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Study of Anemia in Newborn

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Abstract: Nutritional anemias are common in developing countries like India. It is a condition in which the hemoglobin content of the blood is lower than normal as a result of deficiency of one or more nutrients like Iron, Vitamin B12 and folic acid. Hemoglobinopathies is another major problem. The major hemoglobinopathies common in India are thalassemia and sickle cell anemia. About 100,000 children are born every year world over with homozygous state for thalassemia. The aim of the present study is to study anemia in new born to thirteen year age group patients. All the samples of inpatients coming from paediatric department of our hospital for complete blood count were screened and the cases having low hemoglobin count were included in our study. The study has been conducted for the period of May, 2011 to April, 2013.

INTRODUCTION

Anemia is global problem of immense public health significance particularly in children. It is an ancient disease, and commonest chronic malady of mankind seen all over the world. Early diagnosis of anemia enables us to prevent its complications particularly in a growing period and helps to guide further management.1 Anemia is more common in pediatric age group because of Bhargava (1982) and Ghai (1993):

- The rapid growth in infancy when the requirement of nutrition are much more
- High susceptibility to infection due to lack of immunity and malnourishment which produces adverse effect on hemopoiesis
- The lack of compensatory adjustment of hemopoiesis as per demand because of poor storage of hemopoietic factors
- Genetically inherited anemias also manifest in infancy and childhood when their severity is significant

Overall 72.7% of children up to the age of 3 years in urban areas and 81.2% in rural areas are anemic (Lukens, 1984; Chatterjea, 1967). If not corrected it leads to increasing severity of anemia, delayed development of milestones, increased susceptibility to infection and greater risk of death. Anemia in chronic infection is the second most common cause of anemia in childhood. Chronic infections like Tuberculosis, Bronchiectasis, Lower respiratory tract infections are involved in the development of anemia (Abshire, 1996).

With the birth rate of 22.8 per 1000 it is estimated that 8-10,000 children born in India with Thalassemia every year (Chatterjea, 1966). Sickle cell anemias are particularly common among people whose ancestors came from sub Saharan Africa, India, Saudi Arabia and

Mediterranean countries (Chatterjea, 1966). Prevalence rate in various parts of India are as follows: North East India 0-18%, Central India 22-44%, West India 0-33% and South India 0-40% (Lokeshwar *et al*., 2009). With all this above in mind, a small study was undertaken in our institute to study the pattern of anemia in pediatric age group and classify them morphologically and to study the cause of anemia.

Aim: To study anemia in new born to thirteen year age group patients.

Objectives: To study pattern of anemias in new born to thirteen year age group and classify anemias morphologically.

Literature review: The history of pediatric hematology begins in 1889 with Von Jaksch's report on the condition that bears his name which he designated anemia pseudo leukemia infantum (Verma *et al*., 1992; Zuelzer, 1993). The first case report in the medical literature of patient to have pernicious anemia appeared in 1822. In 1849, Addison described a patient with fatal idiopathic anemia which was for many years referred to as "Addisonian" pernicious anemia. The term 'megaloblast' was coined in 1880 by Ehrlich and still used to refer to the abnormal erythroblasts found in megaloblastic anemia. By Zuelzer (1993) reported 25 cases of megaloblastosis in infants, the diagnosis confirmed by the demonstration of megaloblastic bone marrow (Miller and Baehner, 1984; Babior, 1991).

Normal hematopoiesis: Hematopoiesis is the process of production of blood cells from Hematopoitic stem cells which have extensive potential of proliferation to produce more stem cells and differentiate into progenitor cells. Progenitor cells (lineage committed cells) are committed to one lineage that is myeloid and lymphoid. Late progenitor cells differentiate into morphologically recognizable maturing in cells like proerythroblasts, early normoblast, etc. As these cells mature proliferative potential decreases and finally mature white cells, red cells and platelets are produced.

The process of hematopoiesis begins in the yolk sac (embryonal stage) at 3rd week of intrauterine life. From 3rd month onwards hematopoiesis starts in the liver which continues upto 6th months. Bone marrow starts taking over the function of hematopoiesis from 4th month onwards and at birth the bone marrow becomes virtually the only source of blood cells.

Clinical features: The clinical features in anemic patient are due to:

- Anemia itself
- The disorder causing anemia

Symptoms: Patients present with generalized weakness, giddiness, listlessness, loss of appetite, refusal to feeds, failure to thrive, weight loss, pica, dyspnoea on exertion, palpitations, mild fever, lack of concentration and drowsiness.

Signs: Pallor is the most prominent sign which may be seen in the skin, nail beds, conjunctivae, mucus membranes. Nail changes range from lusterlessness and brittleness to koilonychia. Tachycardia, haemic murmur, behavioral changes and irritability. High cardiac output state- characterized by a high pulse pressure with a collapsing pulse. Congestive cardiac failure in severe anemia (Baehner and Miller, 1984).

Acute lymphoblastic leukaemia: The clinical manifestations are extremely variable. The children may present with insidious onset of pallor, easy fatigability, fever, bleeding, easy bruising, infections, lymph node enlargement, abdominal distension, bone pain or with inability to walk. Hepatosplenomegaly is seen in 35-38% of cases. Only 4% of children show central nervous system involvement (Walters and Abelson, 1996).

Laboratory features: The Complete Blood Count (CBC) is deceptively simple test to order and interpret and also relatively inexpensive. CBC includes estimation of Hemoglobin (Hb) concentration, Hematocrit (Hct), cell counts including RBC, WBC and platelets. These preliminary tests give an idea about the presence of anemia and its severity. Other components of CBC include RBC indices (MCV, MCH and MCHC), RBC morphology, reticulocute count and RDW. This data further gives an idea about the subtype of anemia, i.e., Normocytic, Microcytic or Macrocytic. The MCV and the RDW provide a classification of erythrocytes based upon their size and size distribution. The reticulocyte count is used as an index of bone marrow activity and is invariably elevated in states of hemolysis and in deficiency anemias after therapy.

Peripheral smear examination and blood counts often indicative whether bone marrow examination is necessary. It is of value In Macrocytic anemias to establish megaloblastosis, in normocytic anemias to exclude aplasia or haemopoietic neoplasms and in states of iron deficieny through the demonstration of stainable iron. Based on preliminary tests, specific tests can be undertaken to define the nature and pathogenesis of anemia (Bhargava, 1982).

It is therefore, essential to perform a trephine biopsy which chiefly shows fat, fibrous tissue and lymphocytes. Severe aplastic anemia as defined by the international aplastic anemia study group includes two of the following 3 peripheral blood parameters and one of the bone marrow parameters: i.e., in blood-absolute neutrophil count <0.5×109/L, Platelets<20×109/I,

reticulocytes<1%. In bone marrow-severe hypocellularity or moderate hypocellularity with <30% hemopoietic cells. Serum iron level is elevated, iron binding capacity is usually saturated. FEP is increased. Ferrokinetic studies show a delayed clearance of radiolabelled iron from plasma and decreased incorporation of iron into red cells. Red cell life span may be shortened. Hb F levels are increased. Levels>400 mg dL^{-1} have good prognosis. Hb F containing red cells can be identified in smear by acid elution method. Abnormal granulopoiesis like abnormal granulation in the neutrophils and high leukocyte alkaline phosphatase levels.

MATERIALS AND METHODS

The present study is a two year cross sectional study which was carried out in the hematology section of department of pathology in tertiary care centre from May, 2011 to April, 2013. All the samples of inpatients coming from paediatric department of our hospital for complete blood count were screened and the cases having low hemoglobin count were included in our study. The cases were divided into four groups as: 0-1 year, 1-5, 5-8 and 8-13 years.

Hematological investigations: All the routine hematological investigations viz.: complete hemogram, platelet count, reticulocyte count, Peripheral Blood Smear (PBS), red cell indices, Packed Cell Volume (PCV), Erythrocyte Sedimentation Rate (ESR) along with urine and stool examination were done wherever necessary.

The blood for hematological investigations was collected in E.D.TA bulb. 1) Hb concentration, cell counts, i.e., RBC and WBC, red cell indices along with PCV and RDW were recorded on automated analyzer lab life principle: based on aperture impedance technology. It works on the principle of aperture impedance technology. Blood cells being poor conductor of electricity are suspended in electrically conductive electrolyte solution which is then made to flow from an outlet chamber in an inner chamber through a 100 um diameter orifice. When cell passes through orifice during the counting process the cell imparts resistance to the electrical conductivity between the electrodes which is recorded electronically as a voltage pulse the height of pulsesbeing proportional to the volume of cells passing through the orifice. Number of such voltage pulses recorded correspond to the counting of cells. The Hb concentration, cell counts, PCV and RDW are measured electronically whereas the erythrocyte indices are calculated by the microprocessor. Peripheral blood smears were made and stained by Leishman stain and morphology of the RBC, WBC and platelets were studied.

RESULTS AND DISCUSSION

The present study included 138 cases of anemia in new born to 13 year age group. Criteria used in this study for selection of cases was cut off points of hemoglobin concentration given by W.H.O. The distribution of anemia was maximum (35.5%) in 1-5 years of age group followed by (28.98%) in 0-1 years of age group, 24.36% in 8-13 years of age group and least in 5-8 years of age group (10.87%).

This group in our study constituted 63 cases amongst which iron deficiency anemia was seen in 50 cases (36.23%), megaloblastic anemia in 1 case (0.7%) and dimorphic anemia in 12 cases (8.69%). Magotra, etc. in his study found 74% cases of nutritional anemia in which iron deficiency constituted 64%, megaloblastic anemia 2% and dimorphic anemia 8%. We found percentage of anemia of chronic infection 38.40% in our study. All the patients showed signs of respiratory disease except in 3 cases which showed signs of meningeal irritation suggestive of tuberculous meningitis and 4 cases of enteric fever. The Hb levels, MCV and RDW values ranged between 6.4-11.1% g, 3-87 fl and 14-15.8%, respectively. RDW was found to be increased in 20 cases out of 43 where it was normal in 23 cases. The 43 cases showed microcytic normochromic picture on peripheral smear whereas normocytic normochromic anemia was found in remaining 10 cases. Serum iron levels were done. ESR was raised in all cases. RDW and MCV in combination are useful tools for diagnosing the Microcytic anemias. A low MCV with an elevated level of RDW is suggestive of iron deficiency anemia while a low MCV with a normal RDW suggest thalassemia trait. A normal to high RDW and low MCV suggest anemia of inflammation. In our study we compared the range and mean values of MCV and RDW of all the cases of iron deficiency anemia, thalassemia and inflammation. All the cases of iron deficiency anemia had low MCV and high RDW values while those of inflammation showed low to normal MCV and slightly increased RDW values.

CONCLUSION

The present study was a 2 years cross sectional study which was carried out in the Hematology section of Department of Pathology from May, 2011 to April, 2013. The maximum percentage of anemia was found between 1-5 years of age group with male preponderance. The majority of the cases were of moderate anemia (47.82%) followed by severe anemia (34.78%) and then mild anemia (17.40%). The commonest presenting symptom was fever (63.04%) followed by weakness and easy fatiguability (49.27%) followed by loss of appetite (45.65%). Most of the cases presented with pallor (90%) followed by tachycardia (31.7%) and hemic murmur

(26.9%). The microcytic hypochromic anemia was the commonest morphological type observed (47.1%) followed by microcytic normochromic anemia (31.15%). There were maximum cases of nutritional anemia (45.65%) followed by anemia of chronic infection (38.4%). Iron deficiency anemia was present in 36.23% cases. Megaloblastic and dimorphic anemia was found in 0.7 and 8.69% cases respectively. There were 16 cases of hemolytic anemia (11.59%) out of which 15 were of thalassemia major and 1 of sickle cell anemia. Hypoplastic anemia was seen in 2 cases (1.4%) out of which 1 had Fanconi's anemia. There was single case of Idiopathic thrombocytopenic purpura (0.7%) and 3 cases of acute lymphoblastic leukemia (2.1%). All the cases of iron deficiency anemia showed microcytic hypochromic anemia, dimorphic anemia showed a macrocytic hypochromic picture while megaloblastic anemia presented with macrocytic normochromic anemia. Majority of patients 43/53 (31.15%) having anemia of chronic infection showed Microcytic Normochromic blood picture and remaining 10/53 (7.24%) of patients showed Normocytic normochromic blood picture. All the cases of Thalassemia major showed microcytic hypochromic anemia. All the cases of hypoplastic anemia, idiopathic thrombocytopenic purpura and acute lymphoblastic leukemia showed normocytic normochromic blood picture on peripheral blood smear. Thus, to conclude nutritional anemia still continues to be the commonest etiological type in newborn to 13 yr age group followed by chronic infections (Respiratory) which was the second most common cause of anemia. Further work and treatment modalities. Nutritional anemias are preventable as well as treatable. Education of mothers regarding presenting symptoms of anemia as well as proper food habits is necessary. Genetic counseling and prevention of consanguineous marriages is key for prevention of hemoglobinopathies viz. thalassemia and sickle cell anemias.

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