Estimation of risk factors and management of severe anemia in children aged 6 months to 12 years at tertiary care center -a prospective observational study

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Abstract

Introduction:The World Health Organisation (WHO) has estimated that globally anaemia affects1.62 billion people (24.8% of the population). Anaemia is a global problem especially so in the developing countries. In India, 82% of the children under 2 years and 70% of children under five are anaemic.As the prevalence rates vary among various age groups, so are the risk factors appear to vary according to the age group.Early recognition and treatment of anaemia is of crucial importance as the anaemia in children is associated with poor developmental outcome.Its aetiology in developing countries is multifactorial thus, the most important risk factors need to be identified for prevention strategy. **Methodology:**The present study was a Prospective hospital based descriptive study conducted during the period from August 2019 to August 2020 in the Department of Pediatrics, Osmania medical college, Niloufer hospital. **Results:** Severe anemia was more common in the age group of 6 months to 2years(39.6%), compared to other age groups.Female children(51.4%) were more common compared to male children(48.5%).Fever was the most common symptom(76.2%) Pallor was observed in all children. Hepatomegaly (27.7%) was the next most common sign followed by splenomegaly and oedema in 8.9% cases. The most common clinical condition associated with severe anaemia was viral fever(22.9%). Majority of children(80.1%) were diagnosed with Iron deficiency anemia, and Thalessemia major(2.9%), sickle cell disease (1.98%), and anemia of chronic disease(1.93%) were the other contributing causes **Conclusion** :Children aged below two years and an underweight child were significantly associated as a risk factor for severe anemia (P value of < 0.0001)

Keywords: Anaemia,children,nutrition,blood transfusion

Introduction

Anaemia is a major public health problem that affects developing as well as developed countries and has significant adverse health consequences, as well as adverse impacts on economic and social development. Anaemia leads to impaired cognitive function, growth and psychomotor development. Children in the process of growth and development are particularly prone to suffer from this entity. 20% of all death occurs globally in children under five years of age [1]. Anaemia is direct cause of death when it is severe[2]. Detection of risk factors is fundamental for planning and implementation of programs to eradicate child anaemia.Various studies have identified factors associated with severe anemia in children, and the results are variable. No data is available with regard to risk factors for severe anemia in the children in our area. Hence the present study was done to identify the different risk factors associated with severe anaemia and to analyze the various modalities in the management of severe anaemia in children in our area.

Methodology

Aims and Objectives were to analyze the clinical presentation in children with severe anemia,to estimate the risk factors associated with severe anemia and to study the various modalities in the management of a severe anemia in hospitalized children.The present study was a Prospective hospital based descriptive study conducted during the period from August 2019 to August 2020 in the Department of Pediatrics, Osmania medical college, Niloufer hospital. we included 101 Children in the age group 6 months to 12

years admitted to hospital with severe anemia in children.We excluded age below 6 months and above 12 years,children who received blood transfusion within 3 months and children with congenital heart disease.In the present study, children between the ages of 6 months to 12 years with a Hemoglobin <7 gms% were taken as severe anemia for the purpose of the study. Prior to start of the study, approval was taken from the Institutional Ethics Committee, A written informed consent was taken from either of the parent of the child, before enrolling the child in the study. A detailed history, clinical examination was done. Investigations were done for all children depending on the clinical condition of the child. Children with obvious life- threatening conditions were stabilized before details of history was taken. The child was managed as per the clinical condition. The details of the child including symptoms, signs, anthropometric data were documented in a prestructured proforma after the initial stabilization.The factors such as age of the child, Gender, type of family, parity of the mother, literacy of the parent, socio-economic status, diet taken, presence of parasites, nutritional status were analysed and assessed for risk associated with severe anemia. Blood was collected from median antecubital vein and sent for analysis. Hemoglobin estimation, hematocrit , RBC count, WBC count, Platelet count and RBC indices,MCV, MCH, and MCHC were determined using a automated hematology auto analyzer. The automated haematology analyser used in our laboratory was MINDRAY BC-5130.The data collected were entered into MS Excel. Analysis was based on simple percentages, proportions, charts and tables. The data was analysed using Epi info 7 and OpenEpi. The influence of age, gender, socio-economic status of the parents, parity of mother, type of family, literacy status, dietary factors, and presence of certain clinical findings on severe anaemia was assessed. Differences in proportions were compared using the chi square

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statistics. A P-value of <0.05 was taken as statistically significant.   Sample size also justified at power of 80% and p value 0.05[2].

Observations and results

Table 1: Distribution of cases based on age
N=101

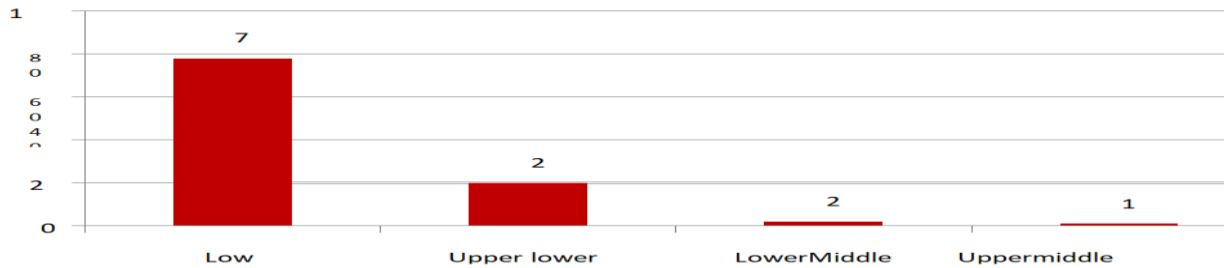| Age groups	No. of cases	%
6 months - <2 years	40	39.6
2 years – <5 years	29	28.7
5 years – 12 years	32	31.7
Total	101	100

Fig 1: Distribution of cases with severe anemia based on Socio economic status

Table 2:Distribution Of Cases With Severe Anemia Based On The Dietry Habits And Iron Supplementation
N=101

Study variables	Number of cases	%
Inadequate calories	79	78.2
Lack of adequate iron containing diet	83	82.1
Oral iron supplementation not given	84	83.1
Delayed weaning	101	100

In the present study, out of the 101 cases with severe anemia, 79(78.2%) children were consuming inadequate calories when calculated by the 24 recall method. 83 children(82.1%) consumed a diet where iron content was inadequate. 84 children with severe anemia in the study, did not receive oral Iron supplementation. All the children(100%) of the present study had history of delayed weaning out of which in 53 children (52.47%), weaning was started beyond one year of age.(Table:2)In the present study, out of the 101 cases admitted with severe anemia, 8 cases (7.9%) had h/o worm infestation. 2 children in the study (1.9%) had malaria.In the present study, out of the 101 children with severe anemia, 71 children (70.29%) were not having malnutrition, whereas 30 children (29.71%) were underweight.

Table 3:Distribution Of Cases With Severe Anemia Based On Presenting Symptoms*
N=101

Symptoms	Number of cases	Percentage
Fever	77	76.2
Weakness	29	28.7
Irritability	9	8.92
Cough	31	30.6
Breathlessness	54	53.4
Palpitation	13	12.8
Lethargy	48	47.5
Vomitings	44	43.4
Loose stools	7	6.92
Dysentery	2	1.98
Abdominal pain	7	6.94
Tremors	3	2.97
Altered sensorium	3	2.91
Convulsions	6	5.94

*Multiple symptoms were present in many children

In the present study, out of 101 children with severe anemia, fever was the most common symptom (76.2%), followed by breathlessness which was present in 53.4%, lethargy in 47.5%, vomitings in 43.4%, cough in 30.6%, weakness in 28.7%. Other symptoms were loose stools, dysentry, pain abdomen, tremor, altered sensorium, convulsions and irritability which was present in <5% of children. Many children had more than one symptom.(Table:3)

Table 4:Distribution Of Cases Of Severe Anemia Based On The Signs*
N=101

Signs	No. of cases	Percentage
Pallor	101	100
Oedema	9	8.9
Jaundice	0	0
Bleeding manifestations	1	1
Abdominal distension	14	6
Stomatitis	2	1.98
Rachitic rosary	4	2.96
Bald tongue	3	2.97
Hepatomegaly	28	27.7
Splenomegaly	9	8.99
Rash	2	1.98
Lymphadenopathy	3	2.93
Frontal bossing	4	3.06
Xerosis	1	0.99

*Multiple signs were present in many children

In the present study Pallor(100%) was the observed in cases. Hepatomegaly (27.7%) was the next most commonly identified sign, followed by Splenomegaly and Oedema was seen in 8.99% cases. The other signs were Abdominal distension in 6%, frontal bossing in 3.06%,rachitic rosary in 3.96%, bald tongue in 2.97%, lymphade-nopathy in 2.97%, stomatitis and rash in 1.98% cases, bleeding manifestation and xerosis in 0.99% children with severe anemia.(Table:4) There were no children with jaundice in the present study.In the present study, out of the 101 children with severe anemia, 49 children(48.5%) had a RBC count of 3.5-4.5 millions/ mm³, 34 children(33.7%) had a count of 2.5-3.5 million and 18 children had a count of 4.5-5.5 million/mm³·In the present study, out of the 101 cases 62 children(61.3%) had a MCH of 60-75 fL, 26 children had MCV of < 60fL, 9 had MCV of 75-90(8.9%) and 4(3.93%) had a MCV of >90fL indicating that majority of children had an MCV of < 75fL .Among the 101 cases in the study, 51 children(50.4%) of the children had a Mean corpuscular hemoglobin of 27-32, 39 children(38.6%) had MCH of >32, and 11children (10.8%) had a MCH of <27.In the present study, 73(72.2%) of the children had a MCHC of30-35,20 children(19.8%) had a MCHC of >35, and 8(7.90%) had a MCHC of 25- 30.In the present study, out of the 101 children, 69(68.4%) children had a reticulocyte count of <2 and 32 children had a count between 2-4%.In our study, 81 (80.2%) children had normal platelet counts, 20 children(19.8%) had thrombocytopenia. The cause for thrombo-cytopenia in these cases was due to the co-morbid condition Viral hemorrhagic fever such as Dengue fever.In the present study, out of the 101 children, 80(79.2%) had decreased S.iron. Decreased S.Ferritin levels were seen in 72(71.2%) of children and Total Iron binding capacity was present in 64 children(63.3%) indicating that majority of the children had iron deficiency anemia.In the present study, 40 children(39.6%) cases were having an RDW of 12-13, and 29 children(28.7%) had RDW of 13.1-14 and 18 cases had RDW of 17.8% and 14 children(13.8) had an RDW of >14.In the present study, Hemoglobin electrophoresis was normal in 95(94.05%) cases and abnormal in 6 (5.95%). The abnormal Hb electrophoresis revealed that 3 cases had Thalessemia Major and 2 cases had sickle cell anemia.

Table 5:Distribution Of Cases Of Severe Anemia Based On Etiology N=101

Disease	No.	%
Iron Deficiency Anemia	81	80.1
Megaloblastic anemia	5	4.92
Thalessemia	3	2.91
Sickle cell disease	2	1.98
Dengue Hemorrhagic Fever	6	5.98
Anemia of chronic disease	3	1.93
Dimorphic anemia	1	0.98

In the present study, majority of the children(80.1%) were diagnosed to have Iron deficiency anemia, 5 children(4.92%) had features suggestive of megaloblastic anemia, 3 children(2.91%) had Thalessemia major, 2(1.98%) had sickle cell disease, 6 (5.98%) were suffering from Dengue Hemorrhagic Fever (2.93%)had anemia of chronic disease, and 1 child had a dimorphic anemia.(Table:5)

Table 6:Distribution Of Cases Based On Conditions Associated With Severe Anemia

Associated conditions	N (%)
Lower Respiratory Tract infection	15(14.8%)
Gastroenteritis	7(6.9%)

Clinical Sepsis	6(5.9%)
Congestive cardiac failure	7(6.9%)
Dengue fever	7(6.9)
Viral fever(other than dengue)	23(22.7%)
Malaria	2(1.9%)
Urinary tract infection	4(3.9%)
Febrile seizures	3(2.9%)

In the present study, the co-morbid conditions for which the children were admitted were Lower respiratory tract infection in 15(14.8%), Congestive cardiac failure, Gastroenteritis and dengue fever in 7(6.9%) cases, Sepsis in 6 children(5.9%), Urinary tract infection in 4(3.9%), febrile seizures in 3(2.9%) and Nephrotic syndrome, cystic fibrosis, seizure disorder, diabetes mellitis Type 1, pulmonary tuberculosis, complex partial seizures in 1 child each. 23 children had features suggesting viral pyrexia.(Table:6)In the present study, all children admitted with severe anemia were given blood transfusion. 97 children received packed cell transfusion, whereas 4 children received whole blood transfusion and 1 child suffering fromDengue fever received Fresh frozen plasma in addition to

wholeblood.In the present study, blood transfusion was administered to all the 101 children admitted with severe anemia. Oral iron and folic acid was given to 82 children and Vitamin B 12 was administered to 5(4.9%)cases.Other treatment given: Six children in the study were treated for Congestive cardiac failure. Antimalarial drugs were given to 2 children with severe anemia having malaria. Supportive treatment was given for 7 cases of dengue fever as per the WHO guidelines. 77 Children admitted with features suggestive of infections received antibiotics according to the institutional guidelines. Among the 101 cases of severe anemia in the study, 46 children(45.5%) had a Hemoglobin of <5 gms% and 55 children(54.5%) had a Hemoglobin of 5-7 gms%.

Table 7:Association Of Age With Severity Of Anemia

N=101

AGE GROUP	Hb<5gm %	Hb 5-7 gms %	Total No. ofcases	%
6 months - < 2 years	24(60%)	16(40%)	40	39.60
2 years – 5 years	16(55.17%)	13(44.8%)	29	28.70
5 years – 12 years	06(18.75%)	26(81.25%)	32	31.70
Total	**46**	**55**	**101**	**100**

Chi square=13.72 ,p value =0.001

In the present study of 101 cases, in the 6 months to less than 2 years group, children with hemoglobin less than 5 gm% were 24(60%) and with Hb 5- 7gm% were 16(40%), in 2 years - 5 years group, children with Hb less than 5 gm% were 16(55.17%) and in Hb 5-7 gm% were 13(44.8%). In the 5 -12 years group, children with Hb less than 5 gm% were 6 and Hb 5-7gm% were 26(81.25%). The difference in the severity of anemia between the various age group was significant with a p valve of 0.001, indicating that younger the child, it had an risk of developing severe of anemia.(Table:7)In the present study of 101 cases, male children with hemoglobin less than 5 gm% were 21(42.86%) and those with Hb 5 to 7gm% were 28(57.14%) than female children with hemoglobin <5 were 25(48.08%) and those female children

with hemoglobin 5 to 7 gms% were 27(51.92%). The difference of severity of anemia between the genders was not significant(p-value >0.59). indicating that the gender was not significantly associated with the risk of developing severe anemia.In the present study of 101 cases, children who belong to the nuclear family with hemoglobin of less than 5 grams% were 17(38.63%) and those children with hemoglobin of 5-7gm% were 27(61.36%). Children who came from a joint family with Hb less than 5gm% were 29(50.87%), whereas those with Hb 5- 7gm% were 28(49.12%). The difference in the severity of anemia based on the type of family was not significant (p valve is more than 0.22), indicating that the type of family was not significantly associated with the risk of developing severe anemia.

Table 8:Association Of Diet And Iron Supplementation With Severity Of Anemia (N=101)

Study variables		Hb<5gms%	Hb 5-7gms%	p value	OR(CI 95%)
Inadequate calories	Yes	36	44	0.510	0.9(0.56-1.57)
	No	10	11		
Lack of adequate iron containing diet	Yes	35	48	0.114	0.464(0.162-1.316)
	No	11	7		

Oral iron supplementation given	Yes	11	8	0.172	1.8(0.672-5.071)
	No	35	47		

In the present study of 101cases,children with inadequate calories withHb<5gm% were 36 and with Hb 5-7gm% were 44. The difference in intake of calories was not associated with the severity of anemia.(value 0.51). Children who have not taken adequate iron containing diet with Hb less than 5 gm% were 35 and those with Hb 5-7gm% were 48. The difference in the intake of iron containing foods in the present study was not significantly associated with severity of anemia.(p value 0.11). Children who did not received oral iron supplementation with Hb less than 5 gm% were 35 and with Hb 5-7 gm% were 47. The difference in the children not receiving iron supplementation was not associated with the severity of anemia (p valve > 0.92).(Table:8)

Table 9 :Association Of Severity Of Anemia With Nutritional Status Of The Child N=101

VARIABLE		Hb<5gms% n =46	Hb5-7 gms % n=55	TOTAL	p VALUE	OR (CI 95%)
Malnutrition	Yes n=30 (%)	27(90%)	3(10%)	3O(100%)	0.0001	24.63(6.69-90.68)
	No n=71 (%)	19(26.76%)	52(73.24%)	71 (100%)		
	TOTAL	46	55	101		

In the present study of 101 children with Severe Anemia, among the 30 children who were underweight, 27(90%) children had Hb < 5gms%, whereas only 3(10%) had Hb 5-7gms%, indicating that child being underweight strongly associated with the severity of anemia and p value was < 0.0001. indicating that the underweight children were strongly associated with the risk of developing severe anemia. (Table:9)

Discussion

Similar studies were done to determine the risk factors for severe anaemia and very few studies were done in our area ,in this study we evaluated for the management of severe anaemia.Suresh et al.,[3] conducted a prospective study on 140 children aged between 6 months to 14 years with severe nutritional anaemia in Hyderabad in 2017 to determine the aetiology of severe nutritional anaemia, to correlate severity of anaemia with serum levels of iron, folic acid and Vitamin B12 and to determine the demographic and socioeconomic factors and dietary practices contributing to nutritional anaemia. Muoneke et al.[4] conducted a cross-sectional study in Nigeria between January and June 2006, in 110 children aged 6 to 60 months with a primary diagnosis of severe anaemia to determine the risk factors associated with poor outcome among under- five children with severe anaemia in sub Saharan Africa. Zareen et al.[5] in 2005 have done a descriptive study in 200 children in Lahore to determine the pattern of anemia in age group of 1 to 5 years in 2005 .Kubavat et al., [6] in 2014-2015 conducted a study in 100 children with severe anaemia to determine the magnitude of severe anemia and its socioeconomic, nutritional, and biological risk factors among children aged below 5 years in Gujarat.Ogunlesi et al,[7] conducted cross-sectional survey of 253 children hospitalized in a secondary health facility in Ogun State, Nigeria, with packed cell volume <20% and who received blood transfusion during 2013-2014 to describe the pattern and immediate outcome of severe childhood anaemia requiring blood transfusion at a secondary level of care.Goswamai et al., [8] during 2005-2006, studied 40,885 children under National Family Health survey to evaluate the socio economic and demographic determinants of anaemia among Indian children aged 6 months -59 months.Jaiswal et al.9 done a prospective observational study in 100 children to determine the clinico-epidemiological profile of nutritional anemia and its impact on developmental outcome in children aged 6 months to 5 years in Uttar Pradesh in 2016.In the present study highest proportion of cases of severe anemia was observed in children of less than 5 years age group (66.2 %), out of which more prevalence i.e., 39.6% of cases were found to be in the age group of 6months to 2years . The lowest age for anemia recorded in this study was of a 6-month-old female child who was suffering from Iron deficiency anemia. This observation is comparable to the study done by Suresh NS et al.[3] factors contributing which had a highest incidence of cases(66%) in age group of less than 5 years. When compared for the prevalence of anaemia in children with the age group of less than 2 years of the present study 39.6% was not similar to the study done by Muoneke et al., which had 63.6% of cases below 2 years and the study of Zareen et al., which had 79.5% of cases below the age of 2 years. The higher proportions of cases in these two studies than the present study might be because they had included only the children below 5 years of age with anaemia. Whereas in the present study children up to the age of 12 years were included, which resulted in the lower population of the cases in the present study. This higher proportion in the preschool children with higher preponderance in less than 2 years might be contributed by comparatively higher incidence of malnutrition, delayed weaning, picky eating habits, infections, infestations and certain constitutional factors like hereditary anemia,improper compli- mentary feeding practices. This higher proportion in infancy explains the need for extra nutritional requirement during this period of rapid growth. In the present study,majority of the cases 51.4% were Females with a Male to Female ratio of 0.96:1. This observation is similar to the study done by Suresh NS et al.[3] which had a female preponderance with 54.28% girls and Kubavath et al.[6] who also reported higher proportion of female children (58.5%) with severe anaemia.In the present study , 57(56.4%) children belonged to Joint families, indicating that majority of children were from joint families. This finding is similar to the study conducted by Kubavath et al., [6] which had higher proportion 62% of anemic cases from joint families. This can be attributed to the difference of larger number of members of the family in the same house and the financial, dietary facilities to meet the demands of the growing children. Children from the joint family suffer from prioritized care from the parents in all the aspects of development which can affect the nutrition and hygiene of the children which can further lead to

anaemia from malnourishment , recurrent infections and worm infestations. Majority of children in the present study i.e. 78 cases(77.3%) belong to lower socio- economic group which is similar to the study conducted by Muoneke et al[4]in which major proportion of cases 81.4% belong to lower socio-economic group, in the study done by Ogunlesai et al,[7] which had 75% of the cases were from lower socio-economic class. Children from low socio-economic class were more prone for recurrent diarrhea, repeated respiratory tract and other infections, parasitic infestations, malnutrition, and lack of education, lack of cleanliness, lack of financial support to meet the nutritional and health demands in the families of this group might contribute to the development of anaemia.In the present study, majority of children i.e. 47 (46.5%) had parents who were illiterate, and 34 (33.7%) had parents who studied up to Primary education. The association of literacy of either of the parents especially mother was studied in very few studies. All the studies showed variable results. In a study done by Manoj et al.,[10] in Kerala, majority of cases(30.45%) had parents with secondary education,19.23% of cases had parents who had primary education and 50.32% with tertiary education. In a study done by Ogunlesai et al., [7] a higher proportion of cases (57.3%) had parents who have studied up to secondary education and 20.5% of the children had parents who have studied up to primary education. This variability in the results might be due to the fact that these studies were conducted in different regions. The children of the present study mostly belong to a tribal population where many of the parents were tribals and workers and few went in for education. These children who were referred from the remote tribal areas were higher in number and therefore the higher incidence of severe anaemia could be due to lack of awareness, lack of health facilities and health education.In the present study, 8 cases (7.9%) had history of worm infestation and 2 children (1.9%) had malaria. A study conducted by Calis et al.,[11] had 10.5% of cases with worm infestations and 72.8% had recent malarial infection. A similar study conducted by Jenifer et al.,[12]showed that 44% of cases with worm infestations. In another study by Zareen et al.,[5]revealed that 8.5% of the children had worm infestations. Kanchana et al.,[13] observed that 26% of cases in their had parasitic infestations. Variations in the observations of all the studies might be because of the regions of the study, difference of dietary habits, practices of cleanliness and awareness, and also might be because of the effect of the scheduled deworming practices observed by the government in risk prone areas. The improved awareness of the association of deworming and prevention of anaemia in the recent years might be having an influence on the prevalence of the cases with parasitic infections.In the present study, out of the 101 children with severe anemia, 29.71% cases were malnourished, and this is higher than the proportion of cases found in Goswmai et al.,[8] which had 15.8% and Muoneke et al.,[4] which had 23.6% malnourished children. The higher number of children with malnutrition in present study could be attributed to the factors of delayed weaning , improper complimentary feeds, children with worm infestations, recurrent infections, lack of iron rich and nutritious diet due to lower socioeconomic status. Adequate nutrition is essential for the normal erythropoiesis and therefore any proportion of malnourishment may be associated with anaemia either directly or indirectly by the risk of reduced immunity in malnourishment leading to recurrent infections.Major proportion 61.4% of the anaemic children from the present study were born to multigravida mother. This is similar to the study done by Kubavat et al., [6] which had 74% of the anaemic children born to multigravida mother. A study conducted by Goswamai et al.,[8] has shown that as the birth order of the child increased by one unit , the risk of severe anaemia increased by a factor of 1.156. As the parity of the mother increases the chances of reduction of the hemoglobin and nutrition of the mother will be higher which effect the iron stores of the newborns which can predispose them to anaemia during periods of rapid growth.The relative prominence of each of these groups of

symptoms varies in the individual patient, depending on the degree of anemia and the nature and severity of the causative disorder. The Hb level at which the symptoms of anemia develop depends on two main factors, the rate of development of the anemia, the age and state of cardiovascular system of the patient. In general, symptoms occur in rapidly developing anemia than in a slowly developing anemia.In the present study, out of 101 children with severe anemia, fever was the most common symptom (76.2%), which is similar to the study conducted by Jenifer et al.,[12] which had 64% cases presenting with fever and 71.4% had fever in the study of Muoneke et al[.4] Breathlessness which was the next most frequent symptom in the present study was found to be in 53.4% of cases, followed by lethargy in 47.5%, vomitings in 43.4%, cough in 30.6%, weakness in 28.7%. Other symptoms were loose stools, dysentry, pain abdomen, tremor, altered sensorium, convulsions and irritability which was present in <5% of children. Many children had more than one symptom. History of dyspnea and Palpitations was seen in 67 children (66.33%). Dyspnea on exertion is a common symptom of anemia. 13 of the children with dyspnea had diseases of the respiratory tract like bronchopneumonia & pulmonary tuberculosis which has contributed to the dyspnea noted. In rest of the children, dyspnea was probably because of anemia itself.In the present study Pallor was the observed in 100% of the cases . This finding is similar to the study done by Zareen et al.,[5] and Sastry et al.,[14] who had 100% of cases with pallor. Muthuraman et al.,[15] had 92% of cases with pallor. Pallor is the most prominent and characteristic sign of severe anaemia. It may be seen in skin, nail beds, mucous membranes , conjunctiva and palmar creases. Pallor of the nail beds, mucous membranes of the mouth and conjunctiva is a more reliable indicator than pallor of the skin. Severity of anaemia can be estimated depending on the site of pallor detection. Pale palmar creases indicate severe anaemia.Edema was seen in 9 cases (8.9%).Out of these 5 children had Congestive Cardiac Failure and in other cases edema was due to hypo proteinemia and dengue. Congestive cardiac failure was noted in 2 of these children, and they had dyspneaeven at rest. Clinical manifestations of cardiovascular system results from three factors – the effect of hypoxia on myocardium, preexisting heart disease, the high cardiac output state. Very severe anemia in its own right can precipitate cardiac failure in individuals with a normal cardiovascular system. In the present study CCF was found in 7 cases (6.9%) whereas in the study done by Ogunlesai et al., [7]CCF was observed in 54.45 cases. This wide variation might be because of the large sample size. Splenomegaly was noted in 9 cases (8.99%) in the present study in cases of malaria and thalassemia. The consistency in most of the cases was from studies by Madoori S et al.,[16] found splenomegaly in 30.70%, Venkatesh G et al.,[17] in 25.8% patients respectively. The soft edge of the spleen in these children contrasts with the hard edge found in pathologic conditions. Splenomegaly is most noticeable with disorders due to blood destruction like hereditary and acquired hemolytic anemia and malignancies. The spleen occasionally is enlarged in patients with iron deficiency anemia and in those with megaloblastic anemia of infancy. Enlargement of liver was seen in 28 cases (27.7%) in the present study. In studies by Madoori S et al.,[16] and Venkatesh G et al.,[17] hepatomegaly was seen in 23.10%and 29.3% of patients respectively. Enlargement of liver is occasionally found in patients with CCF and those with sudden severe anemia from any cause. Often it is enlarged in patients with hemolytic anemia especially those receiving frequent transfusions. In the present study, hepatomegaly was found in cases of malaria, thalassemia and few cases of iron deficiency anemia & hepatitis.In the present study signs of malnutrition like Rachitic rosary, Stomatitis, Xerosis, Bald tongue, was seen in 40 cases. Cause for malnutrition in the present study could be due to deficient calorie intake or may be secondary to the disease process like acute infections, thalassemia & leukemia. Frontal bossing was observed in 4 children (3.06%) having thalassemia syndrome. Other signs

noticed were Abdominal distention(6%,),Bleeding Manifestations (1%), Rash(1.98%), Lymphadenopathy in 2.98% cases.In the present study, majority of the children(80.1%) were diagnosed to have Iron deficiency anemia, 5 children(4.92%) had features suggestive of megaloblastic anemia, 3 children(2.91%) had Thalassemia major, 2(1.98%) had sickle cell disease, 6 (5.98%) from Dengue Hemorrhagic Fever.This observation is similar to the studies conducted by Zareen et al.,[5] Shankar et al.,[18] and Jaiswal et al.,[9] all of which had Iron deficiency anaemia as the most common etiological factor for anaemia. The incidence of iron deficiency anemia is more during the period of growth as in infancy and later during adolescent growth spurt. Very few studies have evaluated the transfusion practices in children with severe anemia. In the present study out of 101 children with severe anaemia 100% of the children were given transfusion which is similar to the study conducted by Muoneke et al.,4 but in discordance with the studies done by Ogunlesai et al.,[7] Lundbland et al.,[19] and Jenifer et al.,[12] in whose studies 35.5% , 55.6% and 14% of cases were given transfusion. The difference in the percentage of children receiving transfusion could be due to the reason that even though all the studies included only severe anaemia, the criteria for transfusion in various studies was different. As Ogunlesaia et al.,[7] had given transfusion only to who were either in failure or with PCV less than 20% and Lundbland et al.,[19] had transfused only to those cases with severe anaemia who were either with fever or in cardiac failure. In the present study transfusion was given to all the children with less than 7gm/dl irrespective of features of failure because almost all the children were from tribal areas and low Socio Economic Status and were referred from the centers where transfusion was not available. Transfusions were considered in view to improve their capacity to meet the physiological demands which would be compromised because of the lack of transfusion facilities in remote areas

Conclusion

In our study, factors such as gender of the child, type of family, parity of mother, literacy of the parents, socioeconomic status, intake of adequate calories, inadequate intake of iron rich foods, delayed initiation of complimentary foods, parasitic infection were all associated with severe anemia, but the association was not statistically siginificant (P value >0.05). Children aged below two years and an underweight child were significantly associated as a risk factor for severe anemia (P value of <0.0001)

Limitations:Probably a further study with a larger sample size would be ideal for identifying the factors with significant risk for severe anemia.

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