Original Article

Neonatal Polycythemia in Children Welfare Teaching Hospital, Medical city complex, Baghdad

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Summary:

Backgroun1d: Polycythemia is defined as a central Hematocrit of at least 65%. Its` incidence is increased in babies who have intrauterine growth restriction (IUGR), are small for gestational age (SGA), and are born post term. Many infants with polycythemia are asymptomatic. However, it may be associated with feeding problems and lethargy.

Objectives: This work aimed to study the polycythemic neonates admitted to neonatal care unit in children welfare teaching hospital, medical city complex, Baghdad, including demographic features, risk factors, management and early outcome.

Patients and Methods: A descriptive study was carried out over 8 months period from 10th of April to the 10th of December 2012, on 50 neonates with polycythemia. The information collected including; age, sex, gestational age, birth weight, risk factors, clinical presentations, management and early outcome. All collected information were taken from patient's medical records, mothers, relatives of patients& residents in the neonatal care unit.

Results: Males were more affected than females with male: female ratio of 1.6:1, irritability was present in 11(22%), Tachypnea 21(42%), Respiratory distress 14(28), Cyanosis 11(22%), Feeding disturbance 28(56%), Jaundice 5(10%), Hypoglycemia 15(30%), and thrombocytopenia in 4(8%). the risk factors include Hypertensive mother in 7(14%), diabetic mother 12(24%), twin pregnancy 7(14%). The gestational age: 18(36%) were term, 8(16%) were preterm, 24(48%) were post term. Regarding birth weight 9(18%) were Appropriate for gestational age, 32(64%) were Small for gestational age, 9(18%) were large for gestational age. The complications include seizure 4(8%), necrotizing enterocolitis 3(6%), renal failure in 2(4%). Partial exchange transfusion (PET) was done to 10 (20%). The early outcome include 36(72%) were discharged well, 5(10%) were discharged on family responsibility, 4(8%) were referred to other hospital, 3(6%) died.

Conclusions: There is a male predominance in neonatal polycythemia. The most common and significant clinical finding was feeding problem. The most significant laboratory finding was hypoglycemia. The most significant risk factors are small for gestational age and Post term neonates. The outcome is generally good.

Keywords: Neonatal polycythemia, plethora, risk factors, Partial exchange transfusion.

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Introduction:

Polycythemia is defined as a central Hematocrit (Hct) of at least 65%. Its incidence is 1-5 % in full term newborns. It is increased in babies that have intrauterine growth restriction (IUGR), are small for gestational age (SGA), and are born post term (1). Infants who have no symptoms by 48 to 72 hours of age are likely to remain asymptomatic (2). Many infants with polycythemia are asymptomatic. One study found that feeding problems and lethargy were the most common symptoms. Other signs and symptoms may include the central nervous, cardiovascular, respiratory, gastrointestinal, renal, hematologic, metabolic systems (3).

Laboratory studies needed in patients with polycythemia include central hematocrit, serum glucose, serum bilirubin, sodium and blood urea nitrogen, urine specific gravity, blood gases, serum calcium, and platelet count (3).

Treatment of symptomatic polycythemic newborns is partial exchange transfusion (PET) with normal saline. A PET should be considered if the Hct is ≥70-75% or even lower if signs of hyperviscosity are present. PET lowers the Hct and viscosity and improves acute symptoms (4). Crystalloids are as effective as colloids and have the advantages of being cheaper, easily available, and not conferring risk of infections or anaphylaxis (5).PET influences duration of hospitalization and time to reach full enteral feeding and increases the risk of NEC in asymptomatic patients (6). Renal manifestations of polycythemia include decreased glomerular filtration rates, oliguria, hematuria, proteinuria, and renal vein thrombosis (2).

There is no evidence of long term benefit from PET in polycythaemic infants, and the incidence of gastrointestinal injury is increased. The long term outcome is more likely to be

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related to the underlying cause of polycythaemia (7).
This work aimed to study the polycythemic neonates admitted to Neonatal Care Unit in Children Welfare Teaching Hospital, Medical City Complex, Baghdad, including demographic features, risk factors, management and early outcome.

Patients and Methods:
This descriptive study was carried out over 8 months period from 10th of April to the 10th of December 2012, on 50 polycythemic neonates, who were admitted to neonatal care unit in children welfare teaching hospital, medical city complex, Baghdad.
The information collected included age, sex, gestational age, birth weight, risk factors, clinical presentations, management and early outcome. All patients are from normal altitude area. All collected information was taken from patient's medical records, mothers, relatives of patients and resident doctors in the neonatal care unit.
Hematocrit was measured in venous blood obtained from antecubital region by free flow using the method of micro-centrifuge at age from (1 to 5 days old age). The diagnosis of asymptomatic polycythemia were defined as a central venous Hct value above 65% while Symptomatic polycythemia was defined as at least one clinical (central nervous system) or cardiovascular system (CVS) or gastrointestinal system (GIS) or renal involvement) or laboratory finding in addition to a Hct value above 65%. Central nervous system findings were hypotonia and lethargy, irritability (excessive crying more than 2-3 hours in day) and seizure. Cardiovascular system findings were defined as tachycardia, tachypnea, respiratory distress, Cyanosis, plethora, cardiomegaly, pulmonary vascular fullness, pleural fluid and pulmonary hypertension. Gastrointestinal system findings were defined as poor sucking, vomiting and NEC (gas accumulation in the submucosa of the bowel wall by erect x ray of abdomen (pneumatosis intestinalis)) (8). Renal manifestations of polycythemia include decreased glomerular filtration rates, oliguria, hematuria, proteinuria, and renal vein thrombosis (2). Oliguria was defined as (urine output <1 ml\kg\hr). Renal vein thrombosis was defined as hematuria with flank mass diagnosed by Doppler study. Laboratory findings were defined as hypoglycemia (<40 mg/dl), hypocalcaemia, thrombocytopenia (<150x109/L) and hyperbiluribinemia (8). PET was performed in all symptomatic or asymptomatic subjects with a venous Hct value above 70% and in symptomatic subjects with a venous Hct value of >=65% and above. In patients in whom no PET was performed, intravenous fluid was administered for at least 6 hours with an appropriate amount for age and weight as medical treatment. PET was performed via umbilical vein. The amount of physiological saline was calculated with the following formula: blood volume x (Hct of the patient-desired Hct) / Hct of the patient. The blood volume of the infant was considered to be 80-90 ml/kg in term infants and 90-100 ml/kg in preterm infants. It was aimed to decrease venous Hct to 55% with blood exchange (8).
Statistical analysis: As this work is a descriptive study, so all data were tabulated and arranged in numbers and percentages.

Results:
Fifty polycythemic neonates were included in this study. The mean age ±SD for patients was 3.8± 1.17 days. There were 31 males (62%) and 19 females (38%). The male to female ratio was1.6:1.
The presenting symptoms and laboratory finding include: feeding problems in 28 patients (56%), tachypnea in 21 (42%), lethargy in 16 (32%), hypoglycemia in 15 (30%). (Table 1)
The risk factors for polycythemia include: maternal diabetes in 12 patients (24%), maternal hypertension in 7 patients (14%), twin pregnancy in 7 patients (14%). PET was done for 10 patients (20%). (Table 1)
Eighteen patients (36%) were term, 8 (16%) were preterm, 24 (48%) were post term. (Table 1)
Nine patients (18%) were appropriate for gestational age, 32 (64%) were small for gestational age, and 9 (18%) were large for gestational age. (Table 1)
The hematocrit of 50 neonates include 34 (68%) had PCV of 65-69%, 13 (26%) had PCV of 70-74%, and 3 (6%) had PCV of > 75%. (Table 2)
The complications includes; Hypoglycemia in 15 patients (30%), seizure treated with anti-epileptic drugs (AED) in 4 (8%), necrotizing enterocolitis in 3 (6%) (2 of them referred to pediatric surgery operated upon and died and another one died in our neonatal care unit), renal failure in 2 (4%)(Referred to central children hospital for dialysis), stroke in 2 (4%), renal vein thrombosis in one patient (2%). (Table 3)
The early outcome include; 36 patients (72%) were discharged well, 5 (10%) were discharged on family responsibility, 4 (8%) were referred to other hospitals, 3 (6%) died, and 2 (4%) were discharged on AED. (Table 4)

Table 1: The study characteristics of 50 polycythemic neonates

Variable	Patient number	Percent (%)
Risk factors		
Maternal diabetes	12	24
Maternal hypertension	7	14
Twin pregnancy	7	14
Neonatal hypothyroidism	1	2
Clinical presentations, laboratory findings and management		
Feeding problem	28	56
Tachypnea	21	42
Lethargy	16	32
Hypoglycemia	15	30
Respiratory Distress (RD)	14	28
Cyanosis	11	22
Irritability	11	22
Hyperbilirubinemia	5	10
Thrombocytopenia	4	8
partial exchange transfusion	10	20

-Patients might have more than one risk factor, clinical presentation, laboratory finding .

Table 2: Hematocrit (PCV) level of 50 neonates with polycythemia

Hematocrit (PCV) level %	No	%
65-69	34	68
70-74	13	26
≥75	3	6

Table 3: Complications among 50 neonates with polycythemia

Complication	No	%
Hypoglycemia	15	30
Central nervous system	6	12
Necrotizing enterocolitis	3	6
Renal failure	2	4
Renal vein thrombosis	1	2

Table 4: Outcome of 50 neonates with polycythemia

Outcome	No	%
Discharged well	36	72
Discharged on family responsibility	5	10
Referred	4	8
Died	3	6
Discharged on antiepileptic drugs	2	4
Total	50	100

Discussion:

The current study revealed that among neonates with polycythemia, the male: female ratio was 1.6:1, a similar result was found by Abbas SS et al in Al-Kadhmia hospital, Baghdad, 2010 (9) , with a male: female ratio of 1.5:1, this may be due to small sample size and poor randomization.

The most common clinical presentations were feeding problem, lethargy, tachypnea and the most significant laboratory findings were hypoglycemia, thrombocytopenia, while in other studies, the most common clinical findings were lethargy, tachypnea, tremor, irritability, poor feeding and vomiting, and the most significant laboratory finding was hypoglycemia.(4) Ramamurthy and Brans (10) found plethora in 63% as the most common finding in 54 patients. Black et al found hypoglycemia in 27% as the most common finding in 111 patients. (11)

Irritability was present in (22%), such symptom is not reported in Abbas study (9), but had been mentioned by Maheshwari A (4), this may be due to hypoglycemia which is significant laboratory finding in this study.

Lethargy was found in 32% of patients, which agree with result of Abbas SS (30%),(9) but lower than the result of Krishnan L study (51%)(12), and more than Wiswell TE study (14.5%) (13). This difference may be due to difference in sample size, time of presentation and including inborn and out born infants.

Feeding problems were found in 56% of patients, which agrees with results of Ramamurthy and Brans et al 50% (10) and Goldberg et al 55%(14).This may be due to lethargy, irritability, hypoglycemia, and because most of our patients were SGA who are more likely to have feeding problems.

Cyanosis was found in 22%, which was more than Black et al (7%) (11) and Ramamurthy and Brans et al (17%)(10), this difference may be due to tachypnea, respiratory distress and hypoglycemia.

Hyperbilirubinemia was found in (10%), which was similar to Ramamurthy and Brans study (6%), (10) and less than Abbas SS study (58%) (9). At least one-third of infants with polycythemia develop hyperbilirubinemia, most likely due to the breakdown of an increased number of circulating red cells. (13,15)

Hypoglycemia was found in 30%, which agree with Black et al 27% (11), and Abbas SS study 26%(9).The mechanism may be increased glucose utilization by the increased number of circulating red cells (13,14,16).

Respiratory distress was found in 28%, which is more than Goldberg et al (15%)(14) and agree with Abbas SS study (26%)(9). This difference may be due to high percent of small for gestational age, which decreases the risk of respiratory distress.

Thrombocytopenia was found in 8%, which is more than Black et al study (0%) (11) But less than Goldberg et al (25%)(14). This difference may be due to variations in time of sample taking and method of laboratory measurement.

The risk factors of neonatal polycythemia as the following: Maternal hypertension was found in 14%, which is less than Krishnan L et al 51% (12). This difference probably due to poor antenatal care and many mothers got undetected hypertension.

The infant of diabetic mother was seen in 24%, which agree with Onal EE in 2012 (17) and agree with Abbas SS study 20% (9). Polycythemia was also more frequently observed in infants of the gestational diabetic mothers (9.3%) than in infants of the non-diabetic mothers (17).

The SGA was found in 64%, which agrees with Krishnan L 55.5% (12). Increased intrauterine erythropoiesis usually results from placental insufficiency and chronic intrauterine hypoxia. This typically is seen in infants who are SGA or whose mothers have preeclampsia or other hypertensive or vascular disorders.(18)

Thirty-six percent of neonates were full term, which was less than Krishnan L 85.1% (12).This may be explained as most of our patients were SGA, which is a significant risk factor for development of polycythemia (18).

Clinicians have focused on the newborn infant's hematocrit (Hct) level as the criterion for therapeutic intervention. PET is traditionally used as the method to lower the Hct and treat hyperviscosity; however, it is unclear whether this is an effective approach in preventing the long-term neurologic consequences (19). Twenty percent of polycythaemia neonates were managed by PET, which was more than Morag I study (2011)(16%) (20), but less than Abbas SS study 2010 (56%) (9), this may be due to difference in hospital policies or

guidelines for managing polycythaemic neonates by PET.
Only normal saline was used for PET, this agrees with de Waal KA in 2006 in Netherlands and Deorari AK (21,22), because it was available, cheaper, and safer than blood products.
Twenty percent of polycythemic neonates were asymptomatic, which agree with Wiswell TE study in 1986, 14.5% (13). Most polycythemic infants have no symptom, particularly if the polycythemia becomes apparent only on routine neonatal screening (15).
Asymptomatic polycythemic neonates were not managed by PET and this agrees with Singh M et al study in India 1990 (23). This may be related to the hospital policy as PET is not completely safe procedure and may be risky (7,24).
The complications related to the polycythaemia and its management (PET) as following: NEC was found in (6%) and this is more than Wiswell TE in1986 (1%) (13). although polycythaemia alone can cause NEC, there are studies which showed that PET was a more significant risk factor for NEC, including Black et al (24) , who found GIT symptoms in 6% in untreated polycythaemic patients and 51% in patients in whom PET was performed. Hopewell et al found that the frequency of NEC increased with PET in polycythaemic patients. These infants had other risk factors for NEC, such as IUGR, birth asphyxia, or both (25).
Early morbidities, due to polycythemia may be reversed with PET within a short time. PET did not increase or cause any complications except NEC (26).

Conclusions:
In neonatal polycythaemia, there is a male predominance. The most common and significant clinical finding was feeding problems. Asymptomatic polycythaemia or those with fewer symptoms were those with PCV less than 70%. The most common laboratory finding was hypoglycemia. The most significant risk factors are neonates being post term and small for gestational age. PET was done to 20% of patients. Generally, the short term outcome is good.

Author's contributions:
Dr Numan: Manuscript concept, Design, Data Collection: Dr Ashraf, Writing the contents of the manuscript: Dr Numan + Dr Ashraf, Statistical analysis: Dr Numan + Dr Ashraf, Manuscript revision and finalization: Dr Numan

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