Research Article

Study of clinical features and associated factors in newborn with polycythemia with high risk antenatal and natal factors

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Abstract

Introduction: Various risk factors such as birth asphyxia, toxemias of pregnancy (preeclampsia /eclampsia), twin pregnancies, hypertension, postmaturity, suspected intrauterine growth retardation, maternal diabetes etc have been reported by various authors associated with polycythemia. Symptomatic children show wide range of symptoms such as lethargy, plethora or cyanosis, poor suck, drowsiness, jitteriness, seizures, myoclonic jerks, vomiting, tachypnea, tachycardia, hepatomegaly and jaundice. **Aims and Objectives:** To study the various clinical features and associated factors in newborn with polycythemia with high risk antenatal and natal factors. **Materials and Methods:** In the present study newborn with various high risk antenatal factors were enrolled. A detailed antenatal (medical and obstetric), intrapartum history of mother was recorded on a prestructured proforma. Complete clinical examination was done in newborns. Cord blood hematocrit determined was done by Wintrobe's hematocrit method from each of the newborns. **Results:** Out of total 200 newborns, 21 newborn were polycythemic. Most common high risk factor observed in the present study was birth asphyxia. And out of these 93 cases polycythemia was diagnosed in 9 newborns. Majority (13) of the polycythemic newborn were having hematoocrit between the range of 65% to 69%. Incidence of polytheminia in twin pregnancies was found to be 22.72%. It was observed that majority of the polycythemic newborn were having birth weight less than 2500gms. Polycythemic newborns have a varying range of clinical manifestations affecting any system but more often the cardiopulmonary and central nervous system than others. **Conclusion:** Respiratory distress, cynosis, plethora, jitterines and jaundice with hyperbirubinemia are the commonest symptoms observed in polycythemtic babies. Convulsions, hypotonia, congestive cardiac failure are found with low frequency.

Keywords: clinical features, polycythemia, twin transfusion syndrome.

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INTRODUCTION

Polycythemia is not uncommon and is a potentially serious disorder of newborns. At birth the mean hematocrit value is found to be 53% (range 40-64%) and mean hemoglobin concentration is found to be 16.8 gm% with range of 13.7 to 20 gm%. Neonatal values of venous hematocrit more than 65% and hemoglobin of more than 20 gm% are considered as polycythemic provided that there is no evidence of hemeconcentration i.e. dehydration or plasma volume contraction. It is important to collect blood from peripheral vein as capillary blood hematocrit value may be falsely elevated by 10%. Various risk factors such as birth asphyxia, toxemias of pregnancy (preeclampsia /eclampsia), twin pregnancies, hypertension, postmaturity, suspected intrauterine growth retardation, maternal diabetes etc have been reported by various authors. Twin transfusion syndrome is also one of the cause for polycythemia. It is an imbalanced placental circulation in monochorionic twins due to vascular anastomosis between their placentas resulting in

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transfusion of blood from one twin to another twin. One twin becomes anemic and other polycythemic. According to Rausen and Colleagues[1] twin transfusion syndrome is said to exist when the difference of hemoglobin and venous hematocrit values is more than 5 gm% and 15% respectively. According to them incidence was 19 out of 130 pregnancies with increased mortality and morbidity. Klienberg[2] in 1955 demonstrated that intertwin transfusion in single ovum human twins was possible inutero by means of arteriovenous shunts, thus substantiating a placental parabiotic circulatory system in one twin and polycythemia in other. Neonatal polycythemia may remain asymptomatic or may produce symptoms related to central nervous system, respiratory system, cardiovascular system, renal system and gestational system and may be late threatening immediately in the neonatal period or may be late with sequelae. The exact incidence of asymptomatic polycythemia in newborn is not known. In a prospective study by Gatti *et al*,[3] out of 629 infants 25 cases were with hematocrit value of more than 75% and nobody had any clinical problem. Humbert[4] observed that out of 11 polycythemia and small for gestational age infants, 7 were females and were totally asymptomatic. According to him male infants are at particular risk for development of symptoms. Black and Lubchenco[5] also reported polycythemia in neonates without symptoms in their study. Symptomatic children show wide range of symptoms such as lethargy, plethora or cyanosis, poor suck, drowsiness, jitteriness, seizures, myoclonic jerks, vomiting, tachypnea, tachycardia, hepatomegaly and jaundice. Immediately complications which may occur are respiratory distress, congestive cardiac failure, convulsions, acute renal failure, hypoglycemia, hypocalcemia, hyperbilirubinemia, thrombocytopenia, necrotizing enterocolitis, peripheral gangrene and priapism. Virtually all of these symptoms or complications occur due to hyperviscosity of blood which occurs in all neonates with hematocrit of 65% or more and in few with hematocrit between 60-64%. Hyperviscosity relates to polycythemia but these two terms are not interchangeable. Viscosity is much higher after hematocrit value of 65%.

AIMS AND OBJECTIVES

To study the various clinical features and associated factors in newborn with polycythemia with high risk antenatal and natal factors.

MATERIALS AND METHODS

The present study was conducted in a tertiary care institute situated in South Mumbai for one year. All the newborn delivered in the study duration with one or more antenatal and natal risk factors mentioned below were enrolled in the study.

- Birth asphyxia
- Toxemias of pregnancy (Preeclampsia/eclampsia)
- Twin pregnancies
- Hypertension
- Postmaturity
- Suspected intrauterine growth relation
- Maternal diabetes

Thus total 179 pregnant women were enrolled in the study. Out of 179 cases 22 were twin pregnancies. One newborn of one pair of twin was still born hence only 200 newborns were available for study. In all cases umbilical cord was calmed immediately after birth or up to 5 to 10 seconds of birth. Therefore, every infant must have received some degree of placental transfusion invariably. However, babies were held at the level of mother's introitus. A detailed antenatal (medical and obstetric), intrapartum history of mother was recorded on a prestructured proforma. Mode of delivery was also recorded. Gestational age of each newborn was determined from mother's menstrual history and confirmed by physical examination of the newborn. Small for date, appropriate for date and large for date infants were determined by birth weights less than 10^{th} percentile, 10^{th} to 90^{th} percentile and more than 90^{th} percentile respectively for gestational age and sex. Neonates were examined in detail clinically by self and other doctors working in the ward and findings were recorded in the proforma. Placenta and cord were examined in most cases. Cord blood hematocrit determined was done by Wintrbe's hematocrit method from each of the newborns. Hemoglobin determination was also made from the same blood sample. Subsequent clinical manifestations, progression and relevant treatment given were also noted.

RESULTS

Table 1: Risk factor wise incidence of polycythemia

Risk factors present during antenatal/natal period	No. of neonates	Newborns having polycythemia
Birth asphyxia	93	9 (9.68%)
Twin pregnancy (22 pairs)	43	5 (11.63%)
Pre-eclampsia/ eclampsia	31	4 (12.90%)
Hypertension	16	0

Postmaturity	6	0
Maternal diabetes	1	0
IUGR	10	3 (30.00%)
Total	**200**	**21 (10.50%)**

It was observed that, most common high risk factor observed in the present study was birth asphyxia. And out of these 93 cases polycythemia was diagnosed in 9 newborns. Total 22 twin pregnancies were screened. One newborn of one pair of twin was still born thus total 43 live birth were recorded and in 5 polycythemia was diagnosed. Out of 10 cases of intrauterine growth retardation in 3 cases polycythemia was diagnosed.

Table 2: Distribution of newborns according to hematocrit values

Hematocrit value in %	No. of neonates
Less than 40	25
40-44	24
45-49	58
50-54	42
55-59	21
60-64	9
65-69	13
70-74	6
75-79	1
80 and above	1

Majority[13] of the polycythemic newborn were having hematoocrit between the range of 65% to 69%. However majority of the normal newborn were having hematoocrit between the range of 45% to 49%.

Table 3: Weight distribution in relation to hematocrit values

Weight of neonates in gms	Percentage Hematocrit Values of neonates Studied				
	30-39	40-49	50-59	60-64	65 and above
1000-1500	5	4	2	1	1
1501-2000	6	8	12	1	5
2001-2500	4	26	13	2	7
2501-3000	7	34	32	3	6
3001-3500	3	10	3	1	2
3501-4000	-	-	1	1	-
Total	**25**	**82**	**63**	**9**	**21**

While studying the weight distribution in relation to hematocrit values, it was observed that majority of the polycythemic newborn were having birth weight less than 2500gms.

Table 4: Distribution according to twin transfusion

		Hemoglobin in gms %	Hematocrit in %
Pair 1	1st born twin	13.0	48
	2nd born twin	21.8	67
Pair 2	1st born twin	18.0	65
	2nd born twin	12.0	37
Pair 3	1st born twin	20.6	67
	2nd born twin	16.0	52
Pair 4	1st born twin	20.0	69
	2nd born twin	15.0	53
Pair 5	1st born twin	22.0	80
	2nd born twin	12.1	36

Out of 22 twin pregnancies screened, in 5 cases polycythemia was noted. Thus incidence of polytheminia in twin pregnancies was found to be 22.72%.

Table 5: Frequency of symptoms of polycythemia in relation to sex

Sex of polycythemia infants	Symptomatic infants	Asymptomatic infants	Total
Male	12	1	13
Female	5	3	8
Total	**17**	**4**	**21**

It was observed that symptomatic newborn were male.

Table 6: Distribution newborns according to clinical features

Symptoms or signs	Number of neonates*	Percentage
Respiratory distress	9	42.86%
Plethora	9	42.86%
Cyanosis	8	38.10%
Jaundice/Hyperbillirubinemia	8	38.10%
Jitterness	7	33.33%
Lethargy	3	14.29%
Feeding difficulty/poor suck	3	14.29%
Convulsions	2	9.52%
Hypoglycemia	2	9.52%
Congestive cardiac failure	1	4.76%

* Multiple responses were obtained.

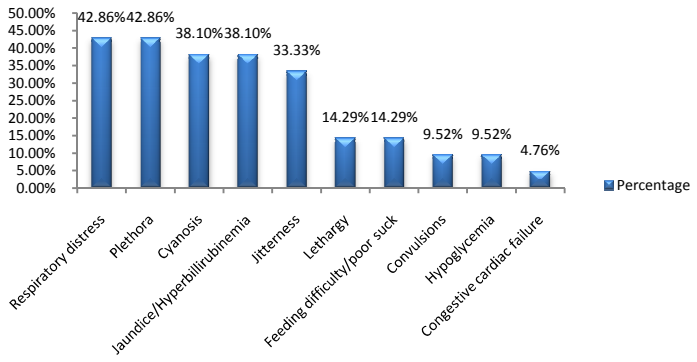

Figure 1: Distribution newborns acceding to clinical features

Respiratory distress, cyanosis, plethora, jitteeness and jaundice with hyperbirubinemia were the commonest symptoms observed in polycythemtic babies. Convulsions, hypotonia, congestive cardiac failure are found with low frequency.

DISCUSSION

In the present study total 200 newborn with high risk antenatal history were screened for polycythemia. And it was observed that 21(10.5%) newborns were polycythemic. It was observed that, most common high risk factor observed in the present study was birth asphyxia. And out of these 93 cases polycythemia was diagnosed in 9 newborns. Total 22 twin pregnancies were screened. One newborn of one pair of twin was still born thus total 43 live birth were recorded and in 5 polycythemia was diagnosed. Out of 10 cases of intrauterine growth retardation in 3 cases polycythemia was diagnosed. Range of hematocrit values in our study is found to be 34% to 80% with a mean of 50.5%. Mean values of 50.5% correlates very well with other studies. Mukerjee[6] observed mean cord blood hematocrit as 50.0%. Mar. Siddique[7] observed mean cord blood hematocrit as 52.4%. Das *et al*[8] reported mean cord blood hematocrit as 51.2% and Pervin Ahemad[9] reported mean cord blood hematocrit at birth as 53.5±4.63% and 57.42±4.23% in early and late cord clamped group of neonates respectively. Out of 22 twin pregnancies screened, in 5 cases polycythemia was noted. Thus incidence of polytheminia in twin pregnancies was found to be 22.72%. Twin transfusion syndrome by definition is difference of hemoglobin equal to or more than 5 gm% and hematocrit of 15% respectively. Aaron rausen[1] stated that twin transfusion occurs in monochorionic twins and found the incidence of 15% (19 cases out of 130). In our study incidence of twin transfusion was 23.73%. The higher incidence in this study may be due to 4 twin pregnancies were also associated with other risk factor as Preeclampsia (2 cases) and Hypertension (1 case). All cases in this study where twin transfusion was

demonstrated were monochorionic twins. In this study one neonate of polycythemia has received twin transfusion died at the age of 32 hours before treatment for polythemia could be given. This child developed severe cardiac decomponation and though treatment of partial exchange was planned child died before it could be given. This was probably due to practice that only symptomatic cases of polycythemia were considered for treatment in this institution. Deaths in twin transfusion syndrome were also noted by Rausen *et al*[1]. In his series only 5 pairs with twin transfusion survived. In our study death rate is considerably less as compared to study of Rausen. It may be due to small sample of 22 twin pairs as compared to Rausen's study and probably better obstetric management at present. In our study out of 5 polycythemic twins 4 were first born and one was second born. Bergstedt and little wood[10] stated that second twin is plethoric but Seip *et al*[11] did not agree with little wood and stated that first born twin is likely to be plethoric than second born. Our finding correlates with finding of Seip *et al*. Various mechanisms were shown to be responsible for twin transfusion syndrome. Bergstedt and little wood[10] believed that it occurs during delivery. Herlitz *et al*[12] thought that there must be continuous slow ooze from one fetus to another throughout pregnancy. Arteriovenous shunts have of placenta, thus substantiating a placental parabiotics circulatory system which functions unequally between the twin circulation to find anemia versus polycythemia[2]. Out of 21 neonates having hematocrit values more than 65%, 4 neonates in our study were found to be without signs and symptoms. Merchant *et al*[13] reported that most infants with polycythemia have no symptoms. Gatti[3] and Humbert[4] had also reported some cases of neonates with asymptomatic polycythemia. The importance of asymptomatic polycythemia lies in facts that these cases may be missed if all babies are not screened for polycythemia routinely. Polycythemic newborns have a varying range of clinical manifestations affecting any system but more often the cardiopulmonary and central nervous system than others. Most babies were asymptomatic at birth and few may remain symptomless throughout the neonatal period. Signs and symptoms generally become evident in first 24 hours of life. Out of 21 polycythemic neonates in this study 17 babies had symptoms out of which one baby had only plethora as a symptom of polycythemia. Respiratory distress was present in 9 babies, cyanosis was present in 8 cases, plethora was present in 9 cases, jitteriness in 7 cases and convulsions in two cases. Lethargy was present in 3 cases. 2 babies showed evidence of hypoglycemia and three had feeding problems like poor suck. Jaundice and hyperbilirubinemia was present in 8 cases and only one baby had evidence of congestive cardiac failure. In our study no baby had evidence of necrotising entercolities, hypothemia, acute renal failure, priaprism, hemorrhage and gangrene. Gross *et al*[14] described cyanosis, plethora or both in polycythemic infants. He also described cardiopulmalonary signs, hyperbilirubinemie, focal or generalized seizures and hypoglycemia. Rammurthy *et al*[15] observed plethora, lethargy and cyanosis commonly and tremors, tachyacardia, pallor and jaundice less commonly while studying neonatal polycythemia and hyperviscosity. Oski and Nainan[16] described transient tachyapnoea of newborn, priapism and necrotising enterocolitis with neonatal polycythemia. Most of the manifestations of polycythemia were explained on the basis of hyperviscosity. A relationship between viscosity and polycythemia being linear up to hematocrit value of 60 to 65% and then viscosity increases exponentially than hematocrit above the hematocrit value of 65% as a general rule all infants having hematocrit value 65% are hyperviscous and about 25% neonates between 60-64% of hematocrit value are hiperviscous. Hyperviscosity does not occur below the hematocrit value of 60%.[15] Neonatal Hyperviscosity depends on hematocrit value, reduced deformability of red blood cells and plasma viscosity[3,17] but hematocrit value is the main determinant of hyperviscosity. Gross[17] also noted that when Hyperviscosity occurs due to polycythemia, signs and symptoms observed are directly related to hyperviscosity. As viscosity of blood increases sludging of blood flow occurs with resulting impairment in tissue oxygenation and formation of microthombi3. As a result of impairment in circulation and tissue hypoxia in vital areas like kidney and brain[18], clinical manifestation occurs. If hypoxia is continuous for long time, infraction occurs and the damage may be irreversible. Hyperbilirubinemia and jaundice found in newborn with polycythemia may be related to premature red cell destruction in an abnormal circulation-Gross[14]. Hyperviscosity causes reduction in cerebral blood flow.[19] Cerebral dysfunction could occur causing manifestation like jitteriness, convulsions, lethargy and hypotonia. Cerebral dysfunction because of Hyperviscosity may be responsible for causing above symptoms in our study. Respiratory distress due to polycythemia could occur secondary to pulmonary venous congestion, edema, fluid and hypoxemia-wesenberg[20], due to reduced pulmonary blood flow (Four on and Hebert)[21] or due to turgidity of lungs - Danks and Stevens[22]. Thus, respiratory distress present in 9 cases of our study was explained. Wesenberg[20] explained the mechanism of congestive cardiac failure to polycythemia. He started that myocardial work required to pump thick Hyperviscos blood was more than Normal and capillary stasis and sludging of blood in systemic and pulmonary circulation further increases strain on myocardium

leading to cardiac decompensations and congestive cardiac failure. In our study, congestive cardiac failure was found in one baby which can be explained by above theory. Plethora was found in 8 cases. Feizal and Tolle[23] also found plethora in majority of neonates with polycythemia but there is no transcutaneous PO_2 or PCO_2. In our study infant had only plethora as an indication of polycythemia and totally 9 infants had plethora. In our study two babies had evidence of hypoglycemia and had feeding difficulty. Hypoglycemia is a common associated factor in babies having hypoxemia due to asphyxia as glycogen stores are depleted earlier. Feeding difficulties like poor suck can be explained on the basis of tachypnoea and respiratory distress associated with polycythemia.

CONCLUSION

Respiratory distress, cynosis, plethora, jitterines and jaundice with hyperbirubinemia are the commonest symptoms observed in polycythemtic babies. Convulsions, hypotonia, congestive cardiac failure are found with low frequency.

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