IRON DEFICIENCY ANEMIA AS A RISK FACTOR FOR ACUTE LOWER RESPIRATORY TRACT INFECTION IN CHILDREN

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ABSTRACT

Background:

Anemia is a major nutritional global problem of immense public health significance. Acute lower respiratory tract infections (ALRTI) is the leading cause of mortality and morbidity in children under- five years of age. Iron deficiency might forms an indirect risk factor for ALRTI.The study was conducted to determine the relationship between iron deficiency anemias as a risk factor in acute lower respiratory tract infection in children of age 6 months to 5 years.

Methods and Materials:

Hospital based cross-sectional descriptive study was conducted at Nepalgunj Medical College, Nepalgunj, Nepal from February 2013 to January 2014. 82 children having ALRTI as per WHO criteria were investigated for Iron Deficiency Anemia (IDA). Statistical analysis of the data was done using SPSS, version 17. Descriptive analysis, bivariate analysis using 't' independent test and chi square test and multiple linear regression analysis done with level of significance at p value < 0.05.

Findings:

Among children, 87.8% were between age group 6 months to 24 months of age with male preponderance (1.5:1). Majority(79.3%) of the patients had pneumonia and remaining 20.7% were bronchiolitis. One third of the children met all six criteria for IDA (as per WHO), majority (78%) of cases had Hb level less than 11gm/dl.Mean of the hemoglobin (Hb), total RBC count, hematocrit, MCV, MCH, MCHC, RDW, serum ferritin were significantly different among the iron deficiency positive group and iron deficiency negative group with highly significant p value < 0.01. MCV and MCH as a strong predictors of iron deficiency anemia with OR [-0.01(-0.03-0.01)], p value of 0.02 and OR [-0.07(-0.13—0.003)], p value of 0.04 respectively in ALRTI.

Conclusion:

Hence IDA can be taken as a indirect risk factor of ALRTI and iron supplementation along with appropriate and adequate complementary feed in children above 6 months of age can be a cheap, dependable, cost effective prevention of anemia and consequently an indirect measure to reduce the incidence of ALRTI.

Keyword: *Iron deficiency anemia[1], Acute lower respiratory tract infections[2], Risk factor[3]*

1. INTRODUCTION

Anemia is characterized by a decreased quantity of red blood cells, often accompanied by diminished hemoglobin levels or altered red blood cell morphology [1]. Anemia is a major nutritional global problem of immense public health significance, affecting persons of all ages, sex and economic group [2].Anaemia affects 76.1% of the world's population and is concentrated in preschool-aged children and women, making it a global public health problem [3]. A 2008 WHO analysis reported that anemia affected 47% of preschool children [4]. Most recently, global anemia prevalence was estimated at 43% in children, with reductions since 1995 in each group [5]. 46 percent of children in Nepal are anemic; 27 percent are mildly anemic, 18 percent are moderately anemic, and less than 1 percent are severely anemic. The prevalence of anemia among children under age 5 has declined by only 2 percentage points in the past five years [6].

Nutritional anemia are a condition due to a deficiency of one or more nutrients needed for hemopoiesis and the hemoglobin can be increased by supplementation of deficient nutrients [7]. The most common cause of anemia is inadequate dietary intake of nutrients necessary for synthesis of hemoglobin, such as iron, folic acid, and vitamin B126. Iron deficiency is the most widespread and common nutritional disorder in the world. It is estimated that 30% of the global population suffers from iron deficiency anemia (IDA) and most of them living in developing countries [8].Iron deficiency anemia in children occurs most frequently between the age of 6 months and 3 years, the same

Lower respiratory tract infection (LRTI) includes all infections of the lungs and the large airways below the larynx. On average, children below 5 years of age suffer about 5 to 6 episodes of LRTI per year [9]. Acute lower respiratory tract infections(ALRTI) are a persistent and pervasive public health problem that cause a greater burden of disease worldwide than human immunodeficiency virus infection, malaria, cancer, or heart attacks [10]. In developing countries, pneumonia is the commonest condition in LRTI which kills three million children every year[11]. ALRTI is responsible for 19.0% of all deaths in children under- five years and 8.2% of all disabilities and premature mortality as measured by disability adjusted life years (DALYS) [12].Acute lower respiratory tract infections are ranked among the first five leading causes of mortality in children in most of the developing countries including Nepal. Mortality due to ALRI was 18% of total under five mortality rate, which was 61 per 1,000 < 5 years population. In Terai, figure was quite in higher side being 85 per 1000 whereas in mid-western region, it was highest, that was 122 per 1000. Half of children with symptoms of ARI were taken to a health facility or health provider[13].

Along with many risk factors for LRTI like low birth weight, lack of breast feeding, severe malnutrition, smoke, low hemoglobin may also be a risk factor [2]. LRTI associated with anemia occur more commonly in children than adults [14]. Iron deficiency exerts adverse effects on immune response and alters the metabolism and growth of pathogens and reported that low hemoglobin impairs tissue oxygenation and acts as an independent risk factor for developing LRTI in children[15].

Iron deficiency anemia in children occurs most frequently between the age of 6 month to 3 years and ALRTI are the leading cause of morbidity and mortality below 5 years of age. Both are more common in developing countries than in developed countries. Simple intervention with cheap, dependable and cost effective prevention of lower respiratory tract infection with iron supplementation in children under-five years of age to reduce incidence of morbidity and mortality.This will result in lowering of infant and under-five mortality rate. And also, no enough study was conducted till date regarding the relationship between iron deficiency anemia and lower respiratory tract infection in children. Hence, the present study was undertaken to determine the relation of iron deficiency anemia with lower respiratory tract infections.

2.METHODS AND MATERIALS

Hospital based cross-sectional descriptive study was conducted in Department of Pediatrics, Lord Buddha Educational Academy, Nepalgunj Medical College, Teaching Hospital, Banke. Study population was diagnosed cases of ALRTI in infants and children of age 6 months to 5 years admitted in Nepalgunj Medical College, Nepalgunj, Teaching Hospital. Sample size was 82 children of under 5 years. Purposive sampling technique was used to collect data. Children of age 6 months to 5 years with acute lower respiratory tract infection as per WHO criteria39 were included in the study. Whereas, children suffering from other systemic illness like congenital heart disease, tuberculosis and protein energy malnutrition (PEM ≥ Grade 3 as per Indian Academy of Paediatrics (IAP)

classification), children who already had received antibiotics from outside, children with congenital malformation of chest wall etc. were excluded from the study.

Dependent Variable of this study was lower respiratory tract infections and independent variable were sociodemographic variables, clinical symptoms and signs, general appearance, vital signs, respiratory examination findings and hematological findings. Detailed history and physical examination was done according to predesigned proforma. History of relevant symptoms like fever, cough, rapid breathing, nasal flaring, chest retraction, refusal of feeds, lethargy, wheeze etc. was taken. Socioeconomic status was graded according to modified Kuppuswamy's scale for use in Nepal. A detailed physical examination was done and respiratory rate was assessed by counting respiration for complete one minute in a quite child and also pulse rate, with the help of stop watch. IAP classification of malnutrition was used to classify children under protein energy malnutrition.All patients had a complete blood count done with examination of peripheral blood smear for red blood cell morphology. Serum ferritin and chest X-ray was also done.The CBC count was quantified using fully automatic complete analyser, Nihon Kohdencelltac E with five differential parts, 22 parameters.The hematology analyser uses the volumetric impedence method for cell counting was used. Peripheral Blood Smear test was used to detect macroscopic and microscoping examination of blood cells. Serum ferritin level was assessed through a machine – Lumace CB 962, Centro LIA/pc and used the technology chemiluminance immunoassay.

The following criteria (as per WHO) is used to define IDA in children 6 months to 5 years of age.

1. Hemoglobin less than 11gm/dl [16, 17-20].
2. MCV less than 76 femtolitres and MCH less than 24 picograms [21].
3. RDW more than 14.5% [16,21].
4. Serum ferritin less than 30 ng/ml in the presence of infection [18].
5. Peripheral blood smear shows microcytic, hypochromic red blood cells with or without significant anisocytosis [20].

A case of ALRTI was defined as per WHO criteria; presence of fever, cough with fast breathing of more than 60 per minute in less than 2 month of age, more than 50 per minute in 2 to 12 month of age and more than 40 per minute in 12 month to 5 years of age, the duration of illness being less than 30 days [22].

Before starting the study, ethical approval was taken from institutional review committee (IRC) of NGMC and finally from School of Medical Science, Kathmandu university. Every participant's willingness was considered before including them in the study. Personal harm to the subject and respondents was guarded and also privacy of the subjects and respondents was maintained. The information was kept confidential and will be used only for the research purpose and every participant was provided with the right to withdraw from the study at any time. Before starting interview, brief introduction was given to parents or who brought the child and informed consent of their willingness was taken from them. They were also informed about the aims of the study. Interview was taken by researcher himself. The study was carried out for a period of one year from February 2013 to January 2014.

After completion of one year of data collection period, the obtained data was fed into computer. Data analysis was done using SPSS (statistical package for social sciences, 17 version).Descriptive analysis was done for demographic and clinical variables and presented by tabulation, pie chart and bar charts. Bivariate analysis using 't' independent test and chi square test was done between demographic, laboratory variable and ALRTI (with or without iron deficiency anemia) presented with mean difference and p value. Bivariate analysis using chi square test was done between demographic, laboratory variables and ALRTI (with or without iron deficiency anemia) presented with odds ratio (OR) and p value. Variables in bivariate analysis with p value up to 0.2 are used for multivariate analysis. Linear regression was done for multivariate analysis and presented with beta coefficient or OR with 95 % CI.

2. Results

The following table and figures represents the major findings of the study among 82 children of 6 months to 5 years of age.

Demographic Variables	**All**	**Iron Deficiency Positive**	**Iron Deficiency Negative**	**OR(95% CI)**	**p value**
Age(in months)					
≥24 months	10(12.2%)	4(4.9%)	6(7.3%)	1	
<24 months	72(87.8%)	30(36.6%)	42(51.2%)	1.07(0.27-4.12)	0.92
Gender					
Male	49(59.8%)	21(25.6%)	28(34.1%)	1	
Female	33(40.2%)	13(15.9%)	20(24.4%)	1.15(0.47-2.83)	0.75
Socioeconomic Status					
Upper and lower middle	50(61%)	20(24.4%)	30(36.6%)	1	
Upper lower and lower	32(39%)	14(17%)	18(22%)	1.16(0.47-2.86)	0.73
Residence					
Mid-western development region	53(64.6%)	18(22%)	35(42.7%)	1	
Far-western development region	29(35.4%)	16(19.5%)	13(15.9%)	2.39(0.94-6.04)	0.06

Table1. Relationship of Iron Deficiency with Socio-demographic

Table 1 reveals, among Iron deficiency cases, most (87.8%) were below 24 months, male population were higher (59.8%),61% of the cases belonged to middle class, and about one third were from Mid Western Development region of Nepal. However, there was no significant association observed between, age, gender, socip-economic status and residence (p=>0.05).

Types of ALRTI	**All**	**Iron Deficiency Positive**	**Iron Deficiency nNegative**
Bronchiolitis	17(20.7%)	7(8.5%)	10(12.2%)
Pneumonia	65(79.3%)	27(33%)	38(46.3%)

Table2. Types of ALRTI on basis of Clinical Features, Clinical Examination and Radiological Findings

Table 2 depicts, pneumonia was predominant with 65 (79.3%). Remaining cases were bronchiolitis (20.7%).

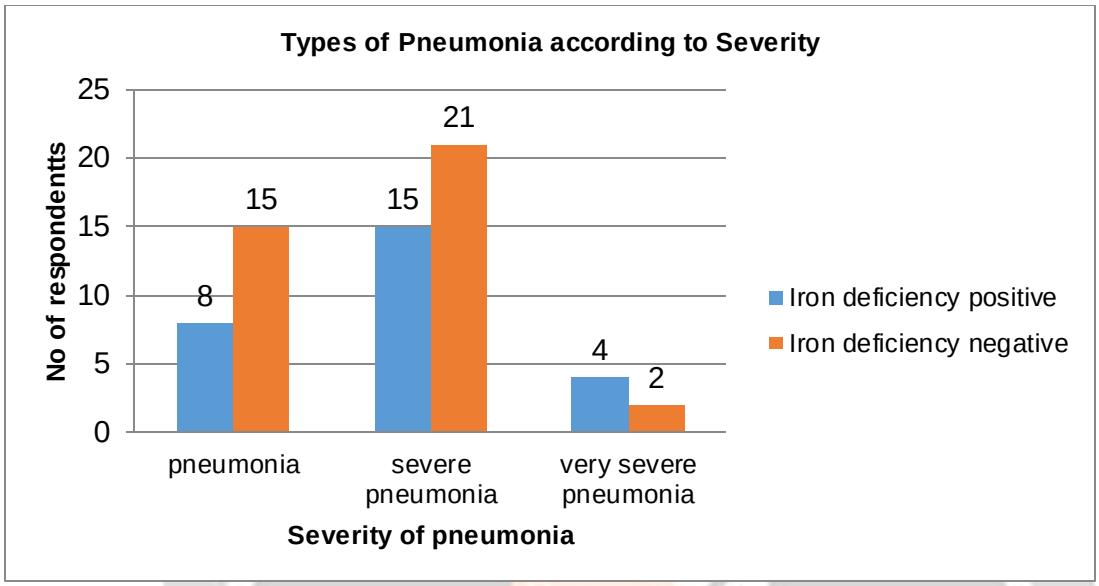

Figure1. Comparison of Severity of Pneumonia with respect to Iron Deficiency

Figure 1 shows, as per WHO criteria for assessing severity of pneumonia, 35.4% were diagnosed as a cases of pneumonia, 55.4% as severe pneumonia and 9.2% as very severe pneumonia.

Hemoglobin level(gm/dl)	**Pneumonia**	**Bronchiolitis**
Hb≥11	14(17.1%)	4(4.9%)
Hb<11	51(62.2%)	13(15.8%)

Table3. ALRTI with respect to Hemoglobin level

Table 3 reveals, 22% had hemoglobin level greater than or equals to 11gm/dl and 64 88% had hemoglobin level less than 11gm/dl. Out of 18 cases with Hb≥11gm/dl, 14 were pneumonia and 4 cases were bronchiolitis. Fifty one cases out of 64 with Hb<11gm/dl had pneumonia and remaining 13 had bronchiolitis.

Laboratory parameters of anemia	**All**		**Iron Deficiency Positive**		**Iron Deficiency Negative**		**Mean Difference**	**P value**
	Mean	**S.D**	**Mean**	**S.D**	**Mean**	**S.D**		
Hemoglobin(gm/dl)	9.46	1.85	7.99	0.96	10.5	1.61	2.51(1.89-3.12)	0.00*

Total RBC(million/mm^3)	4.02	0.62	3.81	0.5	4.17	0.65	0.35(0.09-0.62	0.00*
Hematocrit(%)	29.41	5.45	25.34	2.94	32.29	4.96	6.94(5.2-8.69)	0.00*
MCV(femtolitre)	72.61	9.05	64.49	6.05	78.36	5.84	13.87(111.22-16.51)	0.00*
MCH (picogram)	23.46	3.8	19.92	2.2	25.97	2.46	6.04(4.99-7.09)	0.00*
MCHC(gm/dl)	31.95	1.61	31.13	1.57	32.52	1.38	1.39(0.73-2.04)	0.00*
RDW (%)	17.15	2.93	19.24	1.73	15.67	2.71	-3.56[-4.54-(-2.58)]	0.00*
Total leukocyte count(cells/mm^3)	13887.8	5577.38	14126.47	6290.7	13718.75	5074.91	-407.72(-2909.54-2094.1)	0.74
Neutrophil (%)	59.02	15.76	57.88	16.51	59.83	15.32	1.95(-5.11-9.01)	0.58
Lymphocytes (%)	39.39	15.6	40.47	16.77	38.62	14.85	-1.84(-8.83-5.14)	0.6
Eosinophils (%)	1.14	1.3	1.12	1.57	1.15	1.09	0.02(-0.61-0.65)	0.93
Monocytes (%)	0.44	0.73	0.47	0.82	0.42	0.67	-0.05(-0.38-0.27)	0.74
Platelets(lakhs/mm^3)	3.37	1.08	3.49	1.15	3.28	1.03	-0.21(-0.69-0.27)	0.38
Serum ferritin(ng/ml)	66.52	47.65	40.21	41.46	85.15	43.02	44.94(26.03-63.84)	0.00*

Peripheral blood smear for RBC	**All**	**Iron deficiency positive**	**Iron deficiency negative**	**OR(95% CI)**	**P value**
Normocytic normo chromic	27	0	27	1	
Microcytic hypo chromic	55	34	21	2.61(1.87-3.60)	0.00*

Table4. Mean difference of Laboratory Parameters in relation with IDA among ALRTI

Independent "t" test result in table 4 shows, mean of the laboratory parameters Hb, Total RBC count, Hematocrit, MCV, MCH, MCHC, RDW, Serum ferritin were significantly different among the iron deficiency positive group and negative group with highly significant p value < 0.01. Whereas, total leucocyte counts, differential counts and platelets were statistically insignificant between iron deficiency positive and negative group with p value > 0.05.

	Microcytic hypochromic		**Normocytic normochromic**	
	Mean	**S.D**	**Mean**	**S.D**
MCV(fl)	67.73	6.87	82.54	2.15
MCH(pg)	21.36	2.74	27.75	0.98
MCHC(gm/dl)	31.58	1.69	32.7	1.12
Serum ferritin(ng/ml)	50.19	45.66	99.79	32.07

Table5. Mean value of MCV, MCH, MCHC and Serum Ferritin with respect RBC Morphology in PBS

Table 5 shows, mean value of MCV, MCH and serum ferritin were markedly lower in microcytic hypochromic as compared to normocytic normochromic RBCs. However there is minimal difference in mean value of MCHC between two groups.

Laboratory parameters category	**All**	**Iron deficiency anemia positive**	**Iron deficiency anemia negative**	**OR(95% CI)**	**P value**
Hemoglobin (mg/dl)					
≥11	18(22%)	0(0%)	18(22%)	1	
<11	64(78%)	34(41.4%)	30(36.6%)	3(2.03-4.42)	0.00*
MCV(fl)					
≥76	34(41.5%)	0(0%)	34(41.5%)	1	
<76	48(58.5%)	34(41.5%)	14(17.07%)	3.42(2.2-5.32)	0.00*
MCH(picogram)					
≥24	33(40.2%)	0(0%)	33(40.2%)	1	
<24	49(59.8%)	34(41.5%)	15(18.3%)	12.33(4.16-36.49)	0.00*
RDW (%)					
≤14.5	28(34.1%)	0(0%)	28(34.1%)	1	
>14.5	54(65.9%)	34(41.5%)	20(24.4%)	2.7(1.9-3.82)	0.00*
MCHC(gm/dl)					
≥30	73(89%)	26(31.7%)	47(54.9%)	1	
<30	9(11%)	8(9.8%)	1(1.2%)	14.46(1.71-122.09)	0.002*
Serum Ferritin(ng/ml)					

≥30	48(58.5%)	0(0%)	48(58.5%)	1	
<30	34(41.5%)	34(41.5%)	0(0%)	5.5(2.1-14.36)	0.00*
Peripheral Blood Smear for RBC					
Normocytic normochromic RBC	27(32.9%)	0(0%)	27(32.9%)	1	
Microcytic hypo chromic RBC	55(67.1%)	34(41.5%)	21(25.6%)	2.61(1.87-3.66)	0.00*

Table6. Association between Laboratory Parameters and IDA among ALRTI

Table 6 shows, strong association between Hb level and iron deficiency with odds ratio of 3(2.03-4.42), p value<0.01 among the patients with Hb level less than 11gm/dl as compared to those with Hb ≥ 11gm/dl. Similarly, there is strong association between MCV < 76fl with IDA with odds ratio of 3.42(2.2-5.32) and p<0.01 as compared to MCV>76fl. Similar association was seen with other parameter like MCH, MCHC, RDW, serum ferritin and microcytic hypochromic RBC in PBS with iron deficiency anemia having p value less than 0.01.

Multivariate linear regression analysis		
Variables	**Unstandarized Beta coefficient OR (95% CI)**	**P value**
Hemoglobin(gm/dl)	-0.55(-0.33-0.22)	0.69
Total RBC count(million/mm^3)	0.06(-0.16-0.28)	0.58
Hematocrit (%)	-0.003(-0.09-0.08)	0.95
MCV(femolitre)	-0.01(-0.03-0.01)	0.02*
MCH(picogram)	-0.07(-0.13—0.003)	0.04*
MCHC(gm/dl)	-0.01(-0.1-0.06)	0.66
RDW (%)	0.006(-0.04-0.05)	0.79
Serum ferritin(ng/ml)	2.21(-0.002-0.002)	0.98

Table7. Multivariate Linear Regression Analysis

In table 7, total eight independent variables were entered, multiple regression analysis was done using enter method to predict dependent variable iron deficiency anemia.In multiple linear regression, coefficient of determination (R^2) shows 64% variability in dependent variable iron deficiency anemia was explained by this regression model. Regression model is statistically significant through F statistics with p value of 0.00. Among the laboratory parameters MCV, MCH were statistically significant predictors of iron deficiency with OR [-0.01(-0.03-0.01)], p value of 0.02 and OR [-0.07(-0.13—0.003)], p value of 0.04 respectively. If there is one unit change in MCV, the iron level in blood will decrease by 0.01 unit which is statistically significant. One unit change in MCH will decrease the iron level in blood by 0.07 unit which is statistically significant.

3. DISCUSSION

A total number of 82 cases of age 6 months to 5 years with ALRTI were enrolled in this study among which maximum children (87.8%) were between 6 months to 24 months, of which 60.9% were infants from 6 months to 1 year of age and 26.8% belonged to age group 13-24 months which is quite comparable to studies conducted by Malla T et al [2] 56.4% were below 12 months of age, by Hussain SQ et al [24]92.7% were below 24 months of age and by Rijal P et al [25] 52% were below 2 years of age. This signifies that ALRTI is most common in age group of less than 1year. However, there was no significant difference between the two age groups (≥ 24months and < 24 months) p=0.92.

Male preponderance was found (59.8%) with male to female ratio 1.5:1. Similar results were found in different studies, 70.7% in Malla T et al [2], 63% in Ramakrishnan K et al1[4], 64.42% in Savitha MR et al [23] and 57.3% in Hussain SQ et al[24]. However, no significant difference (p=0.75) occurs between two sex in the study.

According to modified Kuppuswamy's scale for use in Nepal, 61% patients belongs to middle class family and remaining 39% belongs to lower socioeconomic status. No patients belong to upper socioeconomic status. A study conducted in Nepal by Yadav S et al [26]had similar proportion of patient in terms of socioeconomic status i.e. 61.5% belongs to mid-upper class and 38.5% to lower class. In contrast, a study conducted in India to identify modifiable risk factors for ALRTI showed that majority of patients (>90%) belongs to lower and upper lower socioeconomic classes [23]. IDA cases exceed IDA negative cases in patients with lower middle and lower socioeconomic status, and patients from far western development region.

In this study, 79.3%patients were diagnosed as pneumonia and remaining 20.7% cases as bronchiolitis on the basis of clinical features, clinical examination, and laboratory findings. A study done by Rijal P et al [25] showed similar results with pneumonia in 83.6% and bronchiolitis in 16.4%. In contrast, study done by Malla T et al [2] showed approximately equal number of bronchopneumonia and bronchiolitis (51.4 vs 48.6%) and radiological findings of pneumonia and hyperinflation was 50% and 29% respectively. The reason for increase number of bronchiolitis in study done by Malla T et al may be due to inclusion of patients below 6 months of age as bronchiolitis has a peak incidence between two and six months of age58-59.

Independent "t" test done for the laboratory parameter in relation with iron deficiency anemia among ALRTI shows mean of the hemoglobin, total RBC count, hematocrit, MCV, MCH, MCHC, RDW, serum ferritin were significantly different among the iron deficiency positive group and iron deficiency negative group with highly significant p value < 0.01, whereas, total leucocyte counts, differential counts and platelets were statistically insignificant between iron deficiency positive and negative group with p value > 0.05.

The overall mean Hb was 9.46±1.85gm/dl with mean of 7.99±0.96gm/dl for iron deficiency positive group and 10.5±1.61gm/dl for iron deficiency negative group. Out of 64 patients with Hb<11gm/dl, 55 patients (86%) had microcytic hypochromic RBC in peripheral blood smear and 9 with normocytic normochromic RBC. Anemia with normocytic normochromic RBC may be due to other factors such as worm infestations, occult gastrointestinal bleeding due to milk protein allergy, etc. The mean value for MCV in microcytic hypochromic and normocytic normochromic anemia was 67.73±6.87fl and 82.52±2.15fl respectively. Similarly, MCH, MCHC and serum ferritin for the two groups were 21.36±2.74 and 27.75±0.98pg, 31.58±1.69 and 32.7±1.12gm/dl, and 50.19±45.66 and 99.79±32.07ng/ml respectively. In previous study done by Malla T et al [2], considered Hb<10gm/dl as anemic with 68.6% of patient with Hb<10gm/dl and 31.4% with Hb>10gm/dl. Out of total anemic patient 82.3% had microcytic hypochromic RBC and remaining 17.7% with normocytic normochromic RBC. Mean MCV, MCH and MCHC was 64fl, 17pg and 25gm/dl respectively in microcytic hypochromic anemia and 80fl, 25pg and 32gm/dl in normocytic normochromic anemia. In other studies done by Ramakrishnan K et al [14] 74% had anemia; Savitha MR et al [23] 76.92% had anemia; Hussain SQ et al [24] had 64.4% of anemic patient with 78.9% having microcytic hypochromic picture of RBC morphology. However, study done by Mourad S et al [18] had only 32% of cases with anemia.

In this study, chi square test of association showed that among ALRTI cases, chances of iron deficiency anemia is 3 times more among the respondent with Hb<11 gm/dl as compared to respondent with Hb>11gm/dl [OR 3 (2.03-4.42) and p value 0.00]. Similar results were observed with MCV <76fl as compared to MCV ≥76fl with OR 3.42

(2.2-5.32 and p value 0.00, MCH <24pg as compared to MCH ≥24pg with OR 12.33 (4.60-36.49 and p value 0.00, and MCHC <30gm/dl as compared to MCHC ≥30gm/dl with OR 14.46 (1.71-122.09) and p value 0.002. With RDW >14.5%, chances of IDA is 2.7 times more than those with RDW <14.5% [OR 2.7 (1.9-3.82) and p value 0.00] in ALRTI cases. For serum ferritin with value <30ng/ml as compared to >30ng/ml had an OR 5.5 (2.1-14.36) and p value 0.00. Finally, there is 2.61 times more chances of having IDA with microcytic hypochromic RBC as compared to normocytic normochromic RBC in peripheral blood smear [OR 2.61(1.87-3.66) and p value 0.00]. In multivariate linear regression analysis, among the laboratory parameters, MCV andMCH were statistically significant predictors of iron deficiency with OR [-0.01(-0.03-0.01)], p value of 0.02 and OR [-0.07(-0.13—0.003)], p value of 0.04 respectively in ALRTI.

In multivariate linear regression analysis, among the laboratory parameters, MCV and MCH were statistically significant predictors of iron deficiency with OR [-0.01(-0.03-0.01)], p value of 0.02 and OR [-0.07(-0.13—0.003)], p value of 0.04 respectively in ALRTI. In this study, iron deficiency anemia as predicted by low Hb (<11gm/dl) with low MCV (<76fl), low MCH (<24pg) and high RDW (>14.5%) and microcytic hypochromic RBC and low serum ferritin level (<30ng/ml) had strong association with p value less than 0.01 in acute lower respiratory tract infections.

4.CONCLUSION

Most (87.8%) of children were below 2 years of age, out of which maximum (60.9% 0f total children) were below 12 months of age with male preponderance 1.5:1.Pneumoniawas the most predominant (79.3%) over bronchiolitis (20.7%). Bronchiolitis was common in age group 6-12 months (15 out of 17 children) in the present study. The preponderance of neutrophilicleucocytosis was observed in pneumonia whereas lymphocytic predominance in bronchiolitis. One third of the children met all six criteria for Iron Deficiency Anemia (as per WHO), majority (78%) of cases had Hb level less than 11gm/dl.Among ALRTI cases, mean of the hemoglobin, total RBC count, hematocrit, MCV, MCH, MCHC, serum ferritin were significantly low with high RDW among the iron deficiency anemias in comparision with iron deficiency negative group. There is strong association between iron deficiency anemia with different hematological parameters such as Hb<11gm/dl, MCV<76fl, MCH<24pg, RDW>14.5%, serum ferritin<30ng/ml and microcytic hypochromic RBC in acute lower respiratory tract infection. It showed that MCV and MCH as a strong predictors of iron deficiency anemia in ALRTI. Hence it can be concluded that iron deficiency anemia can be taken as an indirect risk factor of acute lower respiratory tract infection.

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