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COMPARATIVE STUDY OF PARTIAL EXCHANGE TRANSFUSION WITH WHOLE BLOOD TRANSFUSION IN PATIENTS OF SEVERE ANAEMIA WITH/WITHOUT CARDIAC FAILURE

Gynaecology

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ABSTRACT

OBJECTIVE(S): To compare the efficacy of partial exchange transfusion and whole blood/packed cell transfusion in improving oxygen carrying capacity in severely anaemic patients with/without cardiac failure.

METHODS(S): These patients were randomly divided into two groups: -

Group A: Study group, partial exchange transfusion with 2 units of whole blood was done.

Group B: Control group, transfusion of 2 unit of whole blood/packed cell volume was done at interval of 24 hours.

RESULTS: The rise in Sp02 beyond 96% was observed immediately after partial exchange transfusion in 89% CASES as compared to only 7% in CONTROLS. The pulse rate settled from average of 126/min before transfusion to 100/min after transfusion in CASE group, whereas there was no obvious difference in pulse rate in CONTROL GROUP even after 30 hours of transfusion. The respiratory rate settled to near normal in CASE group within 60 minutes whereas no obvious difference was seen in CONTROL group even after 30 hours. Haemoglobin rise of 1.04 gm% was noted in all CASES within 60 minutes, compared to negligible rise in the CONTROLS even after 30 Hrs. No major complications like overloading or haemolytic reaction was noted in either group, but comparatively reduced hospital stay, less daily wages loss of their husbands and immediate improvement in quality of life made the partial exchange transfusion a much superior method.

CONCLUSION: Partial exchange transfusion was a superior method in improving Hb % & hence Sp02, settling pulse rate & respiratory rate &cost effectively improving the quality of life compared to whole blood/packed cell transfusion

KEYWORDS

Partial exchange transfusion, Whole blood transfusion, Rise in SPO_2

INTRODUCTION:

Incidence of anaemia is maximum amongst women of child-bearing age. In our country, factors like poverty, illiteracy, under nutrition, dietary deficiencies, successive pregnancies at short intervals, worm infestation, malaria, ignorance, lack of antenatal care, multiparity, menstrual disorders in pre-pregnant state, and teenage pregnancy, add to increased physiological demands during pregnancy. A pre-pregnant anaemic state gets further compounded by PHYSIOLOGICAL HEMODILUTION and increased requirements during pregnancy .Hence the total requirement of iron in pregnancy i.e. 1 gm is also not met with & the woman enters into negative iron balance.

According to WHO, anaemia in pregnancy is present when Hb is less than 11 gm% but due to prevailing conditions in developing countries, level is brought down to 10gm% 1.Severe anaemia is defined as Hb <6.5gm%, but it is not uncommon to see the pregnant patients with Hb < 4gm%. Severe anaemia results in decrease in oxygen carrying capacity thereby predisposing to high fetal wastage2 . Often, these patients develop high-output cardiac failure.

Blood transfusion is frequently required to increase the oxygen carrying capacity of such patients. Transfusion of any appreciable quantity of blood may throw an immediate and fatal burden upon myocardium as there already exists a hyper dynamic state. Hence, best option for such patients is "PARTIAL EXCHANGE TRANSF USION" as volume overload is prevented 3. In our hospital, we frequently come across patients of severe anaemia with/without cardiac failure who require blood transfusion. It was decided to carry out this study to find out "How efficiently and speedily, the oxygen carrying capacity of severely anaemic patients can be improved with partial exchange transfusion compared to whole blood/ packed cell volume transfusion."

MATERIALS AND METHOD

This prospective study was carried out in the department of Obstetrics and gynaecology, DHIRAJ GENERAL HOSPITAL,S.B.K.S. M.I.R.C., PIPARIA, VADODARA from March 2007 to April 2009.

Total 65 antenatal and postnatal patients attending outpatient department or labour room of DHIRAJ GENERAL HOSPITAL were enrolled in this study.

Selection criteria

1. Severe anaemia after 28 weeks of gestation.
2. Severe anaemia with/without cardiac failure within 7 days of delivery.
3. Severe anaemia with cardiac failure in an antenatal patient irrespective of weeks of gestation.

Exclusion criteria

1. Severe anaemia due to acute blood loss.
2. Severe anaemia associated with pre-eclampsia and / or eclampsia.
3. Severe anaemia associated with medical disorder like jaundice, heart disease, bronchial asthma, pneumonia, bronchitis, renal disease.

These patients were randomly divided into two groups:-

Group A: Study group in whom partial exchange transfusion with 2 units of whole blood was done.

Group B: Control group in whom 2 unit of whole blood/packed cell volume were transfused at interval of 24 hours.

Detailed history was taken and clinical examinations (vitals, SpO2, systemic examination, per speculum and per vaginal examination) were carried out. All patients were investigated for Hb%, blood group, RBC indices, detailed urine examination, peripheral smear, sickling test and stool examination. All the patients enrolled in the study were explained the procedure in detail and were counselled to cooperate in the study. Informed and written consent was taken. As the procedure of blood transfusion was carried out in the labour room only, the patients admitted in antenatal ward were shifted temporarily to labour room.

Preparation in labour room

2 units of whole blood or packed cell volume were arranged. Injection ceftriaxone 1gm was given prophylactically. Injectionfrusemide 20mg given intravenously 30 minutes before procedure. Vitals with SpO2 were continuously monitored with multipara monitor.

Procedure:

2 units of whole blood was arranged & checked to avoid mismatched transfusion. Patient was given semi-recumbent position. Foley's catheterization was done. Nasal oxygen at rate of 2-3 litres /minute was started. Intravenous line was secured with 18-gauge needle in right arm for infusion of blood. Sphygmomanometer cuff was applied to left arm from which the blood was to be withdrawn. The pressure in the

cuff was raised to 100 mmHg and maintained at that level.

The 16-gauge needle attached to CITRATE PHOSPHATE DEXTROSE ADENINE bag was introduced into left antecubital vein to withdraw about 500 ml of blood.This was to prevent cardiac overload. 2 units of issued blood was now infused in right arm at the rate of 15 ml/kg & simultaneously blood was withdrawn from left arm at the rate of 20 ml/kg body weight to create negative balance of 5 ml/kg body weight. Electronic weighing scale was constantly used to monitor the withdrawn blood. It was seen that the procedure of transfusion and withdrawing of blood, ended at the same time. The whole procedure took approximately 45-60 minutes. After completion of procedure, injection frusemide 20 mg was repeated. The bag with collected blood was hanged up undisturbed for allowing red blood cells to settle down.This blood which never was more than 100 ml was re transfused to the patient after about two hours.

Monitoring was done up to 2 hours after procedure. Complaints like fever, chills, chest pain, and abdominal pain were noted if any. Examination was done for purpuric spots, haematuria and psychotic behaviour of patient. Uterine irritability in antenatal cases was noted. Breathlessness, chest pain, cough with pink frothy sputum, tachycardia, tachypnoea, neck venous engorgement, hepatojugular reflex, basal crepitation and reduced SpO2 was noted to assess for cardiac overload. Immediate post procedure improvement of patient was judged by reduction in complaints of breathlessness, chest pain and cough, decrease in pallor, neck venous engorgement, tachycardia, tachypnoea, hepatojugular reflex, basal crepitation & increase in SpO_2.

In control group, 2 units of whole blood were transfused at interval of 24hours (1 unit was transfused over 6 hours). Injection Frusemide 20 mg was given intravenously 30 minutes before and after transfusion. Similar monitoring of the patient was done as in case group as well.

If there were no complications, patients were transferred back to ward after the procedure and monitoring. 48 hrs after the partial exchange transfusion in CASE group and both units of whole blood transfusion in CONTROL group, investigations like Hb %, and RBC indices were repeated.

RESULTS

Improvement in patients was judged on the following parameters as shown in table 1:

a. Symptomatic improvement
b. General examination parameters
c. Systemic parameters

All (100 %) CASES were totally relieved of their complaints like breathlessness, palpitations; chest pain etc. immediately after the procedure was over. (TABLE 1)

On general examination also, the improvement was noted.4,5 The average pulse in CASE GROUP was 115.2 / min in antenatal, 136/ min in post natal which reduced to 98.25/ min in antenatal and 104.12/ min in post natal after the partial exchange transfusion. So, there was reduction in pulse by 16.95/ min in antenatal and 31.9/ min in post natal group. But, reduction in pulse in CONTROL GROUP was noted to the tune of 3.6 / min in ante natal group and 3.75/ min in post natal group. (TABLE 1 A)

Similarly, the average reduction in the respiratory rate was 10 (reduced from 26/ min to 16/ min) in antenatal group of CASES and 12 (reduced from 30/ min to 18/ min) in post natal group of CASES .This reduction was only 2.72 in antenatal and 2.2 in post natal group of CONTROLS .(TABLE 1 B) Reduction in pulse and respiratory rate in case group could be attributed to immediate evident rise of hemoglobin , resulting into improvement of oxygen carrying capacity and hematocrit . This also is due to reduced back pressure over lungs and over burden over heart. Pallor, neck venous engorgement and hepato jugular reflex were markedly reduced in a case group but there was no obvious difference in control group. Decrease and / or disappearance of neck venous engorgement and hepato jugular reflex signify decrease in hyper dynamic circulatory rate. Basal crepitations present before the partial exchange transfusion disappeared after the procedure in all cases.This was not so in the controls. The negative balance created in partial exchange transfusions could be the reasons for disappearance of crepitations. Improvement as judged by above parameters in CASES in comparison to CONTROLS was statistically significant.

When we compare the SpO2 before and after transfusion in CASE GROUP, all 33 patients out of 35 (94.28 %) having SpO2 below 95 % showed improvement to the extent that none of patients had SpO2 below 90 % transfusions and only 4 out of 35 (11.42 %) CASES had SpO2 below 91 – 95%. When we look at the CONTROLS, 18 out of 30 (60%) patients had SpO2 below 95 % after the transfusion and 12 out of the 30 (40%) patients didn't show any improvement in SpO2. The creation of negative balance in CASE group enabled us to transfuse the blood over a short period resulting in fast improvement in SpO2. Continued removal of the low hematocrit blood also helped to improve the hematocrit status of the CASE group. Less SpO2 in CONTROLS was due to low rate of transfusion to avoid over loading and due to mixing of transfused blood with circulating blood volume. The difference in SpO2 after transfusion in both CASE and CONTROL group is statistically significant. (TABLE 2), [4,5]

Complications as shown in table were divided into 3 groups. Psychotic behavior developed only in 1 out of 35 (2.85 %) CASE. No major complications in the form of over loading and hemolytic transfusion reactions were seen in case and controls. Only 1 out of 17 (5.88 %) CASE and 2 out of 14 (14.3 %) CONTROLS developed signs of labor. The complication rate in CASE and CONTROL groups was comparable. (TABLE 4). The table shows that time taken to improve was 60 minutes in CASES while it was even more than 30 hrs in CONTROL group. When we compare the average hemoglobin and average rise in hemoglobin in CASE and CONTROLS 48 hrs after the transfusion, it was found to be similar. Rise in hemoglobin was so dramatic in CASE group that hemoglobin beyond 4.5 gm % was seen in 21 cases (60 %) after transfusion compared to 9 cases (25.71 %) before transfusion i.e., the rise was 2 1/2-fold. This rise was achieved within 60 minutes. Whereas in the control group, the hemoglobin beyond 4.5 gm % was seen in 10 (33.3 %) patients after transfusion compared to 9 (30 %) before transfusion, that too after 30 hrs. Thus,this was statistically significant(TABLE 3).

TABLE - 1: IMPROVEMENT IMMEDIATELY AFTERTRANSFUSION

Improvement parameter	CASE (N = 35)		CONTROL (N = 30)	
	Antenatal	Postnatal	Antenatal	Postnatal
	No (%)	No (%)	No (%)	No (%)
1) Symptoms	17 (100)	18 (100)	-	-
2) General Examination i.e. Decrease in • Pulse rate Respiratory rate • Pallor • Neck venous engorgement Hepatojugularre flux	17 (100) 17(100) 17 (100) 17 (100) 17 (100)	18 (100) 18 (100) 18 (100) 18 (100) 18 (100)	-	-
(3) Systemic examination (Respiratory system) Creptitations	17 (100)	18(100)	-	-

TABLE - 1 A: AVERAGE IMPROVEMENT IN PULSE

	CASE (N=35)			CONTROL (N=30)		
	Average pulse before partial exchange transfusion	Average pulse after partial exchange transfusion	Difference or improve-ment	Average pulse before whole blood transfusion	Average pulse after transfusion of 2nd unit of blood	Difference or improvement
Antenatal	115.2/min	98.25/min	16.95	124/min	120.4/min	3.6
Postnatal	136/min	104.12/min	31.9	126.75/ min	123/min	3.75

TABLE - 1 B: AVERAGE IMPROVEMENT IN RESPIRATORY RATE

	CASE (N=35)			CONTROL (N=30)		
	Average respiratory rate before transfusion	Average respiratory rate after partialexchange transfusion	Difference or improvement	Average respiratory rate before transfusion	Average respiratory rate after transfusion of 2nd unit of blood	Difference or improvement
Antenatal	26/min	16/min	10	24/min	21.28/min	2.72
Postnatal	30/min	18/min	12	26/min	23.8/min	2.2

TABLE 2: SpO_2 AFTER TRANSFUSION

SpO2	CASE (N = 35)		CONTROL (N = 30)	
	Antenatal (n = 17)	Postnatal (n = 18)	Antenatal (n = 14)	Postnatal (n = 16)
	No (%)	No (%)	No (%)	No (%)
85-90	-	-	4(28.6)	8(50)
91-95	2(11.8)	2(11.1)	8(57.14)	8(50)
96-100	15(88.2)	16(88.9)	2(14.3)	-

TABLE 3: AVERAGE RISE OF HAEMOBLOBIN

Immediately after transfusion		48 hours after transfusion	
CASE (N = 35)	CONTROL (N = 30)	CASE (N = 35)	CONTROL (N = 30)
1.04 gm%	0.17 gm%	1.84 gm%	1.83 gm%

TABLE - 4: COMPLICATION

Complication	CASE (N = 35)		CONTROL (N = 30)	
	Antenatal (n = 17)	Postnatal (n = 18)	Antenatal (n = 14)	Postnatal (n = 16)
	No (%)	No (%)	No (%)	No (%)
1) Transfusion reaction a) Haemolytic reaction b) Febrile reaction c) Psychotic behaviour	1(5.88)	-	-	-
2) Overloading	-	-	-	-
3) Signs of labour in c/oantenatal patients	1 (5.88)		2(14.3)	

SUMMARY AND CONCLUSION

1. The rise in Sp02 beyond 96% was seen immediately after partial exchange transfusion in 89% CASES when compared to 7% CONTROLS. It was highly significant.
2. The pulse rate settled from average 126/min before transfusion to 100/min after transfusion in CASE group in all patients. There was no obvious difference in pulse rate even after 30 hours of transfusion in CONTROL GROUP. This was highly significant. The respiratory rate settled to near normal in CASE group in 60 minutes whereas no obvious difference was seen in CONTROL group even after 30 hours. This was highly significant.
3. Haemoglobin rise of 1.04 gm% was noted in all CASES within 60 minutes. In the CONTROL group, the rise of haemoglobin was negligible even after 30 hours.
4. The duration of hospital stay was much less in CASES than CONTROLS and the difference was statistically significant.
5. 32 patients had come for follow-up. Out of these, 16 patients had come for regular follow-up. The regular follow-up was more in antenatal patients than postnatal patients as they were more worried about their baby.
6. Cost of material used in CASES and CONTROLS was same. But comparatively less hospital stay, less daily wages loss of their husbands and immediate improvement in quality of life makes the partial exchange transfusion a much superior method

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