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CLINICAL PROFILE OF POLYCYTHEMIA IN SMALL FOR GESTATIONAL AGE NEONATES ADMITTED TO THE NEONATAL INTENSIVE CARE UNIT OF A TERTIARY CARE HOSPITAL

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ABSTRACT **Background:-**Polycythemia is the principal cause of hyperviscosity of blood in neonates and is associated with serious, sometimes life threatening complication of the brain, heart, kidney, lungs and intestines. The incidence is high in small for gestational age neonates. **Aim:-**To assess the incidence, clinical profile of polycythemia among Inborn small for gestational age newborns admitted in the Neonatal Intensive Care Unit of Jorhat Medical College and Hospital. Objectives:-To determine the incidence of polycythemia among small for gestational babies admitted in the Neonatal Intensive Care Unit of Jorhat Medical College & Hospital, and to assess the pattern of clinical manifestations and complications attributable to polycythemia. **Method:-**130 consecutive small for gestational age inborn babies admitted into the NICU of Jorhat Medical College and Hospital, Jorhat during the period of 1 year from May 2021 to April 2022 were screened for polycythemia at 2 - 4 hours of postnatal age using venous hematocrit. The newborns were considered polycythemic if the venous hematocrit was ≥65%.**Results:-**The incidence of polycythemia in small for gestational age was 31.5% (41 out of 130 babies). Among the 130 small for gestational age babies, 57 were preterm,49 were term and 24 were post term. The incidence of polycythemia was 29.2%in preterm, 36.7 % in term and 24.3% in post term babies. Among the polycythemic babies, icterus(70.7%) was the commonest clinical manifestation followed by lethargy (60.9%) and tachypnoea (36.5%).Hyperbilirubinemia (70.7%) was the commonest laboratory abnormality followed by thrombocytopenia(63.4%), hypokalemia (17.07%) , hypernatraemia (9.7%), hypoglycaemia (7.3%) , hypocalcemia (7.3%), hyperkalemia (4.8%) and hyponatremia (2.4%).39 babies underwent partial exchange transfusion with normal saline for correction of polycythemia. There was improvement in clinical features and hematocrit levels following partial exchange transfusion. Two asymptomatic babies did not undergo partial exchange transfusion and were managed conservatively. Conclusion:-Polycythemia is a silent clinical condition which if unrecognized can result in significant morbidity in neonates. As incidence is high in small for gestational age newborns, these babies must be actively screened for its timely detection and management in order to prevent complications attributable to polycythemia-hyperviscosity syndrome. Key words:-Neonatal polycythemia, small for gestational age, Hematocrit, Partial exchange transfusion.

KEYWORDS :

INTRODUCTION:-

Children face the highest risk of morbidity and mortality during the neonatal period (0-28 days) due to unique challenges posed during transition from intra-uterine to extra-uterine environment. It is estimated that about 15 % to 20% of all births worldwide are low birth weight. The incidence in India is higher, varying between 25-30% of which 60-65% are due to intra uterine growth retardation. LBW neonates are prone to various morbidities like birth asphyxia, respiratory distress, meconium aspiration, pulmonary haemorrhage, gastrointestinal problems, persistent pulmonary hypertension, hypotension, hypothermia, polycythemia, acute tubular necrosis, renal insufficiency and metabolic derangements like hypoglycaemia and hypocalcaemia.123In small for gestational neonates, the mortality risk is 2 to 4 times higher than that for appropriate for gestational age neonates born at term or preterm.4The prevalence of SGA is highest in South Asia and in Sub Saharan countries of Africa with India having the world's largest number of SGA births-12.8 million.Among 135 million infants born in low- and middle-income countries in 2010, it is estimated that 29.7 million (22%) were born term-SGA, 10.9 million (8.1%) were born preterm appropriate-for-gestational-age (AGA), and 2.8 million (2.1%) were born preterm-SGA.5Although the terms small for gestational age and intrauterinegrowth retardation are used interchangeably,they refer to two different population subsets .SGA describes a neonate whose birth weight is <10th percentile for gestational age as per intrauterine growth chart. IUGR describes diminished growth velocity in the fetus as documented by at least two intrauterine growth assessment .The etiology and management of SGA and IUGR foetuses overlaps considerably.[6,7]

Polycythemia is a known and recognized condition of normal fetal adaptation to intrauterine hypoxemia and not a true haematopoietic defect. It is defined as venous haematocrit of 65% or greater. The rise in hematocrit increases the risk of hyperviscosity, microcirculation hypoperfusion and multiorgan dysfunction.. About 50% of polycythemic newborns present with symptoms like poor feeding, lethargy, hypotonia, apnoea, tremor, jitteriness, seizure, cyanosis, tachypnoea, heart failure, oliguria, hematuria, thrombocytopenia, poor feeding, icterus, hypoglycaemia, hypocalcaemia and necrotising enterocolitis.Therefore the SGA babies should be actively screened to minimise the complications associated with it.[1,2,3,8]

Partial exchange transfusion is the main stay of treatment in symptomatic polycythemic babies. Management in asymptomatic babies should be individualized. The goal of partial exchange transfusion is to reduce the infant's hematocrit and viscosity to safe levels, while maintaining circulatory volume. Randomized controlled trails have demonstrated that crystalloid solutions are as effective as colloids in reducing neonatal hematocrit and viscosity.9Clinical studies reveal some measurable benefits following partial exchange transfusion.Although partial exchange is associated with disappearance of initial symptoms in majority of babies, controversy exists with respect to the long term benefits to infants treated with partial exchange transfusion.[10]

AIM:-

To assess the incidence, clinical profile of polycythemia among Inborn small for gestational age newborns admitted in the Neonatal Intensive Care Unit of Jorhat Medical College and Hospital.

OBJECTIVE:-

1. To determine the incidence of polycythemia among small for gestational babies admitted in Neonatal Intensive Care Unit of Jorhat Medical College & Hospital.
2. To assess the pattern of clinical manifestations and complications attributable to polycythemia.

METHODOLOGY:-

Study design : A hospital based prospective observational study

Study setting : In the Neonatal Intensive Care Unit of Department of Paediatrics of a Teaching hospital in Jorhat, Assam

Sampling technique: Consecutive sampling
Study population : Small for Gestational age neonates who fulfil the inclusion criteria

Study period : 1 year from May 2021 to April 2022

Inclusion criteria :-Inborn Small for Gestational Age (SGA) newborns admitted into the Neonatal Intensive Care Unit of Jorhat Medical College and Hospital

Criteria for exclusion:-
1.Documented delay in cord clamping >3 minutes
2.Outborn newborns-born in health facility outside Jorhat Medical College, ambulance delivery, home delivery
3.History of blood loss after birth
4.History of Ante partum and Intrapartum haemorrhage in mother
5.Appropriate for Gestational Age neonates.
6.Large for gestational age neonates.

Ethical clearance:-Ethical clearance was obtained from the Institutional Ethics Committee of Jorhat Medical College and Hospital Consent:-Written informed consent was taken from the parents/guardians of the babies included in this study.

Procedure:-Consecutive data was collected after informed consent from parents/guardian of the patient. Gestational age was determined from mother's antenatal history (date of last menstrual period), reports of first trimester antenatal ultrasound (if available) and confirmed by New Ballard Scoring of the admitted newborn. Small for gestational age babies were defined by birth weight according to gestational age, less than 10thpercentile using the Intrauterine Growth Chart. All inborn small for gestational age newborns admitted into NICU were screened for polycythemia at 2 to 4 hrs of postnatal age by measuring peripheral venous haematocrit. The haematocrit was measured by cell counter method by using SYSMEX XN-550- flow cytometry based analyzer. Babies were considered to have polycythemia if venous haematocrit is ≥65%. A repeat haematocrit was performed at 12 hrs (or any age if symptoms appear) if initial haematocrit was found to be high. All neonates were examined clinically and categorized as symptomatic or asymptomatic based on presence/absence of clinical signs attributable to polycythemia. Particular attention was given to babies with presence of sign and symptoms of polycythemia like lethargy, poor feeding plethora, cyanosis, convulsion, icterus and tachypnea. The following investigations were sent for all polycythemic babies- hematocrit, platelet count, blood glucose, serum calcium, serum sodium, potassium and total bilirubin. Total serum bilirubin measurement was done by calorimetric method and serum electrolyte measurement was done with ion selective electrode technique. In symptomatic babies, septicaemia was excluded by negative sepsis screen and blood culture. Lumbar puncture was done for cerebrospinal fluid analysis in case of suspected late onset sepsis and all cases of blood culture positive sepsis. Cranial ultrasound was done to rule out any structural anomalies of the brain. Partial exchange transfusion was performed for following babies- venous hematocrit>65% with symptoms or venous hematocrit>70% without symptoms. Asymptomatic babies with venous haematocrit 65 to 70% were managed conservatively with extra fluids.

Laboratory values:- Hypoglycaemia (Blood glucose <45mg/dl, Hypocalcaemia (Serum calcium<8mg/dl),Hypokalemia (Serum potassium<3.5meq/L), Hyperkalemia (Serum potassium >5.5meq/L), Hypernatremia (Serum sodium >145meq/L),Hyponatremia (Serum sodium <135meq/L), Hyperbilirubinemia (Total serum bilirubin higher than cut off as per American Academy of Pediatrics hourspecific bilirubin nomogram)

Statistical methods applied
All data were analysed using Microsoft Excel, graph pad prism and IBM SSPS V21.Table pie chart and bar diagram were used to show descriptive statistics. Mean and SD were used for numerical values, frequencies and percentages used for categorical variables. Chi square test was used to evaluate association between categorical variables. All data were analyzed using SPSS version 21. A p value less than 0.05 was considered as statistically significant at 5% level of significance.

RESULT AND OBSERVATION:-

A total of 130 small for gestational age babies born consecutively at Jorhat medical college Hospital, Jorhat from 1st May2021 to 30th April 2022 were studied.

Table1: Incidence and Gender distribution of Small for Gestational age neonates.

	Total no of neonates	No of polycythemicneonates	Incidence (%)
Total babies	130	41	31.5%
Male	70	23	32.8%
Female	60	18	30%

Table 1 shows the incidence of polycythemia and distribution of gender in small for gestational age polycythemic neonates. The overall incidence was 31.5% (41 out of 130 neonates) in the present study. Among the total 41 polycythemic neonates 23(56%) were males and 18(44%)were females. Incidence of polycythemia was higher in male compared to the female neonates which was not significant (P >0.9408).

Table 2: Incidence of polycythemia in Singleton vs multiple gestation.

	Total no of neonates	No of polycythemic neonates	Incidence(%)
Singleton	112	37	33%
Twin	18	4	22.2%
Triplet/others	0	0	0

Figure 2 shows Out of 130 neonates 18 neonates were twins (9 pairs). 4 out of 18 twin neonates among the subject had polycythemia.(p=0.4249)

Table3: Relationship between Maternal Medical and Obstetrical risk factors and incidence of Polycythemia.

Risk factor	No of mother	%	No of polycythemic neonates	%	P value
Normal(No risk factor)	102	84.3%	7	17%	<0.001
Pregnancy induced hypertension	10	8.3%	3	7.3%	0.7641
Multiple pregnancy	9	7.4%	4	9.7%	0.5081
Gestational Diabetes mellitus	1	0.8%	1	2.4%	1
Cardiac disease	0	0	0	0	0
Renal disease	0	0	0	0	
Thyroid disorders	1	0.8%	1	2.4%	1
Antepartum hemorrhage	0	0	0	0	0

Table 3 shows the relationship between maternal medical and obstetrical risk factors and Incidence of polycythemia. Among mothers with risk factors, neonates born to mothers with PIH constituted the highest number (10 out of 130 cases). There was no significance in incidence of polycythemia in neonates born to mothers with risk factors.

Table4: Distribution of gestational age in polycythemic neonates.

Gestational age		No of polycythemic neonates(n=41)	Incidence
	Preterm	12	29.2%
	Term	19	46.3%
	Post term	10	24.3%

Table 4shows distribution of gestational age among polycythemic babies. Among the polycythemic babies (n=41), term babies constituted 46.3% (24 out of 31 cases) and Preterm and Post term babies constituted 29.2% and 24.3 % respectively.

Table5:-Spectrum of clinical features in polycythemic neonates.

Clinical sign and symptoms	No of polycythemic neonates	Incidence
Tachypnoea	15	36.5%
Icterous	29	70.7%
Lethargy	25	60.9%
Vomiting	0	0
GI bleeding	5	12.2%
Poor feeding	8	19.5%
Plethora	4	9.7%
Cyanosis	0	0
Oliguria	0	0
Jitteriness	1	2.4%

Table 5 shows the spectrum of clinical features in polycythemic neonates. Among the clinical features, icterus was the most common manifestation (70.7%) followed by lethargy (60.9%), tachypnoea (36.5%), poor feeding(19.5%),GI bleeding(12.2%) plethora(9.7%) and jitteriness(2.4%).The values are found to be statistically significant($p<0.001$).

Table 6:Spectrum of laboratory abnormalities in Polycythemic neonates.

Laboratory parameter	No of polycythemic neonates	%
Hypoglycemia	3	7.3%
Thrombocytopenia	26	63.4%
Hyperbilirubinemia	29	70.7%
Hypocalcemia	3	7.3%
Hypernatremia	4	9.7%
Hyponatremia	1	2.4%
Hyperkalemia	2	4.8%
Hypokalemia	7	17.07%

Table 6 shows the laboratory abnormalities in neonatal polycythemia. Hyperbilirubinemia was the most common laboratory abnormality (70.7%), thrombocytopenia (63.4%), hypokalemia (17.07%), hypernatraemia (9.7%), hypoglycemia (7.3%), hypocalcemia (7.3%),hyperkalemia(4.8%) and hyponatremia (2.4%) .The values were found to be significant using chi square test($p<0.0001$).

In the present study, there was a total of 41 polycythemic babies, out of which 39 babies underwent partial exchange transfusion. 2 asymptomatic babies did not undergo partial exchange transfusion and were managed conservatively with fluid management.

DISCUSSION:-

In the present study, the incidence of polycythemia in small for gestational age was 31.5%, which is comparable to study of Tariq Rushdi et al[11] where the incidence of polycythemia was (34.6%). In contrast to the present study, a study conducted by Lalitha Krishnan et al[9] observed maximum incidence of polycythemic cases (51.1%) followed by Akrem Mohammad Mostefa et al[12](43.75%),Sawsan sati abbas et al[3] (18%), Wiswell et al [15](12.7%), and Wirth et al[14](12.5%). Among the polycythemic neonates the incidence of preterm neonates was found to be 29.2% followed term neonates 46.3% and post term polycythemic neonates (41.6%).

In the present study, maximum numbers of polycythemic neonates belonged to mother with multiple pregnancy (9.7%) followed by mother with pregnancy induced hypertension (7.3%).A study conducted by Tariq Rushdi et al[11] showed that incidence of polycythemic neonates among mothers with pregnancy induced hypertension was 18.8%.Another study conducted by Sawsan Sati Abbas et al[3] found the incidence of polycythemia among mother with multiple pregnancy to be 12%.Study conducted by Tariq Rushdi et al[11]showed the incidence of polycythemic neonates among diabetic mother was 18.8%, which was higher than current study (2.4%).

In the present study, among polycythemic neonates, icterus was the most common manifestation (70.7%) followed by lethargy (60.9%), tachypnoea (36.5%), poor feeding(19.5%), GI bleeding (12.2%), plethora(9.7%) and jitteriness(2.4%).In a study conducted by Tariq Rushdi et al[11], icterous (46.5%) was the commonest manifestation followed by tachypnoea (24.7%), poor feeding(14.8%),lethargy(13.8%), jitteriness(1.9%), vomiting (1.9%) and cyanosis(1.9%). Another study conducted by AH Dawodu et al,[13]reported that maximum number of neonates had plethora(63%), followed by tachypnoea (25%) and icterous(25%).The study conducted by Wiswell et al[15] found that most of the newborns had features of poor feeding (21.8%) followed by plethora (20%). In another study, Sawsan Sati Abbas et al[3]found that 58% of neonates were icteric, 30% were lethargic and 26% showed features of tachypnoea. On the other hand study conducted by Akrem Mohammad et al[12]found that21% neonates were tachypnoeic and 15.62% were icteric.

In the present study hyperbilirubinemia was the most common laboratory abnormality (70.7%) in polycythemic neonates, followed by thrombocytopenia (63.4%), hypokalemia (17.07%), hypernatraemia(9.7%), hypoglycaemia (7.3%), hypocalcemia (7.3%),hyperkalemia (4.8%) and hyponatremia (2.4%)In a study conducted by Tariq Rushdi et al,[11]28.7% polycythemic neonates had hypoglycaemia followed by hypocalcaemia(24.7%) and thrombocytopenia(21.7%).In the study conducted by AH dawodu et al[13]reported that the incidence of hypoglycaemia and hyperbilirubinemia were 19% and 25%.Wiswell et al[15]found the incidence of hypoglycaemia, hyperbilirubinemia and thrombocytopenia as 40%, 21.8% and 5.5% respectively.

CONCLUSION:-

Polycythemia is a silent clinical condition in neonates which if unrecognized can result in significant morbidity and mortality. A high index of suspicion is necessary to identify the complications of polycythemia. Small for gestational age newborns are particularly at risk of polycythemia hyperviscosity syndrome and its associated complications. Close clinical monitoring and screening of venous hematocrit at 2-4 hours of post natal life is necessary for early detection of polycythemia. Partial exchange transfusion can be considered in symptomatic babies with hematocrit >65% and in asymptomatic babies with venous hematocrit >70%. Asymptomatic babies with venous hematocrit 65-70% can be managed conservatively with hydration therapy.

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