

POLYCYTHEMIA IN YEKATIT 12 HOSPITAL NEONATAL INTENSIVE CARE

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ABSTRACT

Background: *Polycythemia is defined as an elevated hemoglobin concentration or hematocrit that is greater than two standard deviations above the normal value for gestational and postnatal age (1). The primary concern with polycythemia is related to hyper viscosity and its associated complications Blood viscosity increases exponentially as the Hct level rises above 42%. This associated hyperviscosity is thought to contribute to the symptom complex observed in approximately one half of infants with polycythemia.*

Objective and Patients: *The objective of this study was to describe prominent features of associated with neonatal polycythemia in newborns admitted to the neonatology unit of Yekatit 12 Hospital for the period of July 2006 up to December 2009.*

Results: *There were 1741 neonatal admissions to Yekatit 12 hospital from July 2006 up to December 2009 and out of these there were 115 cases of Polycythemia which makes the prevalence of Polycythemia 6.5% in the neonatal unit.. Even though most were delivered by SVD the risk of polycythemia was high in C/S group. Majority of the cases presented at the age of less than 24hours with a normal Apgar score.. Seventy eight (73 %) of the cases had a Hematocrit of >70% and 37 (27%) of the cases were symptomatic. The common presenting symptoms were respiratory distress, cyanosis and poor feeding. Forty two (36.5%) had complications including hyperbilirubinemia, necrotising enterocolitis and seizure. One hundred and nine (94.5%) were discharged home with successful treatment with either fluid or partial exchange transfusion; however, there were 5 deaths: 3 females and 2 males; three of them were preterm while two were term but small for gestational age (SGA). Among these deaths three were low birth weights (LBW) while two were very low birth weights (VLBW). (The incidence of polycythemia in the last 6 months of the study period was zero).*

Conclusion: *Polycythemia is fairly a common problem in neonatal period and to avoid serious complications early diagnosis and appropriate interventions are recommended, moreover this study could be used as a base line data for future study of polycythemia in neonates in Ethiopian settings.*

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INTRODUCTION

Polycythemia is defined as an elevated hemoglobin concentration or hematocrit that is greater than two standard deviations above the normal value for gestational and postnatal age. Accordingly, a term infant is considered to be polycythemic if the hematocrit from a peripheral venous sample is greater than 65 percent or the hemoglobin is greater than 22 g/Dl. In clinical circumstances, the definition typically is based upon the hematocrit, rather than the hemoglobin concentration.

The incidence of polycythemia is said to be 1.5 - 4% of all live births. The incidence is higher among both small for gestational age (SGA) and large for gestational age (LGA) infants. The incidence of polycythemia is 15% among term SGA infants as compared to 2% in term appropriate for gestational age (AGA) infants. Neonates born to diabetic mothers and mothers living at high altitudes also have a higher incidence of polycythemia. Polycythemia is unlikely to occur in neonates born at a gestational age less than 34 weeks. (3 -5)

The objective of this study is to identify the factors associated with neonatal polycythemia in newborns admitted to the neonatology department of Yekatit 12 Hospital for the period of July 2006 up to December 2009. We believe this will create awareness on the degree of the problem and will help institute measures to solve the causes and alleviate the problem of neonatal polycythemia.

MATERIALS AND METHODS

Yekatit 12 hospital is one of the referral hospitals managed by the Addis Ababa Health Bureau. The Neonatology unit was

established in July 2006. The unit has 30 inpatient beds with 10 incubators in the NICU, The health workers in the unit includes a neonatologist, a general practitioner and 14 nurses. Paediatric residents from the Medical faculty of Addis Ababa University department of Paediatrics and Child Health are attached to the unit on rotation basis.

This study was a cross sectional review of records using the data collection tools prepared for the purpose . and data was collected from inpatient charts and the High risk clinic registration book. The place and mode of delivery of the cases with the age of onset of the polycythemia and sex differences were analyzed. The association of polycythemia with birth weight, gestational age, Apgar score, number of newborns, maternal parity and the presence of maternal diseases were evaluated. The level of hematocrit at presentation, the presence of and type of symptoms and the type of management instituted, and the length of hospital stay was assessed. Finally the out come of cases with the causes of deaths was analyzed using the SPSS version 17.

RESULTS

There were 1741 neonatal admissions to Yekatit 12 hospital from July 2006 up to December 2009 and out of these there were 115 cases of Polycythemia which makes the incidence of Polycythemia 6.5% in the neonatal unit. Out of these 51% were male neonates while female neonates were 49%. One hundred seven (87.8%) of the cases were from Yekatit 12 Hospital, while two were from other public hospitals, one from a health center and one from a private hospital. The place of delivery for three newborns was not available. Ninety nine (86%) of the polycythemic neonates were singletons, 13(11.3 %) were twin while it

was unknown in two infants. Seventy two (62.6 %) of the mothers were primipara while 41 (35.6 %) were multipara; the parity of one mother was not documented. The majority of the mothers were healthy, but 16 had a variety of diseases: 12 were hypertensive, 3 were diabetic, 5 had HIV/AIDS, 2 had Vaginosis, and 2 others had syphilis and bleeding disorder respectively.

Table 1 shows the incidence of polycythemia by mode of delivery among

live deliveries in Yekatit 12 hospital. There were a total of 11,160 live births in Yekatit 12 hospital during the study period and among these 107 were cases of Polycythemia which makes the incidence of polycythemia to be 0.95% in the delivery room of the Yekatit 12 hospital. Eighty four (73%) of the cases were delivered by spontaneous vaginal delivery (SVD), 21 were delivered by Caesarean section(C/S) while two were assisted deliveries.

Table 1. Distribution of Polycythemia by mode of delivery for newborns delivered at Yekatit 12 Hospital, July 2006-June 2009

Mode of delivery	Number of deliveries	Number of polycythemia	%
SVD	7505	84	1.11
C/S	1375	21	1.52
Assisted delivery	2280	2	0.08
Total	11160	107	0.95

The proportion of polycythemic neonates by the time of presentation is shown in table 2. Eighty four (73%) of the newborns presented at the age of less than 24 hours while 18 presented between 24 and 72 hours.

As shown in table 2 the majority of cases (73%) of polycythemic neonates presented at the age of less than 24 hours of life.

Table 2: Distribution of polycythemia cases by time of presentation, Yekatit 12 Hospitals 2006-2009.

Age at presentation	Number of cases	%
<24 hours	84	73
24 - 72 hours	18	15.7
3 - 5 days	13	11.3
Total	115	100

The characteristics of the polycythemic newborns are shown in table 3. Ninety five (%) of the cases had a normal Apgar score whereas 9 were moderately depressed with an Apgar of 4 - 6 and three were severely depressed with an Apgar of 0 - 3. The Apgar score of seven cases was not documented.

Seventy (60 %) of the cases had a normal birth weight of 2500 – 3999 grams, while 38 had a low birth weight (1500 - 2499gms). Ninety three (80.7%) of the cases were term neonates, 12 were preterm, 8 were post term and in one case it was unknown.

Table3. Characteristics of the polycythemic newborns Yekatit 12 hospital, July 2006-June 2009.

Characteristics	Number of cases	%
1. APGAR Score		
➤ Normal (7-10)	96	83.5
➤ Moderately depressed(4-6)	9	7.8
➤ Severely depressed(0-3)	3	2.6
➤ Unknown	7	6.1
2. Birth Weight		
➤ Normal(2500-3999gm)	71	6.7
➤ LBW(1500-2499gm)	38	33.1
➤ VLBW(1000-1499)	5	4.3
➤ Unknown	1	0.9
3. Gestational Age		
➤ Term(37-42weeks)	94	81.7
➤ Preterm(<37weeks)	12	10.4
➤ Post term(>42weeks)	8	7
➤ Unknown	1	0.9

The hematocrit level and clinical classification of the polycythemic neonates is shown in table 4. Forty- eight (41.7%) neonates had a hematocrit level of 71 - 75%. Thirty seven (32.2%) cases had a hematocrit value of 65-70%; twenty (17.4 %) had a hematocrit of 76-80% and ten (8.7%) >80%. As is shown in the table, 37 (32.2 %) of the newborns were symptomatic whereas 78

(67.8%) were asymptomatic at presentation. Taking these two variables (hematocrit level and the presence of symptoms) together with the postnatal age and the need for treatment, 35 (30.4%) were classified as Hypervolemic symptomatic, 69 (60%) were Hypervolemic asymptomatic; 8 (%) were Normovolemic asymptomatic and 3 (%) were Normovolemic symptomatic.

Table4: Hematocrit level and Clinical classification of Polycythemia cases at Yekatit 12 Hospital Addis Ababa July 2006 - June 2009.

I. Hematocrit Level	Number of Cases	%
➤ 65 - 70%	37	32.2
➤ 71 -75%	48	41.7
➤ 76 -80%	20	17.4
➤ >80%	10	8.7
II. Clinical classification based on symptoms:		
➤ Symptomatic	37	32.2
➤ Asymptomatic	78	67.8
III. Clinical classification based on blood volume:		
➤ Normovolemic Asymptomatic	8	7
➤ Normovolemic symptomatic	3	2.6
➤ Hypervolemic Asymptomatic	69	60
➤ Hypervolemic Symptomatic	35	30.4

The distribution of the clinical features in the 37 symptomatic polycythemic newborns is shown in table 5. The most commonly seen clinical features were respiratory distress (30(%)) followed by cyanosis (27(%)) and poor feeding (7(%)). Apnoea,

Seizure, Oliguria, and Prolonged capillary filling time were seen in three neonates respectively, while Lethargy, Hypotonia, Tachycardia and Priapism were seen in two. One neonate had Tremor. Almost all newborns had more than one presenting feature.

Table 5: Distributions of the presenting features among the thirty seven symptomatic polycythemic newborns, Yekatit 12 Hospital, July 2006- June 2009

CLINICAL FEATURES	NUMBER OF CASES	%
Respiratory distress	30	80.1
Cyanosis	27	73
Poor feeding	7	18.9
Apnoea	3	8.1
Seizure	3	8.1
Oliguria	3	8.1
Prolonged cardiac filling time	3	8.1
Lethargy	2	5.4
Hypotonia	2	5.4
Tachycardia	2	5.4
Priapism	2	5.4
Tremor	1	2.8

Ninety eight (85.2%) of the polycythemic newborns were managed with partial exchange transfusion , 14 (%)were managed conservatively with intravenous fluids, feeding and observation and the remaining two neonates who were candidate for partial exchange died before treatment could be given. Twenty nine cases stayed in the ward for less than 24 hours, 65 cases stayed for less than72 hours. Only 20 cases stayed for more than 7 days.

Seventy two (62.6 %) of the polycythemic newborns showed no complications whereas 43 (37.4 %) had one or more complications. Complications of polycythemia are shown in table 6. The most frequent complication was Hyperbilirubinemia (71.4%) followed by necrotising enterocolitis (34.9) and seizure (6/43). Four each had renal failure and DIC, two had persistent pulmonary hypertension and one had persistent hypoglycaemia.

Table 6: Distributions of complications seen in the polycythemic newborns with complication. Yekatit 12 Hospital, July 2006 - June 2009.

Complications	Number of cases	%
Hyperbilirubinemia	30	71.4
Necrotizing enterocolitis	15	34.9
Seizure	6	14
Renal failure	4	9.3
Disseminated intravascular coagulopathy (DIC)	4	9.3
Persistent pulmonary hypertension	2	4.6
Persistent Hypoglycaemia	1	2.3

One hundred and ten (95.7 %) cases were discharge cured; however, there were 5(4.3%) deaths. Three of the deaths were females and two were males; three were preterm while two were term but small for gestational age (SGA). Among these deaths three were low birth weights (LBW) while two were very low birth weights (VLBW). All cases had respiratory distress with cyanosis and poor and prolonged capillary filling on presentation, four were completely cyanotic; four had oliguria; three had symptoms and signs of Necrotizing Enterocolitis (NEC); two had signs of bleeding disorder and two had central type apnoea. The hematocrit levels of died cases was 83%, 81%, 75%, 72% and 68% respectively. Two of the neonates died before 24 hours, (18 and 22hrs) one died on the 5th day, the 4th and 5th neonates died on the 9th and 12th day respectively. Two of these neonates died before treatment could be initiated, but partial exchange has been done at least twice for the rest of them. The clinical cause of death could not be ascertained in the two neonates who died before 24 hours, however the rest died of multi-organ failure.

Among the successfully managed and discharged neonates only nine did not return to the high risk clinic for follow up . Of the one hundred who were seen at the high risk clinic on follow-up 94 (94 %) didn't have any complaints or show any complications seven days after discharge. Four had prolonged hyperbilirubinemia and two had seizures which were managed accordingly.

DISCUSSION

Polycythemia, defined as a central venous hematocrit (Hct) of greater than 65%, is a relatively common disorder. Neonatal polycythemia is said to be present when the hematocrit greatly exceeds normal values for gestational and postnatal age. The incidence of polycythemia is variable from country to country, but is said to be 1.5-4% of all live births (1, 2). Wiswell *et al* (3) found an incidence of 1.46% in their analysis of 3,768 infants born at Brooke Army Medical Center, San Antonio, TX, from January 1, 1981 through December 31, 1984. Moreover they have also reported lower incidence rates of 1.14% and 0.80% in screened populations numbering 7,133 and 23,125 neonates

respectively(4, 5). In our study the incidence of polycythemia was 6.5% among the total admissions, but 0.95% among the live births of Yekatit 12 hospital. The incidence among the live births is lower than other studies. This could partly be explained by the fact that the incidence of polycythemia has been decreasing progressively since the establishment of the neonatology department in the hospital and the implementation of using the standardly accepted timing in clamping the cord as a routine practice (not part of the study)Studies have shown that delayed (to what time ??) I suggest you remove this as it is contradicting the current teaching of the delay cord clamping (a very old studies cited)

Among the 107 deliveries in Yekatit 12 hospital with polycythemia 84 (%) were delivered by spontaneous vaginal deliveries, 21 (%) were delivered by Caesarian section and two were assisted deliveries. As it is shown in the table the incidence of polycythemia is higher in those delivered by C/S. This could be due to the fact that this procedure is undertaken, most of the times, on emergency basis for maternal and/or fetal conditions. According to a study by Yifru and Ahmed fetal distress was the commonest indication for operative deliveries (32.5%) as well as the commonest cause of low Apgar scores at the 1st minute (61.4%). (8)

As it is shown in table 2, eighty three cases were admitted at the gae of less than 24 hours. However there were still 13 cases who were admitted later than 3 days after delivery. This was mainly due to the delay in the diagnosis of the cases due to lack of awareness on the part of the family or health professionals.

As the characteristics are not known for all live births in our hospital or the other referring hospitals, the risk of polycythemia in each group could not be

calculated. Although most of the cases were of normal birth weight 43 (%) neonates had less than normal birth weight, 5 of them being in the very low birth weight category. In Wiswell *et al* (3) study the birth weight ranged from 1,640 to 5,500g in the 55 neonates with polycythemia with an average birth weight of 3128g. Ramamurthy and his colleague found the birth weight to range from 1,900 to 5,160 gm in the 74 neonates they studied, with only12% of them having a birth weight less than 2500gm (9). However, it is a well known fact that the incidence is higher among both small for gestational age (SGA) and large for gestational age (LGA) infants, presumably because chronic intrauterine hypoxemia stimulates the secretion of erythropoietin which in turn increases red cell production. The incidence of polycythemia is 15% among term SGA infants as compared to 2% in term appropriate for gestational age (AGA) infants (10). In our study, even though the proportion of the different gestational age groups is not known, the finding that 33 of 114 cases were small for gestational age (SGA) could indirectly supports this conclusion. However, contrary to the general belief that polycythemia is unlikely to occur in neonates born at a gestational age less than 34 weeks (11), we have found two cases with a birth weight of 1300 and 1250 gms and a gestational age of 29 and 30 weeks respectively. Similar findings have been observed by Wiswell *et al* (3).

Most reports state that 50% or more of polycythemic infants are asymptomatic. In our study we also found the proportion of symptomatic polycythemia cases to be 32.4% (37/114). However, Wiswell *et al* found that the majority of their polycythemic infants were symptomatic and have other features of

the disorder (3). Respiratory distress (81%) was the most common symptoms followed by cyanosis (72.9%) and poor feeding (18.9%) in the 37 symptomatic neonates. Apnoea, seizure oliguria and prolonged capillary filling time were each seen in 8.1% of the neonates. In the study by Ramamurthy and colleague (9) plethora and lethargy were the most commonly observed symptoms, affecting, respectively, 63% and 50% of all neonates. Whereas, in Wiswell *et al* (3) study the most common signs and symptoms were “feeding problems” (21.8%), plethora (20.0%), lethargy (14.5%), cyanosis (14.5%), respiratory distress (9.1 %).

Moreover, 42 of the polycythemic patients either presented with or developed one or more complications. The most commonly observed complications were hyperbilirubinemia (71.4%), Necrotizing enterocolitis (35.7%), seizure (14.2%) renal failure and DIC (9.5% respectively), persistent pulmonary hypertension (4.7%) and persistent hypoglycemia (2.3%). Wiswell *et al* (3) found hyperbilirubinemia in 21.8% and 33.5% in their two part study involving 55 and 932 neonates with polycythemia, while hypoglycemia was found in 40% and 13% of the same groups. In contrast to

our study they found the incidence of NEC, seizure, renal failure, DIC, and persistent pulmonary hypertension to be 1.4%, 0.5%, 0.4%, 0.2% and 0.1% respectively in the 932 neonates with polycythemia. The difference in these patterns could be attributed to the level of neonatal service in their setup where cases are diagnosed early and managed appropriately before the development of complications.

The case fatality rate of polycythemia was 4.3% in this study. All the deaths were in the high risk groups of small for gestational ages and low and very low birth weights. Besides, all of them presented with symptoms and signs of complications such as severe cyanosis with respiratory distress, NEC or renal failure.

Conclusion: Polycythemia is fairly a common problem in neonatal period and to avoid serious complications early diagnosis and appropriate interventions are recommended, moreover this study could be used as a base line for future study of polycythemia in Ethiopian settings

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