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Original Research Article

Prevalence and outcomes of neonatal anaemia in university of medical sciences teaching hospital, Akure

Rosena O. Oluwafemi[1]*, Emmanuel O. Bello[1], Toluwani M. Oluwafemi[2], Raymond E. Onoja[3], Oluwafemi J. Adeleye[3]

[1]Department of Paediatrics & Child Health, University of Medical Sciences, Ondo, Nigeria
[2]Aviation Medical Centre, Ikeja, Lagos, Nigeria
[3]Centre for African Newborn Health & Nutrition, University College Hospital, Ibadan, Oyo, Nigeria

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***Correspondence:**
Dr. Rosena O. Oluwafemi,
E-mail: bankyfem@yahoo.com

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ABSTRACT

Background: Neonatal anaemia is a public health problem associated with short- and long-term morbidities. It can lead to death if not immediately treated or impairment in brain maturation and development, tissue hypoxia and stunted growth eventually. The aim and objectives of the study is to determine prevalence, associated factors and immediate outcomes of neonatal anaemia in the University of Medical Sciences Teaching Hospital (UNIMEDTH), Akure.
Methods: This was a retrospective review of the medical records of all consecutive neonatal admissions in the neonatal intensive care unit (NICU) of the hospital over a nine-month period. At admission, peripheral blood sample was collected routinely within one hour of life for Packed Cell Volume at the side laboratory. Other relevant data were extracted from the case files and documented in the excel sheet which were exported unto the Statistical Package for Social Sciences (SPSS) version 25.0 for analysis.
Results: Of the 145 babies studied, 30 were anaemic with one mortality; 132 (91.1%) of them were admitted within 24 hours of life, the commonest morbidity among them was prematurity, ABO incompatibility, neonatal sepsis and anaemia. Caesarean delivery, very low birth weight, longer duration on admission, prematurity and lower gestational age were significantly associated with neonatal anaemia while gender was not.
Conclusions: The prevalence of anaemia among neonates in UNIMEDTH was 20.7%. The mortality was 3.3% and the only death occurred among babies with feto-placental transfusion.

Keywords: Anaemia, Neonates, Outcomes, Prevalence, University of medical sciences teaching hospital

INTRODUCTION

Neonatal anaemia is a public health problem associated with short and long term morbidities.[1,2] Anemia can be defined as haematocrit (Hct) or haemoglobin (Hb) concentration>2 SD below the mean for age and sex for the normal population as a result of a reduction in the circulating red blood cells (RBC).[1-4] In Africa, Packed Cell Volume (PCV) range of 45% to 64% is taken as normal and when the PCV is less than 45%, the newborn is categorized as anaemic.[5] Causes of neonatal anaemia is multifactorial, with prenatal factors such as maternal malnutrition, iron-deficiency anemia and infections being the commonest.[6] Neonatal anaemia can be classified based on Red Blood Cell morphology and size of the Red Blood Cells as viewed under the microscope. These cells can be small in size (microcytes) with low mean corpuscular volume (MCV), the cells can also be normal sizes (normocytes) with normal MCV while some can be large in size (macrocytes) with high MCV. The mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) are calculated values and have complementary diagnostic values.[2]

In the newborn period, anaemia may generally be as a result of blood loss, increased Red Blood Cell (RBC) destruction or reduced RBC production.[2] Blood loss in the newborn can be as a result of obstetric causes such as can happen in placental abruption, placenta previa, trauma to placenta or umbilical cord during delivery, rupture of anomalous placental vessels and slipped ligature of the cord.[7] Eight percent of normal pregnancies have some admixture as a result of Feto-maternal transfusion.[8] Feto-Placental transfusion is a major cause of neonatal anaemia in our hospitals especially due to positioning of the newborn above level of placenta immediately after delivery before cutting of the umbilical cord.[9] Partial cord occlusion which happens during cord-round-the-neck or cord prolapse is another cause. Twin-twin transfusion can occur in monochorionic/ monozygotic twin gestation when there are placental vessels which allow shunting of blood from one twin to the other in which case the donor twin will end up with anemia of variable severity while the recipient will have polycythemia of variable degree.[10] A major malady in the preterm newborn baby is the intraventricular hemorrhage, this can also pose as neonatal anaemia.[2] In cases of haemorrhagic disease of the newborn with transient deficiency of Vit K-dependent clotting factors; cephalhaematoma, subgaleal hemorrhage, bleeding into the gut may present as anaemia. Iatrogenic blood loss can lead to neonatal anemia when there are excessive phlebotomies for laboratory tests.[11] This is one of the common causes of anemia especially in the very preterm infants. Increased RBC destruction can occur due to some intrinsic factors such as hereditary RBC disorders such as the glucose-6-phosphatase dehydrogenase (G6PD) deficiency; a RBC Enzyme defect. In cases of RBC membrane defects (hereditary spherocytosis, elliptocytosis, ovalocytosis), anaemia will also ensue. Increased RBC destruction will also occur in cases of neonatal sepsis, Rhesus iso-immunization, ABO blood type incompatibility, haemangiomas (Kasabach Merritt syndrome) and in some minor blood group incompatibility such as Kell and Duffy and majority of these will manifest as jaundice. Reduced RBC production on the other hand can occur as a result of anemia of prematurity due to transient deficiency of erythropoietin and quiescence of the bone marrow since hypoxia has been overcome soon after delivery with good transition.[12,13] Nutritional anemia (iron deficiency) will usually present after the neonatal period.

The major consequences of neonatal anaemia is reduced oxygen delivery to tissue, poor weight gain, poor activities and with cardiovascular low reserves and manifestations such as hypotension, tachycardia, tachypnoea, cardiomegaly and tender hepatomegaly which unfortunately are also cardinal signs of heart failure in them.[2,14] Many of these babies would need replacement of blood and blood products to survive. The prevalence of anemia among newborn babies ranges from 23% – 66% in sub-Saharan Africa.[2] In recent times the rate of blood transfusion in our unit has reached an alarming rate hence a need for self-auditing and proffer solutions on way forward. The study therefore set out to determine prevalence, associated factors and immediate outcomes of neonatal anaemia in the University of Medical Sciences Teaching Hospital (UNIMEDTH), Akure.

METHODS

Study area

The University of Medical Sciences Teaching Hospital (UNIMEDTH), Akure complex is a reference hospital for Ondo State and ally communities. The hospital has a total bed capacity of 170 beds for medicine, surgery, Paediatrics, family medicine, community health and obstetrics/ Gynaecology departments and serves largely an urban population. This was a retrospective study of newborn babies admitted into the neonatal intensive care unit (NICU) arm of the Paediatrics department of the hospital from January 2023 to September 2023.

Sample collection and packed cell volume determination

Packed cell volume (PCV) is a routine test done in the first hour of admission of all babies admitted into the unit after Temperature, Pulse, Respiration, random blood glucose and blood oxygen saturation (SPO2) have been taken and recorded. At admission, peripheral blood sample was collected via venipuncture within one hour of life into the ethylenediamine tetra-acetic acid (EDTA) bottle. By capillary action, some sample was taken into the capillary tube and centrifuged at 12,000 revolution per minute for 15minutes using the SH SURGILAC microhematocrit centrifuge machine in the side laboratory and confirmed in the main laboratory especially if PCV is low and blood transfusion would be required. Newborns were classified as having polycythemia (PCV≥65%), normal (PCV 45-64%) and anemic (PCV<45%).

Patient recruitment and data collection

This was a retrospective review of the medical records of all consecutive neonatal admissions in the NICU of the hospital over a nine-month period. The unit admits newborn babies from the operating theatre, labour ward and postnatal ward. Relevant data such as gestational age, birth weight, age at admission, gender, indication for admission, mode of delivery, indication for mode of delivery and mothers' data such as age, parity, occupation and level of education, were also extracted from the case records and documented in a Microsoft excel sheet.

Data analysis

The documented data on the excel sheet were exported unto the Statistical Package for Social Sciences (SPSS) version 25.0 for analysis. Descriptive statistics such as mean, standard deviation and percentages were done as appropriate. All data analyses were performed using Chi-squared analysis for categorical variables and student's t-

test for continuous variables. P<0.05 was taken as significant.

RESULTS

Socio-demographic characteristics of study participants

Table 1 showed the socio-demographic characteristics of all the study participants, 132 (91.1%) were admitted within 24 hours of life while 13 (8.9%) were admitted after 24 hours of life. Seventy-five (51.7%) of the children were male and 70 (48.3%) were female children. In all 59 (40.7%) neonates were preterm babies and 86 (59.3%) were full term babies with weight ranging between<1000g and above 4,000 g. Sixty-five (44.8%) were delivered by spontaneous vertex delivery while 80 (55.2%) were delivered by caesarean operation.

Indications for caesarean delivery were listed in table 2. Parents of 135 (93.1%) children practice Christianity religion and 10 (6.9%) practice Islam religion. One hundred and thirty-nine (95.9%) babies survived while 6 (4.1%) died. Seventy-six (52.5%) of their mothers had 1 or 2 previous deliveries, 63 (43.4%) had 3 or 4 previous deliveries and 6 (4.1%) had five or more previous deliveries.

Indications for admission

Figure 1 showed the diagnoses and indication for admission. Majority (24.8%) were admitted for severe perinatal asphyxia, 19.4% were admitted for prematurity and low birth weight, 18.6% were admitted for neonatal sepsis (NNS), 3.5% were admitted for neonatal jaundice (NNJ), 2.1% presented with pallor (anaemia), 11.4% had hypoglycaemia while 3.5% were admitted for respiratory distress. Other indications for admission included macrosomia, meconium aspiration, feed intolerance, HIV and HBsAg exposure.

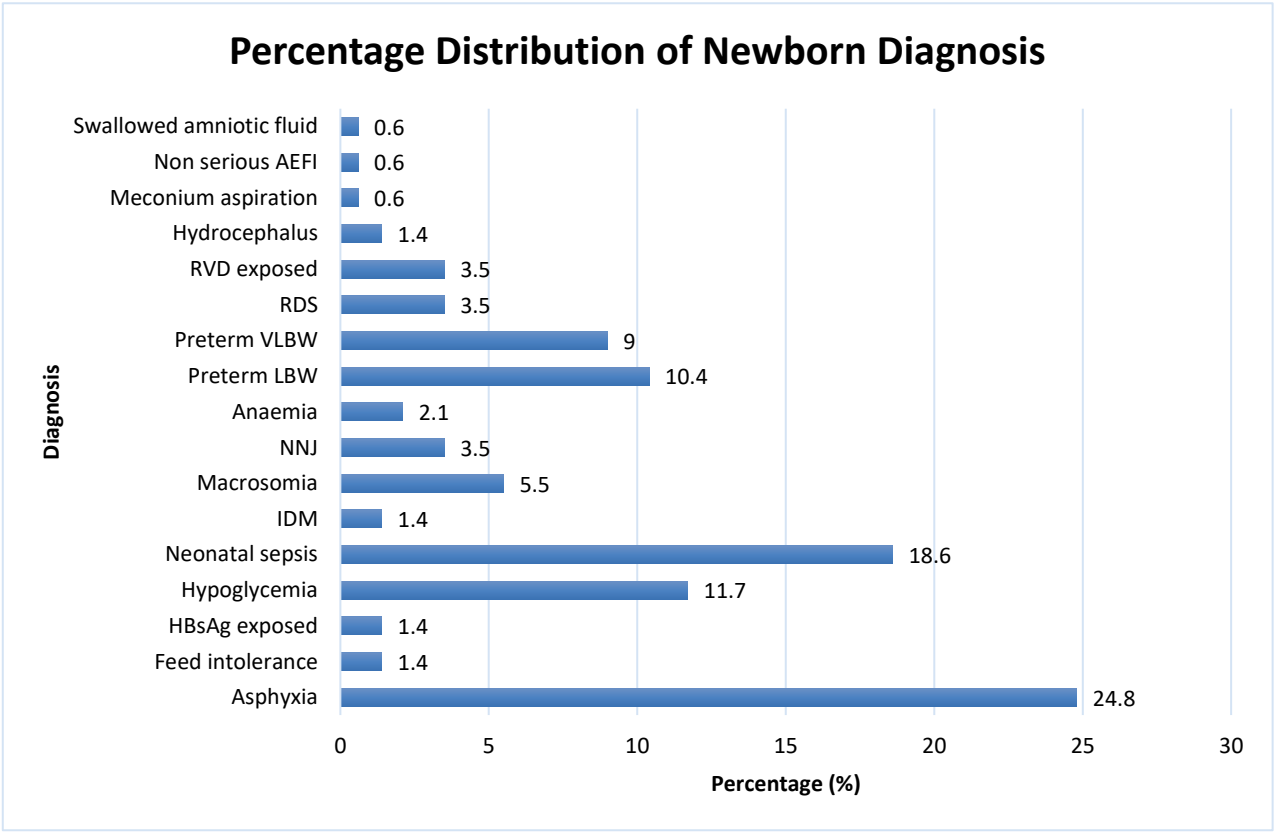

Figure 1: Indication for admission.

Clinical characteristics of the newborn babies

Table 3 showed the clinical characteristics of the newborn babies. Thirty (20.7%) of the babies had anaemia, 3 (2.1%) did not have anaemia yet got blood transfusion while 112 babies (77.2%) had normal PCV. Age at transfusion for the babies was less than 24 hours in 5 (3.4%) of them, 10 (6.9%) were transfused within 24 to 48 hours of admission while 18 (12.4%) were transfused after 48 hours. The duration of admission was less than 24 hours in 23 (15.8%) babies, 98 (67.6%) babies were on admission up to 7 days and 24 (16.6%) were on admission for more than 7 days.

Indications for blood transfusion

Table 4 showed the underlying morbidities and indications for blood transfusion in the babies. Of the 33 babies that were transfused, four babies had birth asphyxia, of which 3 (75%) were anaemic and 1 (25%) was non-anaemic. Six babies were managed for ABO incompatibility, of which

5 (83.3%) were anaemic and got blood transfusion in aliquots while 1 (16.7%) was non-anaemic but had exchange blood transfusion (EBT) for hyperbilirubinaemia. Six babies had neonatal sepsis, of which 5 (83.3%) were anaemic and got blood transfusion in aliquots while 1 (16.7%) had EBT for hyperbilirubinaemia. One baby had Rhesus iso-immunization, 5 babies were admitted with severe pallor; 3 (10%) were as a result of feto-placental transfusion, one (3.3%) was admitted with anaemia and severe respiratory distress as a result of placenta previa in mother while one (3.3%) had anaemia from twin-twin transfusion and the remaining 11 (36.7%) babies were preterm babies. Prematurity was significantly associated with anaemia compared to other morbidities; p=0.039.

Morbidity and mortality pattern of the transfused babies

Table 5 showed the morbidity and mortality pattern of the babies that were transfused with blood. These are basically the same as the underlying morbidity for admission as indicated in table 4. Of the 3 babies that presented with anaemia as a result of feto-placental transfusion, one died, making the case fatality ratio to be 33.3% .

Factors associated with anaemia in the study participants

Table 6 showed the factors associated with anaemia in the babies. Caesarean delivery, very low birth weight, longer duration on admission, prematurity and lower gestational age were significantly associated with neonatal anaemia while gender and morbidity were not significantly associated with neonatal anaemia.

Outcomes of babies with anaemia

Of the 30 anaemic babies, 29 (96.7%) were successfully managed and discharged home while 1 (3.3%) died. The mortality was from among the three babies who had feto-placental transfusion.

Table 1: Socio-demographic characteristics of the newborn babies.

	Frequency (n=145)	%
Age at admission		
<24 hours	132	91.1
≥24 hours	13	8.9
Gender		
Male	75	51.7
Female	70	48.3
Gestational age		
Term	86	59.3
Preterm	59	40.7
Birth weight (g)		
< 1000	2	1.4
1000–1499	10	6.9
1,500–2499	45	31.0
2500–3999	84	57.9
≥4000	4	2.8
Mode of delivery		
SVD	65	44.8
Caesarean section	80	55.2
Religion		
Christianity	135	93.1
Islam	10	6.9
Mothers parity		
P1-2	76	52.5
P3-4	63	43.4
P≥5	6	4.1
Outcomes		
Alive	139	95.9
Dead	6	4.1

SVD: spontaneous vaginal delivery, g: grams, P1-2- one to two previous deliveries, P3-4- three to four previous deliveries, p≥5- five or more previous deliveries

Table 2: Indication for caesarean section delivery.

Indication for CS	Frequency (n=80)	(%)
Previous CS	12	15.0
Breech presentation	3	3.8
Oligohydraminios	4	5.0
Obstructed labour	15	18.7
Severe pre-eclampsia/eclampsia/PIH	8	10.0
Fetal distress	12	15.0
Fetal macrosomia	1	1.2
PPROM	4	5.0
Maternal request	1	1.2
Multiple gestation	11	13.8
Placenta abruptio	2	2.5
Others	7	8.8

CS: Caesarean section, PIH: pregnancy induced hypertension, PPROM: preterm prolonged rupture of membranes, Others: congenital anomaly, prematurity, placenta previa etc.

Table 3: Clinical characteristics of the newborn babies.

	Frequency	(%)
Pre-transfusion PCV		
Anaemic (<45%)	30	20.7
Non-anaemic (≥45%)	3	2.1
Normal PCV	112	77.2
Age at transfusion		
<24 hours	5	3.4
24 hours – 48 hours	10	6.9
> 48 hours	18	12.4
Not transfused	112	77.3
Duration of admission		
<24 hours	23	15.8
>24hrs to ≤7 days	98	67.6
>7 days	24	16.6

NB: the non-anaemic babies had other conditions complicated by neonatal jaundice needing exchange blood transfusion

Table 4: Indications for transfusion.

Diagnosis	Anaemic n=30 (90.9%) N (Row %)	Non Ananemic n=3 (9.1%) N (Row %)	χ^2	P value
Asphyxia	3 (75.0)	1(25.0)		
ABO incompatibility	5 (83.3)	1(16.7)		
Rh iso-immunization	1(100.0)	0 (0.0)	8.5	0.039
Neonatal sepsis	5 (83.3)	1(16.7)		
Anaemia (Feto-placental transfusion)	3(100.0)	0 (0.0)		
Prematurity	11 (100.0)	0 (0.0)		
Anaemia (placenta previa in mother)	1(100.0)	0 (0.0)		
Twin – twin transfusion	1(100.0)	0 (0.0)		

χ^2=8.5, P-value=0.039, NB:Non-anaemic had EBT done for NNJ, EBT: Exchange blood transfusion, NNJ:Neonatal jaundice/hyperbilirubinaemia

Table 5: Morbidity and mortality pattern among the transfused babies.

Diagnosis	Anaemic n=30 (90.9%) N (%)	Non Ananemic n=3 (9.1%) N (%)	CFR (%)
Asphyxia	3 (10.0)	1 (33.3)	0 (0.0)
ABO incompatibility	5 (16.7)	1 (33.3)	0 (0.0)

Continued.

Diagnosis	Anaemic	Non Anaemic	CFR (%)
	n=30 (90.9%) N (%)	n=3 (9.1%) N (%)	
Rh iso-immunization	1 (3.3)	0 (0.0)	0 (0.0)
Neonatal sepsis	5 (16.7)	1 (33.4)	0 (0.0)
Anaemia (Feto-placental transfusion)	3 (10.0)	0 (0.0)	1 (33.3)
Preterm LBW	5 (16.7)	0 (0.0)	0 (0.0)
Preterm VLBW	6 (20.0)	0 (0.0)	0 (0.0)
Anaemia (placenta previa in mother)	1 (3.3)	0 (0.0)	0 (0.0)
Twin – twin transfusion	1 (3.3)	0 (0.0)	0 (0.0)
Total	30 (100)	3 (100)	

CFR: case fatality ratio, NB: Non-anaemic had EBT done for NNJ, EBT: Exchange blood transfusion, NNJ: Neonatal jaundice / hyperbilirubinaemia

Table 6: Factors associated with anaemia.

Variables	Anaemic	Non Anaemic	χ^2	P value
	n=30 (20.7%) N (Row %)	n=115 (79.3%) N (Row %)		
Gender				
Female	11 (15.7)	59 (84.3)	0.846	0.358
Male	19 (25.3)	56 (74.7)		
Gestational age				
Preterm	19 (32.2)	40 (67.8)	5.209	0.022
Term	11 (12.8)	75 (87.2)		
MOD				
SVD	8 (12.3)	57 (87.7)	0.106	0.045
CS	22 (27.5)	58 (72.5)		
Birth weight (g)				
<1000	0 (0.0)	2 (100)	13.570	0.009
1000-1499	6 (54.6)	5 (45.4)		
1500-2499	5(11.4)	39 (88.6)		
2500-3999	16 (19.8)	65 (80.2)		
≥4000	3 (42.9)	4 (57.1)		
Morbidity				
Asphyxia	3 (8.5)	32 (91.5)	15.841	0.070
ABO incompatibility	5 (31.3)	11 (68.7)		
Anaemia	5 (62.5)	3 (37.5)		
Sepsis	5 (17.9)	23 (82.1)		
Macrosomia	1 (5.9)	16 (94.1)		
Hypoglycemia	0 (0.0)	8 (100.0)		
RVD exposed	0 (0.0)	9 (100.0)		
Hypothermia	0 (0.0)	2 (100.0)		
HB exposed	0 (0.0)	1 (100.0)		
Prematurity	11 (52.4)	10 (47.6)		
Duration on admission				
≤24 hours	0 (0.0)	27 (100)	24.084	<0.001
>24 hours to ≤7 days	19 (19.0)	81 (81.0)		
>7days	11 (61.1)	7 (38.9)		

Continued.

DISCUSSION

Of the 145 newborn babies in this study, 30 (20.7%) had anaemia (PCV<45%), the prevalence of neonatal anaemia in this study therefore was 20.7%. This value is lower than the prevalence in Rivers State University, Port-Harcourt (26.4%), Lagos (35%), Abakaliki, Ebonyi state (65.6%).[15-17] The prevalence is also lower than the reports from some sub-saharan region: West Ethiopia (29.1%), Ghana (57%), Malawi (23%) and Benin Republic (61%).[18-20] The value is however higher than the report from Uganda (17%) and Addis Ababa, Ethiopia (9%).[18,21] The differences in the prevalence could be attributed to variation in sample sizes, methodology, socio-economic

status, associated maternal morbidities and geographical location. Many of the studies from Ethiopia were from the rural region while our study was majorly urban region.

There was a slight male preponderance among the babies with a M:F ratio of 1.1:1 similar to reports from Port-Harcourt and Abakaliki and this is in keeping with longstanding belief that the male factor is a significant predictor of health; male children being more vulnerable compared to female children in disease entities.[15,17,22]

Majority of the mothers were young mothers with one or two previous deliveries, this is contrary to report from Uganda where maternal parity was significantly higher among the anaemic babies.[7] Caesarean section rate was 55.2% in the current study, higher than the normal delivery and higher than the recommended 10-15% rate by the World Health Organization (WHO) probably because the hospital is a reference hospital taking emergency cases from other neighbouring and lower capacity hospitals. Caesarean delivery was significantly associated with neonatal anaemia in the current study similar to reports from Uganda, Port-Harcourt, Iran and Afghanistan.[7,15,24,25] Neonatal anaemia could occur more in operative deliveries because the surgeons are mindful of the immediate post-partum haemorrhages which could jeopardize the maternal life hence babies are delivered hurriedly without the AAP and WHO recommendation of 60 seconds delayed cord clamping which allows blood flow to baby to prevent anaemia.[26,27]

More babies were admitted within 24 hours of life, similar to reports from Port-Harcourt but more babies were transfused after 48 hours of life. Thirty babies (20.7%) with anaemia had top-up transfusion, there were three (9.1%) others who were non-anaemic but had exchange blood transfusion for the treatment of hyperbilirubinaemia. This showed that exchange blood transfusion rate has reduced compared to the past when hyperbilirubnaemia was the major cause of blood transfusion in our centres.[23]

Preterm babies presented with significantly higher incidence of anaemia than the term babies, this is expected because of their preterm birth; the fact that they did not wait till the third trimester to receive enough placental transfer of iron for their stores. Furthermore, they are prone to prolonged hospital stay leading to late onset sepsis which causes haemolysis, they are prone to frequent phlebotomies for investigations and they also have plasma expansion as they grow, leading to dilutional anaemia. Other indications for blood transfusion in the current study included ABO incompatibility, sepsis, feto-placental blood loss and twin-twin transfusion.

Majority of the anemic babies 29 (96.7%) were discharged alive while mortality was 3.3% and the only death occurred among babies with feto-placental transfusion, this mortality is lower than for Port-Harcourt (7.5%) while Uganda and Ethiopia did not report any mortality. In all, the study yielded important insights about the prevalence, associated factors and outcomes of neonatal anemia in UNIMEDTH, Akure. The report can help our centre to improve on the existing delivery protocol and hence prevent neonatal mortality from anaemia.

Limitation of study

Maternal anaemia as a cause of neonatal anemia resulting from malaria infection, helminthic infestation and nutritional status which are common in this area were not sought in the study. Maternal iron and folic acid supplementation during pregnancy was also not evaluated and so further studies to determine these factors are needed.

Recommendations

With significant advances in neonatal care, there should be opportunities to identify, prevent and properly manage neonatal anemia and the related morbidities. Micro-collection technique should be considered for use in the neonatal unit, this would reduce blood loss from phlebotomies and hence prevent neonatal anaemia. Delayed cord clamping (DCC) at birth as taught in the courses like helping Babies Breathe (HBB), Neonatal Resuscitation course (NRT) and Essential newborn care course (ENCC) adopted by American Academy of Pediatrics (AAP) should be practiced at our institutions. It is defined as allowing blood flow from the placenta to the newborn for 1-3 minutes or at least 60 seconds before cutting the cord, after delivery of the baby. This has been documented to have significantly improved the neonatal haemodynamics as well as reduced neonatal anaemia. DCC also ensures provision of a greater number of stem cells from the placenta, increase in iron stores, and hence reduction in the need for blood transfusions in immediate and early neonatal life.

CONCLUSION

The prevalence of anaemia among neonates in UNIMEDTH was 20.7%. the commonest morbidity among the babies was prematurity, ABO incompatibility, neonatal sepsis and feto-placental transfusion. The mortality among anaemic babies was 3.3% and the only death occurred among babies with feto-placental transfusion, thus there is need to adhere to the world health organization prescription of delayed cord clamping of at least 60 seconds during delivery of the neonates.

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