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Original Research Article

Clinical profile of neonates with polycythemia at a tertiary care hospital in North East, India

Punyo Beti*, C. Shyamsunder Singh, Chabungbam Smilie, Bharghav Rama

Department of Pediatrics, RIMS Hospital, Imphal, Manipur, India

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***Correspondence:**
Dr. Punyo Beti,
E-mail: punyobeti4@gmail.com

ABSTRACT

Background: Neonatal polycythemia (NPC) is associated with hyper viscosity of blood causing impairment of tissue oxygenation, perfusion and formation of microthrombi. Polycythemia is defined as a venous hematocrit (Hct) of≥65% or a haemoglobin (Hb)>22g/dl. It presents with a nonspecific clinical features like plethora, poor feeding, lethargy, hypoglycaemia, jaundice. The aim of this study was to assess the clinical profile in neonates with polycythemia admitted in the paediatrics ward of a tertiary care centre in North East, India.
Methods: A hospital based cross sectional study was carried out from January 2021 to October 2022 and 149 participants were recruited after fulfilling the inclusion and exclusion criteria with approval from ethical board. Statistical analysis was done using SPSS statistics version 21.0 WINDOWS (IBM Corp. Armonk, NY, USA).
Results: Among the 149 cases, 89 (59.7%) neonates were symptomatic and 60 (40%) neonates were asymptomatic. The most common presentation were poor feeding and plethora in 89 neonates each (59.7% each), followed by lethargy (39.6%), hypogycemia (30.2%), jaundice (29.5%), necrotizing enterocolitis (21.5%), cyanosis (10%) and oliguria (10%). Partial exchange therapy was done in 30 neonates (20%), 59 neonates (39.6%) required intravenous fluid and 60 neonates (40.3%) were treated conservatively. All neonates were successfully discharged and no deaths were noted in our study.
Conclusions: Anticipation, early recognition and intervention can prevent acute short-term complications and long-term sequelae of this easy to treat disorder.

Keywords: Complications, Hematocrit, Neonatal polycythaemia, Partial exchange transfusion

INTRODUCTION

Neonatal polycythaemia (NPC) is defined as a venous hematocrit (Hct) equal to or higher than 65% or a Hb concentration exceeding 22 gm/dl.[1] It is associated with hyper viscosity of blood resulting in impairment of tissue perfusion and oxygenation causing significant damage.[2] The American academy of pediatrics does not recommend universal neonatal screening for NPC, suggesting that this screening should be limited to infants at risk.[3] Its predisposing factors are small for gestational age (SGA), large for gestational age (LGA), intrauterine growth restriction (IUGR), infant of diabetic mother (IDM), neonatal thyrotoxicosis, chromosomal anomalies such as trisomy 13, 18 and 21, congenital adrenal hyperplasia, Beckwith Weidemann Syndrome, mothers having hypertension, hypo/hyperthyroidism, lung disease like chronic obstructive pulmonary disease (COPD), asthma and pulmonary hypertension, maternal smoking during pregnancy; placental factors such as delayed cord clamping, twin to twin transfusion and maternal-fetal transfusion.[4,5] Schedule for screening is at 2 hours of life, if high, repeat at 6 hours, 12 hours, 24 hours and 48 hours.[4] A normal value at 2 hours of age (hematocrit<65%) does not merit any further screening unless the infant becomes symptomatic.[6] The incidence of NPC is said to be 1.5%-4% of all live births and is higher among SGA and LGA neonates, 15% among term

SGA infants is polycythemic as compared to 2% in term appropriate for gestational age (AGA) neonates.[7] Significant changes take place in the hematocrit from birth through the first 24 to 48 hours of life. The hematocrit peaks at around 2 hours of life and so, values up to 71% may be normal at this age.[8,9]

It gradually declines to 68% by 6 hours and usually stabilizes by 12 to 24 hours. The initial rise in hematocrit is related to a transudation of fluid from the intravascular space.[4] Pathophysiology of NPC is multifactorial, secondary to transfusion (e.g. delayed cord clamping, twin-twin transfusion and maternal to fetal transfusion) or intrauterine hypoxia causing increased intrauterine erythropoiesis are two main contributing factors.[10]

Neonates with polycythemia present with non-specific wide range of clinical features such as lethargy, poor feeding, plethora, jitteriness, oliguria, tachypnoea, cyanosis, congestive heart failure, abdominal distention, necrotizing enterocolitis (NEC). Long term sequelae are gross motor, fine motor and speech delays, neurological abnormalities like spastic diplegia, hemiparesis, monoparesis.[5]

Another complication of NPC is thrombocytopenia (platelet count<150X109/l). It could be due to an increased platelet aggregation and adhesion caused by hyper viscosity or repression of platelet precursor cells due to increased erythropoietin production.[11] Laboratory abnormalities include hypoglycaemia (blood glucose<45mg/dl), hyperbilirubinemia, hypocalcaemia (<7mg/dl in preterm and<8mg/dl in term), hypomagnesemia and thrombocytopenia.[5]

The mean venous Hct of term infants is 53% in cord blood, 60% at 2 hours of age, 57% at 6 hours of age and 52% at 12 to 18 hours of age.[12] Asymptomatic neonates with hematocrit value between 70% to 74% can be managed by hydration and repeating the haematocrit in 4 to 6 hours. Those asymptomatic neonates with Hct 65% to 69% should be kept under close observation for symptoms. Partial Exchange Transfusion (PET) to be performed if HCT is≥75% and in any symptomatic polycythemic neonates.[4] It is done with normal saline or fresh frozen plasma. Hematocrit measured at 0-, 6- and 24-hours following PET.[10]

Polycythemia is a significant problem in developing country like India but hidden due to lack of awareness and paucity of literature. Hence this study was undertaken to know the clinical profile of polycythaemia in neonates admitted in Paediatric Ward of a tertiary care centre, Imphal.

METHODS

Study type

A hospital based cross sectional study.

Study place

The study was carried out in Paediatrics Department, RIMS, Imphal, Manipur.

Study duration

The study duration was from January 2021 to October 2022.

Ethical approval

The study was done with approval from research ethics board (A/206/REB-Comm (SP) /RIMS/2015/718/60/2020).

Neonates with gestational age≥34 weeks with risk factors or symptomatic admitted in paediatric ward, were evaluated for polycythemia with venous Hct on admission and repeated if high at 6, 12 and 24 hours of life (HOL).

When Hct remains persistently≥65% at 24 HOL then those neonates fulfilling inclusion and exclusion criteria were included in the study. Sample size (n=4pq/l2) was 149 calculated by taking the p value as 24% (feeding problem out of total cases, N=47 from previous study by Krishnan L and Rahim A13) with allowable error of 7. It was based on convenience sampling.

Data was checked for consistency and completeness and was entered and analysed using SPSS statistics version 21.0 WINDOWS (IBM Corp. Armonk, NY, USA).

Summarization was done by using descriptive statistics like percentage and frequency for sex, gestational age, mode of delivery, history of polycythaemia in siblings, maternal personal habits (smoking), maternal comorbidities (hypertension, diabetes, heart disease, thyroid disorder, chronic lung disease, renal disease), clinical features, short-term outcomes.

Mean and standard deviation was used to summarise age (days), weight (kilograms), haematological findings and duration of hospital stay. To see the association between short-term outcomes (recovered/expired), sex (male/female), mode of delivery (vaginal delivery or caesarean section), birth weight (AGA, SGA, LGA), history of polycythaemia in siblings and maternal complications chi-square test was used.

Study variables

Independent variables

Age in days, sex, gestational age, mode of delivery (vaginal/ caesarean section) and maternal comorbidities (hypertension, diabetes, heart disease, thyroid disorder, chronic lung disease).

Dependent variables

Clinical features, hematocrit value, outcome (cured or expired) and duration of hospital stay.

Inclusion criteria

Neonates (near term- 34 to 36 weeks, term-37 to 41 weeks, post term- after 42 weeks) with Hct of≥65% or Hb of>22mg/dl admitted in Paediatric Ward, RIMS, Imphal.

Exclusion criteria

Neonates with severe cardiorespiratory compromise with shock or bleeding diathesis and congenital malformations.

Study procedure

After obtaining ethical approval, written consent was taken from parents/care takers and with a pre-design proforma including the baseline information i.e. particulars (name, age, sex, inpatient registration number), gestational age, birth weight, risk factors, clinical features were recorded during the admission.

Hematocrit and other relevant investigations like random blood glucose, platelet count, serum bilirubin, serum calcium was performed as indicated according to clinical condition. Asymptomatic neonates with Hct 65% to 69% were observed for rising hematocrit, development of symptoms and intervened when required. Those asymptomatic neonates with Hct value between 70% to 74% were treated by hydration and repeating the Hct in 4 to 6 hours. All symptomatic neonates or those with Hct≥75% were treated by PET. Neonates who were cured or expired, days of hospital stay were recorded.

RESULTS

A total of 149 neonates (near term, term, post term) with Hct≥65% or Hb>22mg/dl admitted in Paediatric Ward were included in the study. Among 149 neonates, majority was LGA (54/36.2%), SGA and AGA were 49 (32.90%) and 46 (30.90%) respectively. In this study term neonates were 60 (40.3%), post-term and near term were 47 (31.5%), 42 (28.2%) respectively. Most of the cases were symptomatic (59.70%) as compared to asymptomatic cases (40.3%) on admission. Most common presentations were decreased feeding and plethora in 89 neonates each (59.7% each), followed by lethargy (39.6%), hypoglycemia (30.2%), jaundice (29.5%), necrotizing enterocolitis (21.5%), cyanosis (10.1%) and oliguria (10.1%).

The maternal comorbidities seen in polycythemic neonates were gestational diabetes mellitus (GDM), hypertension (HTN), thyroid diseases, heart disease, lung disease in 61 neonates (56%), 41 neonates (38%), 8 neonates (7%), 5 neonates (5%) and 3 neonates (3%) respectively. Partial exchange transfusion were given to 30 neonates (20.10%), 59 neonates (39.6%) were treated conservatively by giving intravenous fluid and 60 neonates (40.3%) required no treatment. All neonates were discharged successfully and no deaths were noted in our study.

Table 1: Period of gestation (n=149).

Period of gestation (POG in weeks)	Frequency (N)	(%)
Near term (34-36)	42	28.2
Term (37-41)	60	40.3
Post term (≥42)	47	31.5

Table 2: Birth weight (n=149).

Birth weight for gestational age	Frequency (N)	%
SGA (<10th centile)	49	32.9
AGA (10 to 90th centile)	46	30.9
LGA (>90th centile)	54	36.2

Table 3: Presentation on admission (n=149).

Clinical presentation	Frequency (N)	(%)
Symptomatic	89	59.7
Asymptomatic	60	40.3

Table 4: Clinical features (n=149).

Clinical presentation	Frequency (N)	(%)
Plethora	89	59.7

Continued.

Clinical presentation	Frequency (N)	(%)
Decreased feeding	89	59.7
Lethargy	59	39.6
Hypoglycemia	45	30.2
Jaundice	44	29.5
Necrotizing enterocolitis	32	21.5
Cyanosis	15	10.1
Oliguria	15	10.1

Table 5: Treatment given (n=149).

Treatment given	Frequency (N)	(%)
Partial exchange transfusion	30	20.1
Intravenous fluid	59	39.6
Observation	60	40.3

Table 6: Association between haematocrit (on admission) and status of the participants (asymptomatic or symptomatic) (n=149).

Hematocrit on admission		Symptomatic status N (%)		P value
		Asymptomatic	Symptomatic	
65% to 69%	No of neonates	75	0	0.001
	% within Hematocrit	100.0%	0%	
70% to 74%	No. of neonates	44	0	
	% within Hematocrit	100.0%	0%	
75% or more	No. of neonates	0	30	
	% within Hematocrit	0.0%	100.0%	

Table 7: Maternal co-morbidities (n=149).

Outcome	Frequency (N)	(%)
Gestational diabetes mellitus (GDM)	61	40.9
Hypertension	41	27.5
Thyroid disorder (hypo/hyperthyroidism)	8	5.4
Heart Disease	5	3.3
Lung Disease (COPD, asthma, pulmonary hypertension)	3	2

DISCUSSION

In this study male were more affected than female with a ratio of 1.5:1 (male: female). It may be due to random sample collection as the contrast finding was found in study conducted by Aslam S et al with male:female ratio of 0.9:1.[14] In the present study, decreased feeding and plethora were the commonest clinical presentations followed by lethargy, hypoglycemia, jaundice, NEC, cyanosis and oliguria. Yalcinkaya R and Zenciroglu A, also noted similar clinical presentations with hypoglycaemia (32.5%), feeding difficulty (11.8%), tachypnoea (6.9%), plethora (5.4%), cyanosis (5.1%), convulsion (2.8%) and apnoea (1.1%).[15] In the study conducted by Chaudhari AR et al, found that jaundice was the commonest symptom i.e. in 68 neonates (43.3%) neonates followed by lethargy in 33 (21%).[2] Other symptoms observed were refusal to feed (18.4%), respiratory distress (11.4%), jitteriness (6.3%), decreased urine output (2.5%) and cyanosis (1.2%). The present study showed that 60 neonates (40.3%) were asymptomatic and 89 neonates (59.7%) were symptomatic. Similar findings were seen by Yalcinkaya R and Zenciroglu A, that 64.9% of the polycythemic babies were symptomatic.[15] In the study conducted by Abbas and Fayadh, 50% were symptomatic. But in contrary to our study by Barros et al 55.5% were asymptomatic and the remaining 45.1% were symptomatic.[16,17]

The present study showed that the higher hematocrit value (>70%) has significant association with maternal diabetes mellitus, LGA, SGA, symptomatic polycythemic neonates. A study by Abbas and Fayadh, showed similar findings where higher hematocrit was found in SGA neonates, twin pregnancy, neonates of diabetic mother.[16] Kurlat and Sola, also found higher hematocrit in polycythemic neonates with maternal diabetes, SGA and

LGA neonates.[18] In this study, 20.1% out of total case required PET and 39.6% required hydration and rest were managed conservatively. In Hameed and Jalil, partial exchange transfusion (PET) was done in 10 neonates (20%).[19] In the study by Morag et al similar finding was found where PET was given to 31 neonates (16.6%).[3] But in one of the study conducted by Abbas and Fayadh, PET was done in 28 cases (56%) which was much higher compared to the present study finding.[16] This difference observed may be due to different hospital policies or guidelines for managing polycythemia.

The main limitations of the study were small sample size, time constraint, long term sequelae of the patient were not known and therefore, further studies with a larger sample size on a multicentric level could help in better understanding and management of the disease.

CONCLUSION

Neonatal polycythaemia is a frequent problem in neonates. Most of the complications associated with polycythaemia were due to delay in diagnosis and institution of therapy. In the present study some neonates were asymptomatic indicating the importance of assessing the risk factors in mother and neonates. Polycythaemia has a non-specific presentation and so anticipation in neonates with risk factors, early recognition and intervention can prevent acute short term complications and long term sequelae. Plethora and decreased feeding were the most common presentation followed by lethargy. The present study showed that the higher hematocrit value (>70%) has significant association with maternal risk factors such as gestational diabetes, LGA, SGA, symptomatic polycythemic neonates. Hence further studies with a larger sample size in a multicentric level could add robustness to our study thereby helping in better understanding and management of the condition.

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