Study of Prevalence, Risk Factors and Hematological Parameters in Children Suffering from Iron Deficiency Anemia in a Tertiary Care Centre in Pokhara

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ABSTRACT

Introduction: Iron deficiency anemia (IDA) is the most common anemia worldwide. It adversely affects the physical growth, cognition, behavior and the immune status of infants and children. There are limited number of studies in Nepal analyzing its prevalence, risk factors and diagnosis in pediatric population. Restriction of analgesics intake, increased intake of iron rich food and deworming are important determinants in the disease management.

Methods: Hospital based prospective comparative study was conducted in the Department of Pediatrics in Manipal Teaching Hospital from December 2014 to December 2016 enrolling all children aged 6 months to 5 years with anemia. Demographic profile, clinical features and information regarding risk factors were noted along with detailed physical examination. Iron profile was done to confirm diagnosis of IDA. Data was analyzed using SPSS 21.

Results: Out of 168 anemic children, 110 (65.45%) children were diagnosed as IDA. Dietary factors, pica and intake of analgesics/antipyretics were major risk factors. Serum iron, serum ferritin, transferrin saturation were low whereas total iron binding capacity was high in IDA.

Conclusion: Iron deficiency anemia is a common, preventable and easily treatable disease which has potentially serious consequences if not treated. Non compliance to exclusive breastfeeding in the first 6 months of life, introduction of cow's/buffalo's milk in the first year, pica and rampant use of analgesics/antipyretics are major risk factors.

Keywords: Iron deficiency anemia, pica, serum ferritin, transferrin saturation

INTRODUCTION

Iron deficiency anemia (IDA) is the most common nutritional disorder in the world.[1] 30% of global population suffers from it. Most of this population belongs to developing country like ours and undernutrition is the major cause. Pre-school age children and women are the most vulnerable age group for the disease.[2] In Nepal, 46% of children with age of less than five years suffer from anemia out of which 69% belong to less than 2 years of age.[3]

Iron deficiency (ID) causes delay in cognitive development, poor motor and sensory system functioning and impaired mental development. Iron supplementation in early years may prevent these complications among children.[4] Conversely, routine iron treatment in non-iron deficient children may have adverse consequences increasing the morbidity and infections.[5] Therefore, it is very important to detect ID at its earliest stage in children and replenish the iron stores by proper supplementation.

IDA is microcytic and hypochromic morphologically but it is not diagnostic. Bone marrow analysis is its diagnostic standard but it is an invasive procedure.[6] So it is very important to develop a more simple method for its diagnosis. This study aims to analyze prevalence, risk factors and hematological parameters among anemic children and compare them in two groups (iron deficiency and non iron deficiency)

MATERIALS AND METHODS

This is a hospital based prospective comparative study done in Department of Pediatrics, Manipal Teaching Hospital from December 2014 to December 2016. A total of 168 children were enrolled in the study. All children of both sexes between ages 6 months to 5 years with anemia were included in the study. Cut off value for Hemoglobin levels to be considered as anemia were < 9.5 gm/dl for 6 months, < 10.5 gm/dl for 7 mo nths to 2 years and for 25 months to 5 years < 11.5 gm/dl. Children who received iron therapy anytime over the

past one month, received blood transfusion over the past 3 months, with active bleeding, and of age below 6 months and above 5 years were excluded from the study.

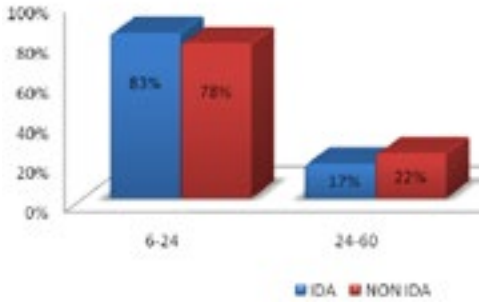
Detailed history, examination and investigations were done for all patients who had either pallor on clinical examination or had low hemoglobin level as defined as anemia earlier. Demographic profile of the patients, along with diagnosis based on their chief complaints, physical examination and investigations were noted along with risk factors for iron deficiency anemia. Confirmation of IDA was done on the basis of serum iron, serum ferritin, total iron binding capacity and transferrin saturation percentage considered together. Based on these observations, out of 168 children with anemia 110 (65.4%) children were diagnosed to be IDA (cases) and 58 children were diagnosed to be non IDA (controls). Data analysis was done using Microsoft excel software and SPSS-21. Results obtained from the study were discussed with reference to current available literature.

RESULT

According to age children were categorized into two groups. First group (6-24 months) constituted 83% of IDA and 78% of non IDA. Second group (24-60 months) constituted 17% of IDA and 22% of non IDA. Thus it was found that anemia and IDA was prevalent in the first 2 years of age.

Table 1: Distribution of age in anemia

Age (Months)	IDA		NON IDA	
	Number	Percentage	Number	Percentage
6-24 (n=136)	91	82.73	45	77.59
24-60 (n=32)	19	17.27	13	22.41
Total (n=168)	110	100.00	58	100.00



History of pica was present in 85% of children of more than 2 years of age in IDA in comparison to 9.6% of non IDA and it is significant (p-value = 0.02).

DIETARY HISTORY

Our study showed that only 31% of IDA children were exclusively breastfed in comparison to 60% in non IDA. 78% of IDA children were fed with cow's/buffalo's milk whereas only 52% of non IDA children were fed with cow's/buffalo's milk in the first year of life. P value = 0.00 is clinically significant. Hence IDA was found to be more in children in whom cow's/buffalo's milk was introduced in the first year of life. 81% of children with IDA did not receive adequate iron rich food while 72% of non IDA children received iron rich diet.

Table 2: Exclusive breastfeeding and intake of cow's/buffalo's milk in IDA and non IDA

Exclusive Breast	IDA		NON IDA		x^2 Test	p value
Feeding	No.	%	No.	%		
Yes	34	31%	35	60%	13.596	0.00
No	76	69%	23	40%		
Total	110	100%	58	100%		
Intake of Cow's/Buffalo's Milk						
Yes	86	78%	30	52%		
No	24	22%	28	48%	12.439	0.00
Total	110	100%	58	100%		

Table 3 : Dietary history pertaining to iron rich food in IDA and non IDA

Intake of Iron	IDA		NON IDA		x^2 Test	p value
rich food	No.	%	No.	%		
Yes	21	19%	42	72%	46.071	0.00
No	89	81%	16	28%		
Total	110	100%	58	100%		

The study also showed that 86% of children with IDA had history of NSAIDS intake while only 7% of non IDA children had similar history and this was statistically significant (p value is 0.00). Melena was present in 7% of IDA children. None of the non IDA group gave history of melena.

Table 4: NSAIDS intake in IDA and non IDA

NSAIDS	IDA		NON IDA		x^2 Test	p value
	No.	%	No.	%		
Yes	95	86%	4	7%	99.088	0.000
No	15	14%	54	93%		
Total	110	100%	58	100%		

Analysis of hematological parameters found that TIBC was significantly increased while serum iron, serum ferritin and transferrin saturation were significantly decreased in IDA in comparison to non IDA. The findings are depicted in the table.

Table 5: Hematological Parameters in the Study Groups

Mean	IDA	NON IDA
WBC(per microliter)	11310.91± 4842.63	12420.69 ± 6950.7
Polymorphs(%)	51.41 ± 20.96	54.12 ± 18.86
Lymphocytes(%)	47.12 ± 20.62	44.31 ± 18.79
HB(gm/dl)	7.96 ± 1.1	8.59 ± 0.88
Platelets Count (per microliter)	356.64 ± 139.7	346.09 ± 133.89
MCV(fl)	58.16 ± 8	64.3 ± 7.57
MCH (pg)	18.53 ± 2.97	21.36 ± 3.26
MCHC(gm/dl)	31.4 ± 2.04	33.1 ± 1.93
TIBC(µg/dl)	438.32 ± 129.37	382.97 ± 149.99
Iron(µgm/dl)	24.86 ± 12.05	87.3 ± 70.27
Ferritin(ngm/ml)	14.62 ± 8.14	40.44 ± 36.98
Transferrin Saturation	6.13 ± 3.28	28.83 ± 52.73

DISCUSSION

Iron deficiency (ID) is the most common nutritional deficiency in children which causes anemia. It is a challenging problem in developing nations in Asia and Africa.[7] So the need of this kind of study in our country has to be emphasized. In this study 168 children of age 6 months to 5 years were included. Children with TIBC > 400 ugm/dl, serum ferritin < 30 ugm/dl (assuming presence of infection in all children), serum iron < 22 ugm/dl and transferrin saturation < 16% were diagnosed as IDA.[8]

Maximum cases were found in the age group of 6 months to 2 years (80.9%) which is in concordance with observation made by various workers.[9,10,11] Due to the peculiarity of diet, rapid growth, lack of immunity and increased susceptibility to infections, anemia is common in infancy and early childhood.

Our study showed significant relation between pica and IDA in children above 2 years of age with p value < 0.02 with 85% of IDA children being associated with history of pica which is believed to be a symptom of IDA rather than a cause. Similar studies in children are yet to be done but a study done in adults in Spain by Munoz et al. reported a prevalence of pica of about 5% among patients with iron deficiency.[12]

Dietary factors were found to have major impact in the occurrence of IDA as it was found to be more prevalent in children not consuming enough iron rich food. Only 19% of IDA children took food rich in iron content in comparison to 78% of non IDA children which was statistically significant (p < 0.00). 31% of IDA children were exclusively breastfed in comparison to 60% of non IDA. It was clinically significant (p value < 0.00). The children who were not exclusively breastfed were found to be supplemented by cow's/buffalo's milk. In this study, 78% of IDA children were fed with cow's/buffalo's milk in comparison to 52% of non IDA children. P value < 0.00 is clinically significant which maintains that children fed with cow's/buffalo's milk are more prone to be affected with IDA. Cow's milk increases intestinal blood loss in infant. In one study of infants of five to six months of age, switching to cow's milk increased the proportion of guaiac-positive stools (from 3 to 30 %) during the first 28 days.[13]

86% of IDA children had history of NSAIDS intake in comparison to 7% of non IDA. P value < 0.00 is significant. Loss of blood due to NSAIDS induced gastric erosion leads to melena. Hence rampant use of NSAIDS is one of the major causes of IDA which requires further evaluation. Exposure to NSAIDs increases gastrointestinal blood loss in patients without gastrointestinal disease and NSAID induced chronic bleeding from the small intestine may also contribute to iron deficiency anemia.[14] In a study by Rockey et al and Cook et al, Aspirin/NSAID use is associated with 10 to 15 percentages of cases of iron deficiency anemia.[15,16] However literature in pediatric age group is not available. In our study 7% of IDA children had history of melena which is statistically significant in comparison to 0% non IDA (p value < 0.031) establishing melena as a risk factor in IDA.

Most common presentation of children with anemia in this study was irritability and loss of appetite (both with incidence of 89%). Among the clinical signs, more than half (52.4%) of the anemic children did not have significant pallor emphasizing the need to screen all children for anemia irrespective of pallor as pallor may be difficult to appreciate unless carefully sought. Similarly, in a field study of 535 preschool children, clinical pallor in the conjunctiva, palm and nail beds was detected in only 20% of those with hemoglobin less than 11.0 gm/dL and 61% of those with severe anemia.[17] A study by Stoltzfus estimated sensitivity and specificity of pallor to detect anemia to be 50% and 92% respectively.[18]

In our study the mean hemoglobin was (7.96 ± 1.1)gm/dl in IDA and (8.59 ± 0.88) gm/dl in non IDA. The average MCV in IDA was 58.16 fl. Similarly the mean value of MCH was 18.53 pg and mean value of MCHC was 31.4%. The report by Bainton showed mean MCV to be 74 fl, mean MCH 20 pg, mean MCHC to be 28%, and mean hemoglobin to be 7.6 gm/dL in patients with IDA.[19] The mean value of serum iron in IDA was 24.86 µgm/dl, which is significantly less than that in control (87.3 microgram/dl). In a study conducted in geriatric patients the mean was found to be 22.7 microgram/dL.[20] This was similar to our study.

The mean total iron binding capacity was also greater in IDA (438.32 microgram/dL) than in control.The mean percentage saturation of transferrin in IDA was found to be 6.13% that is markedly less than in control (28.83%). The mean serum ferritin in IDA was 14.62 ng/mL, which is less than in control (40.44 ng/ml) which matches with a similar study.[21]

CONCLUSION

IDA is a leading cause of morbidity among children of Nepal. The incidence of IDA was highest in age group of 6 months to 2 years. Lack of exclusive breast feeding, introduction of cow's/buffalo's milk in the first year of life, inadequate intake of iron rich diet, pica and use of NSAIDS were the major risk factors. Avoidance of these risk factors can easily prevent IDA. Irritability and loss of appetite were the most common clinical presentation of anemia. In developing countries like ours, confirmation of IDA with bone marrow iron is not feasible to be done routinely. So other parameters need to be made available and established for the easy diagnosis of iron deficiency anemia and early treatment should be commenced.

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