VALUE OF PLACENTA BLOOD TRANSFUSION.

Report of Preliminary Work

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The difficulties experienced in getting people to donate blood even to their near relatives, specially women, have set us to evolve a method by which this rich source of blood with a high haemoglobin and r.b.c. content could be utilised for blood transfusions.

It was Major H. S. Waters, who, in 1941, first suggested its possibility to me when I was a house-surgeon. My desire was fulfilled when a beginning was made from a grant by the Gujarat University. As we have an average of 4800 deliveries every year and the yield of blood from each placenta averaged 90 to 100 c.c. it was felt that a very large amount of blood suitable for blood transfusion could be collected almost free of cost. Besides the unused blood could be processed into plasma and other plasma fractions which can be utilised in specific conditions, the chief examples being fibrinogen and globulins. This opens up a new vista for research institutes like the Haffkine Institute. As there is a possibility of a similar institution being started in Gujarat in the near future, this fertile source of blood from the maternity hospitals of the State can be utilised for the preparation of plasma and its fractions.

Rubin, in 1914, was probably the first to describe the use of placental blood for transfusions. Since then many investigators have recorded their experiences with the collection, storage and use of placental blood for transfusions. While many of them have reported successful results, others have found a high precentage of bacterial contamination, accompanied by high incidence of severe transfusion reactions.

According to Josepson (1958) a full-term baby received 75-100 c.cs. of extra blood by late ligation of the cord and Sison and Curtis (1958) found that the volume of blood of the baby increased by 22% and r.b.c. level by 45% if delayed ligation is carried out. They were, however, not sure of the usefulness of this observation.

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It was calculated by Gotsev and Barcroft (1937) that nearly 120 cc. of blood is transfused to the foetus at birth (in sheep) but only 80 cc. of blood could be obtained from the severed umbilical cord. In 1942, Windle Marsh et al obtained 107 c.c. of blood from the human placenta. This results partly from contraction of the umbilical and foetal vessels and partly by contraction of the uterine musculature. They believed that about 50 c.c. of blood remains as residue in the placenta.

In the light of the present day knowledge of transfusions of stored blood, it is apparent that two defects stand in the techniques employed by past investigators:

(1) Rh factor determinations were not made.
(2) The technique of blood collection was subject to contamination.

The present work was started in May 1961 with very meagre literature in English available. Most of the work is being carried out on the Continent in Scandinavian countries. The literature is in Polish language and is difficult to translate.

We learnt from the article by James Walker (1954) that maximum amount of blood from placenta is transferred to the baby within 3-5 minutes if the baby is kept 6″ below the level of the mother.

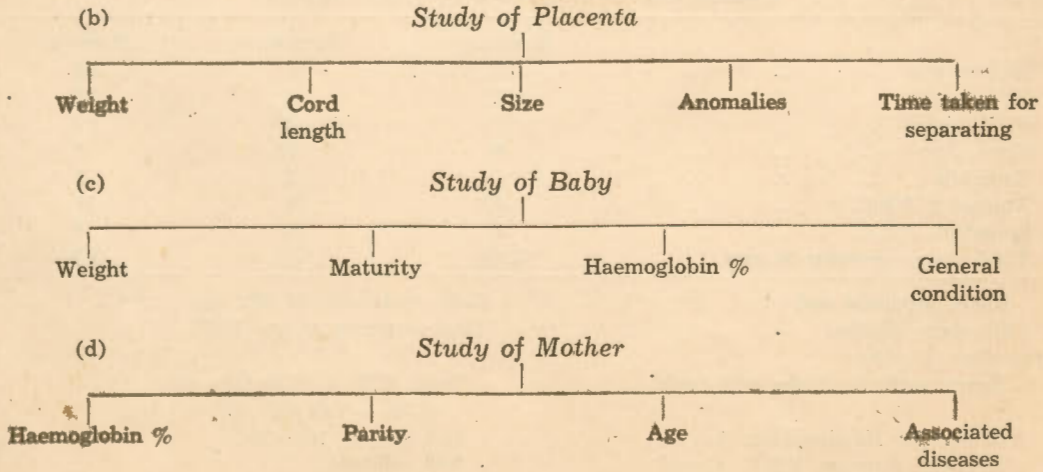
We decided to carry out the work in three stages. During the first stage volume of blood obtained was noted and complete haematological study of the blood was done.

During the second stage a technique of collecting the blood aseptically for transfusions was evolved and cultural studies were undertaken. During the third stage blood transfusions were given for various indications and the results studied.

Stage I

(a) Separation of baby as soon as possible after birth — collection of blood in a beaker from the severed end of cord to decide the available amount of blood. We also collected

TABLE I



the blood in oxalate bulb for different laboratory investigations.

(e) Follow-up of the babies as far as general development, general health, anaemia, development of jaundice and respiratory disease within first few days of life was also made.

Stage II

(a) Collection of placental blood by aseptic precautions.
(b) Storage of blood and its examination at different periods of storage.
(c) Culture of placental blood.

Stage III

(a) Transfusion of placental blood.
(b) Fractions in recipients.
(c) Follow-up of recipients.
(d) Importance and inference of utilisation of this blood.

I hope, it will be quite interesting and important to know the result of our efforts.

TABLE II

Stage I

Observations on Placental Blood

1. No. of blood samples collected			..26
2.	*Minimum*	*Maximum*	*Average*
Quantity of blood obtained ..	52 cc	104 cc	73.63 cc
(Maximum amount in subsequent series 140 cc)			
3. Haemoglobin in gms.	11	18	13.83
4. R.B.C. in millions/cmm	3.6	5.2	4.24
5. W.B.C./cmm	6000	12600	7750

TABLE III

Haematocrit Indices

	Minimum	*Maximum*	*Average*
P.C.V.	38	54	46
M.C.V. cum.	81.2	138.5	99.1
M.C.H. rr	23.9	36.1	30.7
M.C.H.C.%	22.6	57	44.7

TABLE IV

Cytological Examination of Blood Smear

	Minimum	*Maximum*	*Average*
Polymorphs	37	57	45
Lymphocytes	21	44	32
Eosinophils	0	8	3.4
Monocytes	0	3	1
Basophils	0	2	1
Nucleated R.B.C.	6	26	11
Immature R.B.C.	3	14	8
Total serum proteins in gms. ..	3.65	5.13	4.9

Blood grouping and Rh were decided	Only two cases of Rh -ve Most common group B-III
American Workers:	
Serum proteins in the new-born:	Total 6.13 + 0.64 Gm. % (4.96 — 7.40 Gm. %)
(Bancroft) Haemoglobin %:	16.5 Gm. to 18.0 Gm.
(Marks) Average R.B.C. Count:	5.09 millions.

Judging by these standards the figures of r.b.c. and hb.% and serum proteins are slightly on the lower side.

Study of Placenta:

	Minimum	*Maximum*	*Common*
1. Weight of placenta	12 Ozs.	1 Lb. 4 Oz.	1 Lb. to 14 Oz.
2. Size of placenta	5″ x 3″	7″ x 7½″	6″ x 6½″
3. Cord length	12″	20″	18″

(In subsequent series we had two cases where cord lengths were 30″ and 36″).

4. Time taken for separation of placenta in minutes	6′	18′	11′

(In subsequent series one placenta separated after 30 minutes. No case of P.P.H.).

5. *Anomalies of Infarcts*:
At times the infarcts of placenta were observed and lateral insertion of cord was observed. In one case there were two true knots of umbilical cord.

TABLE VI

Study of Baby

1. Sex:	17 males and 9 females.		
2. Weight:	*Minimum*	*Maximum*	*Average*
	Lb. Oz.	Lb. Oz.	Lb. Oz.
	5 - 4	8 - 8	6 - 7
3. Maturity:	All of them were mature.		
4. Haemoglobin %	16.5 Gms.	21.5 Gms.	19.3 Gms.
5. General condition of all was good after delivery.			

TABLE VII

Study of Mother

1. Age.	18 years to 45 years.		
2. Parity:	1st to 17th	common 1st and 4th.	
3. Hb. %.	32% to 72%	Common	52%.
4. Associated diseases — Anaemia, toxaemia and gastrointestinal disorders.			

Follow-up of babies in first week:

We looked for anaemia, jaundice, general development, respiratory diseases, suckling reflex and general activities of babies as compared with other babies. None of the above mentioned conditions could be attributed directly to the withdrawal of blood by early ligation in any baby.

After study of stage I we concluded that on an average we can collect 80 cc. of blood from a placenta and the blood has high haemoglobin concentration.

Stage II

Having been convinced of the high value of the placental blood we proceeded to improve our technique of collection of placental blood.

Collection of Placental Blood by Aseptic Technique:

1. Soon after delivery the baby is separated by cutting the umbilical cord between two clamps applied 2″ to 3″ away from the umbilicus of the baby.

2. The investigator washes the hands and puts on sterile gloves.

3. Placenta remains inside the uterus and the umbilical cord is put on stretch. The umbilical vein is cleaned with sterile dry cotton swab and then with 2-3 spirit swabs.

4. A big-bore (No. 15) needle is inserted in the turgid umbilical vein. It should not remain in close contact with vessel wall which acts like a valve.

5. This needle is connected by 3′ to 4′ rubber tubing of autoclaved tapping set of blood bank to another similar needle inserted in the autoclaved transfusion bottle. This contains 40 cc of A.C.D. mixture of blood bank as anticoagulant and preservative. The bottle has another needle which acts as an outlet for the air.

6. Transfusion bottle is kept nearly one foot below the level of mother and the bottle is continuously stirred to prevent clotting.

7. Exsanguination of placenta is accelerated by gravity. 80 to 100 cc of blood is transferred to bottle within 5 minutes. Milking of the cord is carried out if a long column of blood is present in umbilical vein.

8. Blood remaining in the tubing is taken into two pilot test tubes (one plain and another citrated) and in an oxalate bulb.

9. After removing all the needles the lid of the bottle must be sealed and after applying appropriate number and name, the bottle should be transferred to the storage cabinet at its earliest.

Contra-indications for collection of blood:

1. Premature baby.
2. History of a.p.h.
3. When umbilical cord is clamped very late.
4. History of prolonged labour with early rupture of membranes i.e. probably an infected case.
5. If first puncture does not yield the blood.
6. Twin pregnancy.
7. Maternal diseases like syphilis, Rh incompatibility, jaundice, pulmonary tuberculosis or acute infective fevers.

Storage of blood and its examination at different periods of storage:

We stored the blood up to 21 days and blood was repeatedly examined for microscopic and macroscopic haemolysis, clot formation, disintegration of r.b.c., size of r.b.c. etc. We did not find any adverse effect of storage on r.b.c. sodium, potassium and other biological estimations of serum were not carried out.

Blood was stored in storage cabinet in an airconditioned room.

Culture:

Blood cultures on nutrient broth and sub-cultures on plain agar were carried out on 20 cases of stage II.

The following organisms were grown in 6 cases; cultures were negative in 14 cases.

The common organisms were staphylococcus albus and aureus and B. subtilis, and only in one case streptococus haemolyticus.

Associated Observations in II Stage:

(a) Samples collected.....20.
(b) Seven bloods transfused to five patients. (Will be discuss-

ed with other transfusions in III stage).

(c) Amount: 45 cc to 135 cc on an average 90 cc.

(d) Baby: Weight: 4 lb. 9 oz. to 9 lbs.
Sex: 13 males/7 females.
Blood Groups: again B-III was common.
All were Rh. positive.

(e) *Placenta and cord:*

Time taken for separation of placenta was 12 minutes on an average but varied from 5 minutes to 30 minutes. Length of cord was 17″ on an average but varied from 12″ to 36″.

(f) *Mother:* Para: 1st to 9th — common 1st and 2nd.

Age: 20 to 36 years — common 25 years.

(g) Cord should be clamped very early and exsanguination should be done before separation of placenta.

(h) There was no definite relation between the yield of blood to that of baby's weight or that of placenta; however, it was noticed that the big placenta of healthy mothers, with healthy and heavy babies having long turgid cords, yielded more blood.

Stage III

The red letter day of our project was the 20th of September 1961 when our first placental blood was transfused to an anaemic ante-natal patient having haemoglobin of 28%. The quick improvement in her haemoglobin soothened our tension and prompted us to transfuse further patients. We transfused 63 placental bloods to 43 patients.

In the beginning the placental blood was given only to ante-natal and post-natal anaemic patients, but gradually we extended our transfusions to a variety of patients. It is really interesting to know the number of this varied group who gave excellent response to our placental blood.

As the amount of blood is small there should not be any waste, so we use the following technique:

1. Venepuncture is done and intravenous drip is started with little saline and as the drip settles.

2. Filtered blood is added to the bottle or the blood bottle itself is changed.

3. Blood is given very slowly and when the blood is over, little saline is added to wash the bottle.

TABLE VIII

Patients	*Cases*	*Blood given*
1. Operated cases (during or after operations) .. (Wertheim's Fothergill's, Vaginal hysterectomy, abdominal hysterectomy, ruptured uterus, D & C, evacuation of vesicular mole)	18	28 (1 to 3 bloods)
2. Ante-natal case with anaemia	12	16 (1 to 3)
Ante-natal case with A.P.H.	1	1
3. Post-natal case with anaemia	3	12
4. Post-abortion bleeding	1	3
5. Metropathia	1	1
6. Anaemic patient in medical ward	1	1
7. New-born anaemic baby .. .. (Mother had C.S. for A.P.H.)	1	1

Reactions in recipient:

Mild reactions like rigors and rise of temperature occurred in 12 cases. But no severe reactions like haematuria, haemoglobinuria, anuria, petechial haemorrhages or intra-uterine death of foetus were observed. In one case patient got hyper-pyrexia, in another case we had to stop transfusion as patient had severe vomiting and rigors.

Antihistaminic drugs were used for all the mild reactions and we got quite a good response. All of these mild reactions were transient.

However, three patients, who received placental blood expired but cause of death could not definitely be attributed to placental blood as post-mortem was not done.

1st Case: One day old caesarean baby weighing 5 lbs. 3 ozs. was very anaemic. Caesarean section was done for severe bouts of bleeding (a case of placenta praevia). Baby was getting attacks of cyanosis and respiratory distress; 60 cc. of placental blood was transfused very slowly and general condition of baby improved after transfusion but 2 to 3 hours later baby expired with cyanosis, respiratory distress and convulsions.

2nd Case: A case of prolapse, on whom Dr. Shirodkar's operation of bringing utero-sacral ligaments in front of cervix with perineorraphy and high obliteration of pouch of Douglas was performed, received 140 cc. of placental blood during operation and 350 cc. blood-bank blood afterwords, had severe rigors and hyperpyrexia after operation. Patient became psychotic also and she collapsed later on and expired suddenly in the night.

3rd Case: A post-natal case with severe anaemia was admitted with psychosis and c.c.f. Haemoglobin was only 14% — was given 180 cc. of placental blood very slowly. Patient got a severe rigor and hyperpyrexia after blood transfusion. Patient expired 6 to 8 hours after the transfusion due to congestive cardiac failure.

It is likely that these deaths may have been due to placental blood.

Follow-up of patients:

We could follow-up only few patients. In the patients followed, no untoward reactions were observed. No jaundice was known in any case (Homologous serum jaundice was not recorded by Irving also).

Inference of usefulness of placental blood:

1. Seventy to 140 cc. of blood was available from one patient.
2. Blood has high biological value and high haemoglobin concentration. Hence it is very useful in cases of anemia in adults and children. It acts like packed-cell transfusion.
3. Blood was transfused from first to 19th day of storage without any adverse effect.
4. An anaemic patient, refractory to two transfusions with blood bank blood, responded dramatically to placental blood.
5. Homologous serum jaundice was not observed in any patient.
6. Three to 4 per cent rise in haemoglobin after 2 to 3 days was observed after 80 to 100 cc. of placen-

tal blood. Sense of well-being was observed in all of them.

7. No macroscopic or microscopic haematuria was observed in patients who received placental blood.

8. Patients were given 1 to 3 bottles of placental blood at one time or after an interval of few days.

9. In three operated cases, blood pressure went down to 80 to 90 mm. of Hg. but rose to 120 mm. of Hg. after only 100 cc. of placental blood was transfused. Whether this is due to the presence of any pressor substance in the placental blood (if any) or the blood transfusion itself, it is difficult to decide.

10. No marked effect on the yield of blood was observed in cases who were given oxytoxics. However, the yield was greater when gentle pressure was exerted on the fundus.

Our future plans:

We are planning to make the technique of collecting blood so simple and fool proof, that the staff on duty will be able to collect blood from as many healthy cases as possible. This will enable us to supply a fairly large amount of blood free to the patients from the placental blood bank. The chief problem is the personnel required and observance of asepsis.

Preparation of plasma and plasma fractions may be undertaken in future.

Further haematological studies like haemoglobin typing, fibrinogen levels, serological tests and albumin globulin fractions may be carried out.

Long term follow-up of babies whose umbilical cords were ligated early, with references to the following points, will be carried out:

(a) Examination at birth.
(b) Follow-up after one week.
(c) Follow-up after 3 to 6 months.

Study of hormonal status of the placental blood and its therapeutic value in gynaecological bleeding will be taken up.

Last but not the least, establishment of a Blood Bank from placental blood in the maternity block. This will prove a great blessing to poor patients of ours.

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