ORIGINAL RESEARCH PAPER

Volume-9 | Issue-2 | February-2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A STUDY ON EFFICACY OF PARTIAL EXCHANGE TRANSFUSION WITH NORMAL SALINE IN NEONATAL POLYCYTHEMIA.

Paediatrics

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ABSTRACT

BACKGROUND: Neonatal polycythemia is a significant health problem. Partial exchange is the mainstay of treatment. Fresh frozen plasma (FFP) is usually used as replacement fluid but associated with blood product transfusion related complications. Normal saline is inexpensive and devoid of blood product related complications. With this background, this prospective study was undertaken to evaluate the efficacy of normal saline as replacement fluid in PET for treatment of neonatal polycythemia.

MATERIAL & METHODS: The proposed study was undertaken in the sick newborn care unit of Department of Pediatrics of Bankura Sammilani Medical College. Partial exchange transfusion was done in symptomatic polycythemic neonates with PV Hct > 65% and in asymptomatic polycythemic with PV Hct. >70%. Normal saline was used as a replacement fluid. Pre & post exchange umbilical venous hematocrit (UV Hct) was also estimated. After completing the PET, the neonates were followed up to note the improvement the clinical signs and symptoms, blood biochemistry and venous hematocrit. Peripheral venous hematocrit was repeated 12 hours & 24 hours after PET.

RESULTS: Out of total fourteen polycythemic neonates of our study, eleven were symptomatic and three were asymptomatic. Average age for estimation of venous hematocrit was 7.1 hrs (+1.9hrs). Average capillary hct was 81% (+3.3%). Average PV Hct was 71.9% (+3.1%). Average pre exchange UV Hct was 70.3% (+3.4%). Immediate post exchange UV Hct was 56.7% (+1.58%). Average volume of blood that was exchanges was 49.9ml (+1.8ml). During the first follow up at around twelve hours after PET the average PV Hct were 57.9%(+4.3%) which were less than Polycythemic level (<65%). There was also symptomatic improvement. Plethora & peripheral cyanosis disappeared in all the neonates except one. By 24 hrs from the time of PET, all the neonates became asymptomatic except two neonates. No complications were noted that could be due to PET.

CONCLUSION: Early PET is effective in reducing raised hematocrit & avoiding life threatening complications. Normal saline is a cheap, readily available, safe and effective replacement fluid for PET.

KEYWORDS

Polycythemia, neonates, PET, hematocrit

BACKGROUND:

Neonatal polycythemia is a significant health problem. Partial exchange is the mainstay of treatment. Fresh frozen plasma (FFP) or any other colloidal solution is usually used as replacement fluid in partial exchange transfusion[1,2]. Since use of FFP as replacement fluid in PET poses concern about transfusion related diseases & also chance of persistence of hyperviscosity because of protein content. Normal saline is inexpensive and devoid of blood product related complications.

With this background, this prospective study was undertaken to evaluate the efficacy of normal saline as replacement fluid in PET for treatment of neonatal polycythemia.

AIMS & OBJECTIVES:

To find, out the effectiveness of partial exchange transfusion with normal saline in neonatal polycythemia.

MATERIAL & METHODS:

The proposed study was undertaken in the sick newborn care unit of Department of Pediatrics of Bankura Sammilani Medical College. Study period was from February 2019 to November 2019. Neonates with peripheral venous hematocrit ≥ 65% were considered to be suffering from polycythemia[3]. Those neonates diagnosed as neonatal polycythemia were critically evaluated for clinical signs & symptoms. Polycythemic neonates with more than two or more signs and symptoms were considered as symptomatic polycythemic neonates.

Partial exchange transfusion was done in symptomatic polycythemic neonates with PV Hct ≥ 65% and in asymptomatic polycythemic with PV Hct. ≥70%. Normal saline was used as a replacement fluid & it was infused through a peripheral vein and blood was taken out through umbilical venous catheter. Pre & post exchange umbilical venous hematocrit (UV Hct) was also estimated.

The amount of blood that had to be taken out was estimated using following formula:

$$\text{Volume to be exchanged} = \frac{\text{Blood volume*} \times (\text{Observed hematocrit} - \text{Desired hematocrit})}{\text{Observed hematocrit}}$$

*Blood volume is estimated to be 80-90 ml/kg in term babies and 90-100 ml/kg in preterm babies. Desired UV Hct was 55%[3]. After completing the PET, the neonates were followed up to note the improvement the clinical signs and symptoms, blood biochemistry and venous hematocrit. Peripheral venous hematocrit was repeated 12 hours & 24 hours after PET.

RESULTS:

Table 1: Profile of polycythemic neonates that undergone PET:

SR NO	SEX	GES. AGE	BIRTH WEIGHT	AGA/ SGA/ LGA	AGE FOR Hct	Cap. Hct. (%)	PV Hct. (%)	Hb (gm %)	MATERNAL FACTORS	OBS. COMPLICATIONS	FETAL FACTORS	CLINICAL FEATURES & LAB. ABNORMALITY
1	F	36	2455	AGA	7	82	70	22.9				Tachypnoea, tachycardia, plethora, peri. Cya.jaundice.
2	F	41	2460	SGA	6.5	89	81	26.6				Seizure, tachypnoea, plethora, peri. Cya., hypoglycemia.
3	M	40	2421	SGA	5.5	77	71	22.1				Tachypnoea, tachycardia, plethora, irritability.
4	F	39	4830	LGA	6	81	73	23.8	Diabetes on insulin			Tachypnoea, tachycardia, plethora.
5	M	36	2013	SGA	10.5	79	70	22		PET, Oligohydramnios		Tachypnoea, plethora, peri. Cya.
6	M	36	1980	SGA	11.5	77	69	22.8			twin	Tachypnoea, plethora, peri. Cya.lethargy, hypoglycemia.

7	M	37	2324	SGA	7.5	85	70	22.9		PET		Tachypnoea, tachycardia, plethora.
8	F	38	3105	AGA	8	79	71	20				Jaundice, plethora,
9	F	37	2705	AGA	5.5	81	74	21.2				Plethora, peri. Cya. Jaundice, hypoglycemia.
10	M	37	2168	SGA	4	83	72	20.8		PET		Tachypnoea, Jaundice, plethora, hypoglycemia, Hypocalcemia
11	F	39	3308	AGA	6.5	79	70	21.3				Tachypnoea, tachycardia, plethora, peri. Cya. Jaundice.
12	F	35	2380	AGA	6	81	71	22.5			twin	asymptomatic
13	M	37	2900	AGA	7.5	84	73	23.2				asymptomatic
14	F	39	2870	AGA	8.5	79	71	22.3				asymptomatic

Table 1, showing the profile of polycythemic neonates which undergone partial exchange transfusion. Six were boy & eight were girl baby. Ten babies were term and four were preterm. Six were small for gestational age (SGA), one was Large for gestational age (LGA) and seven were appropriate for gestational age (AGA). Average age for estimation of venous haematocrit was 7.1 hrs (+1.9hrs). Average capillary hct was 81% (+3.3%). Average PV Hct was 71.9% (+3.1%). Average hemoglobin was 22.4 gm% (+1.6gms %). Out of total fourteen polycythemic neonates of our study, eleven were symptomatic and three were asymptomatic. The most common signs & symptoms were cardio respiratory signs & symptoms (tachypnoea, tachycardia, peripheral cyanosis). All the symptomatic neonates develop clinical jaundice and eight required phototherapy. Four neonates were hypoglycemic. Hypocalcemia was detected in one neonate. All asymptomatic neonates were plethoric but no other signs or symptoms were noted.

Table 2 shows the results of partial exchange transfusion.

SR NO	Age At PET(hrs)	Pre Exchange UV Hct (%)	Vol. Of Blood Exchange (ml)	Immediate Post Exchange UV Hct (%)	FOLLOW UP					
					FIRST OBSERVATION (8 hrs after PET)			Second Observation (24 hrs after PET)		
					AGE (hrs)	PV Hct (%)	CLINICAL STATUS	AGE (hrs)	PV Hct (%)	CLINICAL STATUS
1	9.5	68	45	58	17.5	59	No plethora, mild lethargy	33.5	54	normal
2	8.5	78	56	59	16.5	62	No peri, cyanosis, no plethora, irritability present.	32.5	55	Irritability present, otherwise normal
3	11.25	68	46	56	20	59	No peri, cyanosis.	35.5	53	Normal
4	10	71	76	57	18.5	60	Tachypnoea &tachycardia improved.	34	57	Normal
5	7.5	67	36	56	15.5	59	Tachycardia improved, cyanosis disappeared.	31.5	51	Normal
6	12.5	66	33	57	21	59	Tachycardia &tachypnoea improved no cyanosis.	36.5	55	Normal
7	10.25	68	44	54	18	61	No cyanosis, sys. Murmur disappeared	34.5	58	Normal
8	14	71	56	57	22	51	No plethora	36	55	
9	9	73	53	56	17	52	No cyanosis, Plethora present.	33	59	Normal
10	11.5	75	56	59	20	53	No plethora, respiratory distress improved.	35.5	57	Persistent tachypnoea
11	16.5	69	53.5	58	24.5	61	No peri. Cya. No plethora, res distress improved.	36.5	57	Normal
12	8.5	69	43	54		49			51	
13	9.5	71	52	57		59			55	
14	10	68	44	53		58			54	

Average pre exchange UV Hct was 70.3% (±3.4%). Immediate post exchange UV Hct was 56.7% (±1.58%). This value was near the desired UV Hct of 55%. Average volume of blood that was exchanges was 49.9ml (±1.8ml). During the first follow up at around twelve hours after PET in all babies the PV Hct were 57.9%(±4.3%) which were less than Polycythemic level (<65%). There was also symptomatic improvement. Plethora & peripheral cyanosis disappeared in all the neonates except one. Improvements in respiratory symptoms were also noted. There was significant reduction in respiratory rate & effort. By 24 hrs from the time of PET, all the neonates became asymptomatic except two neonates. At 24 hrs the average PV Hct was 55.1% (±2.47%). One was with persistent tachypnoea and another was irritable & intolerant to oral feed. Jaundice improved in all the neonates with hyperbilirubinemia and phototherapy could be discontinued by fourth day of age.

DISCUSSION:

Hyperviscosity is the main pathophysiology contributing to different clinical signs & symptoms by impairing microcirculation and sludging of rbcs in different organs[4,5]. Partial exchange transfusion (PET) is the only way of reducing the rbc mass & thereby reduction of hyperviscosity in polycythemic neonates. The immediate efficacy of PET in reducing the haematocrit level & in normalizing the abnormal hemodynamic has been confirmed by different studies[2,6]. In our study also there was reduction of pre exchange hematocrit. But this procedure is not without risk[3]. There is no controversy regarding management of symptomatic polycythemic neonate by PET. Many recommended PET in asymptomatic polycythemic neonates with PV Hct ≥70% but some others differ in the view[7,8]. In this study PET was done in symptomatic and also in asymptomatic polycythemic neonates with PV Hct ≥70%.

Plasma from an adult person or any colloid solution (5% albumin) is usually used as a replacement fluid during PET. But in using plasma as a replacement fluid, there is chance of transmitting viral infections viz, cytomegalo virus, hepatitis B virus, HIV infection etc. Above all the viscosity of adult plasma is reported to be higher than that of newborn[9,10]. So PET with plasma can reduce the hematocrit level but may not reduce the viscosity. So the neonate may still continue to suffer from hyperviscous state even after PET.

Normal saline is a cheap, safe & readily available substitute of plasma that can be used as replacement fluid. Efficacy of PET with normal saline in reducing hematocrit and viscosity had been reported by many workers[9,11,12]. This has been confirmed in this study also. There was significant decrease in umbilical venous hematocrit from pre exchange mean (±SD) level of 70.3% (±3.4%) to 56.7% (±1.58%) immediately after PET. There was also improvement in clinical signs & symptoms (particularly cardio respiratory signs & symptoms) with 12 hrs after PET, with complete recovery on the second day after 24 hrs post PET

except in two neonates. No complications were noted that could be due to PET. No neonates needed repetition of PET in our study though some reported repetition PET in their study[11]. All these findings confirmed the efficacy of PET with normal saline.

CONCLUSION:

Early PET is effective in reducing raised haematocrit & avoiding life threatening complications. Normal saline is a cheap, readily available, safe and effective replacement fluid for PET.

REFERENCES:

1. Wintrobe MM: the diagnostic & therapeutic approach to hematologic problems. In: Lee GR, Bithel TC, Foerster J, Lukens JN: Wintrobe,s clinical hematology, vol-I, 9th edn. Philadelphia, KM Varghese Company, 1993, pp.3.
2. Black VD, Lubchenco LO et al: Neonatal hyperviscosity: Randomized study of effect of partial exchange transfusion on long-term outcome. Pediatrics 1985, 75: 1048.
3. Ramamurthy RS, Brans YW: Neonatal polycythemia: Criteria for diagnosis & treatment. Pediatrics 1981, 68: 168.
4. Writh FH, Goldberg KE, Lubchenco LO: Neonatal hyperviscosity: I. Incidence. Pediatrics 1979, 63: 833-36.
5. Oski FA, Naiman JL: Hematologic problems in newborn, 3rd edition. Philadelphia: WB Saunders, 1982.
6. Murphy DJ, et al: Effects of neonatal polycythemia and partial exchange transfusion on cardiac function: An echocardiographic study. Pediatrics 1985; 76: 909.
7. Singh M, Singhal PK et al: Polycythemia in newborn: Do asymptomatic babies need exchange transfusion? Indian Pediatrics 1990, 27: 61.
8. Bada HS, Korones SB, et al: Asymptomatic syndrome of polycythemic hyperviscosity: Effects of partial exchange transfusion: J Pediatr 1992, 120: 579-85.
9. Mazzuccheli MT, Kurlot I, Sola A: Partial exchange transfusion for neonatal polycythemia: Plasma or normal saline. Pediatr Res 1989, 223A: 1324.
10. Linderkamp O, Versmold HIT, Riegel KP et al: Contributors of red cells and plasma to blood viscosity in preterm and full term infants and adults. Pediatrics 1984, 74: 45-52.
11. Deorari AK, Paul VK, Shreshta L, Singh M. Symptomatic neonatal polycythemia: comparison of partial exchange transfusion with saline versus plasma. Indian Pediatr. 1995 Nov;32(11):1167-71.
12. Villalta I, Pramanik AK, Krouskop R, et al: Comparision of partial exchange transfusion with fresh frozen plasma versus saline in neonatal polycythemia. Pediatr Res 1989, 274A: 1627.