EXCHANGE TRANSFUSION

This LOP is developed to guide clinical practice at the Royal Hospital for Women. Individual patient circumstances may mean that practice diverges from this LOP.

PURPOSE & SCOPE: To replace an infant's blood volume with cross-matched blood that is appropriate (See note) to treat severe Haemolytic Disease of the Newborn

NOTE: Blood and Plasma from Blood Bank
- Red Blood Cells (RBCs) less than 5 days old
- Type O Rh negative RBCs and cross-matched against infant and mother
- 10% Dilution of RBCs with FFP or Albumin is recommended e.g 90mL RBC + 10mL FFP or Albumin.

[Refer to Appendix 1 (p 7/15) for instructions on dilution].
• Medical Staff is to re-constitute the blood with nursing assistant/s
(Ref.: Minutes of NCC Clinical Management Meeting of 26th August & 6th October 2004)

Volume of RBCs and FFP to be Prescribed:-
ESTIMATED SINGLE VOLUME EXCHANGE = 85mL x weight (kg).

ESTIMATED DOUBLE VOLUME EXCHANGE = 85 x2 x weight (kg) = 170 mL x weight (kg).

EQUIPMENT:
Hat, mask, Sterile gown
Surgical gloves & Goggles
Cross-matched blood/packed cells
Vygon Set or REM System Level 2 Set
Extension Set (WB35000) [for use with Biegler Dry Heat Infusing Warmer]
Blood & Infusion Warmer (Biegler BW 485L)
Pathology tubes for biochemistry & haematology
Exchange Transfusion Record Chart/s
Cardiorespiratory monitor
Oximeter
Servo control and skin probe cover.
NSW Newborn Screen Card
Consent form for parents
Viraclean Solution
Antiseptic solution for line insertion:
≥ 28 weeks gestation = Chlorhexidine 0.5% in 70% alcohol (Pink solution)
≤ 28 weeks gestation = Chlorhexidine Acetate Aqueous Solution 0.05%w/v (Blue solution)

Standard Precautions (Ref. In Intranet; Southern Sector Intranet; Infection Control Procedures; Standard Precautions – S.8)

PROCEDURE

<table>
<thead>
<tr>
<th>Process</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ensure the procedure is explained to parent/s and a written consent is obtained.</td>
<td>Written consent for use of blood product is required .</td>
</tr>
<tr>
<td>2 Identify the infant for exchange transfusion. Proceduralist performs a “Time Out” on the infant.</td>
<td>Time Out: Correct Patient; Correct Procedure; Correct Site; Correct equipment.</td>
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<tr>
<td>3 Transfer infant to Level 3. Place infant on an open bed under radiant heater if not in an incubator.</td>
<td>To allow for easy access during the procedure.</td>
</tr>
<tr>
<td>4 Ensure an appropriate vascular access is established to allow infusion and withdrawal of infant’s blood.</td>
<td>Umbilical venous access is recommended for single exchange access.</td>
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</tbody>
</table>
5. Ensure that pathology request forms are printed for pre-exchange SBR & Biochemistry.

NOTE: Performing the Exchange via an Umbilical Access:
- See Procedure on Insertion of an Umbilical Venous catheter to establish the access.

6. **Pre-exchange transfusion Preparation and Requirements**

   6.1 Nurse the infant in a comfortable position. To keep the infant comfortable during the procedure.

   6.2 Attach temperature probe and set it on servo control. To monitor the infant’s body temperature during the procedure.

   6.3 Attach cardio-respiratory monitor and oximeter to infant to establish a good QRS trace. Set alarms as appropriate for the infant. To provide vital signs monitoring during the procedure. To establish a set of baseline observation to reference for deviation during the exchange procedure.

   6.4 Ensure access line/s for exchange procedure are secured. To prevent the risk of accidental dislodgement.

   6.5 Check the infant’s identification label with nursing notes, parenteral fluid chart and the bag of blood with particulars on the *Blood and Blood Products Administration Form* together with the *SEALS Blood Bank Issue Report*. Check with the Medical Officer:
   - Name of infant
   - CMV Negative
   - MRN
   - Irradiated
   - Blood Group – Patient and Product
   - Expiry Date & Time
   - Product No. of Blood

   6.6 MO and nurse must sign the appropriate charts. To verify and record the checks that is done.

   **NOTE:** Ensure the nurse who commences the procedure must complete the exchange procedure with the MO. This is a safety “rule” to monitor the procedure and the infant’s behaviour.
6.7 Before commencing exchange transfusion, obtain a set of observations:

- Axilla temperature (Temp)
- Heart rate (HR)
- Respiratory Rate (RR)
- Saturation reading ($\text{Spo}_2$)
- Blood pressure (BP)
- Blood sugar level (BSL)
- Colour of infant
- ABG (as appropriate for infant)
- Girth measurement

Provide a baseline for reference.

7 **EXCHANGE TRANSFUSION VIA AN UMBILICAL ACCESS**

7.1 Wash hands

7.2 MO puts hat, mask and protective eye goggles on before performing a surgical scrub. Dons sterile gown and sterile gloves after scrub.

To adhere to the 5-Moments of Hand Hygiene. To ensure PPE.

Exchange transfusion via the umbilical access is a sterile procedure.

8 **Using a Vygon Exchange Transfusion Set**

8.1 RN open and pass the green pack of Vygon exchange transfusion set to MO. (See picture 1 & 2).

To maintain Sterility of equipment.
**EXCHANGE TRANSFUSION cont’d…**

**MO:**

- connect the blood giving set (with filter) to the heating tubing (Picture 3)
- then connect the heating tubing end to the 4-way tap (Picture 4)
- connect the plastic tubing for the waste bag to the 4-way tap (Picture 4)
10 MO pass the spike-end of the blood giving set to RN. to connect to the bag of blood (Picture 5).

11 Prime the blood giving set with blood (Picture 6).
12 Using a REM Level 3 – SINGLE Access Exchange Transfusion Set (See Appendix 1) via an Umbilicus

12.1 Attach the bag of Plasma and Blood to the Y-filter set.

12.2 Mix the RBCs and FFP (See Note on Page 7) in the burette.

12.3 Connect burette to the infusion line.

12.4 Connect Warming circuit to the infusion line.

12.5 Prime the line and attach to 4-Way Tap.

12.6 Prime the 4-way tap and attach to the Umbilical catheter.

12.7 Attach the Waste-line to the 4-Way Tap.

12.9 Connect a 5mL luer syringe to the nozzle of the 4-way Tap that has a “Flag” (Picture 6).

12.10 Ensure that there is no trapped air in the line.

13 The Blood Warmer

13.1 Connect power cable to power supply and switch on.

A short beep (control of alarm) sounds and the standby LED (Picture 7 – No. 1) lights up.

13.2 Adjust the desired temperature to 37°C:
Use buttons ▲ and ▼ (Picture 7 – No. 2) in Standby mode to adjust temperature.
Temperature can only be adjusted in Standby Mode.

13.3 Press ◐ button (Picture 7 – No. 3) to start the heating.

13.4 Position the tube in the groove of the heat exchanger. (Picture 8).

13.5 Starting from rear of heat exchanger, coil the tube forward without tension in a clockwise direction – x 4 coils. (Picture 8).

(Caution: Length of tubing between the instrument and patient must not be shorter than 40 cm or be under tension) (Ref.: BW 685/685S Instruction Manual, Edition 08/2010).
13.6 Ensure that the temperature reading on the BW 458 L is at 37ºC during the procedure. (Ref. Haematological Registrar, Blood Bank, Extn. 29041).

NOTE:
1. Load the burette with 135 mL of RBCs and 15 mL of FFP = 10% dilution
2. Prime the line. (Only a small amount of blood will be left in the burette)
3. Re-load the burette with 126mL RBC and 14mL FFP = 10% dilution to the remainder of blood in the burette.
4. Gently rotate the burette every 10 minutes to minimise sedimentation of RBCs in the burette.
5. Gently rotate the RBCs pack before using for the burette.

APPENDIX 1 – SINGLE ACCESS EXCHANGE SET-UP

Ref:
Exchange Transfusion Set, Level 2, REM Systems Pty.Ltd.
14 While waiting for the blood giving set being primed, MO to insert the waste line into the waste bag (Picture 9). RN/RM to secure it with leucoplast *(if using a Vygon Exchange Transfusion Set).*

![Picture 9](image.png)

To provide a receptal to discard the infant’s blood. To avoid accidental blood spillage on the floor if the tube detaches from the waste bag during the procedure.

15 The set-up is now ready for the procedure.

**Using a REM Level 3 – DOUBLE Access Exchange Transfusion Set**

*Appendix 2*
16 Use the REM Systems Pty. Ltd.: Two Vessel Exchange Transfusion Kit (see Appendix 2).

16 Establish an arterial access (umbilical or radial access) aseptically. Maintain patency with an infusion until the second intravenous access (peripheral) is established and exchange transfusion blood is available to start the procedure.

17 Establish a peripheral venous access. Maintain patency with an infusion while waiting for the availability of exchange transfusion blood to start the exchange procedure.

18 Ensure that Pre-exchange transfusion Preparation and Requirements are done and the intravenous cannula is correctly strapped (Picture10).

19 Set up equipment when blood is available. (See Appendix 3).

APPENDIX 3 – DOUBLE ACCESS EXCHANGE SET-UP

Transfusing infant with fresh blood

Removing blood from infant via an Umbilical arterial access.
THE EXCHANGE PROCEDURE

Double Access Procedure

20.1 Establish an arterial access: umbilical or radial.
21.1 Attach 3-way tap to umbilical catheter and tubing from waste-bag.
21.2 Attach a 20 mL syringe to 3-way tap.
20.1 Turn the 3-way tap in a **clockwise direction** to the umbilical/radial catheter.
20.2 Draw blood sample for serum bilirubin, serum electrolytes, haemoglobin measurement and NSW Newborn Screen (if not previously collected) via a 5 mL syringe.
20.3 Turn 3-way tap to the **OFF** position before disconnecting the 5 mL syringe. Change syringe to a 20 mL luer-lock syringe before commencing the exchange transfusion.
20.4 Assisting RN/RM is required to send blood samples to pathology immediately and ensure samples and pathology forms are marked “Urgent”.
20.5 Record amount of blood taken for pathology on Observation Chart.
20.6 Turn the 3-way tap in a clockwise direction to the 20 mL syringe: **OPEN** to the umbilical catheter /radial arterial cannula.
EXCHANGE TRANSFUSION cont’d…

20.7 Draw 5 mL of infant’s blood into 20 mL syringe.

20.8 Turn the 3-way tap (clockwise direction) to the waste line and discard the blood.

20.9 While the infant’s blood is withdrawn, simultaneously, turn the 3-way tap (clockwise direction) of the venous access to the bag of blood.

20.11 Withdraw 5mL of new blood from the blood bag into the 20 mL syringe.

20.12 Turn 20 mL syringe (clockwise direction) to the venous cannula, slowly push the new blood into the peripheral vein as the infant’s blood is withdrawn from the arterial access. Wait for 2 seconds.

20.14 Continue withdrawing and infusing simultaneously blood during the exchange procedure.

20.17 Repeat actions from No. 20.6 to No. 20.14 until the procedure is complete.

NOTE:
Calcium Gluconate is no longer required during exchange transfusion.

21 Double Access Procedure

Peripheral Intravenous Access

21.1 Attach the bag of Plasma and Blood to the Y-filter line.

21.2 Mix the RBCs and FFP (See Note on Page 7).

21.3 Connect burette to the Y-filter line.

21.4 Connect the infusion line to the burette.

21.5 Connect Warming circuit to the infusion line.
EXCHANGE TRANSFUSION  cont’d…

21.6 Prime the line and attach to 3-Way tap.

21.7 Attach a 20mL syringe to 3-way tap and then to the infant’s peripheral intravenous cannula.

**ALTERNATIVELY**

21.8 Attach the primed line to the infant’s peripheral intravenous cannula.

21.9 Insert the infusion line into an infusion pump

21.10 Calculate the infusion rate and set the infusion pump to transfuse the infant simultaneously with the blood withdrawal via the umbilicus.

22 Observations during the Exchange Procedure

22.1 Ensure continuous monitoring of the infant via the cardio-respiratory monitor. Observations to be written on Exchange Transfusion Record *(Page T7 – 12/14 & T7 – 13/14)* are:

- 15 minute readings from the monitor of:
  - Heart Rate
  - Respiratory Rate

Hourly readings of –

- Servo temperature
- Temperature of Blood & Infusion Warmer (Biegler BW 685) – maintain at 37°C
- Blood Pressure (Cuff Reading)
- Hourly saturation reading

Observe infant’s behaviour during the procedure.

22.2 RN/RM is required to record the amount of blood removed and infused on the Blood Exchange Chart (Appendix 4).

22.3 Collect blood sample for: serum electrolytes at half-way through the procedure. Send to pathology with samples and pathology forms marked “Urgent”.

NOTE: A staff is required to assist with the procedure by drawing blood into the syringe and infusing slowly and simultaneously with the blood that is withdrawn from the umbilical access.

To assess the post-exchange biochemistry and haematology of the infant.
**EXCHANGE TRANSFUSION**

23 **On completion of the procedure:-**

- detach the exchange transfusion set from the umbilical catheter
- connect a maintenance infusion line to the umbilical catheter and continue infusing as prescribed
- remove all the sterile drapes
- insert blood pack in a plastic bag.
- Keep by the infant’s bed for 24 hours. Dispose the bag in the contaminated waste bin thereafter.
- remove and dispose sharps
- discard disposable equipment
- ensure access line is secured.
- check access site for bleeding
- clean work area.

24 Wash hands.

25 Document the infant’s notes

26 **Post-Exchange Transfusion**

24.1 Monitor the infant’s BSL immediately post-exchange transfusion.

24.2 If stable, monitor the infant as per Unit Protocol.

24.3 Measure the infant’s girth and record (See Page.....).

24.4 Auscultate and assess for bowel sounds.

24.5 Observe all stools for blood.

24.6 Maintain a strict intake and output record.

24.7 Ensure phototherapy lights are on the infant.
**EXCHANGE TRANSFUSION** cont’d…

24.8 Inform parent/s of the completed procedure. Invite parent/s to visit the infant.

24.9 Document the procedure in the nursing notes. Include the infant’s behaviour, response and related incidence/s to the procedure.

To provide data for reference of the infant’s state during the procedure.

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**References**

Australian Red Cross Blood Services, Use of Blood Filters, Transfusion Medicine Manual, [www.AustralianRedCrossBloodService](http://www.AustralianRedCrossBloodService), 2009, ARC.


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<table>
<thead>
<tr>
<th>Date</th>
<th>Revised No.</th>
<th>Author; Revised by</th>
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<td>2005</td>
<td>Primary</td>
<td>CNC K.B. Lindrea</td>
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<tr>
<td>2013</td>
<td>3</td>
<td>CNC K.B. Lindrea &amp; NCC Policy/ Procedure Working Group</td>
</tr>
</tbody>
</table>
### Blood Group

<table>
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<tr>
<th>Date</th>
<th>Time Taken</th>
<th>Temp (°C)</th>
<th>HR (bpm)</th>
<th>RESP (mmHg)</th>
<th>MEDS</th>
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<td>1st April</td>
<td>Hr</td>
<td>36.5</td>
<td>70</td>
<td>90</td>
<td>None</td>
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<tr>
<td>2nd April</td>
<td>Hr</td>
<td>36.8</td>
<td>80</td>
<td>100</td>
<td>None</td>
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<td>3rd April</td>
<td>Hr</td>
<td>37.0</td>
<td>90</td>
<td>110</td>
<td>None</td>
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</table>

### Comments
- Increased urine output
- Tachycardia
- Hypotension

### Investigations
- Blood tests: CBC, PT/INR, glucose, electrolytes, albumin
- Urinalysis: microscopy, culture
- Electrocardiogram
- Chest X-ray: cardiac enlargement

### Discharge
- Patient discharged on 3rd April
- Instructions given to follow-up at clinic
- Medications: Metformin, Atorvastatin

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**Additional Notes:**
- Blood for group, crossmatch, HBsAg, HCV, HIV, Hepatitis, TB
- Consent & Explanation to parents
- Baseline vital signs, temperature, HR, BP, and oxygen saturation
- Access times for exchange procedure are secured

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**Tick the following procedures:**
- Phototherapy
- Intravenous fluids
- Oral feeds
- Intravenous medications
- Corticosteroids
- Pain medications
- Antibiotics
- Diazepam
- Paracetamol
- Monitor electrolytes
- Monitor blood pressure
- Monitor temperature
- Monitor respiration
- Monitor urine output
- Monitor bowel sounds
- Monitor complications

**Tick the exchange procedure:**
- Phototherapy
- Intravenous fluids
- Oral feeds
- Intravenous medications
- Diazepam
- Paracetamol
- Monitor electrolytes
- Monitor blood pressure
- Monitor temperature
- Monitor respiration
- Monitor urine output
- Monitor bowel sounds
- Monitor complications

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**Post-Exchange:**
- Monitor electrolytes
- Monitor blood pressure
- Monitor temperature
- Monitor respiration
- Monitor urine output
- Monitor bowel sounds
- Monitor complications

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**Medications:**
- Metformin, Atorvastatin
- Corticosteroids
- Diazepam
- Paracetamol
- Intravenous fluids
- Intravenous medications
- Antibiotics
- Monitor electrolytes
- Monitor blood pressure
- Monitor temperature
- Monitor respiration
- Monitor urine output
- Monitor bowel sounds
- Monitor complications

**Post-exchange medications:**
- Monitor electrolytes
- Monitor blood pressure
- Monitor temperature
- Monitor respiration
- Monitor urine output
- Monitor bowel sounds
- Monitor complications

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**Referral:**
- Neurology
- Cardiology
- Hematology
- Nephrology
- Endocrinology

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**Follow-up:**
- Clinic appointment in 3 months
- Repeat blood tests
- Repeat ultrasound

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**Next of Kin:**
- Mr. John Smith
- Phone: +1234567890

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**References:**
- Hospital Policies
- Clinical Guidelines
- Evidence-Based Medicine

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**Signatures:**
- Doctor: Dr. Jane Doe
- Nurse: Nurse Jane
- Parent: John Smith