Neonatal Polycythemia: Risk Factors, Clinical Manifestation and Treatment Applied

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ABSTRACT:

BACKGROUND:

Polycythemia is defined as a venous hematocrit above 65%.Polycythemia is sometimes associated with hyper viscosity of blood .The etiology of polycythemia is related either to intra-uterine hypoxia or secondary to fetal transfusion. Increased viscosity of blood is associated with symptoms of hypo-perfusion. Clinical features related to hyper viscosity may affect all organ systems.

OBJECTIVE:

To evaluate the prevalence of polycythemia among neonates who were admitted to the nursery care unit, to evaluate the difference between peripheral and central hematocrit (PCV) and to have an idea about the main presentation and modes of treatment of polycythemia.

PATIENTS AND METHODS:

A case – control study was done in the nursery care unit of AL - Kadhyimia Teaching Hospital , one hundred neonates (50 polycythemic and 50 control healthy neonates) were taken , for each neonates , information regarding (name ,age , sex , gestational age , mode of delivery , body weight ,length, head circumference , clinical presentation and risk factors) were taken, investigations including hematocrite (PCV) , random blood sugar and total serum bilirubin were done for all neonates.

RESULTS:

The prevalence of neonatal polycythemia was (2.2%) , male was affected more than female with male : female ratio equal to (1.5:1) . The difference between peripheral and central PCV was (4 - 15%) with a mean and standard deviation of
(7 ± 0.33%). The main signs & symptoms were jaundice (58%), lethargy (30%) , respiratory distress (26%) and hypoglycemia (26%) . Risk factors were preterm (36%) , neonates of diabetic mother (20%) , small for gestational age (18%) , twin pregnancy (12%) and down's syndrome (10%) . Partial exchange transfusion was done to 28 cases (56%).

CONCLUSION:

Males were affected more than females. Jaundice was the main presentation followed by lethargy, respiratory distress and hypoglycemia .Higher risk in twin pregnancy ,neonates of diabetic mother , small for gestational age , preterm and down's syndrome while delivery by caesarian section reduce the risk of polycythemia.

KEY WORDS: polycythemia , neonates , partial exchange transfusion.

INTRODUCTION:

Polycythemia is associated with hyper viscosity of blood .As viscosity increases , there is an impairment of tissue oxygenation and perfusion and a tendency to form microthrombi . Significant damage may occur if these event occur in the cerebral cortex , kidneys and adrenal glands . Hence , this condition requires urgent diagnosis and prompt management [1] .A diagnosis of polycythemia is made in the presence of a venous hematocrit more than 65%or a venous hemoglobin concentration in excess of 22.0 gm /dl [2,3] . Polycythemia occur in 0.4 –12% of neonate [4][5] .The incidence is higher among both small for gestational age (SGA) and large for gestational age (LGA) infants. The incidence of polycythemia is 15% among term SGA infants compared to 2% in term appropriate for gestational age (AGA) infants [6] [7] [8] .

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Polycythemia in newborns may be a compensatory mechanism for intrauterine hypoxia or secondary to fetal transfusions[9]. About 50% of neonates with polycythemia develop one or more symptoms. However, most of these symptoms are non-specific and may be related to the underlying conditions rather than due to polycythemia [9][10] .The definitive treatment for polycythemia is partial exchange transfusion[11] .

The aim of the study is to evaluate the prevalence of polycythemia among neonates admitted to the nursery care unit, to evaluate the difference between peripheral and central PCV and to have an idea about the main presentation and mode of treatment of polycythemia.

PATIENTS AND METHOD:

This study is a case-control study , done in the nursery care unit of AL-Kadhyimia Teaching Hospital , in the period between 19th of March 2009 to 20th of July 2009 , included 100 neonates for whom history were taken including name , age ,sex, residence, gestational age , mode of delivery .Body weight, length , head circumference were measured .Clinical presentation and risk factors were determined. The first group include 50 neonates with polycythemia, had central PCV > 65% ,with gestational ages ranging from 31 to 40 weeks and body weights ranging from 1500g to 4600g ,venous blood was collected from them after they had peripheral PCV more than 65% , and the blood samples collected in heparinized micro-capillaries (75mm long and 1.1-1.2 mm internal diameter) then centrifuged in a micro hematocrit centrifuge at 3000 rpm for 5 minute and PCV was measured . The second group include 50 neonates with central PCV < 65% ,they were admitted to the nursery care unit for reasons other than polycythemia , their gestational ages rang from 32 to 40 weeks and body weights ranging from 1500g to 4000g , for each neonates blood samples were aspirated from vein after taken family consent , PCV was measured by the same method as above . In all 100 neonates total serum bilirubin and blood sugar were measured using Bilirubin meter (APEL Co. LTD) and Glucomete (Gluotrend 2, Roche) respectively .Statistical analysis was done using SPSS13 computer software. Prevalence was estimated. Prevalence was estimated .The statistical significance of difference in mean of a quantitative normally distributed variable (such as PCV) between two groups was assessed by independent samples t-test. Associations between two categorical variables was explored by cross-tabulation. The statistical significance of such associations was assessed by Chi-square test of homogeneity and P. value less than 0.05 was considered statistically significant. The odds ratio (OR) was used to measure the magnitude of risk of having the disease in a case-control study design for selected risk factors. The 95% confidence interval for the calculated odd ratio was also presented.

RESULTS:

Total number of patients were 50 and total number of neonates delivered during the study period were 2256 , so prevalence of polycythemia was (2.2%) .

From 50 polycythemic neonates , 30 cases were male (60%) and 20 cases were female (40%) with male : female ratio equal to 1.5:1 , while in the control group , 26 cases were male (52%) and 24 cases were female (48%) , so being male gender increase the risk of polycythemia by (1.4) times and this factor was statistically not significant (P > 0.05) as it is shown in (table- 1-)

The difference in PCV measurements between peripheral and central PCV is shown in (table- 2-) , the range in peripheral PCV was (70%-85%) with a mean and standard deviation of (75 ± 0.5%) , the range in central PCV was (66%-75%) , with a mean and standard deviation of (68 ± 0.27%) while the difference between peripheral and central PCV was (4%-15%) with a mean and standard deviation of (7 ± 0.33%) .Using the regression analysis , a linear correlation was found between the central and peripheral PCV as it is shown in (figure- 1-) .

Jaundice was the main presentation in polycythemic neonates 29 cases (58%) followed by lethargy 15 cases (30%) , respiratory distress 13 cases (26%) and hypoglycemia 13 cases (26%) . No feeding problems, jitteriness and cyanosis encountered in this study as it is shown in (figure – 2-) .

The risk of jaundice was 29 cases (58%) in polycythemic group only, so the rate of jaundice was highly significant (P < 0.05) . The risk of lethargy was 15 cases (30%) in polycythemic group only , so the rate of lethargy was highly

significant (P < 0.05). The risk of respiratory distress was 13 cases (26%) and 11cases (22%) in polycythemic and control group respectively , the result is statistically not significant (P > 0.05) .The risk of hypoglycemia was 13 cases (26%) and 7 cases (14%) in polycythemic and control group respectively , the result is statistically not significant (P > 0.05) as it is shown in (table- 3-). From 50 polycythemic and 50 control neonates , preterm was 18 cases (36%) and 11 cases (22%) , neonates of diabetic mother were 10 cases (20%) and 4 cases (8%) , small for gestational age was 9 cases (18%) and 4 cases (8%) , twin pregnancy was 6 cases (12%) and 4 cases (8%) and delivered by caesarian section was 22 cases (44%) and 33 cases (66%) respectively , down's syndrome was 5 cases (10%) in polycythemic group only . So being preterm , neonates of diabetic mother , small for gestational age and twin pregnancy increase the risk of polycythemia by (2 , 2.9 , 2.5 and 1.6) times respectively and being delivered by caesarian section reduce the risk of polycythemia by (2.5) times as it is shown in (figure- 3- and table- 4-).

Partial exchange transfusion done to 28 cases (56%), the procedure was for those with hematocrite > 65% , normal saline was used and PCV decreased immediately post exchange and it was sustained over the following 48 hours.

Table 1: Shows Case – Control difference in gender distribution.

Sex	Control		Polycythemic				
	No.	%	No.	%	Odd ratio	95%CI of OR	P. value
Male	26	52	30	60	1.4		
Female	24	48	20	40	Reference	0.6-3.1	
Total	50	100	50	100			0.42(N.S.)

Table 2: Shows the mean difference in PCV measurement between peripheral and central locations among neonate with established polycythemia.

Difference between both	Peripheral	Central	PCV %
Range	(66-75)	(70-85)	(4-15)
Mean	68	75	7
SE	0.27	0.5	0.33

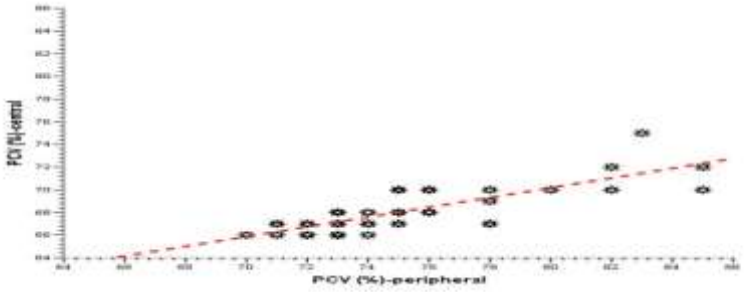

Figure (1): Scatter diagram with fitted regression line showing the linear correlation between peripheral and central PCV measurements. r=0.78

Fiqure1: Scatter diagram with fitted regression line showing the linear correlation between peripheral and central pcv measurnts. R=0.78.

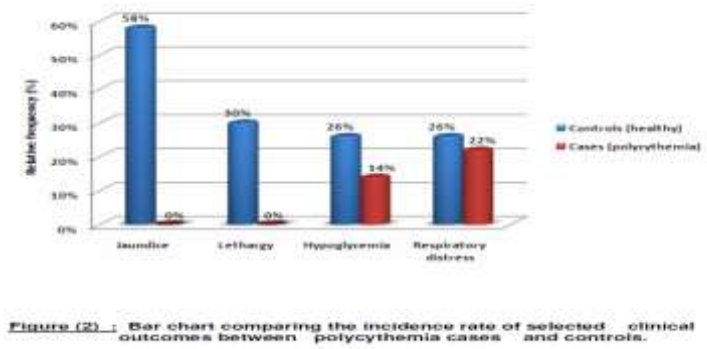

Figure (2) : Bar chart comparing the incidence rate of selected clinical outcomes between polycythemia cases and controls.

Fiqure1: Bar chart comparing the incidence rate of selected clinical outcomes between polycythemia cases and controls.

Table 3: Shows the Case-Control difference in the incidence of signs and symptoms.

Signs and symptoms	Control		Patients		Odd ratio	95%C.I. of O.R.	P. value
	No.	%	No.	%			
Jaundice	0	0	29	58	0	0	< 0.001
Lethargy	0	0	15	30	0	0	< 0.001
Respiratory distress	11	22	13	26	1.2	(0.6-2.4)	0.64 (N.S.)
Hypoglycemia	7	14	13	26	1.9	(0.8-4.3)	0.13 (N.S.)

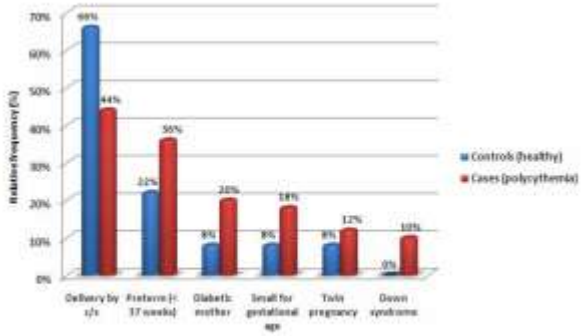

Figure (3): Bar chart showing the case-control difference in relative frequency of selected risk factors.

Fiqure 1: Bar chart showing the case-control differrnce in relative frequency of selected risk factors.

Table 4: Shows Case- Control difference in relative frequency of selected risk factors.

Risk factors	Control		Polycythemic		Odd ratio	95% confidence interval of OR	P. value
	No.	%	No.	%			
Twin pregnancy	4	8	6	12	1.6	(0.4-5.9)	0.51(N.S.)
Down's syndrome	0	0	5	10	0	0	0.022
Infant of diabetic mothers	4	8	10	20	2.9	(0.8-9.9)	0.08(N.S.)
Small for gestational age	4	8	9	18	2.5	(0.7-8.8)	0.14(N.S.)
Preterm(<37 weeks)	11	22	18	36	2	(0.8-4.8)	0.12(N.S.)
Caesarian section	33	66	22	44	0.4	(0.2-0.9)	0.027

DISCUSSION:

In this study the prevalence of polycythemia was found to be (2.2%) . In comparison with previous studies it varies between (0.4-5%) [6] [7] .Male was affected more than female with male : female ratio of 1.5:1 .This may be due to random sample collection as no such difference was found in literature [9] [10] . Peripheral PCV was higher than central PCV and the difference between them was (4-15%). In comparison with what is mentioned in the literature the difference was (5-15%) [3]and (5-20%) [9].

Concerning signs and symptoms , jaundice , lethargy , respiratory distress and hypoglycemia were the main finding (58% , 30% , 26% ,26%) respectively . No feeding problems , jitteriness and cyanosis encountered in this study .In a study done in United States Army hospitals 1986 , they found that jaundice , respiratory distress and hypoglycemia present with the percentage of (33.5% , 6.6% ,13%) respectively [12] .

In another three studies from India , the first one in January 1990 in New Delhi demonstrated the presence of lethargy , respiratory distress and jitteriness with a percentage of (11.1% ,14.8% , 25.9%) respectively [13] . The second study done in April 1990 in Chandigarh showed the presence of jaundice , lethargy , respiratory distress , hypoglycemia and feeding problems with a percentage of (26% , 15% , 10% , 10.8% ,13%) respectively [14]. In the third study in 1994 in Karnataka , they found that lethargy, hypoglycemia and feeding problems encountered with a percentage of (51% , 51% , 34%) respectively [15] . The risk was higher in preterm, neonates of diabetic mother, small for gestational age and twin pregnancy and the rate was (36% , 20% , 18% 12%) [15]

In comparison with the study done in Chandigarh the incidence was (36%,8%,13.8%,15%) respectively[14].

In this study delivered by caesarian section reduce the risk of polycythemia by (2.5) times , in cesarean delivery there is usually a lower risk of placental transfusion if the cord is clamped early because of the absence of active uterine contraction and gravitational effects [16] .

CONCLUSION:

Male predominance was noticed . Jaundice was the main presentation followed by lethargy, respiratory distress and hypoglycemia. Higher risk in twin pregnancy , neonates of diabetic mother , small for gestational age , preterm and down's syndrome. Delivery by caesarian section reduces the risk of polycythemia .Treatment is mainly by partial exchange transfusion.

Recommendation:

PCV checking is indicated in preterm and in neonate with Jaundice , lethargy, hypoglycemia , neonates of diabetic mother , twin pregnancy and small for gestational age .

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