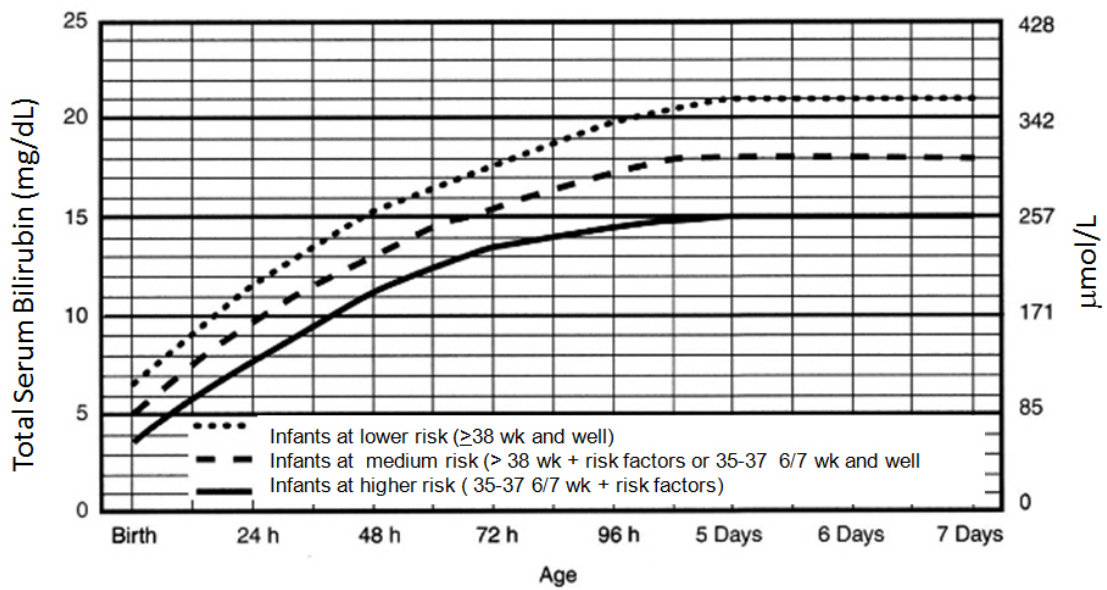
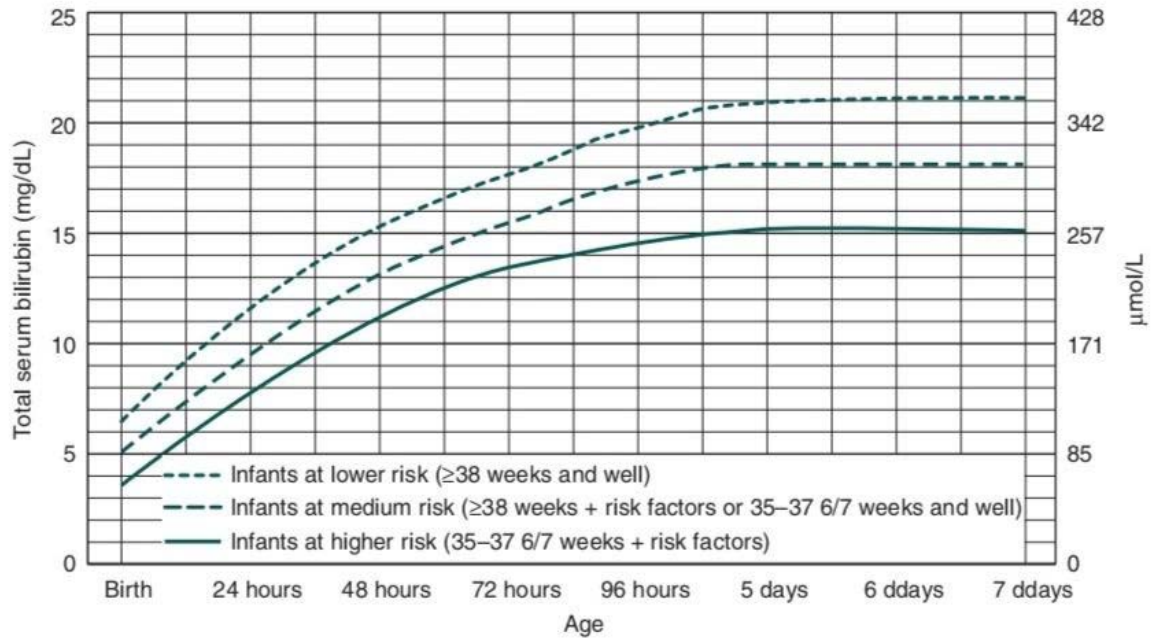


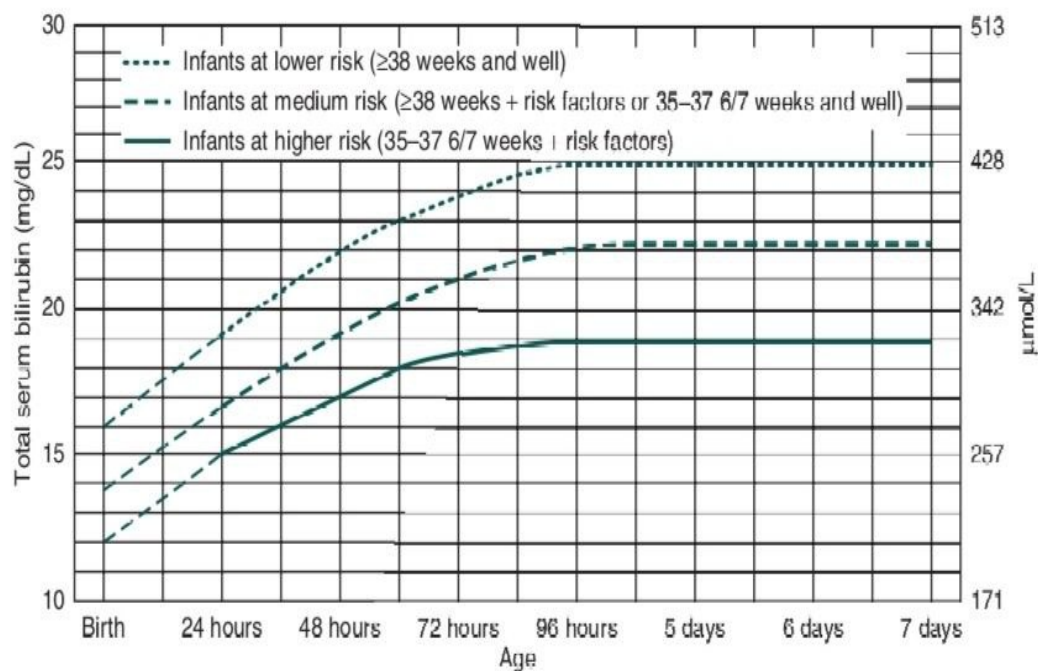
**GUIDELINES FOR PHOTOTHERAPY IN TERM NEWBORNS (BHUTANI CHART)**



## GUIDELINES FOR PHOTOTHERAPY AND EXCHANGE TRANSFUSION IN PRETERM NEWBORNS (NICE GUIDELINES)

GESTATION (WEEK)	PHOTOTHERAPY				EXCHANGE TRANSFUSION			
	12 HR	24 HR	48 HR	≥72 HRS	12 HR	24 HR	48 HR	≥ 72 HR
23	3.2	4.0	5.9	7.6	6.1	7.6	10.5	13.5
24	3.2	4.4	6.4	8.2	6.1	7.9	11.1	14
25	3.5	4.7	6.7	8.8	6.4	8.2	11.4	14.6
26	3.5	4.7	7.0	9.4	6.4	8.2	11.7	15.2
27	3.6	5.0	7.3	10	6.5	8.5	12.0	15.8
28	3.8	5.0	7.6	10.5	6.7	8.5	12.3	16.4
29	3.8	5.3	8.2	11.1	6.7	8.8	12.9	17
30	4.0	5.3	8.5	11.7	6.9	8.8	13.2	17.6
31	4.1	5.6	9.0	12.3	7.0	9.1	13.7	18.1
32	4.1	5.9	9.4	12.9	7.0	9.4	14.0	18.7
33	4.2	6.1	9.9	13.5	7.1	9.7	14.6	19.3
34	4.2	6.1	10.2	14	7.1	9.7	14.9	19.9

## GUIDELINES FOR EXCHANGE TRANSFUSION IN TERM NEWBORNS WITH JAUNDICE



**GUIDELINES FOR PHOTOTHERAPY AND EXCHANGE TRANSFUSION IN PRETERM NEWBORNS  
(NICE GUIDELINES)**

GESTATION (WEEKs)	PHOTOTHERAPY				EXCHANGE TRANSFUSION			
	12 HR	24 HR	48 HR	>=72 HRS	12 HR	24 HR	48HR	>=72 HR
23	3.2	4.0	5.9	7.6	6.1	7.6	10.5	13.5
24	3.2	4.4	6.4	8.2	6.1	7.9	11.1	14
25	3.5	4.7	6.7	8.8	6.4	8.2	11.4	14.6
26	3.5	4.7	7.0	9.4	6.4	8.2	11.7	15.2
27	3.6	5.0	7.3	10	6.5	8.5	12.0	15.8
28	3.8	5.0	7.6	10.5	6.7	8.5	12.3	16.4
29	3.8	5.3	8.2	11.1	6.7	8.8	12.9	17
30	4.0	5.3	8.5	11.7	6.9	8.8	13.2	17.6
31	4.1	5.6	9.0	12.3	7.0	9.1	13.7	18.1
32	4.1	5.9	9.4	12.9	7.0	9.4	14.0	18.7
33	4.2	6.1	9.9	13.5	7.1	9.7	14.6	19.3
34	4.2	6.1	10.2	14	7.1	9.7	14.9	19.9

## **EXCHANGE TRANSFUSION**

### **DEFINITION:**

To exchange all or part of an infant's blood supply for certain medical conditions. A double volume exchange transfusion is replacing the baby's total blood volume twice, leaving the intravascular amount the same. A partial exchange is either increasing or decreasing an infant's hematocrit, while maintaining a constant blood volume.

### **INDICATIONS OF DVET**

1. Double volume exchange transfusion (DVET) should be performed if the TSB levels reach to age specific cut off for exchange transfusion or
2. The infant shows signs of bilirubin encephalopathy irrespective of TSB levels.
3. Indications for DVET at birth in infants with Rh isoimmunization include:
  - a. Cord bilirubin 5mg/ dL or more, OR
  - b. Cord Hb 10 gm/dL or less.
4. Hyperammonimia
5. To remove bacterial toxins
6. To correct life-threatening electrolyte and fluid imbalance

### **INDICATIONS OF PARTIAL EXCHANGE TRANSFUSION**

1. At birth, if a baby shows signs of hydrops or cardiac decompensation in presence of low PCV (<35%), partial exchange transfusion with 50 ml/kg of packed cells should be done to restore oxygen carrying capacity of blood, before doing DVET.
2. Severe anemia in the face of normal or excess blood volume.
3. Clinical polycythemia

### **Precautions/Contraindications**

1. When alternatives such as a simple transfusion or phototherapy would be just as effective with less risk.
2. When a contraindication to placement of necessary lines outweighs the indication for exchange transfusion.
3. When the patient is unstable and not likely to benefit from the procedure.

### **General information**

#### **Double Volume Exchange**

- Try to use the freshest blood available (procured within 3-5 days) for the double volume exchange.
- If whole blood is not available, use a combination of fresh frozen plasma and packed red blood cells.
- The exchange volume is twice the infant's blood volume, using 85 ml/kg as the infant's blood volume.

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- This procedure should be done slowly, over a minimum of 45 minutes and the blood volume should be kept fairly constant.
- A consent must first be obtained for blood transfusion.

### **Materials Required for Double Volume Exchange**

1. Hat
2. Mask
3. Sterile gloves
4. Sterile gown
5. Umbilical catheter tray with extra catheters
6. Heparinized flush solution
7. 10 or 20 ml syringes (depending on size of infant)
8. Blood warmer, filter, and tubing
9. Whole blood, or FFP and PRBC's
10. Calcium Gluconate

### **Procedure of Double Volume Exchange**

#### **A. Pre-treatment evaluation**

1. Premedicate infant for pain control and/or sedation. Assess need for further medication throughout the procedure.
2. Check relevant labs
3. Obtain consent for blood transfusion

#### **B. Set up (if applicable) Double Volume Exchange**

1. Calculate the volume to be exchanged ( $2 \times 85 \text{ ml/kg}$ ).
2. Check the hematocrit of donor blood.
3. Run the filtered blood through the blood warmer to maintain a temperature of 37-38°C.

#### **C. Patient Preparation**

1. Don hat and mask, scrub hands, don sterile gown and gloves
2. Insert umbilical arterial and venous catheters per procedure, or a single umbilical catheter. Ensure adequate placement. Never infuse PRBC's through an umbilical arterial catheter. Only blood with aHct < 55 may be infused through an umbilical venous catheter.

#### **D. Procedure of DVET**

1. Perform time out with all appropriate steps.
2. If two catheters are in place, withdraw 5ml/kg blood from the arterial catheter and infuse 5ml/kg donor blood through venous catheter simultaneously.
  - a. If only an umbilical venous catheter is in place, withdraw 5-20 ml of infant's blood first, then replace with 5-20 ml of donor blood. Use smaller amount for smaller neonates – usually 5 ml /kg is desired amount at a time.
  - b. Continue in 5 ml/kg aliquots until desired volume is exchanged.

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3. Send first blood drawn for pre-exchange bilirubin, blood gas and other labs
4. The bedside nurse is to maintain strict in/out record, monitor vital signs, and blood temperature.
5. Halfway through the exchange, send blood gas and bilirubin.
6. To prevent hypocalcemia during procedure, give 30 mg/kg Calcium gluconate IV after each 100 ml blood exchanged. May also administer Calcium gluconate if there is unexplained tachycardia or arrhythmias

**Potential Complications of Double Volume Exchange**

1. Same complications as UAC & UVC line insertion.
2. Microemboli
3. Arrhythmias
4. Volume overload.
5. Cardiac arrest – from too rapid exchange or K<sup>+</sup> toxicity.
6. Hyperkalemia, hyponatremia, hypocalcemia
7. Metabolic acidosis
8. Respiratory alkalosis
9. Thrombocytopenia
10. Infection
11. Transfusion reaction

<b>RECOMMENDED LAB WORK FOR DOUBLE VOLUME EXCHANGE TRANSFUSION</b>			
<b>BEFORE</b>	<b>DURING</b>	<b>AT COMPLETION</b>	<b>4-6 HRS AFTER EXCHANGE</b>
<p><b>Donor blood</b> - Hct</p> <p><b>Infant</b> – ABG, Total &amp; direct bilirubin, K, Ca, Total Ca, Hct, Plts, Glucose, ABG/VBG.</p> <p>PKU and Chromosomes as needed prior to procedure</p>	<p>Total and Ca halfway through procedure.</p> <p>Glucose q 30 minutes during exchange</p> <p>ABG/VBG half way through if infant is on increased oxygen or assisted ventilation</p>	<p>ABG/VBG Total &amp; direct bilirubin and repeat q hr X 2</p> <p>Ca, Total Ca, K, Ca, Hct, Plts, Glucose.</p> <p>Glucose screen at 15, 30, &amp; 60 minutes, then hourly until stable</p>	<p>Hct at 4 hrs post procedure</p> <p>ABG/VBG prn</p> <p>Total &amp; Direct bilirubin</p>

### **PARTIAL EXCHANGE TRANSFUSION**

#### **To Lower Hematocrit:**

1. Perform time out with all appropriate steps.
2. Exchange the infant's blood for normal saline, in increments not to exceed 5% of the estimated total blood volume. Continue until the total exchange volume is reached.
3. Obtain a post-exchange hematocrit. If the Hct is 55% or greater, take out an additional 5 ml/kg of infant's blood to prevent further hemoconcentration.

#### **To Raise Hematocrit:**

1. Perform time out with all appropriate steps.
2. Exchange the infant's blood for donor blood, in increments not to exceed 5% of the estimated total blood volume. Continue until the total exchange volume is reached

#### **Partial Volume Exchange Procedure**

- A consent must first be obtained for blood transfusion when raising hematocrit.
- An exchange is usually done for polycythemia when the HCT is between 65-72, depending on if infant is symptomatic or not.
- Use normal saline for an exchange to lower Hct.
- An exchange is done to raise the HCT when the infant has a chronic anemia, with a normal blood volume.
- Use PRBC's to raise Hct.

An infant's blood volume is 85 ml/kg.

The desired Hct is usually 45 –55%.

Use the following formulas to calculate the amount of the exchange:

#### **To Lower Hematocrit:**

$$\text{Volume to exchange} = \frac{(\text{Wt in Kg} \times 85) \times (\text{Observed Hct} - \text{Desired Hct})}{\text{Observed Hct}}$$

#### **To Raise Hematocrit:**

$$\text{Volume to exchange} = \frac{(\text{Wt in Kg} \times 85) \times (\text{Desired Hct} - \text{Observed Hct})}{\text{Hct of PRBC's}}$$

- Calculate the amount of normal saline to be exchanged for the infant's blood to lower the hematocrit to the desired value, or the amount of PRBC's needed to be exchanged for the infant's blood to increase the hematocrit.
- For a partial exchange, insert umbilical catheter per procedure. If unable to place an umbilical catheter, the partial exchange can be done by withdrawing blood from a peripheral arterial line and infusing saline or PRBC's through a PIV.

**Follow-up treatment ..**

**After Double Exchange Transfusion ...**

1. At completion, send post-exchange labs.
2. Resume phototherapy if exchange was done for hyperbilirubinemia.
3. Observe in ICN. Do not feed for at least 4 hrs after umbilical lines removed.

**After Partial Exchange Transfusion...**

1. Send hematocrit at completion of exchange and 4 hrs after completion.
2. Observe in ICU for at least 4 hours and do not feed until at least 4 hrs after umbilical catheters removed

**Termination of treatment**

Stop the procedure if the infant's condition worsens