



## GUIDELINE & PROCEDURE

**SUBJECT:** Exchange transfusion in NICU

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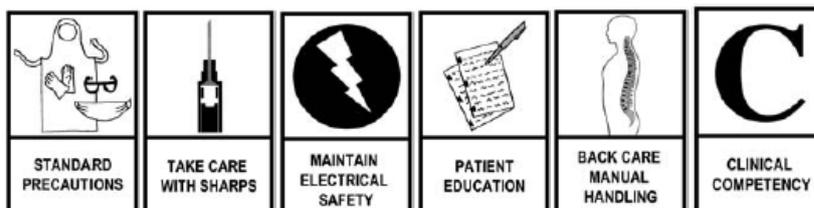
NICU Executive Management Committee

**KEYWORDS:** blood, transfusion, exchange, neonates, jaundice, hyperbilirubinaemia, NICU

**Disclaimer:**

It should be noted that this document reflects what is currently regarded as a safe and appropriate approach to care. However, as in any clinical situation there may be factors that cannot be covered by a single set of guidelines, this document should be used as a guide, rather than as a complete authoritative statement of procedures to be followed in respect of each individual presentation. It does not replace the need for the application of clinical judgment to each individual presentation.

S.W.P.



**RATIONALE:**

Since the introduction of intensive phototherapy and immunoglobulin infusion for isoimmune haemolytic jaundice, exchange transfusions are performed in rare instances in the neonatal intensive care unit, and only after careful consideration. The procedure is utilized for the management of hyperbilirubinaemia and haemolytic disease of the newborn, when other methods of treatment have been ineffective.

Other indications for exchange transfusion or partial exchange transfusion are listed.

**AIM:**

To modify abnormal values of the circulating bloods composition, by removing one or more components whilst maintaining a close to constant blood volume.

**OUTCOME:**

1. The procedure is streamlined, NEVER RUSHED, and the infant's wellbeing is monitored and supported accordingly to promote immediate and long term outcomes.
2. Asepsis is maintained throughout procedure.
3. HNEAH Policies & NICU Guideline for blood product administration are adhered to.
4. Parents are fully informed of procedure and signed consent for blood products is obtained on the Blood Transfusion Form.
5. Supportive strategies are implemented post procedure to assist therapeutic efficacy.

**INDICATIONS FOR EXCHANGE TRANSFUSION:**

- Hyperbilirubinaemia – to lower serum bilirubin (SBR) levels and prevent Kernicterus
- Rhesus/ABO incompatibility – removal of red blood cells with antibodies or free circulating antigens to reduce degree of red cell destruction
- Severe Anaemia – replace volume with that containing a higher red blood cell mass
- Hydrops Foetalis – to regulate blood volume and allay potential heart failure
- Other rare indications – Hyperkalaemia, Drug toxicity, Disseminated Intravascular Coagulation (DIC)

## **HYPERBILIRUBINAEMIA**

Bilirubin is produced from the metabolism of haeme, the active component of the red blood cells. When abnormal or premature red cell destruction occurs the concentration of bilirubin increases. These normal processes are physiological in nature, however certain factors can influence the level of bilirubin produced. Severe hyperbilirubinaemia is usually pathological in nature including;

- **Haemolysis;**
  - ABO/Rhesus incompatibilities
  - Bacterial and viral sepsis (TORCH infections, bacterial septicaemia/meningitis)
  - Inherited disorders of RBC metabolism
    - RBC membrane defects (e.g. spherocytosis)
    - RBC enzyme defects (e.g. G6PD deficiency)
  - Inherited disorders of bilirubin metabolism (e.g. Gilberts disease, Dubin-johnson syndrome, Crigler Najjar syndrome type I and II)
  - Hypothyroidism
- **Extravasation of blood**
  - Cephalhaematoma/Excessive bruising
  - Pulmonary/cerebral/retroperitoneal haemorrhages
- **Diminished hepatic perfusion and function (Hypoxia, asphyxia)**
- **Inborn errors of metabolism**
  - Galactosaemia
  - Fructosaemia
  - Cystic Fibrosis.

Significant haemolysis, regardless of the cause, places a greater metabolic workload on the immature neonatal liver. This increased bilirubin load commonly results in unconjugated hyperbilirubinaemia. The need for an exchange transfusion as a necessary treatment method can be determined through assessment of:

- serum bilirubin (SBR) levels,
- the rate at which SBR levels are increasing,
- the gestational age,
- days of age, and
- possible existing conditions or prenatal factors,

As serum bilirubin levels rise and binding sites are lacking, free bilirubin results which crosses the blood brain barrier and deposits into the brain tissue resulting in varying

degrees of neurological injury (Kernicterus).

A double volume exchange transfusion replaces up to 85-90% of the circulating red blood cell volume and removes antibody coated red cells helping to prevent further haemolysis and also facilitates a reduction of serum bilirubin by up to 50%.

While this is beneficial for neurological protection, it can be a transient result. As serum bilirubin levels decrease post-exchange, bilirubin stored in the tissues is then released, which is reflected in a rebound escalation in the serum bilirubin levels of the blood. Along with close monitoring of serum bilirubin levels, and the use of high intensity phototherapy the need for further exchange transfusions is often curtailed.

**See Appendix 1: Guidelines for exchange transfusion in infants 35 or more weeks' gestation.**

These cut offs are a guide only and individual levels for determining need for exchange transfusion will be made by the Neonatologist after evaluating various factors such as infant's gestation, reason of hyperbilirubinaemia, day of life, rate of SBR rise etcetera.

## **EXCHANGE TRANSFUSION VOLUME FORMULAE:**

The volume required is dependent on the reason for exchange and is determined by the consultant.

### *1. SINGLE VOLUME EXCHANGE (anaemia with volume overload)*

Preterm/Term infant - 80-100mls/kg

Extremely Preterm (<28 weeks) infant - 100-120mls/kg

$$\text{Volume exchanged (mls)} = \frac{\text{Wt (kg)} \times \text{Blood volume} \times (\text{Hb desired} - \text{Hb initial})}{\text{Hb of red blood cells} - \text{Hb initial}}$$

### *2. DOUBLE VOLUME EXCHANGE (for hyperbilirubinaemia)*

Preterm/Term infant – 80-100mls/kg x 2

Extremely Preterm (<28 weeks) infant – 100-120mls/kg x 2

## **PRE - EXCHANGE REQUIREMENTS:**

### *Staffing:*

- The exchange transfusion should ideally be performed in the intensive care nursery
- It must always be supervised by an experienced senior medical staff member and an experienced nurse. These two clinical members must carry out the exchange from beginning until completion.
- Attach a “Do Not Disturb During Procedure” sign at bedside

### *Ordering Blood:*

- Use current bare weight or birth weight (which ever is greater) for calculations.
- Calculate volume of blood products required in accordance with relevant formula and in accordance with the indication for exchange transfusion.
- Request appropriately cross-matched blood products (Packed red cells and FFP) from Haematology indicating reason for exchange transfusion
  - Specify total volume required for exchange including priming of lines
  - Donor blood should be CMV negative and irradiated
  - Request most freshly available blood; to promote count of viable RBC and to minimise risk of hyperkalaemia and acidosis

### *Consent:*

- Informed parental consent for procedure must be attained prior to commencement.
- Signed consent should be obtained on Blood Transfusion form for blood products as per unit guidelines.

### *Monitoring equipment:*

- Nurse infant on open care bed with servo controlled radiant heater, ensure temperature probe secured to infant
- Cardio- respiratory monitor applied to infant
- Pulse oximeter applied
- ABG & BSL available

### *Resuscitation equipment:*

- Check infant’s resuscitation equipment (Neopuff and Suction) connected and in working order

- Ensure resuscitation trolley checked, stocked and in close proximity

*Nursing Management:*

- Infant should be made nil by mouth with a size 8 orogastric tube in situ. Any gastric contents must be aspirated and discarded and the orogastric tube must remain on free drainage
- Ensure availability of separate IV line for maintenance fluids & medications
- Ensure that the infant is safe and settled using non-pharmacological means (e.g. nesting, sucrose, pacifier)
- Phototherapy should preferably be continued during the exchange transfusion
- Record baseline observations, including;
  - Heart rate
  - Temperature
  - Respirations
  - Blood Pressure
  - Oxygen Saturations
  - Infants' colour, tone & behaviour
  - Urine output/urinalysis

**INITIAL STEPS:**

- Confirm correct patient, check patient identification labels on infant
- Undertake set-up in a sterile manner
- Follow the NICU guidelines for insertion of UVC and UAC (optimal for monitoring and sampling, necessary for isovolumetric method) using appropriate set up
- Check blood products as per hospital policy and NICU Guideline 5-5. 6. 4
- Set up two sterile trolleys for second sterile procedure (using equipment from exchange transfusion box);
  - one for exchange procedure
  - one for line set up
- Determine need for using FFP/ 4% Albumin by checking Hct of packed cells to be used. Determine required volume of FFP/ 4% Albumin to be infused from table in **Appendix 2.**

## EXCHANGE TRANSFUSION METHODS:

### 1. PUSH - PULL METHOD

This method requires a reliable venous access – preferably via a centrally placed umbilical venous catheter. This is a one person method where blood is slowly withdrawn, at a pre-determined aliquot **following** which donor blood is replaced slowly through manual infusion of an aliquot of matching volume. This process is attended by the medical officer, whilst the nurse monitors and records volumes in/out and vital signs.

The procedure takes 90-120 minutes. The volume in/volume out balance should not exceed 5% of infant's blood volume. Thumb rule: 5ml aliquots for a pre-term baby (< 2000gms); 10ml for a term baby (or >2000gms). Calculate the actual time per aliquot.

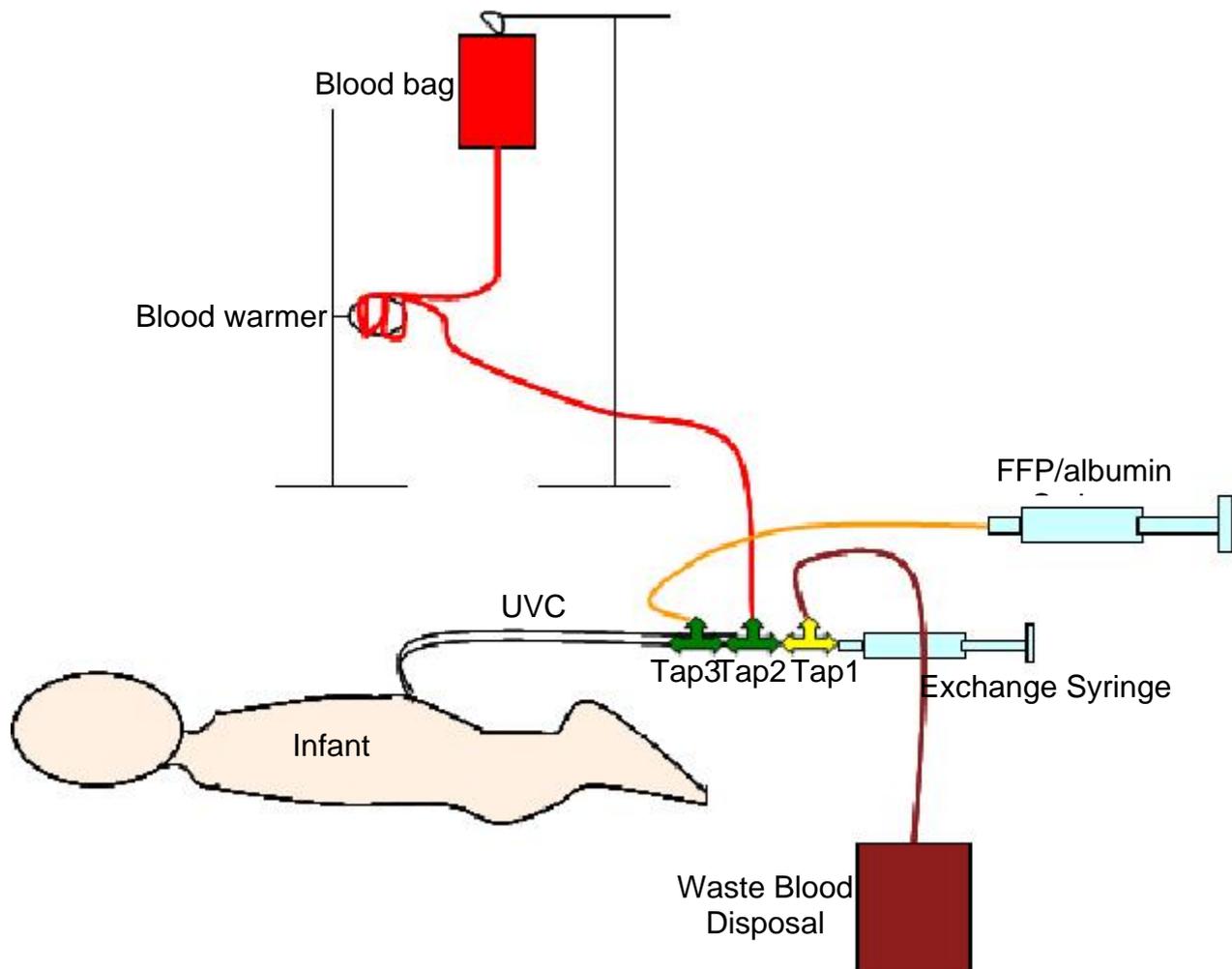


Diagram 1: PUSH-PULL METHOD

## STEPS:

- Connect 2 three-way taps and a syringe (size appropriate to pre-determined aliquot volumes) in sequence. [NOTE: You may require a third three-way tap (tap 3) for infusion of FFP/ Albumin]
- Connect the filtered line from blood pack to the proximal three way tap (tap1 - closer to the infant)
- Attach the line to the waste bag to the distal three way tap (tap 2 - closer to the syringe) for closed disposal of withdrawn blood
- Prime the set-up system from blood pack and ensure set-up free of air bubbles
- Set up blood line within the blood warmer at set temperature of 37 degrees
- Connect set-up to **primary lumen** of umbilical venous catheter - ensure tap1 turned off to blood pack and tap 2 turned off to waste disposal bag
- Withdraw first aliquot slowly, announce volume (x-mls) 'out', nurse records, attain baseline blood samples from this volume, including;
  - Rhesus Group, Direct Coomb's
  - SBR
  - UEC and Ca+
  - Arterial blood gas
  - FBC
  - NBST (if less than 48hrs of age)
  - ensure extra samples kept on 'hold' (Heparin, EDTA and plain)
- Fill syringe for replacement from blood pack via tap1
- Infuse the desired amount and announce volume (x-mls) 'in', nurse records
- The following out is sent to the disposal bag via tap2
- Volumes 'in' and 'out' are repeated sequentially (approximately 1 minute for each action) and recorded each time by the nurse on flow sheet including running totals
- The nurse announces the running total every 100 mls
- Vital signs must be recorded at 5 minute intervals from baseline, including;
  - Heart rate
  - Temperature
  - Respirations
  - Non-invasive Blood Pressure every 15 minutes
  - Oxygen Saturations
  - Infants' colour, tone & behaviour
  - Blood warmer temperature

- Gently agitate the blood bag every 10-15 minutes to prevent settling of red blood cells
- Check ABG every 30 minutes (or more frequently if required), including ionised Ca<sup>+</sup>, BSL and K<sup>+</sup>
- Attend formal blood tests at midway point of exchange, including;
  - EUC
  - Ca<sup>+</sup>
  - FBC
- Continue process until the pre-calculated volume to be exchanged is achieved
- End in exact balance (or positive balance if indicated by Haemoglobin level)
- Collect last out sample for testing as described in the section on post-exchange care

NB. Take special care to ensure position of 3 way taps is appropriate for the action

## **2. ISOVOLUMETRIC METHOD**

The isovolumetric method of exchange transfusion requires an arterial access (peripheral or preferably umbilical arterial) and venous access (preferably umbilical venous). It can be a two person method where blood is slowly withdrawn, at pre-determined aliquots with concurrent manual replacement of donor blood by the second person using the same aliquot size.

Preferably it is a one person procedure where blood is slowly withdrawn manually at a constant rate over a fixed period, and in lieu of manual replacement of volumes, donor blood is continuously infused in coordination with the infants' blood that is withdrawn, via mechanical pumps. This removal process is attended by the medical officer, whilst the nurse is responsible for the set-up and monitoring of the infusing blood, recording of the blood volumes in/out, and monitoring and recording of the infants' vital signs. This process generally takes up to 60-90 minutes to complete.

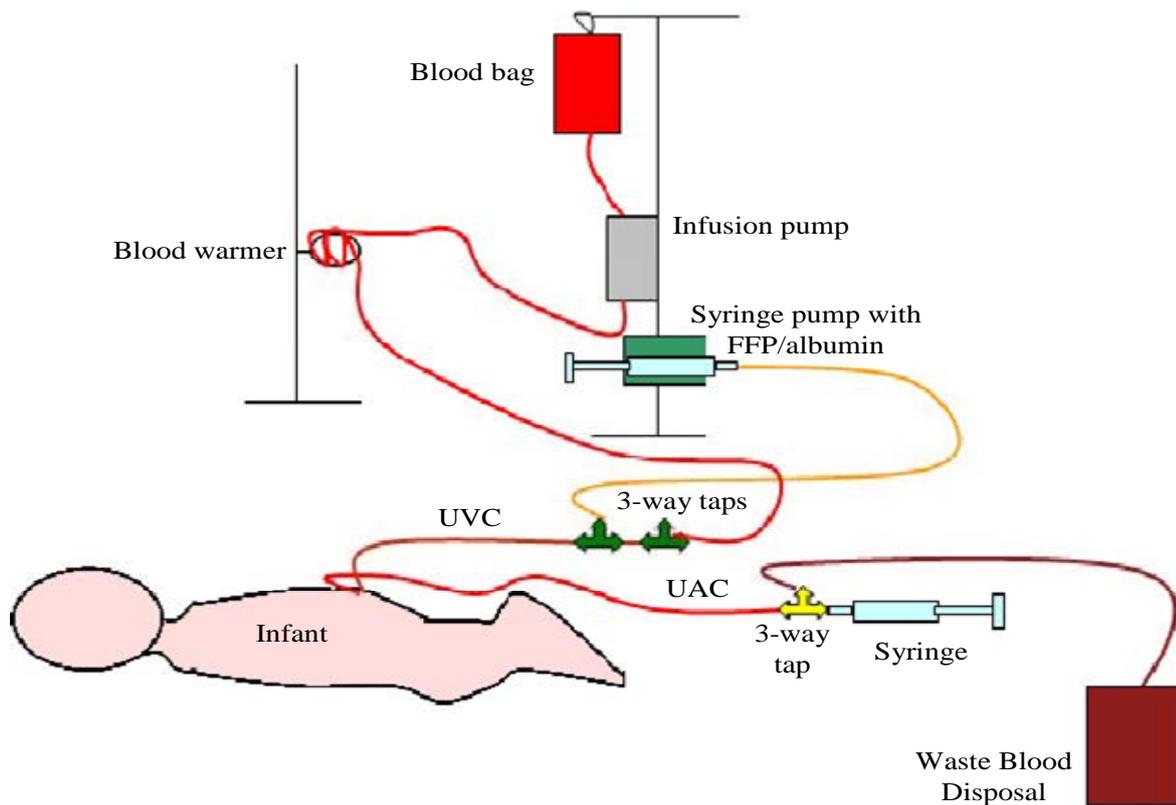


Diagram 2: ISOVOLUMETRIC METHOD

STEPS:

- Connect a syringe for withdrawal process (size appropriate to pre-determined aliquot volumes) to a three way tap
- Attach waste bag to the remaining site on the three way tap for closed disposal of withdrawn blood



Waste System from UAC connects to 3 x way tap with syringe to one port and waste bag to other

- Connect to umbilical arterial catheter (or peripheral arterial line)

- Prime the set-up system (via blood filter) from blood pack through infusion pump and ensure lines free of air bubbles



Set-up of Donor line

Prime blood packs via adult filters, giving set, three way taps (as many as required for each blood line) and extension line for blood warmer and connect to UVC. Allow 70mls for priming of entire line set-up plus 30mls for each additional giving set.

- Place blood line into the blood warmer at set temperature of 37 degrees



To set-up blood warming line pull with tension and wrap around warmer pulling down into grooves wrap as many times as able whilst leaving a 40cm gap between end of line and baby

- Connect set-up to umbilical venous catheter. Add an additional three way tap to the set-up for FFP/ Albumin infusion if required



Overview of Isovolumetric Exchange Transfusion Setup

NOTE (1) Adult infusion pump (capable of delivering 500mls/hr) required for isovolumetric method  
(2) Donor blood to UVC  
(3) Waste System to UAC

- Set infusion pump (capable of delivery rates up to 500 ml/hour) to deliver volume at pre-determined rate to complete exchange over prescribed time frame (e.g. Exchange volume determined to be 300 mls, prescribed time 90 minutes – therefore delivery rate set at 200ml/hour)
- Set up infusion of FFP / Albumin via syringe driver for infusion if required
- Commence infusion at the corresponding time to the initiation of the first withdrawal process
- Withdraw first aliquot slowly, announce volume (x-mls) 'out', nurse records, attain baseline blood samples from this volume
- At this time the nurse monitors and announces volume (x-mls) 'in', and records both volume out and in, including running totals
- Repeat the sequence, at all times ensuring that volume being removed is kept at exact pace to volume being supplied via infusing pump
- Following volumes out are disposed of via waste bag set-up
- The nurse announces the running total every 100 mls
- Vital signs must be recorded at 5 minute intervals from baseline, including;
  - Heart rate
  - -Temperature
  - Respirations
  - Non-invasive Blood Pressure every 15 minutes
  - Oxygen Saturations
  - Infants' colour, tone & behaviour
  - Blood warmer temperature

- Gently agitate the blood bag every 10-15 minutes to prevent settling of red blood cells
- Check ABG every 30 minutes (or as required), including ionised Ca<sup>+</sup>, BSL and K<sup>+</sup>
- Attend formal blood tests at midway point of exchange, including;
  - EUC
  - Ca<sup>+</sup>
  - FBC
- Continue process till end of pre-calculated volume to be exchanged finished
- End in exact balance (or positive balance if indicated by Hb level)
- Collect last out sample for testing as described in the section on post-exchange care

**NOTE: Take special care to ensure withdrawal rate matches set pump infusion rate**

*KEY POINTS TO CONSIDER WITH EXCHANGE TRANSFUSIONS:*

- BSL tends to rise due to the preservative in the blood bag and should settle without requiring treatment (see post-exchange care)
- Occasionally, Ca<sup>+</sup> correction may be required at the midway point, or in event of unexplained arrhythmias
- If FFP/Albumin required, infuse via syringe pump to complete volume over the exchange period for the isovolumetric method. For push-pull method of exchange, infuse one aliquot of FFP/albumin after every 5 aliquots of packed cells. Calculate aliquot size of FFP/albumin as follows:

$$\frac{\text{Total FFP/albumin required}}{[\text{Exchange volume} / (5 \times \text{aliquot volume for exchange})]}$$

- Monitor the infant continuously, slowing the rate of exchange, temporarily pausing the procedure or curtailing it as warranted by the infant's condition
- If the exchange has to stop completely if or when the infants' condition warrants, the exchange is OVER despite the point of procedure

**EXCHANGE TRANSFUSION EQUIPMENT BOX:**

50ml syringe x 2

21-gauge needle x 2

Adult blood filter x 3

Albumin filter x 2

Intravenous giving set x 3

Intravenous extension line (for blood warmer)

Exchange transfusion pack (containing blood waste disposal system)

3 way taps x 5

5ml syringe x 2

10ml syringe x 2

Small sterile plastic drape

Large sterile plastic drape

Large sterile drape

Small sterile fenestrated drape

EDTA, Heparin and coagulation tubes

Blood gas syringes

Heparin ampoules (50IU in 5mls)

Normal saline (10 ml) ampoules

Calcium gluconate ampoules

Exchange transfusion recording chart

**Additional equipment required:**

Sterile gown pack

Appropriate sized sterile gloves

Blood warmer (set 37 degrees)

Infusion pump (adult settings/capable of volumes up to 500 ml/hour) (necessary for isovolumetric method only)

Exchange transfusion can have a significant morbidity and mortality, and the infant should be observed for the following complications.

<b>COMPLICATIONS</b>	<b>PREVENTION STRATEGIES</b>
<b>Thrombocytopenia</b>	Packed red blood cells used for exchange transfusion are low in platelets and counts should be monitored post exchange
<b>Volume Imbalance</b>	Strict fluid balance recording throughout exchange Consistent pacing during push-pull method to minimise fluctuations in blood flow
<b>Arrhythmias</b> (Hypocalcaemia)	Continuous ECG monitoring and observation for abnormal wave formations Monitor electrolyte levels throughout procedure via arterial blood gases and formal collections as per policy Have Calcium gluconate on hand in case of unexplained arrhythmias
<b>Hyperkalaemia</b>	Stored blood can have high potassium levels, request the use of blood less than 5 days old Assess status through biochemistry electrolyte samples and arterial blood gases Monitor ECG rhythms
<b>Acidosis</b>	Blood is preserved in citrate phosphate and dextrose resulting lower pH levels of blood Monitor arterial blood gas samples and for signs of respiratory distress
<b>Air Embolus</b>	Ensure lines are set up and primed correctly and observe lines closely for presence of air during exchange
<b>Anaemia/Polycythemia</b>	Gently agitate blood bag at frequent intervals to prevent separation of blood components, particularly the settling of red blood cells
<b>Hyperglycaemia</b>	Blood is preserved in Dextrose. BSL's can be elevated during exchange and generally resolve without intervention
<b>Necrotising Enterocolitis</b>	Ensure UVC in correct position (not low lying as this can occlude portal vein) Minimise fluctuations in blood flow through consistent pacing during withdrawal or pushing volumes

## POST EXCHANGE CARE:

- The last out specimen must be sent for follow-up testing including;
  - SBR
  - EUC/Ca+
  - Coagulation studies
  - ABG
  - BSL
  - FBC
- These bloods should be repeated again at 4-6 hours post exchange and then as per consultant \* **particularly SBR levels**
- The infant must be kept NBM for a minimum of 4 hours post exchange (to decrease the risk of NEC) after which feeding may be cautiously re-initiated
- Monitor BSL's closely for a minimum of 6 hours for rebound hypoglycaemia (as banked blood is preserved in dextrose, it triggers an increase in insulin production leading to increased glucose metabolism)
- The infant must remain in a level three setting for 48 hours post exchange
- Monitor infant for abnormal signs and symptoms and possible complications including thrombocytopenia, bleeding, signs of infection, feed intolerance or abdominal distension
- High intensity phototherapy needs to be continued and reviewed in relation to SBR results
- Once discharged the infant must be followed up in NICU follow up clinics to monitor anaemia, growth and development and assess neurological outcomes.

## REFERENCES:

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## DEPARTMENT OF HEALTH CIRCULARS:

GL2007\_01 Neonatal exchange transfusions in NSW. Department of Health, New South Wales.  
Available URL: <http://www.health.nsw.gov.au/policies/>

**ACKNOWLEDGEMENTS:**

**APPENDIXES:**

Appendix 1: *Guidelines for exchange transfusion in infants 35 or more weeks gestation.*

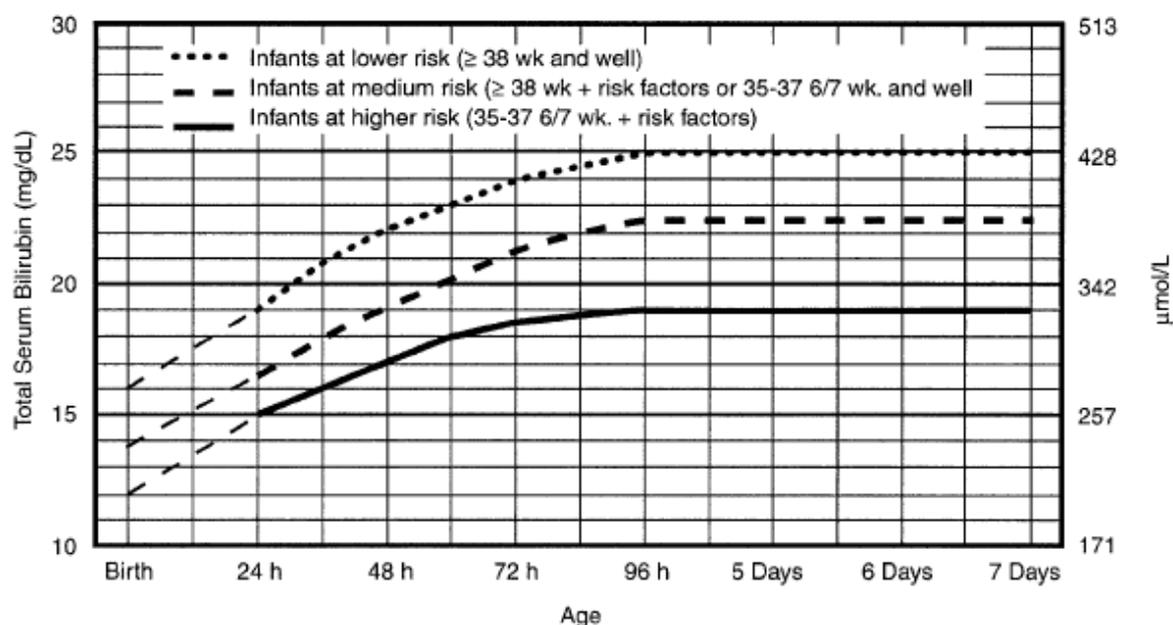
Appendix 2: *Exchange transfusion recording chart*

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**APPROVED:** NICU Management Executive Committee 15<sup>th</sup> June 2011

**APPENDIX 1: Guidelines for exchange transfusion in infants 35 or more weeks' gestation.**



- The dashed lines for the first 24 hours indicate uncertainty due to a wide range of clinical circumstances and a range of responses to phototherapy.
- Immediate exchange transfusion is recommended if infant shows signs of acute bilirubin encephalopathy (hypertonia, arching, retrocollis, opisthotonos, fever, high pitched cry) or if TSB is  $\geq 5$  mg/dL (85  $\mu$ mol/L) above these lines.
- Risk factors - isoimmune hemolytic disease, G6PD deficiency, asphyxia, significant lethargy, temperature instability, sepsis, acidosis.
- Measure serum albumin and calculate B/A ratio (See legend)
- Use total bilirubin. Do not subtract direct reacting or conjugated bilirubin
- If infant is well and 35-37 6/7 wk (median risk) can individualize TSB levels for exchange based on actual gestational age.

Fig 4. Guidelines for exchange transfusion in infants 35 or more weeks' gestation.

Note that these suggested levels represent a consensus of most of the committee but are based on limited evidence, and the levels shown are approximations. See ref. 3 for risks and complications of exchange transfusion. During birth hospitalization, exchange transfusion is recommended if the TSB rises to these levels despite intensive phototherapy. For readmitted infants, if the TSB level is above the exchange level, repeat TSB measurement every 2 to 3 hours and consider exchange if the TSB remains above the levels indicated after intensive phototherapy for 6 hours.

The following B/A ratios can be used together with but in not in lieu of the TSB level as an additional factor in determining the need for exchange transfusion<sup>52</sup>:

Risk Category	B/A Ratio at Which Exchange Transfusion Should be Considered	
	TSB mg/dL/Alb, g/dL	TSB $\mu$ mol/L/Alb, $\mu$ mol/L
Infants $\geq 38$ 0/7 wk	8.0	0.94
Infants 35 0/7-36 6/7 wk and well or $\geq 38$ 0/7 wk if higher risk or isoimmune hemolytic disease or G6PD deficiency	7.2	0.84
Infants 35 0/7-37 6/7 wk if higher risk or isoimmune hemolytic disease or G6PD deficiency	6.8	0.80

If the TSB is at or approaching the exchange level, send blood for immediate type and crossmatch. Blood for exchange transfusion is modified whole blood (red cells and plasma) crossmatched against the mother and compatible with the infant.<sup>53</sup>

**Reference**

American Academy of Pediatrics, Subcommittee on Hyperbilirubinemia. (2004) Management of hyperbilirubinemia in the newborn infant 35 or More Weeks of Gestation. Pediatrics, 114, 297 - 316.  
 Available URL: <http://aappolicy.aappublications.org/>

**APPENDIX 2: Calculation table for required volume of FFP/ 4% Albumin to achieve desired haematocrit for exchange transfusion**

Volume of Albumin 4% / FFP to add to donor packed cells to obtain Haematocrit of approximately 0.55 within that pack. (Range 0.50 – 0.60).

		<b>Weight of blood bag (gm)</b>													
<b>Initial Hct In Bag</b>	<b>270</b>	<b>280</b>	<b>290</b>	<b>300</b>	<b>310</b>	<b>320</b>	<b>330</b>	<b>340</b>	<b>350</b>	<b>360</b>	<b>370</b>	<b>380</b>	<b>390</b>	<b>400</b>	
<b>0.56</b>	4	5	5	5	6	6	6	6	6	7	7	7	7	7	
<b>0.58</b>	13	14	14	15	15	16	16	17	17	18	19	19	20	20	
<b>0.60</b>	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
<b>0.62</b>	31	32	34	35	36	37	39	40	42	43	44	45	46	47	
<b>0.64</b>	38	40	42	43	45	46	48	50	51	53	54	56	59	61	
<b>0.66</b>	48	50	52	54	56	58	60	62	64	66	68	70	72	74	
<b>0.68</b>	57	59	61	64	66	68	71	73	75	78	80	83	85	88	
		<b>Volume of 4% Albumin / FFP to be added (mls)</b>													

C Arnold Haematology (2002). Dilution methods

Infant MRN Label

### NICU Exchange Transfusion Chart

Date		Aliquots (circle one) 5ml 10ml 20ml			Total volume to be exchanged:		HR	Resps	BP	Sats	BSL	Temp	Water bath temp
Cycle	Time	Volume Out	Total Out	Volume In	Total In								
1.						Send Bloods to HAPS							
2.													
3.													
4.													
5.													
6.													
7.													
8.													
9.													
10.						Bloods (gas machine)							
11.													
12.													
13.													
14.													
15.													
16.													
17.													
18.													
19.													
20.						Bloods (gas machine)							

Infant MRN Label

### NICU Exchange Transfusion Chart

Date		Aliquots (circle one)			Total volume to be exchanged:	HR	Resps	BP	Sats	BSL	Temp	Water bath temp
		5ml	10ml	20ml								
Cycle	Time	Volume Out	Total Out	Volume In	Total In							
21.												
22.												
23.												
24.												
25.												
26.												
27.												
28.												
29.												
30.						Bloods						
31.												
32.												
33.												
34.												
35.												
36.												
37.												
38.												
39.												
40.						Bloods						

# NICU Exchange Transfusion

## Blood Results Chart.

<b>Date</b>							
<b>Time:</b>							
<b>SBR</b>							
<b>Hb</b>							
<b>WCC</b>							
<b>Platelets</b>							
<b>Sodium</b>							
<b>Potassium</b>							
<b>Calcium</b>							
<b>Creatinine</b>							
<b>Glucose</b>							
<b>pH</b>							
<b>pO<sub>2</sub></b>							
<b>pCO<sub>2</sub></b>							
<b>Base Excess</b>							