRTI increased.

ACKNOWLEDGEMENTS

Authors would like to thanks the immense help received from the scholars whose articles are cited and included in references of this manuscript. They are also grateful to authors/editors/publishers of those articles, journals and books from where the literature for this article has been reviewed and discussed.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Chisti MJ, Tebruegge M, La Vincente S, Graham SM, Duke T. Pneumonia in severely malnourished children in developing countries-mortality risk, aetiology and validity of WHO clinical signs: a systematic review. Trop Med Int Heal. 2009;14(10):1173-89.
2. Paul VK, Bagga A. Ghai essential pediatrics. 8th Edition, CBS Publishers and Distributors Pvt Ltd. 2019.
3. Mulholland K. Global burden of acute respiratory infections in children: implications for interventions. Pediatr Pulmonol. 2003;36(6):469-74.
4. Broor S, Pandey RM, Ghosh M, Maitreyi RS, Lodha R, Singhal T et al. Risk factors for severe acute lower respiratory tract infection in under-five children. Indian Pediatr. 2001;38(12):1361-9.
5. Malla T, Pathak OK, Malla KK. Is low hemoglobin level a risk factor for acute lower respiratory tract infections? J Nepal Paediatr Society. 2010;30(1):1-7.
6. World Health Organization. The global prevalence of anaemia in 2011. World Health Organization. 2015;1:19-24. Available at: https://apps.who.int/iris/bitstream/handle/10665/177094/9789241564960_eng.pdf. Accessed on 2 April 2023.
7. Gobinaath AD. Association between anemia and acute lower respiratory tract infection in under-five children at Puducherry, India: a case control study. Int J Contemporary Pediatr. 2020;7(3):679.
8. Avhad Y, Wade P, Ghildiyal RG. Anemia as a risk factor for lower respiratory tract infections (LRTI) in children. Int J Contemporary Med Res. 2016;3(12):3512-4.
9. Km R, Gupta V, Ahmad S, Ranhotra S, Issrani R, Prabhu N. Assessment of anemia as a risk factor for acute lower respiratory tract infections in children: a case-control study. Int J Clin Pediatr. 2015;4(2-3):149-53.
10. Shakya H, Singh S, Lakhey A. Anemia as a risk factor for acute lower respiratory tract infection in children below five years of age. Nepalese Med J. 2018;1(1):5-8.
11. Sheikh Quyoom Hussain MA, Wani JG, Ahmed J. Low hemoglobin level a risk factor for acute lower respiratory tract infections (ALRTI) in children. J Clin Diagnos Res. 2014;8(4):PC01.
12. Vashishth D, Sharma GL, Masand R. Anemia as a risk factor for lower respiratory tract infection in children of 6 months to 5 years of age. Indian J Child Health. 2019;6(3):113-6.
13. MK AK, Badakali AV, Mirji G, Vanaki RN, Pol R. Clinical profile and outcome of acute lower respiratory tract infection in children aged between 2 months to 5 years. Inte J Contemporary Pediatr. 2017;4(1):105.
14. Ahmad S, Banu F, Kanodia P, Bora R, Ranhotra AS. Assessment of iron deficiency anemia as a risk factor for acute lower respiratory tract infections in nepalese children-a cross-sectional study. Ann Int Med Dent Res. 2016;2(6):71-80.
15. Behairy OG, Mohammad OI, Elshaer OS. Iron-deficiency anemia as a risk factor for acute lower respiratory tract infections in children younger than 5 years. Egypt J Bronchol. 2018;12(3):352-7.

Cite this article as: Tailor D, Bamnawat S, Sareen D, Jain S. Association of anemia with acute lower respiratory tract infection in children aged 2 months to 5 years. Int J Contemp Pediatr 2023;10:1053-6.