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A Case Report on Exchange Transfusion in New Born Infant with Neonatal Jaundice and Rh Incompatibility

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ABSTRACT:

Neonatal hyperbilirubinemia is a common concern in newborns, with ABO blood group incompatibility serving as a significant risk factor for severe jaundice. This case report outlines the successful management of a 3 kg male infant born to a primigravida mother with ABO incompatibility-induced hyperbilirubinemia. The neonate, born at 38.1 weeks via normal vaginal delivery with episiotomy, exhibited signs of jaundice at 6 hours of life, prompting screening and subsequent confirmation of serum bilirubin levels 29.6. The decision was made using the American Academy of Pediatrics (AAP) and categorized the child under high risk according to age and bilirubin level to implement a complete exchange transfusion.

Careful handling of umbilical venous lines, coupled with aseptic precautions, sought to mitigate the risk of sepsis. The procedure, conducted over two hours, demonstrated stability in vital signs and was monitored with a transcutaneous bilirubinometer. Post-transfusion, repeat serum bilirubin tests showed a decrease in bilirubin of 11.6. The infant was discharged after a five-day hospital stay, show casing this innovative approach's potential efficacy and safety. This case contributes to the evolving strategies in neonatal care and emphasizes the importance of tailored interventions in managing hyperbilirubinemia associated with ABO incompatibility.

Categories: Pediatrics, Medical Education, Medical Simulation

Keywords: exchange transfusion, abo incompatibility, neonatal hyperbilirubinemia,push-pull method.

INTRODUCTION;

Hyperbilirubinemia, which is the most common clinical problem encountered in the neonatal period of infants, is an important neonatal problem that may have potentially toxic effects on the central nervous system such as kernicterus, seizures, and permanent neurodevelopmental damage in newborns and increases the stress burden on children. Exchange transfusion has declined in recent years but is still performed in many countries - the procedure is associated with considerable complications.

Among the various etiologies, ABO blood group incompatibility has been identified as a significant risk factor for severe hyperbilirubinemia in newborns. ABO incompatibility is a condition that occurs when a mother's blood type is incompatible with her baby's blood type, which can lead to hemolytic disease of the newborn (HDN). The prevalence of ABO incompatibility varies depending on the ethnic group and location. In general, ABO hemolytic disease is seen in 0.3-0.8% of Caucasian pregnancies, but it is more severe and more frequent at 3-5% in Asian or African pregnancies.

Exchange Transfusion is a procedure performed within Newborn Services for the treatment/correction of anaemia, hyperbilirubinaemia, and to remove antibodies associated with red blood cell haemolysis.

Exchange transfusion (ET) is the removal of an infant's blood with high bilirubin levels and/ or antibody-coated red blood cells (RBCs) and replacement with fresh donor blood. It is indicated when hyperbilirubinemia remains at high levels despite intensive phototherapy and is particularly useful when there is excessive hemolysis. Another indication for ET is moderate-severe acute bilirubin encephalopathy, regardless of the bilirubin level at the time. Although the frequency of neonatal ET has declined markedly in the last two decades, which is associated with the widespread use of intensive phototherapy, anti-D prophylaxis use for Rh-negative mothers, intravenous immunoglobulin (IVIG) use in infants with hemolysis, and advances in prenatal and postnatal care, this procedure is still performed in many countries, especially in those with a high incidence of severe hyperbilirubinemia.

Blood Volumes:

The volume of blood for exchange is calculated using an estimate of the neonate's circulating blood volume.

Procedure

- Consent must be obtained by the Doctor from the parent(s) prior to commencement of the exchange transfusion.
- All exchanges are to be conducted in NICU level 3 by either a Consultant or Registrar/NS-ANP under Consultant's authorisation
- There must be at least one doctor/NS-ANP and one nurse **exclusively involved in the exchange throughout its progress**. If called away, the exchange is to be stopped and the lines flushed with NaCl 0.9%.
- Resuscitation equipment and drugs must be checked and ready for use including adrenaline 1:10,000.
- Ventilator must be set up ready for use at the bed space.
- Blood and IV fluids must be prescribed by medical staff on appropriate charts.

- Asepsis must be maintained throughout the procedure.
- Meticulous care must be taken with volume balance, the rate of the exchange, the vital signs and any signs of air in the lines.

During the exchange ensure volume in/volume out balance does not exceed:

- 5ml < 1000g baby
- 10ml > 1000g baby
- 15ml > 2000g baby

- Nurse the baby on a radiant heat table.
- If the exchange is being done for hyperbilirubinaemia, ensure optimal exposure to phototherapy and biliblanket is maintained
- The infants cardiorespiratory status and oxygen saturation must be monitored continuously. Non-invasive blood pressures are to be taken every 15 minutes.
- Baby remains NBM throughout the exchange. Aspirate stomach contents prior to commencement of procedure and leave the gastric tube on free drainage. This eliminates the risk of aspiration.
- If the exchange transfusion is stopped for any reason for longer than 2-3 minutes, disconnect blood line from the baby, remove blood line from heating sheath, remove line from under radiant heater.
- Observe carefully throughout the procedure that there is no air in the lines.
- In the event of a collapse during an exchange transfusion see 'Procedure in case of adverse reaction and/or negative outcome

Double volume exchange transfusion:

- most commonly used for removal of bilirubin and antibodies
- 2 x circulating blood volume (for example, for a term infant 2 x 80ml/kg = 160ml/kg)
- Replaces approximately 85% of the blood volume
- This will cause an approximate reduction of 50% of the pre-exchange bilirubin level (but can be expected to rebound 4 hours post transfusion to approximately two thirds of pre-exchange level)

Single volume exchange transfusion

- 1 x circulating blood volume (for example, for a term infant 80ml/kg)
- Replaces approximately 60% of the blood volume
- Consider when aetiology is not Haemolytic Disease of the Newborn.

Complications

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 injection of blood): hypo or hypertension, intraventricular haemorrhage (preterm)
- Hypo or hyperglycaemia Hypocalcaemia,
- hyperkalaemia,
- acidaemia

Potential complications related to exchange transfusion:

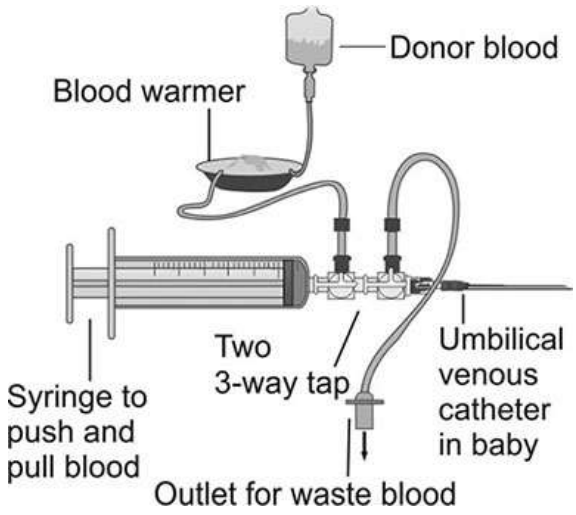
- Arrhythmias
- Bradycardia
- Neutropenia, dilutional coagulopathy
- Feed intolerance, necrotizing enterocolitis
- Septicaemia, blood born infection
- Hypo or hyperthermia

CASE DISCUSSION:

A male infant weighing 3 kg was admitted in the Neonatal Intensive Care Unit (NICU) was born to a primigravida mother at 38.1 weeks of gestational age through a normal vaginal delivery with episiotomy, His APGAR score was 8 and 9 at 1st min and 5th minutes of life respectively. According to the mother's history, the infant cried immediately after birth and was placed by her side, and breastfeeding was given. However, at 6 hours of life, the infant displayed reduced activity and appeared jaundiced. Vitamin K was given within one hour of birth. On 10th June, BCG, OPV, and Hepatitis B vaccines were administered. Initial blood tests, including liver function tests, indicated a total serum bilirubin of 7.2mg/dl, Hence the Coombs test was done that showed positive results, whereas the blood test showed a decrease in reticulocyte count 9.1 (ref: 20000-80000 cells/uL) and grouping revealed the infant to be O positive, in contrast to the o negative blood type of the mother, suggesting ABO incompatibility. At 6 hours of life, serum bilirubin was elevated at 29.6 mg/dL,

and phototherapy was started for 60 hours. On day 4, double surface phototherapy continued for 30 hours. Reticulocyte count was 9.1% and hemoglobin was 11.1 g/dL.

On 17th June, bilirubin remained high at 29.6 mg/dL. The baby was diagnosed with neonatal jaundice and Rh-isoimmunization, and exchange transfusion was planned. Counseling was done with parents and preparation was taken for doing the umbilical catheterization. Subsequently, the pediatrician and the medical team decided on a complete exchange transfusion, other laboratory test results were normal, and the infant was vitally stable and was on formula feed. The parents were briefed about the infant's condition, and written consent for the procedure was obtained. This marked the first instance in the hospital where a complete exchange transfusion was planned for push-pull method. The procedure for performing an exchange transfusion using a UVC line in a newborn begins with the insertion of a sterile umbilical venous catheter under aseptic conditions. The catheter is carefully advanced through the umbilical vein to reach the inferior vena cava-right atrium junction, typically confirmed by radiographic imaging. Once proper placement is ensured, the UVC is connected to a sterile three-way stopcock system to facilitate controlled withdrawal and infusion of blood. The lines, an umbilical venous catheter, were secured for the procedure. Double volume exchange transfusion was done over one-two hours by ensuring all aseptic precaution. The exchange transfusion is carried out in small aliquots, usually 5–10 mL depending on the infant's weight, to maintain hemodynamic stability. Each aliquot of the infant's blood is slowly withdrawn through the UVC and replaced with an equal volume of compatible, pre-warmed donor blood. This cycle is repeated until the desired total exchange volume—commonly twice the estimated blood volume of the newborn is achieved. Throughout the procedure, vital signs, blood glucose, calcium levels, and acid-base status are closely monitored to detect and manage any complications. O-negative blood was arranged for the exchange transfusion, with the calculated volume to be transfused and removed set at 480 ml over two-three hours.



Baby did not have procedure related complications during that period. Jaundice was gradually decreasing. Serum bilirubin level reduced to 11.6 g/dl. Feeding was initiated since day 8 of life and was tolerated well.

Baby was showing signs of gradual improvement up to 9th day of life in terms of decrease in oxygen requirement, feeding tolerance and increase in activity.

DISCUSSION:

The presented case underscores the successful implementation of a push-pull method to exchange transfusion in a neonate with ABO incompatibility-induced hyperbilirubinemia. While further studies are needed to validate the broader applicability and safety of this approach, the present case offers valuable insights into optimizing the management of neonatal jaundice, particularly in cases involving ABO incompatibility.

CONCLUSIONS:

The results of this study demonstrate that hyperbilirubinemia requiring ET and bilirubin encephalopathy are still problems in our country. Although hemolysis is the major cause of hyperbilirubinemia in infants needing ET, the other important factors are early discharge from maternity ward after birth without establishing appropriate breastfeeding, insufficient feeding, under-recognition of jaundice by parents, and late presentation to hospital. Simple policies for blood group analysis of pregnant women, breastfeeding consultations through postnatal care, bilirubin monitoring of newborns before discharge from the maternity ward, and health education of the population about jaundice can identify infants with high risk and help to prevent severe hyperbilirubinemia related short and long-term complications.

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