Waikato District Health Board

Procedure

Exchange Transfusion and Reduction Exchange transfusion– Nursing management in Neonatal Intensive Care Unit (NICU)

Procedure Responsibilities and Authorisation

Department Responsible for Procedure	NICU
Document Facilitator Name	Joyce Mok
Document Facilitator Title	Associate Charge Nurse Manager, NICU
Document Owner Name	Chantelle Hill
Document Owner Title	Charge Nurse Manager, NICU
Target Audience	Registered Nurses, Neonatal Nurse Practitioner, Clinical Nurse Specialist, Medical Staff
Disclaimer: This document has been developed by Waikato District Health Board specifically for its own use. Use of this document and any reliance on the information contained therein by any third party is at their own risk and Waikato District Health Board assumes no responsibility whatsoever.	

Procedure Review History

Version	Updated by	Date Updated	Summary of Changes
3	Joyce Mok	Jan 2013	3 yearly review
4	Joyce Mok	Feb 2016	3 yearly review
5	Joyce Mok	May 2020	3 yearly review

Exchange Transfusion and Reduction Exchange transfusion– Nursing management in Neonatal Intensive Care Unit (NICU)

Contents

1 Overview

1.1 Purpose

To ensure safe & effective management of baby during exchange transfusion or reduction exchange transfusion.

1.2 Scope

Waikato District Health Board staff working in the Newborn Intensive Care Unit (NICU)

1.3 Patient group

Babies and infants in NICU

1.4 Contraindications

Exchange transfusion may be declined by parents for religious or cultural reasons.

1.5 Indications

- Severe hyperbilirubinemia
- Severe anaemia
- Red blood cell haemolysis
- Polycythaemia

1.6 Definitions

Acute bilirubin encephalopathy	A clinical manifestation of bilirubin toxicity. The clinical course is hypotonia followed by hypertonia, retrocollis (backward arching of the neck), or opisthotonos (backward arching of the back) or both. This is due to unconjugated bilirubin entering into the brain causing acute short-term and long-term neurological dysfunction.
Kernicterus	The disposition of bilirubin which causes a yellow staining of the deep grey matter within the brain. Kernicterus is also used to describe a group of signs typical of chronic bilirubin encephalopathy, which include athetoid cerebral palsy, hearing loss, visual and dental problems. The exact level of bilirubin that is likely to cause neurotoxicity in each baby varies and depends on the interplay of other factors that include acidosis, postnatal age, rate of rise of bilirubin level, serum albumin concentration and other illness e.g. infection.
Exchange transfusion	This is a procedure involves removal of infant's blood in small aliquots and replacement with donor blood to remove toxic substances from the blood.
Purpose of exchange transfusion	• Removal of antibody-coated red cells in haemolytic disease e.g. RH incompatibility, ABO incompatibility or autoimmune conditions • Removal of excessive unconjugated bilirubin • Correction of severe anaemia

IV	Intravenous line
UAC	Umbilical arterial catheter
UVC	Umbilical venous catheter
PAL	Peripheral arterial line
Reduction exchange transfusion	A reduction exchange transfusion is a procedure performed to correct polycythaemia or severe anaemia without hypovolaemia. This can be performed using either the one catheter or two catheter push pull technique. The purpose is to reduce polycythaemia and hyperviscosity of circulating blood volume
Polycythaemia	Polycythaemia is used as a crude measure for hyperviscosity and is defined by a venous haematocrit of greater than 65% (0.6-0.65). Affected infants often have associated thrombocytopenia, hyperbilirubinaemia and hypoglycaemia. Treatment is generally based upon the presence of consistent signs and symptoms.
Common Reasons for polycythaemia	• Delayed cord clamping may increase the blood volume and red cell mass of the infant by as much as 55%. • Twin to twin transfusion. • Maternal factors: e.g. diabetes, smoking, hypertension syndromes • Fetal factors: e.g. Beckwith Weidman Syndrome, Neonatal thyrotoxicosis
Symptomatic polycythaemia	Symptoms include respiratory distress, hypoglycaemia, thrombosis
Single catheter push-pull technique	Sequential withdrawal of baby's blood and infusion of fresh donor blood via a UVC or a UAC
Two catheter push-pull technique	Blood is removed from a UAC and fresh donor blood is return through a UVC

2 Clinical Management

2.1 Responsibility

Nurses
Set up equipment for exchange transfusion

NNP/CNS/Medical staff
Must check the set-up prior to commencing the exchange

The set–up is a joint responsibility between medical and nursing staff, but the NNP/CNS/medical staff doing the exchange has the overall responsibility for the procedure

2.2 Competency required

Registered Nurse who has completed Level 3 orientation

2.3 Equipment

- Fresh blood, irradiated, cross-matched and ready for use
- Monitoring equipment – cardio-respiratory monitor, blood pressure monitor, and oximeter
- Radiant warmer / Omnibed™
- Line access, e.g. UAC or UVC, or PAL & IV
- Blood giving set
- Sterile (large) urine meter for waste blood (in hallway store room)
- Extension set
- 3-way taps x3
- 10 or 20mL syringes
- Chlorhexidine with alcohol cleansing agents for lines
- Non-alcohol chlorhexidine cleansing agents for skin
- Cap, mask & gloves
- Sterile CVL gown pack
- Resuscitation equipment – Neopuff™, masks, suction, and drugs available in Resus Trolley
- Blood specimen tubes and laboratory forms
- Consent signed by parents and medical staff/CNS/NNP
- Exchange Transfusion Record forms (in NICU Clinical Workroom)
- Blood warmer and blood warming set – **borrow from Theatre – contact theatre for availability of the warmer and get the warmer from theatre before setting up**

2.4 Procedure for Exchange Transfusion

2.4.1 Preparations

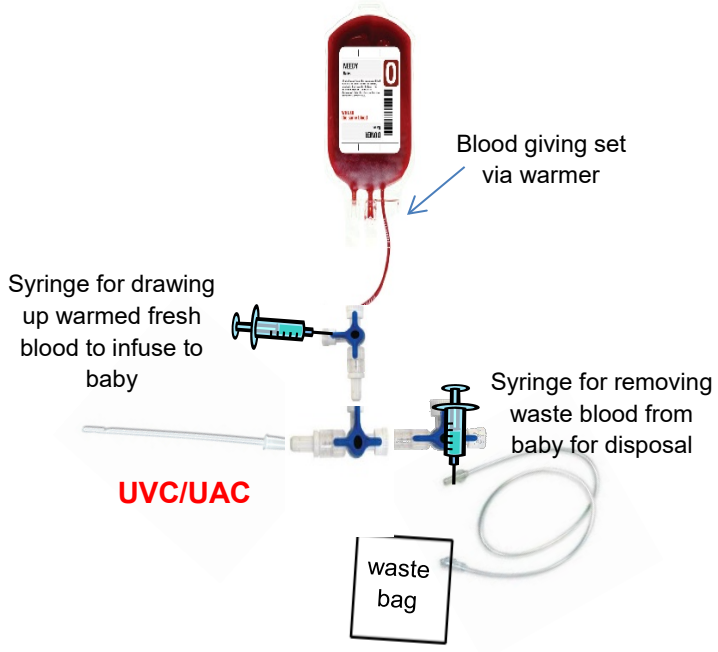
1. Ensure parents understand the procedure and check that consent form has been signed.
2. Prepare infant for exchange:
   - Check serum electrolytes and glucose (no more than 4 hours before starting exchange).
   - Perform procedure with baby on radiant heater/Omnibed.
   - Continuous monitoring of infant's vital signs.
   - Check and record infant's axilla temperature.
   - If infant is not nil by mouth (NBM) for 3-4 hours prior to the procedure, aspirate stomach contents to prevent aspiration should vomiting occur during the procedure.
   - Ensure resuscitation equipment is functional and emergency drugs are ready.
   - Maintain IV maintenance fluids throughout procedure to prevent hypoglycaemia and provide adequate fluid intake.
3. Must ensure IV, UAC, UVC or PAL in situ and patent before sending for blood.
4. Order blood when ready according Waikato DHB Lippincott Procedures: Blood Component and Fractionated Blood Product Transfusion (on intranet) and it must be started within 30 minutes after leaving the Blood Bank.
5. Check blood according to Waikato DHB Lippincott Procedures: Blood Component and Fractionated Blood Product Transfusion against infant's identity blood forms and prescriptions according to steps outlined in Waikato DHB "*Everything Blood*" on the intranet.

2.4.2 Setting up equipment by sterile technique

> ***Special note:***
> *If there are doubts about the set up or the method of doing the exchange transfusion, they must be immediately referred to senior medical or nursing staff and the exchange interrupted until they are answered satisfactory.*

- Perform hand hygiene.
- Put on mask and cap.
- Perform hand hygiene again and put on sterile gown and gloves for sterile procedure.
- Set up equipment on sterile drapes.
- Connect blood giving set to blood warming set, extension set and then three 3-way adaptors (refer to diagram on next page)

- Prepare blood warmer according to manufacturer's instructions.



- Attach extensions set and waste bag to 3-way tap next to syringe for removing waste blood.
- Ensure all connections are luer-locked and secure.
- Check and ensure the lines are correctly set up.
- Attach blood bag to blood giving set and run blood through the lines, blood warming set and blood warmer.
- Medical staff/NNP/CNS connects lines and syringe to 3-way taps using sterile procedure when using UAC and UVC.
- Observe carefully throughout the procedure that there is no air in the line.
- Phototherapy to be continued during exchange.

2.4.3 Calculate volume of blood to be exchange

- Before the procedure, medical staff/NNP/CNS calculates the volume of blood and cycles of out and in according to the infant's weight: a double volume exchange is performed.
- Refer to Waikato DHB NICU Medical Procedure: Exchange and Reduction Transfusions in Neonates (Ref:1646)

2.4.4 Before commencing exchange transfusion

- Nursing and medical staff must check and agree that the circuit set up is correct.
- Ensure the blood is warm before connecting the line to baby to decrease risk of hypothermia because administering cold blood increases blood viscosity and can cause ventricular fibrillation.
- Medical staff/NNP/CNS connects lines and syringe to 3-way taps using sterile procedure.
- The nurse is responsible for recording the “out and in” blood volumes
- Send the first withdrawal of blood for SBR, complete blood count (CBC), blood gas, blood sugar level (BSL) and electrolytes (U&E); other blood tests might be needed as indicated
- If exchange is performed for reasons other than known blood group antibodies, send blood for other tests, e.g. glucose-6-phosphate dehydrogenase (G6PD) screening and viral serology.

2.4.5 Techniques

One catheter push-pull technique

- Medical staff/NNP/CNS performs the exchange transfusion by the push-pull technique via a UVC using sterile technique.
- UAC can be used as directed by the NICU consultant.
- One catheter push-pull technique is commonly used in NICU if UAC/UVC is available.

Two catheter push-pull technique

The UAC/UVC is the preferred routes of administration; however, if they are not available, PAL and IV line may be inserted for the exchange transfusion

- Medical staff/NNP/CNS performs the exchange transfusion by withdrawing blood from PAL and the fresh donor blood is transfused via an IV line by aliquots.
- PAL may be temperamental and withdrawing of blood may cause spasm of vessel and delaying, e.g. the “out cycle”. Therefore the medical staff/NNP/CNS and nurses must pay special attention to ensure the correct volume out and volume in is administered.
- A nurse may be required to assist the procedure by managing one of the lines as directed by the NICU Consultant. If this happens, another nurse must be doing the observations and documenting the blood volumes in and out.

2.4.6 During exchange transfusion

1. Nurse is responsible for recording the volume balance and observations on *Exchange Transfusion Record* throughout the exchange.
2. Observe and document:
   - Time exchange started
   - Time of each withdrawal (out cycle) and infusion (in cycle) of blood
   - Amount of blood withdrawn and infused
   - Continuously monitor and record at 15 minute intervals on the record of *Exchange Transfusion Record* the following observations: heart rate, respiratory rate, SpO_2, BP (non-invasive), skin colour, skin temperature
   - Record axilla temperature recorded 15 minutes after each donor pack is commenced, and then every 30 minutes during the transfusion
   - Monitor Blood Sugar Level (BSL) half way through
   - Observe carefully throughout the procedure that there is no air in the lines
   - Send blood samples to the laboratory for Complete Blood Count (CBC), Serum Bilirubin (SBR), BSL, Electrolytes (U&E) and blood gas.
3. Be aware of possibility of complications and observe the baby carefully
   - Have resuscitation equipment ready.
   - Watch the lines continuously for air.
   - Turn the line off immediately if air is seen.
   - Never have a 3-way tap open to air and the baby.
   - Be very careful if there are large swings in intrathoracic pressure.
   - Observe for apnoea, bradycardia, and tachycardia.
   - Observe for any changes in neurological status: drowsiness, irritability.

   Note:

   If complications occur during procedure, stop procedure, check circuit for leaks and send blood for blood gas, electrolytes and blood glucose.
4. Notify medical staff/NNP/CNS when each 100mL of blood exchanged to evaluate for hypocalcaemia after each 100 mL of exchange completed.
5. Blood is exchanged slowly with calculated volume and cycles according to the weight of the infant.

   Note: Rapid exchange can aggravate cardiovascular changes and prevent normal metabolism.
6. Replace precise volume as calculated with the donor blood slowly using a syringe and discard “out blood” into the waste bag.
7. Gently agitate blood bag every 15 minutes to mix well and prevent blood separating.

8. Take blood for U&E, CBC BSL half way through (if indicated), and at the end of the exchange transfusion. If infant is ventilated, blood gas may be necessary halfway through and at the end of the exchange transfusion.

2.4.7 At completion of transfusion

1. Document the following:
   - Time transfusion complete
   - Total amount of blood withdrawn (out) and infused (in)
   - Any changes in vital signs and condition
   - Medications administered during exchange
   - Infant's current vital signs and colour
   - Infant's tolerance to the procedure
   - Any blood samples taken before, during and after exchange
2. Obtain blood from final aliquot for U&E, CBC and SBR as prescribed to review whether further exchange transfusion is needed.
3. Infant should remain NBM for at least 4 hours post-exchange to prevent complications, e.g. respiratory distress, bowel complications.
4. Inform parents when exchange transfusion is complete.
5. Monitor infant's vital signs continuously. Record and document observations hourly.
6. Monitor infant for any signs of post-exchange transfusion complications, which may be due to blood transfusion, related to the procedures, umbilical catheterisation or fluid overload.
7. Check BSL: one hour post exchange and then 2-4 hourly to detect rebound hypoglycaemia.
8. Nurse infant in neutral thermal environment – radiant heater/incubator and continue phototherapy. Check and record infant's temperature at end of exchange and 1-4 hourly as indicated.

2.5 Reduction Exchange

- This procedure is still to be treated as an exchange transfusion and must follow the same technique, procedure guidelines, observations and documentation as a full exchange transfusion above.
- Consent for treatment is required and documented on a consent form.
- Use either the one catheter or two catheter push pull set up.
- The Consultant MUST give guidance as to the requirements for this procedure.
- For polycythaemia, normal saline can be given through an IV as blood is removed from the UVC or UAC/PAL.

2.6 Potential complications

- Hypotension / shock – too much blood being removed too fast
- Arrhythmia – hypocalcaemia or hyperkalaemia
- Infection
- Catheter malfunction
- Venous thrombosis
- Air embolus
- Hypoglycaemia
- Bowel complications
- Cardiac arrhythmias
- Necrotising enterocolitis
- Coagulopathy
- Apnoea and bradycardia
- Electrolyte disturbances
- Acidosis owing to non-fresh blood
- Thrombocytopenia
- Craft versus host

2.7 After care

- Perform hand hygiene and put on gloves.
- Care of blood warmer: Clean the blood warmer with disinfectant wipes and return it to Theatre.
- Place used lines (e.g. transfusion set and blood warming sets) and any sharps in appropriate containers.
- Place blood bag swing label on baby's *Blood administration checklist*.
- Return used blood bag to Blood Bank by attendants via out tray.
- Remove gloves and wash hands.

3 Audit

3.1 Indicators

- There is documented evidence of signed consent form for every baby receiving an exchange or partial exchange transfusion.
- All required laboratory investigations are completed as per guideline.
- There is documented evidence of physiological assessments at no less than hourly intervals.

4 Evidence base

4.1 References

- Starship Newborn Services (2018). Exchange Transfusion in the Neonate. *Clinical Guideline*. Retrieved on January 24, 2019 from https://www.starship.org.nz/for-health-professionals/newborn-services-clinical-guidelines/e/exchange-transfusion-in-the-neonate/
- Corkery, C. (2015). Communications via email on December 16, 2015.
- Gardner S. et al. (2016). Merenstein & Gardner's handbook of Neonatal Intensive Care (8th Ed.). St. Louis, Missouri: Elsevier.

4.2 Associated Waikato DHB Documents

- Waikato DHB Blood Resources: Everything Blood (intranet)
- Lippincott Procedure: Blood Component and Fractionated Blood Product Transfusion
- Waikato DHB ICU Medical Protocol: Exchange and reduction transfusion in Neonates (1646)
- Waikato DHB NICU Medical Protocol: Phototherapy in NICU (2615)
- Waikato DHB NICU Nursing Procedure: Phototherapy – Nursing management (4944)
- Waikato DHB forms:
  - Skills checklist: administration of blood products W0582HWF
  - Blood administration checklist P0028FXS
  - Consent for use of blood components/products T1528HWF
  - Medical Directive for patients who refuse blood transfusions (including Jehovah Witness) G3825HWF
  - Parent information for blood transfusion in children C1806HWF
  - Blood Bank Request Form P0003FXS