A Prospective , Cross Sectional Study On Prevalence And Etiology Of Severe Anemia Among Pediatric Population (6 Months-18 Years) In Tertiary Care Set Up Of Andhra Hospitals , Vijayawada, Andhra Pradesh.

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I. Introduction

Anemia is a global problem of immense health significance affecting persons of all ages and economic groups. It is ranked as the most common chronic malady mankind has ever suffered. Approximately 1500 million people, i.e. 30% of the world population suffers from iron deficiency state. It is more common in developing countries like India. 30-50% of pregnant ladies and 60-80% of school going children are reported to be iron deficient.[1] Normal hemoglobin and hematocrit vary substantially with age and sex. Anemia in childhood is defined as a hemoglobin (Hb) concentration below cut off levels established by the World Health Organization:[2]

Table 1: Cut off levels established by the World Health Organization (in gm%)

age	Mild anemia	Moderate anemia	Severe anemia
6-59 months	10-10.9	7-9.9	<7
5-11 years	11-11.4	8-10.9	<8
12-14 years	11-11.9	8-10.9	<8
Female > 14 years	11-11.9	8-10.9	<8
Male >14 years	11-12.9	8-10.9	<8

AIM OF THE STUDY: To study the prevalence and etiology of severe anemia among pediatric population in tertiary care set up of Andhra hospitals , Vijayawada, Andhra Pradesh.
MATERIAL AND METHODS :
Study site : Hospital based study done at Andhra hospitals , Vijayawada.
Study population: Three different age groups of pediatric population categorised as 6-59 months , 5 years to 11 years and 12 years to 18 years.
Study design: A prospective, cross sectional, observational study is being conducted in the department of Pediatrics of Andhra hospitals , Vijayawada , Andhra pradesh , India.
Sample size: Data was collected from a total of 240 patients of all pediatric age groups.
Study duration: From January 2017 to May 2018.
Inclusion criteria:
1.Pediatric population belonging to three different age groups – 6 months -59 months, 5 years to 11 years and 12 years to 18 years.
2.Hospitalised patients with severe anemia.

Exclusion criteria:
1.Hospitalised patients with mild and moderate anemia
2.Hospitalised patients with anemia secondary to acute blood loss ,bleeding disorders, renal disease and endocrinopathies
3.Infants between 0-6 months of age
4. Anemia due to acute blood loss secondary to trauma
5.All patients who have received blood transfusion within the last four weeks.
Detailed history and physical examination were undertaken of children with Hb% less than 7gms/dl / 8gm/dl according to age at the time of admission according to proforma. The following investigatins were done using the venous blood sample of patients-Hb estimation by microns 60 autoanalyser & Sahli's hemoglobinometer, haematocrit, RBC, were done using microns 60 auto analyser, WBC count, differential count, & platelet count were done using microns 60 auto analyser , RBC indices-MCV, MCH & MCHC using microns 60 auto analyser , peripheral smear examination using Leishman's stain, Reticulocyte count by Brilliant Cresylblue staining ,

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stool examination , urine examination , montaux test , chest x – ray , U.S abdomen , CT scan in relevant cases , serum ferritin , Hb electrophoresis , bone marrow examination , LFT and RFT in relevant cases.

The primary outcome variable measured is the prevalence and etiology of severe anemia among hospitalised children. The secondary outcome variables measured include age specific prevalence and etiology of severe anemia.Data was entered in MS excel spread sheet and was analysed using SPSS v 21 soft ware. Categorical data will be represented as numbers and percentages. Continuous data was presented as mean and standard deviation. Bar diagrams and pie charts will be drawn wherever needed. Chisquare test and Independent sample T test and ANOVA test will be used as tests of significance. P value less than 0.05 was considered as statistically significant.

II. Observations And Results

The percentage of cases of pediatric age group (between 6 months to 18 years) admitted in paediatric ward of Andhra hospitals , Vijayawada between January 2017 and May 2018 with mild anemia were 46.34 % , moderate anemia 43.44 %   and severe anemia 10.22 % .

240 cases of severe Anemia due to various causes admitted to paediatric ward of Andhra hospitals , Vijayawada were studied.

Of the 240 cases studied 144 cases (60%) were males and 96 cases (40%) were females
i.e the present study showed a male preponderance with male to female ratio 1.5 :1

FIG 1 : DISTRIBUTRION OF CASES BASED ON GENDER
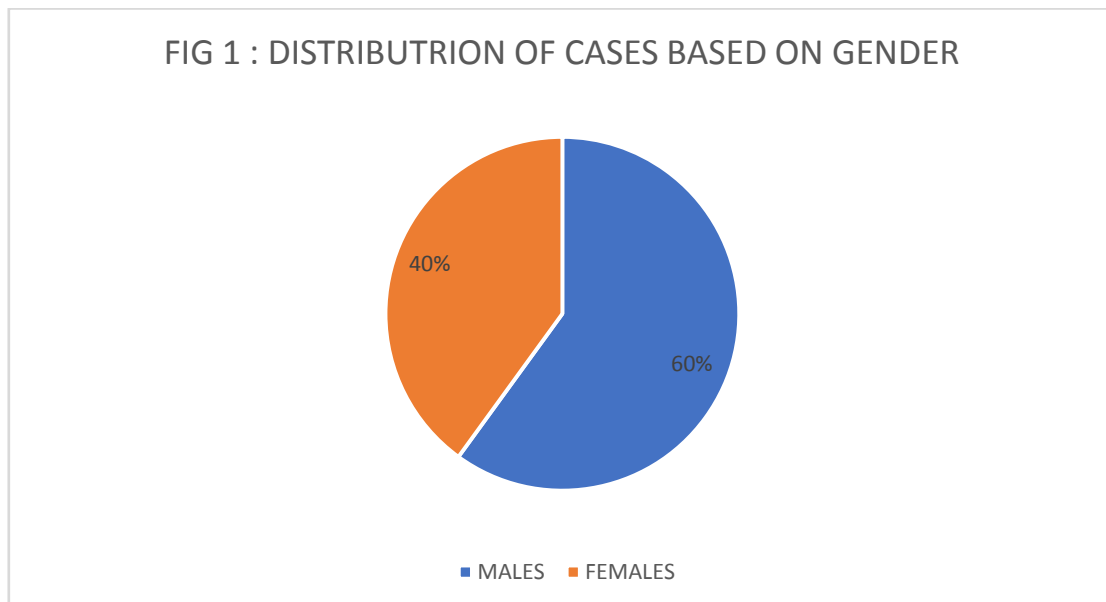
The highest prevalence of severe Anemia was found in the age group between 6 months to 59 months (48.3 %) followed by 5 yrs- 11 yrs (35 %) age group with least prevalence between 12-18 yrs (16.7 %).

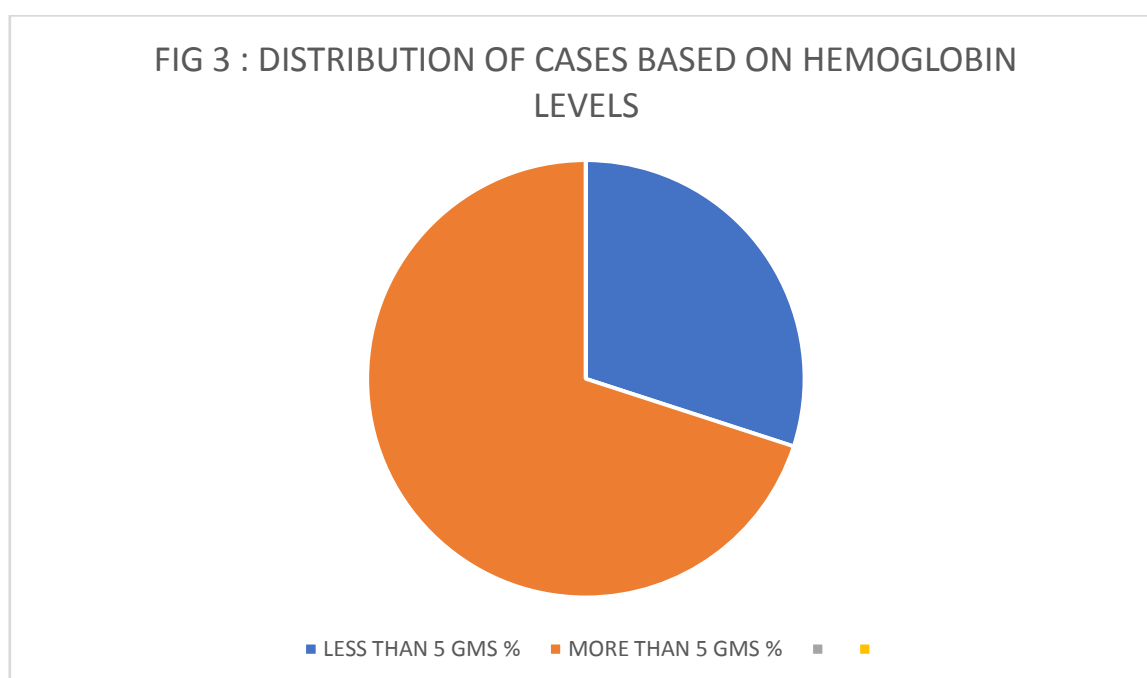FIG 2 : DISTRIBUTION OF CASES BASED ON AGE GROUP
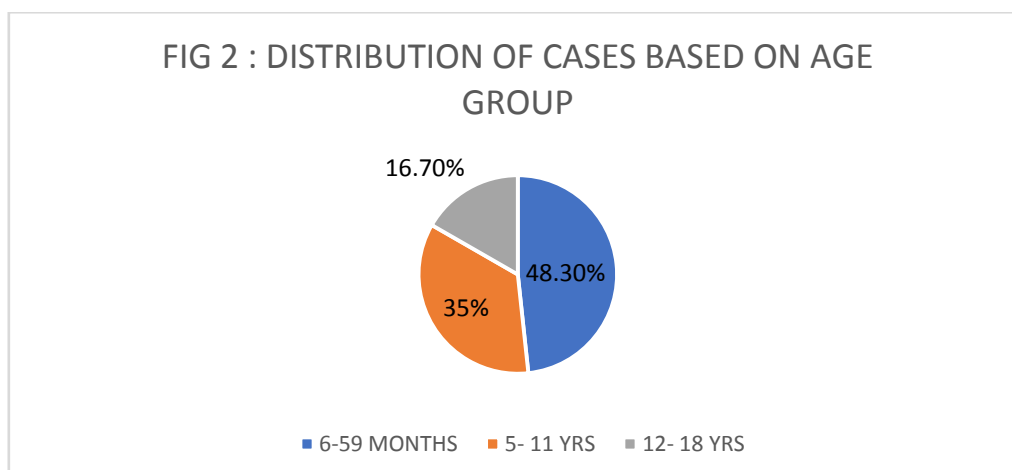
The prevalence of severe anemia was maximum in children of class III socioeconomic status (25 %) with minimum incidence (13.3 %) in children of class I socioeconomic status.

IAP grading was used to classify PEM. Out of 240 cases 48 cases (20%) had grade 1 PEM ,36 cases (15%) had grade 2 PEM , 36 (15%) cases had grade 3 PEM & 40 cases (16.7 %) had grade 4 PEM. 80 cases (33.3 %) had body wt in the normal range.216 cases had gastrointestinal symptoms of which 80 cases (33.3%) had abdominal distension, 72 cases had anorexia (30 %), 28 cases had abdominal pain (11.7 %), 12 cases had loose stools (5 %), 4 cases had bald tongue (1.7 %) and 20 cases had dysentry (8.3 %).

Of 240 cases , 88 cases had cough (36.7 %) , 80 cases had breathlessness (33.3 %) and 16 cases (6.7 %) had palpitations.

Pallor of the skin , conjunctiva and mucous membranes was seen in 228 cases (95 %) cases with fever in 172 cases (71.7 %) , xerosis in 32 cases (13.3 %) , frontal bossing in 20 cases (8.3 %) , edema in 64 cases (26.7 %) , jaundice in 24 cases (10 %) , bald tongue in 36 cases (15 %) , hypothermia in 4 cases (1.7 %) , lethargy in 16 cases (6.7 %) , lymphadenopathy in 4 cases (1.7 %) , clubbing in 4 cases (1.7 %), apathy in 8 cases (3.3 %) and stomatitis in 12 cases (5 %).The most common neurological symptom was irritability seen in 28 cases (11.7 %) followed by altered sensorium in 12 cases (5 %) , lethargy in 12 cases (5 %) cases. Apathy and dementia were found in 8cases (3.3 %).

FIG 3 : DISTRIBUTION OF CASES BASED ON HEMOGLOBIN LEVELS

■ LESS THAN 5 GMS %   ■ MORE THAN 5 GMS %   ■   ■

168 cases (70 %) had hemoglobin levels > 5 gm % and 72 cases (30 %) had hemoglobin levels < 5 gms % 112 cases (46.7 %) had RBC count between 2.1- 3 million / cu mm , 44 cases (18.3 %)with count between 3.1-4 million/cu mm , 40 cases (16.7 %)with count between 1-2 million / cu mm , 28 cases (11.7 %) with count between 4.1-5 million/ cu mm and 16 cases (6.7 %) with count less than 1 million / cu mm.The mean corpuscular volume was less than 60 fl in 32 cases (13. 3 %) , between 60-75 fl in 80 cases (33.3 %) , between 75-90 fl in 84 cases (35 %) and more than 90fl in 44 cases (18.3 %).The MCH values were less than 27 pg in 112 cases (46.7 %) , between 27-32 pg in 64 cases (26.7 %) and more than 32 pg in 64 cases (26.7 %).The MCHC values were less than 20 gm/dl in 4 cases (1.7 %) , between 20-25 gm/dl in 40 cases (16.7 %), 25-30 gm/dl in 68 cases (28.3 %) , 30-35 gm/dl in 108 cases (45 %) and more than 35 gm/dl in 20 cases (8.3 %).The reticulocyte percentage was less than 2 in 128 cases (53.3 %) and between 2-10 in 112 cases (46.7 %).The peripheral smear showed microcytic hypochromic picture in 88 cases (36.7 %) , normocytic hypochromic picture in 32 cases (13.3 %) , normocytic normochromic picture in 64 cases (26.7 %) and dimorphic picture in 56 cases (23.3 %).

The most common assosiated disease with severe anemia was malaria in 60 cases (26.7%) and iron deficiency anemia in 60 cases (25 %) cases.20 cases had pneumonia followed by TB and thalassemia with 12 cases (5 %) each.ALL , aplastic anemia , dengue and dysentry , empyema were diagnosed in 8 cases each (3.3 %) and hepatic encephalopathy , hyperspleenism ,megaloblastic anemia and septicemia were diagnosed in 4 cases each (1.7 %).

The prevalence of severe anemia was more common in males than in children of age group betweem 6 months - 11 yrs while it was equal among males and femlaes between age group 12 -18 yrs. Chi-square test

showed no significant association between age and gender(c=3.42;p=0.18).In the age group between 6-59 months malaria was the most common disease assosiated with severe anemia followed by other causes of anemia apart from hemolytic anemias and nutritional anemias. In the age group between 5 yrs- 18 yrs , nutritional anemias and anemias due to other causes were predominantly asssiated with severe anemia. Chi-square test showed significant association between age and diagnosis (c= 207.93;p=0.00). The mean hemoglobin levels were grossly reduced in cases of aplastic anemia (2.95).the mean MCV , MCH and MCHC were lowest in nutritional deficency anemias with mean values being 63.4fl , 19.56 pg, 26.9 gm/dl respectively. ANOVA showed statisticalsignificant difference between the diagnostic factors with respect to Hb(p=0.00); MCV(p=0.00);MCH(p=0.00); MCHC(p=0.00); Reticulocyte count (p=0.00).

III. Discussion

Anemia is generally defined as a reduction in the O2 carrying capacity leading to tissue hypoxia. . According to WHO grading of anemia, in severe anemia, haemoglobin level is less than or equal to 7g/dl or 8 gm/dl depending on age group of child taken into consideration.

Age distribution : The highest incidence of severe anemia was seen in children of age group 6 months- 59 months (48.3 %) with lowest incidence in the age group of 12-18 yrs (16.7 %). This observation is comparable to the study done by S.S. Manchanda et al[3], 1961 (highest incidence in < 3 years – 51.42%), R.G. Goel et. Al[4], 1978 and B.D. Patel et al[5],1959. In Venkatesh G etal[6] study , the incidence of severe anemia was more common in the children of age group 1-2 yrs. The high prevalence in this age group can be justified by the increased nutritional needs for growth in this age group as well as the high prevalence of hereditary anemias.

Sex distribution : The incidence of severe anemia showed male preponderance with a male to female ratio of 1.5 : 1.This is comparable with studies done by R.G. Goel et al. 1978 (male : female ratio 1.7: 1) Manchanda et al., 1961 (male female ratio 2.1 : 1) and M.M Kumbhat et al[7], 1959 (1.5 :1). The male predominance may be due to sheer coincidence.

Nutritional status : IAP grading was used to classify PEM. Out of 240 cases 48 cases (20%) had grade 1 PEM ,36 cases (15%) had grade 2 PEM , 36 (15%) cases had grade 3 PEM & 40 cases (16.7 %) had grade 4 PEM. 80 cases (33.3 %) had body wt in the normal range.In a study conducted by Venkatesh G etal , most of the patients were in class V socioeconomic group i.e. 53.9%, class IV - 24.2%, class III –14.8%, class II - 1.9% and class I - 0%. This was according to Kuppuswamy socioeconomic scale.

Associated diseases : The most common disease associated with severe anemia was malaria in 60 cases (26.7%) and iron deficiency anemia in 60 cases (25 %) cases.20 cases had pneumonia followed by TB and thalassemia with 12 cases (5 %) each .ALL , aplastic anemia , dengue and dysentry , empyema were diagnosed in 8 cases each (3.3 %) and hepatic encephalopathy , hyperspleenism ,megaloblastic anemia and septicemia were diagnosed in 4 cases each (1.7 %). In Taniya Sarkar dutta etal[8] study the percentage of cases with severe anemia was higher in nutritional anemia (67.4%) compared to that in hemolytic anemia (63%) and anemia from other causes (66.7%).

Presenting symptoms : The symptomatology is so diverse that almost any symptom can occur in anemic children. The symptoms and signs in anaemic children are due to the anemia itself and due to the disorder causing the anemia. 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 anemias than in a slowly developing anemia

Clinical signs : The present study showed pallor as the most reliable clinical sign in 95 % cases. Pyrexia was present in 71.7 % cases.Hepatomegaly was present in 28.3 % cases with spleenomegaly in 8.3 % cases. Hepatospleenomegaly with lymphadenopathy being major clinical sign in malignancies and malaria cases.Edema and dyspnea were major features seen in patients with CCF.Nutritional anemia cases were associated with nail and skin changes in 7.7 % and 13.3 % cases respectively. Signs of malnutrition were seen in 66.6 % cases .Malnutrition may be because of deficient calorie intake or may be secondary to the disease process like acute infections, thalassemia & leukemia seen in this study. In study by Manchanda et al ,Sharma et al and Patel et al, it was seen in 85%, 74% and 55.6% of patients respectively. Vit A deficiency like xerosis, bitot's spots was noted 13.3 % cases.Frontal bossing was observed in 8.3 % cases having thalassemia syndrome.In 1 case (1%) suffering from leukemia, bony tenderness was observed. It is seen due to leukemic cell infiltration to periosteum and bone.

Hemoglobin : 168 cases (70 %) had hemoglobin levels > 5 gm % and 72 cases (30 %) had hemoglobin levels < 5 gms %. In studies by Manchanda et al, Hb% < 5g/dl was seen in 62.92% and between 5- 7g/dl in 37.08% cases. Goel et al in their study found Hb < 5g/dl in 52% cases and between 5- 7g/dl in 48.5% cases.

MCV, MCH AND MCHC : The mean corpuscular volume was less than 60fl in 32 cases (13. 3 %) , between 60-75 fl in 80 cases (33.3 %) , between 75-90fl in 84 cases (35 %) and more than 90fl in 44 cases (18.3 %).The MCH values were less than 27 pg in 112 cases (46.7 %) , between 27-32 pg in 64 cases (26.7 %) and more than 32 pg in 64 cases (26.7 %).The MCHC values were less than 20 gm/dl in 4 cases (1.7 %) , between 20-25 gm/dl in 40 cases (16.7 %), 25-30 gm/dl in 68 cases (28.3 %) , 30-35 gm/dl in 108 cases (45 %) and more than 35 gm/dl in 20 cases (8.3 %).

Peripheral smear : The peripheral smear in hemolytic anemias showed dimorphic picture in 4 cases , normocytic hypochromic picture in 4 cases and normocytic normochromic picture in 4 cases. In nutritional anemias 64 cases had microcytic hypochromic picture with 8 cases each with normocytic hypochromic and dimorphic picture.20 cases had dimorphic anemia, 4 cases normocytic normochromic and 40 cases normocytic normochromic anemia among malaria cases.

Incidence of etiology in the present study is compared with studies by G.C. Bothra et al[9], 1969 and studies by R.G. Goel et al, of severely anaemic children in Afghanistan, 1981.Nutritional anemia and malaria were the most common causes of severe anemia in the present study attributed to endemicity of malaria in the area of study as well as under nutrition and lack of adequate nutrient supplementation among children in the area of present study.

Serum ferritin was done in all the cases. It is a sensitive indicator of iron status. In 36 cases, serum ferritin was less than 12mg/dl.

Stool examination was done in all the cases and it revealed worm infestations in 23.3 % cases.So stool examination is a very important test which should not be overlooked in any case of anemia.

Bone marrow aspiration was done in 23.3 % cases with hypocellular marrow found in 18 % and normocellular marrow found in 5.3 % cases. Aplastic anemia was diagnosed in 8 cases, who presented with generalised weakness, progressive pallor and breathlessness. Peripheral smear showed pancytopenic picture. Bone marrow examination revealed few adipocytes and hypocellular marrow.

Anemia due to TB was seen in 8 cases and anemia assosiated with UTI in 4 cases.

IV. Conclusion

Nutritional anemias and malaria are the major causes of severe anemia because of the malnutrition and endemicity of malaria.Among nutritional anemias iron deficiency anemia is the most common cause .Most of the children were malnourished and had infection indicating that severe anemia is directly related to malnutrition and infection.Pallor is the most consistent clinical sign of severe anemia followed by fever.Severe anemia is more common in children between 6 months- 59 months age group.

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