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Original Research Paper

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A STUDY OF POLYCYTHEMIA IN 34-41 WEEK SMALL FOR GESTATIONAL AGE(SGA) /INTRAUTERINE GROWTH RESTRICTED (IUGR) NEONATES

Dr. G. Ratish Chandra*	Junior Resident, Department of Paediatrics, KVG Medical College and Hospital, Sullia, India *Corresponding Author
Dr. Shyam Sundar. S	Associate Professor, Department of Paediatrics, KVG Medical College and Hospital, Sullia, India
Dr. Praveen Kumar Sindhur	Professor and HOD, Department of Paediatrics, KVG Medical College and Hospital, Sullia, India

ABSTRACT

Background: Polycythemia in neonates is defined by hematocrit value more than or equal to 65% on venous sample. Polycythemia is associated with hyperviscosity syndrome. In clinical setting,as it is not feasible to measure viscosity of blood, hematocrit value is used as a surrogatefor hyperviscosity. There is a need to evaluate the incidence of polycythemia in SGA babies as SGA is the commonest risk factor for PC followed by pregnancy induced hypertension (PIH) and infant of diabetic mother (IDM). **Objectives:** To estimate the incidence of polycythemia in 34 to 41week SGA/IUGR neonates and its relation with severity of polycythemia and birth weight-for gestational age-s.d score and its associated morbidity with polycythemia **Methodology:** Allasymptomatic enrolled neonates will be screened for polycythemia at 2,12, 24, 48 hours of life. Blood sample for hematocrit is obtained by venipuncture (venous hematocrit). These babies will be screened for hypoglycemia, hypocalcemia and where ever applicable for sepsis. The highest hematocrit value of the polycythemic neonates during the course of stay will be considered to study the relationship between severity of polycythemia and birth weight -for gestational-age-s.d score. **Results:** The Incidence of polycythemia in our study was 16.3%, Distribution based on morbidities associated with polycythemia, the odds of having polycythemia is 4.3 times in those with transient tachypnea of newborn, and it was 8.04 times in respiratory distress syndrome is compared to those without respiratory distress syndrome. Where it was 6.38timesin sepsis compared to those without sepsis, and in meconium aspiration it was 15.02 times compared to those without meconium aspiration. This observation were statistically significant.Distribution based on morbidity profile of symmetrical and asymmetrical small for gestational age babies, in this study hypothermia was observed in 38 study participants out of which 10 were symmetrical 28 were asymmetrical small for gestational age babies. This observation was not statistically significant. **Conclusions:** The prevalence of polycythaemia among SGA babies in the present study was 16.3%.The main problems need to be anticipated in the newborn are perinatal asphyxia, hypothermia, apnea, jaundice, sepsis and hypoglycemia. Improvement of perinatal care is required in order to prevent the birth of SGA babies and also to manage the problems associated with them.

KEYWORDS : IUGR, SGA, Polycythemia, Haematocrit,

INTRODUCTION

The incidence of polycythemia (PC) varies from 1.5% to 4% of all live births[1,2]and about 10-15% of term small for gestational age (SGA) infants develop polycythemia as compared to 2% of term appropriate for gestational age (AGA) infants[3,4]. Majority of cases of polycythemia occur in the first 72 hours of life, after which the incidence declines. Routine screening is performed in all SGA/IUGR newborns during the first 48 hours of life and thereafter as per symptomatology, the value at first test and further on to assess response to intervention for same. Polycythemia in neonates is defined by hematocrit value more than or equal to 65% on venous sample. Polycythemia is associated with hyperviscosity syndrome.

In clinical setting, as it is not feasible to measure viscosity of blood, hematocrit value is used as a surrogate for hyperviscosity. Hematocrit value >65% is more likely to cause hyperviscosity, which manifests as lethargy, poor feeding, tachypnea, hypotonia, jitteriness ,apnea, persistent pulmonary hypertension of newborn (PPHN), thrombosis of cerebral and renal vein, predisposes to hypoglycemia and hypocalcemia. Polycythemia in the neonatal period has been recognized as a physiologic adaptation to the advancing gestational age of the fetus.

There is a need to evaluate the incidence of polycythemia in SGA babies as SGA is the commonest risk factor for PC followed by pregnancy induced hypertension (PIH) and infant of diabetic mother (IDM).[5]

By the study of haematocrit (hct) profile and associated risk factors, we can determine newborns at additional risk for PC in the SGA/IUGR neonates. By understanding the factors affecting the hematocrit levels in SGA/IUGR newborns like gestational age, mode of delivery, birth weight, maternal comorbidities, type of cord clamping, the monitoring, screening and intervention for neonatal polycythemia in SGA/IUGR neonates can be tailored further.

The study also intends to explore possibility of any relation between severity of polycythemia and birth weight for gestational age-standard deviation score. The study also intends to know the symptom profile in IUGR/SGA neonates who become polycythemic and incidence of associated morbidities like hypoglycemia, hypocalcemia and hyperbilirubinemia

There is a paucity of data regarding incidence of polycythemia in a rural setup in SGA/IUGR neonates of 34-41 weeks of gestation. The study will shed light on the effect of DCC (Delayed Cord Clamping) on the incidence of PC in the SGA/IUGR neonates.

AIMS AND OBJECTIVES

1. To estimate the incidence of polycythemia in 34 to 41week SGA /IUGR neonates during the first 72 hours of life.
2. To study the relationship between severity of polycythemia and birth weight-for gestational age-s.d score.
3. To study morbidity associated with polycythemia.

MATERIALS AND METHODS

Methodology

Source of data: All newborns born in KVG medical college and hospital, Sullia who fulfil the inclusion criteria were included in the study group as a source of data.

Method of collection of Data:
Study design: Cross sectional study
Sample size: 104

The Incidence of Neonatal Polycythemia in SGA neonates is 10-15%. [3,4]

The sample size is calculated from the following formula by taking incidence as 'p' value = 15%

$$n = \frac{4pq}{l^2}$$

p = Expected prevalence/incidence of the event in the study group = 15%
q = (100 – p) = 85
l = Expected absolute allowable error in the 'p' = 7%
$n = (4 \times 15 \times 85) / 7^2 = 104$

Study Instrument: BC-500 AUTO HEMATOLOGY ANALYZER, The auto hematology analyzer calculates HCT%, HCT= (RBC count × MCV) /10

All the newborns born in KVG Medical College and hospital, Sullia during the study period who fulfils the inclusion criteria were enrolled into study after applying exclusion criteria. All asymptomatic enrolled neonates were screened for polycythemia at 2,12, 24, 48 hours of life.

In case of polycythemic values and symptomatic babies, testing frequency and duration was modulated as per norms of standard care. Clinical details with respect to symptoms of polycythemia, other comorbidities such as sepsis, hypocalcemia, hypoglycemia was noted.

Blood sample for hematocrit is obtained by venipuncture (venous hematocrit). These babies were screened for hypoglycemia, hypocalcemia and where ever applicable for sepsis. The highest hematocrit value of the polycythemic neonates during the course of stay was considered to study the relationship between severity of polycythemia and birthweight -for gestational-age-standard deviation score. Intergrowth 21st international standards 2016 will be used to study the relationship between severity of polycythemia and birth weight-for gestational-age-sd score.

Inclusion criteria:
All the newborns born in KVG medical college and hospital with period of gestation between 34-41weeks with weight below the 10th percentile for gestational age. and/or Appearing clinically IUGR (loose skin folds in the gluteal region/thigh with paucity of subcutaneous fat, having difference of head circumference and chest circumference >3cm or having skinny appearance / visible severe wasting).[6]

Exclusion criteria:
- Neonates with GCA (Gross Congenital Anomalies)
- Neonates requiring DVET (Double volume exchange transfusion) within 48 hours for sepsis/neonatal hyperbilirubinemia and fluid therapy for reasons other than polycythemia in first 48 hours.
- Documented birth asphyxia requiring positive pressure ventilation (PPV) for >1minute at birth in the form of bag and mask ventilation/mechanical ventilation.
- Antepartum haemorrhage, abruptio placentae, retroplacental clot, cord injury with significant bleeding
- Neonatal shock requiring fluid bolus/inotropes.

Statistical analysis:
Data was collected and added in Microsoft office Excel 2007 file and further analyzed using SPSS software version 21. The variables were summarized as percentages, frequencies, mean, standard deviation. Pearson's correlation was done to assess the association between haematocrit values and z score. A "p" value less than 0.05 was considered as significant.

RESULTS:
In our study the total sample was 104 neonates with IUGR/ SGA. Among which 55.8% (58) were males and 44.2% (46) were females. Most of the neonates 55.8% (58) were delivered through vaginal delivery and 44.2% (46) of the neonates through LSCS.

Most of the neonates 44.2% (46) born were weighing 1500-1999 gms and 42.3% (44) of neonates weighed between 1000-1499 at the times of birth and only 13.5% (14) weighed between 2000-2500 gms, which is shown in Figure 1.

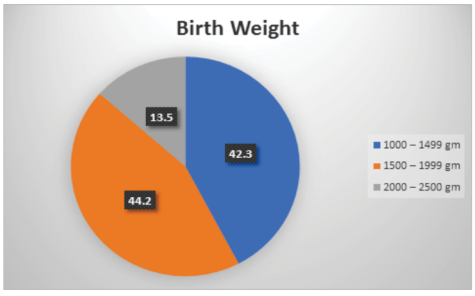
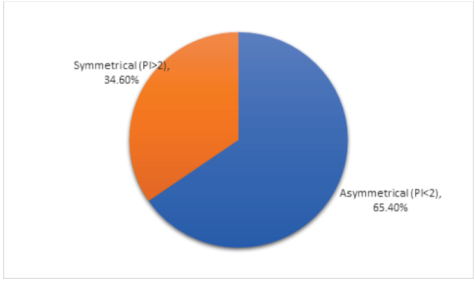


Figure 1: Graph showing Birth weight of the neonates

In our study distribution of IUGR by ponderal index was done 65.4% were asymmetrical (PI<2) and 34.6% were symmetrical (PI>2) shown in Figure 2.

Figure 2: Graph showing Ponderal Index (PI) of the study sample



In our study the incidence of polycythemia was 16.3%. Based on morbidities associated with polycythemia, the odds of having polycythemia was 4.3 times in those with transient tachypnea of newborn. and this observation was statistically significant. The ODDS of having polycythemia in respiratory distress syndrome was 8.04 times compared to those without respiratory distress syndrome. This observation is statistically significant. The odd of having polycythemia in sepsis was 6.38 times compared to those without sepsis. This observation was statistically significant. The odds of having polycythemia in meconium aspiration was 15.02 times compared to those without meconium aspiration. This observation was statistically significant, shown in Table 1.

Table 1: Morbidities associated with Polycythaemia

	With Polycythemia	Without Polycythemia	Odds ratio	P value
Transient tachypnoea of newborn	11	26	4.30	0.006*
Hyperbilirubinemia	5	42	0.45	0.15
Respiratory distress syndrome	12	20	8.04	0. 0001*

Hypoxic ischemic encephalopathy	4	10	2.37	0.18
Infant of diabetic mother	2	2	5.67	0.07
Sepsis	4	4	6.38	0.008*
Meconium aspiration	1	0	15.02	0.02*
Congenital heart disease with heart failure	0	2	0.00	0.52
Esophageal atresia	0	2	0.00	0.52

In our study, distribution based on morbidity profile of symmetrical and asymmetrical small for gestational age babies, hypothermia was observed in 38 study participants out of which 10 were symmetrical 28 were asymmetrical small for gestational age babies. This observation was not statistically significant.

Out of the 37 cases with apnoea, 15 were symmetrical and 22 were asymmetrical small for gestational age babies. This observation was not statistically significant. Out of the 12 cases with physiological jaundice 10 were symmetrical and 2 were asymmetrical this observation was statistically significant and out of the 8 babies with bleeding, 6 were symmetrical and 2 were asymmetrical small for gestational age babies. Whereas out of the 77 babies with neonatal sepsis, 21 versus symmetrical and 56 were asymmetrical SGA babies. This observation was statistically significant.

Out of the 17 babies with meconium aspiration syndrome, 5 symmetrical and 12 were asymmetrical small for gestational age babies. Out of the 50 babies with hypoglycaemia, 12 are symmetrical and 38 were asymmetrical small for gestational age babies. Out of the 17 cases with polycythemia 6 were symmetrical and 11 were asymmetrical small for gestational age babies shown in Table 2.

Table 2: Morbidity profile of Symmetrical and Asymmetrical SGA babies

		Symmetrical (n=36)	Asymmetrical (n=68)	P value
Hypothermia	Yes	10	28	0.17
	No	26	40	
Apnea	Yes	15	22	0.34
	No	21	46	
Physiological jaundice	Yes	10	2	0.0002*
	No	26	66	
Bleeding	Yes	6	2	0.01*
	No	30	66	
Neonatal sepsis	Yes	21	56	0.008*
	No	15	12	
Meconium aspiration syndrome	Yes	5	12	0.62
	No	31	56	
Hypoglycemia	Yes	12	38	0.02*
	No	24	30	
Polycythemia	Yes	6	11	0.94
	No	30	57	

DISCUSSION:

In the present study the incidence of polycythemia in intrauterine growth retardation or small for gestational age babies is 16.3%. Aggarwala et al[7] study reported a incidence of 2.76% in this study population. Drew et al[8]reported an incidence of 47.4% in preterm neonates. Mostefa et al[9]reported that out of the 32 neonates with polycythemia 56.25% delivered at term and 43.75% were preterm deliveries. With the above findings it can be inferred that premature infants are at a significant risk of developing polycythemia.

In the present study, 15.4% belong to <6 hours, 34.6% belong to 7-12 hours, 28.8% belong to 12-24 hours, 21.2% belong to 24-72 hours. out of the 17 babies with polycythaemia 4 belong to less than 6 hours, 6 babies belong to 7 to 12 hours, 2 belong to 12 to 24 hours, 5 belong to 24 to 72 hours. There is no statistically significant difference observed with relation to age and polycythemia as the p value calculated to be more than 0.05.

Similar to our study findings, Mostefa et al[9]reported that out of 162 babies included in the study 85 belong to 1-2 days of age, 64 belong to 3 - 4 days of age, 28 belong to 5 - 6 days of age and 17 belong to >7 days. In their study 32 patients observed to have polycythemia out of which 59.3% belongs to one to 2 days of age, 21.7% belong to 3 to 4 days of age, 6.25% belong to 5 to 6 days of age, 12.5 % belong to more than 7 days of age. This observation was not statistically significant as the P value calculated to be > 0.05which is similar to our study findings.

In the present study, 55.8% are male and 44.2% are female. out of 17 babies with polycythemia 9 are male and 8 are female. There is no statistically significant difference observed with relation to gender and polycythemia as the p value calculated to be more than 0.05Arjun Chandra Dey et al[10]reported that 57% are male and 43% are female.

In the present study ,96.2% delivered in institution and 3.8% delivered in home and 55.8% delivered through vaginal route and 44.2% delivered by LSCS. In the present study ,29.8% delivered at 34-36 weeks of gestational age, 70.2% delivered at 37-41 weeks of gestational age.

In the present study, 100% had lethargy, 94.2% had reluctance to feed, 11.5% with jaundice, 51.9% had abdominal distension, 11.5% had convulsion, 52.9% had leucocytosis, 16.3% had leukopenia, 78.8% had raised IT ratio, 61.5% had positive CRP.

In this study hypothermia was observed in 38 study participants out of which 10 were symmetrical 28 were asymmetrical small for gestational age babies. this observation was not statistically significant. out of the 37 cases with apnea, 15 were symmetrical and 22 were asymmetrical small for gestational age babies. This observation was not statistically significant. Out of the 12 cases with physiological jaundice 10 were symmetrical and 2 were asymmetrical. this observation was statistically significant. out of the 8 babies with bleeding, 6 were symmetrical and 2 were asymmetrical small for gestational age babies.out of the 77 babies with neonatal sepsis, 21 versus symmetrical and 56 were asymmetrical SGA babies. This observation was statistically significant.

Out of the 17 babies with meconium aspiration syndrome, 5 symmetrical and 12 were asymmetrical small for gestational age babies. Out of the 50 babies with hypoglycemia, 12 are symmetrical and 38 were asymmetrical small for gestational age babies. Out of the 17 cases with polycythemia 6 were symmetrical and 11 were asymmetrical small for gestational age babies.

Wiswell TE et al[11]found that 61.8% of polycythemic babies in their study were symptomatic, 38.2% had no overt clinical finding and 14.5% had neither clinical nor laboratory abnormalities). Wiswell TE et al[11]and Lalitha Krishnan et al[12] also reported refusal to feeds, plethora and lethargy, in that order as the commonest clinical findings.

In the present study ,25% had birth weight of <1000gm, 41.3% had birth weight of 1000-1499gm, 20.2% had birth weight of 1500-1999 gm, 13.5% had birth weight of 2000-2500 gm. Mostefa et al[9] reported that the birth weights of patients with polycythemia 53.12% (n=17) had birth weight less than 2500 grams while the remaining 46.88% (n=15) had birth weights between 2500 and 4000 grams. Among patients without polycythemia, 45.67% (n=74) had birth weights less than 2500 grams, 49.38% (n=80) between 2500 and 4000 grams and 4.95% (n=8) had weight more than 4000 grams.

Oxygen saturation and Polycythaemia

In the present study, out of 17 babies with polycythaemia 2 babies had low oxygen saturation and 15 babies had normal oxygen saturation. And 6 showed low APGAR score and 11 had normal APGAR score Mostefa et al[9] study reported that Oxygen saturation (SpO2) of all patients was measured and majority of patients in both groups had normal SpO2 and there was no significant relation between low SpO2 and polycythemia. Most patients of both groups normal Apgar score at birth and low Apgar score was not significantly related to polycythemia.

APGAR score and Polycythemia

Respiratory distress and Polycythemia

In the present study, out of 17 babies with polycythemia 11 showed respiratory distress. This observation was statistically significant as the p value calculated to be less than 0.05

Mostefa et al[9] study reported that 34.37% with respiratory distress had polycythemia. This observation was not statistically significant.

Morbidities associated with Polycythaemia

In the present study, the odds of having polycythemia is 4.3 times in those with transient tachypnea of newborn. and this observation is statistically significant.

The ODDS of having polycythemia in respiratory distress syndrome is 8.04 times compared to those without respiratory distress syndrome. this observation is statistically significant

The odds of having polycythemia in sepsis is 6.38 times compared to those without sepsis. This observation is statistically significant.

The odds of having polycythemia in meconium aspiration is 15.02 times compared to those without meconium aspiration. This observation is statistically significant.

Mostefa et al[9] study reported that among those with polycythemia, 21.87% had transient tachypnea of newborn, 15.62% had hyperbilirubinemia, 37.5% had respiratory distress syndrome, 6.25% had hypoxic ischemic encephalopathy, 6.25% are infant of diabetic mother, 12.5% had sepsis.

Infant of diabetic mother is present more frequently in polycythemic neonates is mostly because maternal hyperglycemia increases erythropoiesis in foetus by causing hyperinsulinemia and tissue hypoxia leading to increased erythropoietin production.[13]

CONCLUSION

- The prevalence of polycythaemia among SGA babies in the present study was 16.3%. Respiratory distress syndrome, transient tachypnea of newborn and Hyperbilirubinemia were the three leading causes of admission of polycythemic patients
- In the study greater proportion of SGA babies is contributed by asymmetrical pattern of intrauterine growth retardation. The main problems need to be anticipated in the newborn are perinatal asphyxia, hypothermia, apnea, jaundice, sepsis and hypoglycemia.
- Improvement of perinatal care is required in order to prevent the birth of SGA babies and also to manage the problems associated with them.

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REFERENCES:

1. Wirth FH, Goldberg KE, Lubchenco LO. Neonatal hyperviscosityI. Incidence. Pediatrics. 1979;63:833–6
2. Stevens K, Wirth FH .Incidence of neonatal hyperviscosity at sea level.Pediatrics 1980;97:118
3. Bada HS, Korones SB, Pourcyrous M, et al. Asymptomatic syndrome of polycythemichyperviscosity: effect of partial exchange transfusion. J Pediatr1992;120:579-85.
4. Digal KC, Singh P, Srivastava Y, Chaturvedi J, Tyagi AK, Basu S. Effects of delayed cord clamping in intrauterine growth-restricted neonates: a randomized controlled trial. Eur J Pediatr. 2021 Jan 21
5. Mimouni F, Miodovnik M, Siddqi TA, Butler JB, Holroyde J, Tsang RC. Neonatal polycythemia in infants of insulin-dependent diabetic mothers. Obstet Gynecol. 1986;68:370–2.
6. Ghai OP Ghai Essential Pediatrics [Book]. - [s.l.] : CBS Publisher., 2013. - Vol. 8th edition
7 Aggarwala R, Punj A. Polycythemia in neonates: incidence, maternal and fetal risk factors, clinical profile, umbilical cord blood haematocrit as a screening test for polycythemia. Index Copernicus Value. 2015;78:96.
8. Drew JH, Guaran RL, Grauer S, Hobbs JB. Cord whole blood hyperviscosity: Measurement, definition, incidence and clinical features. J Paediatr Child Health. 1991;27:363–5.
9 Mostefa AM. A Study of Prevalence and Risk Factors of Polycythemia in Neonatal Nursery in Duhok. Isra Med J. 2018; 10(2): 113-117.
10. Dey AC, Ahmed FU, Mannan MA, Saha L, Barua CC, Mahmood CB. Small for Gestational Age Babies: Morbidity and Immediate Outcome in a Tertiary Care Hospital-A Prospective Study. Bangladesh Journal of Child Health. 2007:1-7.
11. Wiswell TE, Cornish DJ, Northam RS: Neonatal polycythemia: Frequency of clinical manifestations and other associated findings. Pediatrics, 1986; 78: 26-30.
12. Lalitha Krishnan, Rahim A: Neonatal polycythemia. Ind. J of Pediatrics, 1997; 64: 541-546
13. Chalouhi GE, Stirnemann JJ, Salomon LJ, EssaouiM, Quibel T, Ville Y. Specific complications of monochorionic twin pregnancies: Twin-twin transfusion syndrome and twin reversed arterial perfusion sequence. Semin Fetal Neonatal Med. 2010;15:349–56.