

NEONATAL AND OBSTETRIC TRANSFUSION

*Prof. S. Riaz Mehdi¹, Dr. Fiza Mustaqueem² Dr. Nishi Tandon²,
Professor¹, Assistant Professor², Department of Pathology
Era's Lucknow Medical College, Lucknow*

ABSTRACT

Up to four weeks of birth a newborn is considered a neonate. Most often, these neonates are in need of blood or one of its components. The naturally occurring ABO antibodies are not fully developed in neonates and the presence of Wharton's jelly poses problems in routine grouping and cross matching procedures. Indications and the guidelines for transfusion are different in cases of neonates. Extra precautions are recommended. The proper choice of component is of utmost importance. Hemolytic Disease of Newborn (HDN) is a frequently encountered disorder, occasionally requiring exchange transfusion. The indications, procedure and the complications of Exchange Transfusion have to be understood properly by the pediatricians before employing the procedure, especially in low birth weight babies.

The transfusion in obstetric cases and in post partum hemorrhage (PPH) too requires guidelines, which have to be followed. Most of the deaths in obstetrics take place due to PPH which is preventable if the obstetricians take precautions and start the transfusion timely. Beside PPH, perioperative hemorrhage is often an indication for transfusion. All pregnant women must be monitored regularly for iron deficiency anaemia, hemoglobinopathies and alloantibodies during their antenatal period.

Neonates quite often require blood transfusion and their requirements are different and unique. A normal neonate has approximately 85 ml/kg of blood volume. Frequent blood collection for laboratory investigations leads to iatrogenic blood loss and need for transfusion.

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Address for Correspondence

Prof. S. Riaz Mehdi

505, Dilkash Apartment, 3-River
Bank Colony,
Lucknow-226018
Ph. No. : 09506942129, E-mail :
riaz_mehdi@hotmail.com

BLOOD GROUPING OF NEWBORN'S OR CORD BLOOD

ABO Grouping

The ABO antigens are not fully developed on the red cells of a newborn. The naturally occurring complete antibodies are also not present. Whatever alloantibodies are present in the cord blood are of maternal origin.

The reverse grouping is not recommended on newborn's blood. The cord blood contains Wharton's jelly, which may lead to error unless the cord cells are thoroughly washed 3-4 times in saline.

Rh Grouping

In a normal neonate the routine Rh grouping poses no problem, unless the neonatal red cells are heavily coated by IgG antibodies. The contamination by Wharton's jelly may also lead to inaccurate result. In case of Rh Hemolytic Disease of Newborn (HDN) the neonatal red cells may be fully saturated with maternal anti-D leading to "blocked D". The anti-D reagent may not react with the unavailable antigen leading to a false negative result. The forward ABO blood grouping and Rh-D can also be performed by the gel card technique. The card has 6 microtubes. The sixth microtube carries Anti Human Globulin (AHG) reagent and used for Direct Antiglobulin Test (DAT). The requirements and

procedure for the blood grouping and DAT is similar to that employed in cases of adults. (1, 2, 3)

Coombs' (AHG) Test

The DAT is strongly positive in HDN. If the DAT is positive and the maternal serum is negative for antibody screen, there is a strong possibility of ABO HDN or HDN due to low incidence antigen. In case of low incidence antigen HDN the eluate should be tested against the father's red cells. For confirmation, mother's serum against father's cells should be tested. (4)

CROSS MATCHING IN NEONATES

If antibody screen is negative and the neonate has been transfused with O negative or ABO compatible blood then compatibility testing can be omitted. If unexpected antibodies are detected in neonate's or mother's serum then compatibility testing must be carried out. If the neonate is to receive RBC concentrate of an ABO group incompatible with mother's serum, it is necessary to cross match the RBC with neonate's serum.

Procedure

1. Determine the ABO and Rh (D) grouping of the neonate by forward grouping only.
2. Perform DAT on the neonate's red cells for Haemolytic Disease of Newborn (HDN).

3. Screen the maternal serum for any alloantibody.
4. When DAT on neonate's cells and the Indirect Antiglobulin Test (IAT) on mother's serum are negative, cross match the group specific donor cells with the neonate's serum.
5. If the antibody screening on mother's serum is positive or the DAT on neonate's cells is positive (HDN), the donor's cells must be cross matched with the maternal serum.
6. If group O blood is to be given to group A or B recipient then RBC concentrate and not whole blood is recommended. (1, 5, 6, 7, 8, 9)

COMPONENTS TRANSFUSION IN NEONATES

Red Cell Concentrate

The neonates require small amounts of blood transfusion. Many aliquots can be prepared from a single unit of blood or small amount of blood may be collected from a donor after adjusting the blood and anticoagulant ratio. A single unit of blood can provide 12 aliquots of 20 ml each and a unit of Fresh Frozen Plasma (FFP). Units containing 30-60 ml of whole blood (WB) can also be collected. A unit intended for WB should be collected in a double bag. The unit intended for component preparation of RBC, FFP and Platelet Concentrate (PC) should be collected in a set of quadruple bags. (10, 11, 15)

Criteria for RBC Concentrate Transfusion in

Neonates

1. Hb. < 13 gm/dl with severe pulmonary disease.
2. Hb. < 10 gm/dl with moderate pulmonary disease.
3. Hb. < 13 gm/dl with severe cardiac disease.
4. Hb. < 8 gm /dl with symptomatic anaemia.

Criteria for FFP Transfusion in Neonates

The criteria for FFP transfusion in neonates are slightly different from adults.

1. Reconstitution of RBC concentrates to simulate whole blood for use in exchange transfusion.
2. Hemorrhage secondary to vitamin K deficiency.
3. Disseminated intravascular coagulation (DIC) with bleeding. (11)
4. Bleeding in congenital coagulation factor deficiency. (12)

EXCHANGE BLOOD TRANSFUSION

In exchange transfusion the blood volume is replaced by fresh blood. This is one genuine reason for use of fresh blood, where blood no more than 5 days old is recommended. (13)

The aim of Exchange transfusion is;

- To lower the serum bilirubin level and reduce the risk of brain damage (kernicterus);

- To remove the infants' affected red blood cells and circulating maternal antibodies to reduce red cell destruction;
- To correct anaemia and treat any potential for heart failure whilst maintaining euvolaemia. (14, 20)

The indications for exchange transfusion are

- Haemolytic disease of newborn (HDN)
- Sickle cell anaemia
- Cord Hb < 12 mg/dl and/or cord Serum Bilirubin (SBR) > 80: (immediate exchange transfusion)
- 2 Exchange transfusion if rate of rise in SBR is such that SBR is likely to reach 300 micromol/L (aim to keep SBR below 340 micromol/L) (15)

Cross Matching for Exchange Transfusion

The serum or plasma of either mother or neonate can be used for cross matching with the donor's RBC. (16, 17)

Techniques

An exchange transfusion equal to twice the newborn's blood volume is recommended. The blood volume of a full term newborn is approximately 85 ml/Kg of body weight. Volume of whole blood required for two volume exchange transfusion is calculated as ; Weight of newborn in Kg \times 85 \times 2 Two catheters of identical size are required for isovolumetric method. The umbilical artery is used for withdrawal and umbilical vein for infusion. A maximum of 5 ml/kg is used for each with drawal and infusion. (18,19)

GUIDELINES FOR EXCHANGE TRANSFUSION IN LOW BIRTH WEIGHT INFANTS BASED ON AGE

Age Hours	Wt<1500g SBR(micromol/L)	Wt1500g-2000g SBR(micromol/L)	Wt >2000g SBR(micromol/L)
<24	>170-255	>255	>270-310
24-48	>170-255	>255	>270-310
49-72	>170-255	>270	>290-320
>72	>255	>290	>310-340

Complications of Exchange Transfusion

- The most commonly reported adverse events during or soon after exchange transfusion: Catheter related complications; air emboli; thrombosis; haemorrhage
- Haemodynamic (related to excess removal of blood): hypo or hypertension,
- Intraventricular haemorrhage (preterm)
- Hypo or hyperglycaemia
- Hypocalcaemia, hyperkalaemia, acidaemia Potential complications related to exchange transfusion:
- Arrhythmias
- Bradycardia
- Neutropenia, dilutional coagulopathy

- Septicaemia, blood born infection
- Hypo or hyperthermia
- Thrombocytopenia

INTRAUTERINE TRANSFUSION

Intrauterine transfusion can be performed after 24th week of gestation.

The procedure is performed under radiographic monitoring. A needle is passed through the mother's abdomen and uterine wall into the fetal abdominal cavity. The transfused red cells enter the fetal circulation by absorption from the lymphatic channels. An intrauterine exchange transfusion, under ultrasound guidance can also be performed through the umbilical vein.

The high levels of bile pigments in the amniotic fluid, a sign of fetal haemolysis in cases of impending HDN, is an indication for intrauterine transfusion.

Cytomegalovirus Infection

Cytomegalovirus (CMV) infection may occur in perinatal period or can be harboured from mother's breast feed or nursery personnel. CMV is also transmitted by blood transfusion which can be and should be avoided. The CMV is carried by leukocytes. The premature and under weight babies requiring multiple transfusions are at a higher risk of CMV infection. The washing of red cells and leukocyte depleted red cells diminish the chances of acquired CMV infection.

OBSTETRICAL TRANSFUSION PRACTICE

Massive perioperative or periparturitional bleeding occasionally occurs in obstetric and gynaecologic patients. Placenta previa, uterine atony, ectopic pregnancy and post partum haemorrhage are just a few examples of many conditions that could predispose patients to significant blood loss. Therefore, it is important for physicians specializing in obstetrics and gynaecology to be proficient in managing episodes of massive haemorrhage and the practice of most commonly used blood components. Postpartum haemorrhage (PPH) is one of the top 5 causes of maternal mortality in developed and developing countries. The incidence of PPH is 40% after vaginal delivery and 30% after cesarean section.

Criteria for transfusion in PPH are based on the amount of blood loss. In clinical obstetrics, exact measurement of blood loss is often difficult. The most important treatment of PPH is red cell concentrate transfusion. In the past few years, increasing concern has arisen about this treatment. Despite the introduction of several new guidelines, transfusion criteria still vary widely between clinicians. The decision whether to prescribe RBC transfusion is mostly based on postpartum hemoglobin (Hb) values. RBC transfusion should be aimed to reduce morbidity.

Criteria for Obstetric Transfusion

The aim of these guidelines is to offer guidance about the appropriate use of blood in obstetric cases as well as to minimize blood loss.

1. Anaemia should be treated first. If the haemoglobin level is less than 10.5 gm/dl in the antenatal period, iron deficiency anaemia should be considered, once the haemoglobinopathies have been ruled out.
2. All pregnant women should have their blood group and antibodies status checked at 28 weeks of gestation.
3. Patient blood samples used for cross matching of RBC should be no more than 7 days old.
4. Preferably, a Kell- negative blood should be used for transfusion to avoid HDN.
5. The decision to perform transfusion should be based on haematological and clinical profile of patient. Transfusion is rarely indicated in a stable patient with Hb greater than 10gm/ dl and always indicated when less than 6 gm/dl.
6. The red cells and platelets concentrate for transfusion should be Cytomegalovirus (CMV) seronegative.
7. Blood salvage is recommended in patients where intraoperative blood loss is expected to be greater than 1500 ml.
8. Predeposit autologous transfusion is not an option in pregnancy.
9. In cases of DIC or a total blood loss of almost 1 volume of blood, a combination of platelets, FFP and cryoprecipitate is recommended.
10. Fibrinogen level should be maintained above 1.0gm (21,22)

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