

Original Research Article

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Prevalance of anemia in children with acute lower respiratory tract infection: a case control study in children between 6 months to 23 months

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ABSTRACT

Background: Anemia and ALRI are quite common in infants and toddlers in developing countries. ALRI is a leading cause of mortality in children below 5 years of age and it is important to prevent risk factors for development of ALRI. Present study was conducted to know the prevalence of anemia in children between 6 m to 23 m with ALRI and the relation between ALRI and anemia.

Methods: This is a prospective case control study, conducted at Level 2 hospital situated in backward district over a period of 1 year. Two hundred cases who had ALRI as per WHO criteria and 200 controls were taken as the study group. Children were divided in to 3 different age groups. Haemoglobin level was estimated in all. Anemia was defined and classified according to WHO criteria.

Results: Out of total 200 children both in cases and controls, 128 (64%) were males and 72 (36%) were females. Overall 190 (95%) of cases and 187 (93.5%) of controls had anemia. The prevalence of anemia was uniform in both sexes and all age groups. Children in the age group 6m -11m were more likely to develop ALRI.

Conclusions: Prevalance of anemia in children between 6 m to 23 m with ALRI and without ALRI was 93.5% and 95% respectively. Authors cannot declare with affirmation that there was no association between Hb levels and ALRI as prevalence of anemia was very high in control group. Screening all children for anemia and taking proper intervention measures is necessary while treating for other ailments like ALRI.

Keywords: Anemia, Acute lower respiratory tract infection, Children, Prevalance

INTRODUCTION

Both anemia and acute lower respiratory tract infections are quite common in infants and toddlers between 6 m to 24 m. Acute lower respiratory tract infection (ALRI) is a leading cause of mortality in children below 5 years of age in developing countries.¹ Hence it is important to control the risk factors to prevent deaths from ALRI. Present study was conducted to know the association of anemia as a risk factor for ALRI. Anemia is defined as a hemoglobin level of less than 5th percentile for age.² Anemia is one of the most common diseases of childhood

and is a health problem globally, particularly in developing countries and in children less than 2 years of age.^{3,4} Majority of India's population (72.2%) is rural and anemia is especially prevalent among rural children.⁵ The World Health Organization (WHO) has estimated that globally 1.62 billion people are anemic, with the highest prevalence of anemia (47.4%) among preschool-aged children; of these 293 million children, 89 million live in India.⁶ However, despite the existence of a national anemia-control programme, the prevalence of anemia in India between 2000 and 2005 increased from 75.3% to 80.9% in children aged 6 to 36 months.⁷ The third

National Family Health Survey (NFHS) 2005-2006 revealed that at least 80% of Indian children aged 12-23 months were anemic.⁸ According to NHFS survey conducted in 2015-16, 57.2% in urban areas and 63.4% in rural areas children in Karnataka between age 6-59 months were anaemic.⁹ The study conducted in Maharashtra showed that 59.2% of the rural pre-school children were anaemic.¹⁰ Iron-deficiency anemia, is believed to be the most important cause of anemia among children in India and a leading risk factor for burden of disease in developing countries. The prevalence of anemia and iron deficiency anemia (IDA) remains high in late infancy and early childhood.^{7,11} IDA in infants remains undiagnosed as most infants are asymptomatic and do not undergo blood tests unless reasonable clinical events are present.¹² An anemic child is likely to remain vulnerable to infection and continue to have lower immunity towards infection throughout childhood and predisposes to many common childhood illnesses, lower respiratory tract infections are the commonest.^{13,14} ALRI includes all infections of the lungs and the large airways below the larynx i.e bronchitis, bronchiolitis, and pneumonia.^{15,16} On an average, children below 5 years of age suffer about 5 to 6 episodes of ALRI per year.¹⁷ In developing countries pneumonia is said to be the biggest single cause of death in the age group of 0-5 years (NFHS4). Every year approximately 150 million episodes of childhood pneumonia and about 3 million deaths due to pneumonia are reported worldwide in children less than 5 years of age and accounts for 18% of deaths of children under 5 years worldwide.^{18,19} IDA in children occurs most frequently between the age of 6 months and 3 years, which is the same period of repeated respiratory tract infections.²⁰ It is reported that low hemoglobin impairs tissue oxygenation and acts as an independent risk factor for developing ALRI in children.²¹ The normal function of Hb facilitates oxygen and carbon dioxide transport, it carries and inactivates nitric oxide and also plays the role of buffer. This could be the reason that low Hb level is found to be a serious risk factor for developing ALRI.²² Iron deficiency also impairs cell-mediated immunity leading to lung injury.²³

METHODS

This is a case control prospective study conducted at a Level 2 hospital in a backward district in Karnataka South India. The study was conducted for a period of 1 year during 01/01/2019 and 31/12/2019 in children aged between 6 months to 23 months. Study consists of 400 children (200 cases and 200 controls) who were selected randomly. Two hundred children attending OPD or admitted who had ALRI as per WHO criteria were taken as cases.¹⁷ Age and sex matched another 200 children attending OPD for immunization and other afebrile ailments without ALRI were selected as controls. Children with Leukemia and haemoglobinopathies, severe PEM and ALRI associated with CHD and congenital anomalies of chest were excluded from the study group. Ethical permission was taken by the local ethical committee. Parents /guardians were explained about the research and informed written consent was taken before drawing blood for CBC. Complete haemogram was done in all the children. Haemoglobin level was estimated from a venous blood sample ran through Swelab-alpha Biomerix cell counter with a turn around time of 1 hour and the haemoglobin level was collected on the same day. Recent reading was taken if the blood examination was repeated for the same child. Anemia was defined and classified according to WHO criteria and the severity of anemia was defined according to patients' Hb levels (severe anemia, Hb<7.0 g/dL; moderate anemia Hb 7.0-8.9 g/dL; and mild anemia, Hb 9.0-10.9 g/dL).²⁴ In ALRI children, chest X-ray and other investigations as per the protocol were done.

Data obtained were compiled, tabulated, and analyzed. Descriptive statistics were computed with percentages, mean, median, confidence interval, odds ratio and p value using Binary logistic regression analysis.

RESULTS

Out of total 200 children both in cases and controls, 128 (64%) were males and 72 (36%) were females.

Table 1: Sex distribution.

| Status/Sex | Case | Percentage | Control | Percentage | OR | CI | p - value |
|------------|------|------------|---------|------------|-------|---------------|-----------|
| M | 128 | 64 | 128 | 64 | 0.924 | 0.605 - 1.412 | 0.715 |
| F | 72 | 36 | 72 | 36 | 1 | | |

Table 2: Age distribution.

| Age/Status | Case | Percentage | Control | Percentage | OR | CI | p - value |
|-------------|------|------------|---------|------------|-------|---------------|-----------|
| 6M - 11M | 100 | 59.52 | 68 | 40.48 | 2.697 | 1.603-4.537 | 0.000* |
| 12M - 17M | 66 | 48.53 | 70 | 51.47 | 1.598 | 0.924 - 2.768 | 0.094 |
| 18M - 23M | 34 | 35.42 | 62 | 64.58 | 1 | | |
| Grand total | 200 | 100 | 200 | 100 | | | |

Both cases and controls were categorized into 3 age groups i.e 6m-11m, 12m-17m and 18m-23m to assess the age distribution of Hb level in different age groups. Amongst cases, 100 (50%) belonged to 6m-11m age group, 66 (33%) belonged to 12m-17m age group and 34 (17%) belonged to 18m-23m group and in control 68 (34%) belonged to 6m-11m age group, 70 (35%) belonged to 12m-17m and 62 (31%) belonged to 18m - 23m group (Table 2).

Table 3: Classification of severity of anemia.

| Hb/Status | Case | Percentage | Control | Percentage | OR | CI | p -value |
|-------------|------|------------|---------|------------|----------|---------------|----------|
| < 7mg | 4 | 2 | 0 | 0 | 2.32E+09 | 0 | 0.999 |
| 7 - 8.9 mg | 73 | 36.5 | 75 | 37.5 | 1.232 | 0.491-3.0922 | 0.655 |
| 9 - 10.9 mg | 113 | 56.5 | 112 | 56 | 1.228 | 0.4988-3.0269 | 0.654 |
| > 11 mg | 10 | 5 | 13 | 6.5 | 1 | | 0 |

Mean Hb was 9.3mg in control group and 9.2mg in cases where as median Hb was 9.2mg in control and 9.4mg in cases.

Table 4: Mean Hb, std deviation and median Hb.

| Hb levels | Mean Hb | SD | Median |
|------------|---------|-----|--------|
| Control Hb | 9.3 | 1.0 | 9.2 |
| Case Hb | 9.2 | 1.1 | 9.4 |

There was no significant association between gender and developing ALRI. There was significant association between age and developing ALRI, $p = (0.000)$. It was observed that significant higher number from the age group 6m-11m have developed ALRI as against 18m-24m (OR=1) at the CI of 95%. Children in the age group 6m-11m are 2.69 times likely to develop ALRI than children in the age group 18m-24m.

There was no significant association between Hb levels and ALRI. However, severe anemia was present only in children with ALRI between 12m-17m group.

DISCUSSION

Authors analyzed the cohort of children between 6m to 23 m for the prevalence of anemia and its association with lower respiratory tract infection. This research found 95% prevalence of anemia in children with ALRI and 93.5% in control groups, much higher than the national average. The difference between 2 groups was statistically not significant. Anemia was almost uniform in both sexes and through the 6 m to 23 m of age. The various reasons for this higher prevalence of anemia are, study population consisted of children who attended OPD and the majority of the children were poor, rural and from low socioeconomic status.^{4,5} In Asia, the prevalence of anemia in children may exceed 90% for children under two years of age.¹³ However other studies conducted in various regions support this findings. A study conducted

Out of 200 cases 190 (95%) and 200 controls 187 (93.5%) had anemia. Amongst cases, 4 (2%) belonged to <7mg group, 73 (36.5%) belonged to 7mg-8.9 mg, 13 (56.5%) belonged to 9-10.9 mg group, 10 (5%) belonged to >11mg and in control none belonged to <7mg (0%), 75 (37.5%) belonged to 7-8.9 mg group, 112 (56%) belonged to 9-10.9 mg, and 13 (6.5%) belonged to >11mg group (Table 3).

in Orissa yielded 94% prevalence of anemia in under 5 children.²⁵ According to NHFS 3, 79% children under 3 years were anemic and in 6m to 23m, 81.8% were anemic.¹³ In a study conducted in Burma, the prevalence of anemia in children between 6 m to 36 m was 72.6%.²⁶ The normal birth weight full-term infants may present with anemia as high as 80% at 3-6 months of age and 90% at 6-9 months of age.²⁷

There was no significant association between Hb levels and ALRI among all age groups. In both cases and controls Mean and Median Hb levels were also not statistically significant. To support this study Broor et al, found that anemia was not found to be a risk factor for ALRI in 512 infants and children below 5 years of age.²⁸

However other studies have shown significant association between anemia and ALRI. Anemia was associated with more incidence of respiratory infections.²⁹ A study conducted in India in 2014 by Ashraf M et al, in Srinagar found 64.5% of the cases anemic while only 28.2% of the controls were anemic.³⁰ Another study conducted in India by Ramkrishnan et al, found 74% of the cases anemic while only 33% of the controls were anemic.²¹ Study conducted in Nepal by Malla et al, found 68.6% of the cases having anemia while only 38.6% of the controls were having anemia.³¹ Roma et al, found that 72% of cases and 34% of controls were anemic.³² Savitha et al, did a study on modifiable risk factors for ALRIs and concluded that anemia was a significant risk factor for ALRI.³³ So based on this study authors can't affirmatively say that there is no relation between level of Hb and ALRI as the prevalence of anemia itself is very high at this age group in this area.

However ALRI was more common in infants between 6m-11m which is in accordance with other studies conducted in India.^{34,35} According to Huang Y, anemia was highest in infants between 6-11m.¹¹ The peak IDA incidence was also observed among infants aged 9-12

months.^{12,36} Hemoglobin levels in children were primarily related to iron stores.⁷ This is due to an inadequate iron supply despite a high iron requirement at this age.¹² The concentration of iron in human milk is relatively low, so iron is supplied mainly from iron stores from birth until 6 months of age. However, iron stores are depleted after 6 months of age, the time at which iron demand increases because of rapid growth and development.³⁷ Therefore, risk of anemia increases after 6 months of age in breastfed children.³⁸ So, the American academy of Pediatrics and the WHO recommend routine screening for anemia at 12m of age.³⁹

This study has some limitations which have to be taken in to consideration. As the sample size was small and being a hospital based study it does not reflect the prevalence of anemia in general population. Other parameters of nutritional anemia like iron and ferritin levels could not be studied in these cases due to financial burden on the patient and the parents had attended OPD for different kind of illnesses.

CONCLUSION

Anemia is a common health problem in children between 6m to 23m and is highly prevalent accounting for 93.5%-95% of children in this region. Though in the present study, anemia was not found to be a risk factor for ALRI in children aged from 6 m to 23 m, all children in this age group for anemia and taking proper intervention measures is necessary while treating for ALRI and other ailments because of its high prevalence in this community. The findings of this study support an urgent need to initiate specific public health action to prevent anemia considering the grave consequences of anemia and iron deficiency on the physical and mental growth and development of these children and on their long-term health.

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