Haematological pictures in full term new born children in Sudan

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Background Anemia can occur when red blood cells are broken down too rapidly, too much blood is lost, or the bone marrow does not produce enough red blood cells. Normally, the bone marrow does not produce new red blood cells between birth and 3 or 4 weeks of age, causing a slow drop in the red blood cell count (called physiologic anemia) over the first 2 to 3 months of life. Very premature newborns have a slightly greater drop in red blood cell count. More severe anemia can occur when red blood cells are broken down too rapidly, a lot of blood is taken from preterm infants for blood tests, too much blood is lost during labor or delivery or the bone marrow does not produce blood cells. (Arthur E., et al 2009) The aim of this study are to measure Hb level, RBCs indices, serum iron, total iron binding capacity and serum ferritin in newborns at the time of delivery. Methods: 80 blood samples were collected from new born cord blood, complete blood count was measure using Sysmex Kx-21. Serum iron and total iron binding capacity (TIBC) were measured by an automatic instrument (BTS- 370 Plus), which performs spectrometric measurements. Serum ferritin was estimated by ELIZA technique. Results: this study showed that 18 (22.5%) babies had low Haemoglobin level, while 62 (77%) had normal level, 70 (87.5%) had normal MCV, while 10 (12.5%) had low MCV, 79(98.7%) had normal MCH, while 1(1.3%) had low MCH while all studied babies (80) had normal MCHC. Eight (10%) babies had low S. ferritin, while 69 (86.3%) babies had normal S. ferritin, and 3 (3.7%) babies had high S. Ferritin while four (5%) babies had low S. iron, 54(67.5%) babies had normal S. iron and 18(22.5%) had high S. iron. TIBC showed that 5(6.3%) babies had low TIBC, while 67(83.7%) had normal TIBC and 8(10%) babies had high TIBC. Conclusion: This study concluded that anaemia in newborn babies is not uncommon and early cord clamping should always be taken in to consideration, if other causes could not be found.

Keywords: Haemoglobin, indices, iron, ferritin.

INTRODUCTION

Anemia is a condition in which the body does not have enough healthy red blood cells. Red blood cells bring oxygen to body tissues. There are many types of anemia. Iron deficiency anemia is a decrease in the number of red blood cells in the blood due to a lack of iron. Iron deficiency anemia is the most common form of anemia. Iron deficiency can be due to:

- An iron-poor diet.
- Malabsorption.
- Long-term, slow blood loss, usually through menstrual periods or bleeding in the digestive tract.
- Rapid growth, in the first year of life and in
adolescence, when more iron is needed. Babies are born with iron stored in their bodies. Because they grow rapidly, infants and children need to absorb an average of 1 mg of iron per day. Since children only absorb about 10% of the iron they eat, most children need to receive 8-10 mg of iron per day. Breastfed babies need less, because iron is absorbed 3 times better when it is in breast milk. Iron deficiency anemia most commonly affects babies 9 - 24 months old. All babies should have a screening test for iron deficiency at this age. Babies born prematurely may need to be tested earlier. (Stettler et al., 2011)

Pathological anaemia in the newborn

It can result from haemorrhage, haemolysis or failure of red cell production. Anaemia at birth is usually due to severe immune haemolysis or haemorrhage. Infants with impaired red cell production do not usually develop anaemia until after 3 months, like congenital red cell aplasia and congenital dyserythropoietic anaemia. (Behraman et al., 200)

Neonatal haematopoiesis

Neonatal erythropoiesis

Erythropoiesis in the human embryo can be detected 2-3 weeks after conception, blood islands form in the yolk sac, the peripheral cells of which differentiate to form the first blood vessels, the central cells becoming the primitive haemocytoblast. The mean Hb level in cord blood at term is 16.8g/dl, with 95% of the values falling between 13.7 and 20.1g/dl. More extreme ranges (12 to 25g/dl) are thought to depend on large feto-materna l or materno-fetal transfusion. This variation reflects perinatal events, particularly asphyxia (Beutler, 2001) and also the amount of blood transferred from the placenta to the infant after delivery. Delay of cord clamping may increase the blood volume and red cell mass of infant by as much as 55 % (Beutler, 2001). The mean total blood volume after birth is 86.3 ml/Kg for the term infant. The blood volume per kilogram decreases over the ensuing weeks, to reach a mean value of about 65ml/Kg by 3 or 4 months of age.

Normally the Hb and Haematocrit values rise in the first several hours after birth because of the movement of plasma from the intravascular to the extravascular space. (Beutler, 2001) A venous Hb concentration of less than 14g/dl in a term infant or a fall in haematocrit in the first day of life is abnormal. The haematocrit of a newborn is (53.6-68.4).

The value of MCHC is (30- 36 pg). The MCH is (31-37g/dl). There are significant numbers of circulating progenitor cells in cord blood. (Beutler, 2001) By 3-5 days after birth, nucleated RBCs are not found normally in the blood of term or premature infant, but they may be present in markedly elevated numbers in the presence of haemorrhage or hypoxic stress.

The RBCs and Hb and haematocrit values decrease only slightly during the first week, but decline more rapidly in the following 5 to 8 weeks, producing the physiologic anaemia of the newborn, and this occur by two months of age, when Hb concentration falls below 11 g/dl (Rennie and Robertson, 2001)

Neonatal Iron status

Although iron transport to the fetus is unidirectional, with maternal-fetal serum ferritin ratio of 1:2 to 1:4, and there is adequate fetal iron stores even in cases of maternal iron deficiency, there is some evidence of reduced red cell mass in the offspring of iron- deficient mothers and that iron stores, although high by adults standards are reduced in these infants compared to those born to iron-replete mothers. The fetus in uterus normally recruits 75 mg iron/Kg body weight, 75% of which is incorporated into RBCs. Iron status at birth will therefore be related to birth weight and maturity. (Behraman et al., 200) the effect of maternal iron deficiency may have long-term effect on the fetus, neonate and developmental parameters in the first few years of life. (Nilman et al.,)

Serum iron level in cord blood of the normal infant is elevated compared to maternal level (Beutler, 2001).

Objectives

The main objectives of this study are to measure Hb level and RBCs indices in newborns at the time of delivery, to determine iron status newborns at time of delivery by measuring serum iron, total iron binding capacity and serum ferritin and to work out the frequency of iron deficiency anaemia in newborn.

METHODS

This is prospective comparative hospital based study was conducted in Khartoum Teaching Hospital and Omdurman Maternity Hospital.

Eighty deliveries were attended, of which 64 were normal vaginal delivery, and 16 were elective caesarian sections, after delivery cord blood samples were taken from the babies. All newborn after term pregnancy, irrespective of gravity of the mother, taking iron supplements or not, if the mother having systemic disease or not, mode of delivery (C/S or vaginally) were included in this study. Only twin newborns, preterm or newborn of IUFD were excluded.
Samples were collected, 2.5 ml venous blood in EDTA for measurement of hematological values, 4 ml venous blood was collected as clotted blood to obtain 2 ml of serum, which was stored in cryo-tubes at -20°C for measuring the biochemical values, and the following tests were done:

Haemoglobin (Hb), Haematocrit (Hct), Red cell indices (MCV, MCH, MCHC) were measured using automatic blood counter (Sysmex Kx-21), at the same time peripheral blood film was made.

Serum iron and total iron binding capacity (TIBC) were measured by an automatic instrument (BTS-370 Plus), which performs spectrometric measurements. Serum ferritin was estimated by ELIZA technique. Data was analysed by computer software statistical package for social science (SPSS) program.

RESULTS

All 80 newborns were included in the study. All babies were term, 78 of them were healthy, and while two were diseased (one with jaundice and the other with growth retardation). (Figure 1)

The weights of the studied babies: between 2.5 and 4.5 kg. (Figure 2), and the gender showed 33 (41.3%) males, while 47 (58.7%) were females. (Figure 3).

Haematological findings in the studied babies

Haemoglobin value in the studied babies: 18 (22.5%) babies had low Haemoglobin level, while 62 (77%) had
normal level. (Figure 4) the mean value of red cell indices in studied babies showed that 70 (87.5%) had normal MCV, while 10 (12.5%) had low MCV, 79 (98.7%) had normal MCH, while 1 (1.3%) had low MCH while all studied babies (80) had normal MCHC as seen in (Figure 5).

**Biochemical findings in the studied babies**

Serum ferritin values in the studied babies showed that eight (10%) babies had low S. ferritin, while 69 (86.3%) babies had normal S. ferritin, and 3 (3.7%) babies had high S. ferritin. Figure (6) Serum iron values in the studied babies
babies showed that four (5%) babies had low S. iron, while 54(67.5%) babies had normal S. iron and 18(27.5%) had high S. iron. Figure (7)

TIBC showed that 5(6.3%) babies had low TIBC, while 67(83.7%) had normal TIBC and 8(10%) babies had high TIBC. Figure (8) Peripheral blood film examination showed macrocytosis and very few showed hypochromia.

DISCUSSION

This study aimed to measure the haematological parameters in newborn children to detect the frequency of anaemia among newborns. This study found that anaemia in the studied newborns was found to be 22.5% as 18 babies had low Hb level (<14g/dl). This agreed with a study done in Sudanese newborn babies, which reported it to be 29.9% (Suad El-Nour, 1997) Most of our anaemic babies had normal haematological indices. 7 of them had low MCV and only one had low MCH and none of them had low MCHC. Only one baby (5.6%) had low serum ferritin level. This confirms the finding stated by Milman, (1987); fenton et al, (1987) that severely depleted maternal iron stores can affect the baby. (Makrides et al).

17 of the anaemic babies had normal serum ferritin and normal indices. Their anaemia can be due to undiscovered causes or probably due to early clamping of the umbilical cord, which can lead to anaemia (Blot and co workers, 1999). It is worth mentioning that none of these babies was clinically jaundiced which rules out haemolysis as a cause of their low Hb.

TIBC was found to be unexpectedly low in some babies in our study. Contrary to our findings it has been reported in the literature that TIBC is not elevated above reference limits in 30% -40% of patients with chronic iron deficiency anaemia so normal but not low levels may be found (Ravel, 1995) In another study however 69% of iron deficiency patients with low serum iron levels had an elevated TIBC, 11% had a TIBC within reference limits, and an additional 21% had decreased TIBC values. (Ravel, 1995)Therefore our results of low TIBC can be acceptable.

Three of the studied babies had serum ferritin of more than 300ng/ml. This is high if we take the upper limit of normal as 300 ng/ml, but it can be regarded as normal if we take the upper limit mentioned in some books e.g. Text Book of Neonatology (674 ng/ml). The mean serum ferritin levels are high at birth and it rises further during the first month of life, and then fall to a mean of 30microgram/l by one year of age. The reference ranges is 15 -200 ng/ml. (Ravel, 1995). Total binding capacity rises throughout the first year of life, the normal range is
Peripheral blood film examination was performed in all newborns, as for anaemic neonates, all of them showed macrocytosis and very few showed hypochromia and this usually is the typical feature in newborns as mentioned by Bentley, (1985).

CONCLUSION

This study concluded that anaemia in newborn babies is not uncommon and early cord clamping should always be taken into consideration, if other causes could not be found.

A peripheral blood film examination in newborn is not a reliable tool in diagnosing iron deficiency anaemia. Ferritin level is the best parameter for assessment of iron status and combined reduction of MCV and MCH is more sensitive to detect iron deficiency anaemia while MCHC reduction comes late.

REFERENCES


