

LESS EXPOSURE TO BLOOD PRODUCTS AND PREVENTION OF EXCHANGE TRANSFUSION

This module is designed to improve knowledge, skills and clinical practice of all stakeholders involved in the care of preterm neonates in safe and rational blood transfusion

Learning objectives

The participants will learn

- To understand the potential harm resulting from unnecessary and excessive use of blood products.
- To know when and how to use blood products judiciously and safely.
- To know use of equipment needed for treatment of jaundice.
- To be able to manage neonatal jaundice.
- To be able to use various clinical practices which can reduce exposure to blood products.
- To be able to monitor and improve processes related to blood product exposure following quality improvement practices in local context.

Module contents

This module includes following elements

- **Script:** Easy to read format, gives quick introduction and is an essential reference material for the participants.
- **Key messages:** After having read through the script, these key messages summarize the important learning points in the webinar and the script
- **Video demonstration:** The videos in this module cover the use of transcutaneous bilirubinometer, micro-centrifuge, microbilimeter, flux meter, effective phototherapy, supplies needed for exchange transfusion including arranging blood and conducting exchange transfusion in special newborn care unit and ward.
- **Webinar:** The webinars in this module shall help the participant to gain knowledge about potential harms from excessive use of blood products, importance of management of jaundice, indications of use of packed red blood cells and platelets, monitoring of adverse events during transfusion, the indications of phototherapy, investigations of baby with jaundice and strategies to minimize blood transfusion.
- **Poster demonstration:** The participant shall learn about the charts displaying the triggers including packed cell, platelets, exchange transfusion and phototherapy.
- **Self-assessment:** This will be done at the end of each objective, based on what you have already learnt. Feel free to consult your text material, if you need assistance in recapitulating.
- **Checklist:** There will be a checklist on phototherapy, blood transfusion, exchange transfusion and phototherapy.

- **Skill check:** The skill check includes evaluation of your skills on “administering a blood product”, “packed cell volume (PCV) estimation and decision about the use of packed red blood cell transfusion”, “measurement of total serum bilirubin (TSB)”, “performing exchange transfusion” and “measuring transcutaneous bilirubin”.
- **Simulation:** After reading through the text material, viewing videos and webinars and reading through the posters, you shall be asked to perform the necessary procedure and act as a team this will be followed by feedback and team debriefing.

Learning objective 1

The potential harms resulting from unnecessary and excessive use of blood products.

This objective covers the concept of potential harms resulting from unnecessary and excessive use of blood products and the optimal management of jaundice is delivered as:

- Webinars
- Script
- Key messages
- Self- check MCQs

After viewing the webinar and reading the script and the key messages you shall undergo a self-evaluation based on what you have already learnt.



1.1: Webinar

You will view and listen to webinar on potential harm resulting from unnecessary and excessive use of blood products with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions.

Potential harms of blood transfusion in preterm neonates

DR. GEETA GATHWALA
Professor and Head
Department of Pediatrics
PGI, Rohtak

Blood and blood component transfusions in SNCU

- Blood transfusion is an important component of SNCU care
- Preterm infants in the SNCU receive frequent transfusions due to diverse reasons
- Blood transfusions have potential harms especially in preterm infants
- Often, these blood transfusions can be avoided by adopting standard guidelines

Potential harms of blood and blood component transfusion

- Mismatched transfusion
- Transfusion transmitted infections e.g. HIV, HBV, HCV, CMV etc.
- Procedure related infection risk
- Hyperkalemia (increased potassium)
- Volume overload

Severe side effects that are unique to PT neonates

- Increased mortality
- Oxygen free radical injury
- IVH
- NEC
- CLD

Why reduce unnecessary transfusions?

- Reduction of transfusion rates has been shown to lower the incidence of:
 - ROP
 - NEC
 - IVH
 - CLD

Balance the benefits of blood transfusion against possible harms

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



1.2: Script of webinar

Potential harm of blood transfusion

Blood transfusion is an important component of treatment in the SNCU and it has potential harms, especially in the preterm infants. Very importantly, these blood transfusions can be avoided or decreased by adopting standard transfusion guidelines. The harms associated with blood transfusions include mismatched transfusions that can result from human errors and transfusion transmitted infections like HIV, HBV and HCV. A small but definite risk of acquiring these exists despite the screening that is done. Hyperkalemia and volume overload can happen when additional volume transfused is not taken into account. Severe side effects that are peculiar to the preterm infant include increased mortality and oxygen free radical injury (compromised anti oxidant defence in preterm), intraventricular haemorrhage, necrotizing enterocolitis and chronic lung disease. Reducing transfusion rates has been shown to reduce the incidence of retinopathy of prematurity, necrotizing enterocolitis, intraventricular haemorrhage, and chronic lung disease and improve outcomes in the preterm infant.



1.3: Webinar

You will view and listen to webinar on the optimal management of jaundice with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions.

Treatment of jaundice in preterm neonates

DR. ASHISH JAIN
MD,DNB,DM (Neonatology)
Assistant Professor
Department of Neonatology
Maulana Azad Medical College
New Delhi

- Upto 80% preterm neonates have jaundice
- Many of these neonates can be managed by phototherapy alone
- Few neonates may require exchange transfusion in addition to phototherapy

Effects of exchange transfusion

- Exchange transfusion for jaundice carries significant risk of mortality and morbidity in addition to the usual risks of blood transfusions
- Effective use of Phototherapy in the management of NNJ can drastically decrease the need for ET

How to manage jaundice optimally?

- Risk stratification
- Timely identification
- Effective use of phototherapy
 - Initiation as per guidelines
 - Dose and duration
 - Monitoring
- Judicious use of exchange transfusion
- Post discharge follow up

Why optimal management?

- Adequate and timely treatment of jaundice is important.
- It helps prevent
 - Acute neurological injury
 - Long term neurological damage
- Effective usage of phototherapy can prevent exchange transfusion and its associated risks

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



1.4: Script of webinar

Management of jaundice optimally

Jaundice is a very frequent problem in preterm neonates and upto 80% of them develop neonatal jaundice. In most cases, it can be managed with phototherapy alone but a few neonates may require exchange transfusion in addition to phototherapy. Exchange transfusion carries an inherent risk of mortality and morbidity in addition to the usual risks associated with blood transfusions. Effective use of phototherapy in the management of neonatal jaundice can drastically decrease the need for exchange transfusion. Optimal management of jaundice includes risk stratification and timely identification of those needing therapeutic interventions. Effective use of phototherapy would mean initiating phototherapy as per standard guidelines and using the right dose and duration of phototherapy. It is also important to ensure that these infants are adequately monitored when under phototherapy. Exchange transfusions must be done only when indicated as per standard guidelines. All preterm infants with jaundice must be followed up after discharge for hearing and neuro-developmental assessment. It is important to manage jaundice optimally because; adequate and timely treatment of jaundice helps prevent acute as well as long term bilirubin induced neurological injury, can prevent the need for exchange transfusion and can therefore prevent the mortality and morbidity associated with this procedure.

1.5: Key messages

- Sick preterm neonates and neonates less than 24 hours old with any clinical jaundice and stable neonates with jaundice below the chest need serum bilirubin assessment.
- Decision on whether to treat jaundice should be based on serum bilirubin levels.
- Thresholds for treatment are based on birth weight and are lower in neonates with sickness/ sepsis/ asphyxia or clinical instability
- Exchange transfusion is indicated only if the serum bilirubin value is greater than the birth weight specific threshold despite effective phototherapy OR if the neonate has signs of acute bilirubin encephalopathy.



1.6: Self-check MCQs

1. The risks associated with blood transfusion in the preterm neonates include
 - a) Transfusion transmitted infections like HBV, HCV, HIV and CMV.
 - b) Retinopathy of prematurity
 - c) Neonatal necrotising enterocolitis
 - d) All of the above
2. Reducing blood transfusion in preterm infants reduces the incidence of
 - a) Retinopathy of prematurity
 - b) Intraventricular haemorrhage
 - c) Chronic lung disease
 - d) All of the above
3. Neonatal jaundice occurs in upto _____% of preterm neonates
 - a) 50%
 - b) 60%
 - c) 70%
 - d) 80%
4. Adequate and timely management of neonatal jaundice is important to prevent
 - a) Acute bilirubin encephalopathy
 - b) Retinopathy of prematurity
 - c) Chronic lung disease
 - d) Intraventricular haemorrhage
5. Potential harms of blood and blood component transfusion are
 - a) Mismatched transfusion
 - b) Procedure related infection
 - c) Hyperkalemia
 - d) All of the above

Learning objective 2

To know when and how to use blood products judiciously and safely.

This objective covers the use of blood products judiciously and safely and is delivered as:

- Webinar
- Script
- Key messages
- Posters
- Self- check MCQs

After viewing the webinar, reading the script and the key messages you shall undergo a self- evaluation based on what you have already learnt.



2.1: Webinar

You will view and listen to webinar on indications of transfusion of packed red cell in preterm babies with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions.

Transfusion of packed red cells in preterm babies

DR. ASHISH JAIN
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Assistant Professor
Department of Neonatology
Maulana Azad Medical College
New Delhi

Learning Objectives

- Importance of using guidelines to transfuse a baby
- Understand the transfusion guidelines to be followed for packed red blood transfusion in preterm babies
- Procedure of giving packed cell transfusions

Importance of using guidelines

- One may tend to give transfusion when it is not required
- Unrequired transfusion may put the preterm baby at higher risk of complications than term babies

Packed red blood cell (PRBC) transfusion

Postnatal Age	< 32 weeks O2 or CPAP	All other neonates
<24 hrs	<12	<10
2 To 7 days	<10	<10
8 to 14 days	<9.5	<7.5
More than 15 days	<8.5	<7.5

Adapted from British Society of Haematology ; Guideline for transfusion in infants . 2016

All the values represent haemoglobin levels in gm%

Practical points

- **Cross matching** : Required
- **Dose** : 15 ml per Kg
- **Duration** : 2- 4 hr
- **Feeds** : Can be continued for a stable baby
- **Fluids** : Withhold the maintenance fluids unless the baby is being treated for hypoglycaemia or is on ionotropes
- **Note** :
 - Maintain strict asepsis
 - Furosemide should not be given routinely

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



2.2: Script

This script shall help you to understand the transfusion of packed red cell in preterm babies.

The decision to transfuse is generally taken on clinical assessment or haemoglobin levels of the baby. These, assessments may differ from person to person, resulting in wide variation in transfusion practices. Hence, if the guidelines are not used, one may tend to give transfusion when it is not required. These unnecessary transfusions may put the preterm baby at undue risk of complications and the preterm babies are at higher risk of all these complications compared to term babies. Hence, it is very important to always use standard guidelines for transfusing packed red cell in preterm babies.

Postnatal age	< 32 weeks O2 or CPAP	All other preterm neonates (<32 Wk)
<24 hrs	<12	<10
2 To 7 days	<10	<10
8 to 14 days	<9.5	<7.5
More than 15 days	<8.5	<7.5

Important considerations for PRBC transfusion are

- The volume of the transfusion should be 15ml/kg , which should be given over 4 hrs preferably by an infusion pump
- Strict asepsis should be maintained while initiating and giving the transfusion
- The baby may continue accepting feeds during transfusion, unless he/she is haemodynamically unstable
- It is generally advisable to stop the IV maintenance fluid, while administration of PRBC transfusion, unless the baby is being treated for hypoglycaemia with IV fluids.
- In such a baby a separate line for the PRBC transfusion should be established, ionotropes if any should be continued.



2.3: Webinar

You will view and listen to webinar on transfusion of platelets in preterm babies with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions.

Transfusion of Platelets in preterm babies

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Learning Objectives

- Understand the guidelines to be followed for platelet transfusion in preterm babies
- Procedure of giving platelet transfusion in preterm babies

Platelet transfusion Guidelines

Platelet Count	Indication for platelet transfusion
<20000	Neonates with no bleeding
<50000	Neonates with <ul style="list-style-type: none"> Bleeding Current coagulopathy Before surgery Neonates with NAIT (Neonatal alloimmune thrombocytopenia) if previous sibling has ICH (Intracranial haemorrhage)
<100000	Neonates with <ul style="list-style-type: none"> Major Bleeding Before major surgery (e.g. Neurosurgery)

Adapted from British Society of Haematology ; Guideline for transfusion in infants . 2016

Other considerations during Platelet transfusions

- Cross matching : Not needed unless it is a refractory case
- Dose : 10ml per kg
- Time : As soon as it is received as the half life is short
- Duration : Over 30 minutes
- Note :
 - Feeds may continue
 - Strict asepsis to be maintained
 - Maintenance IV fluid may be withheld in stable babies

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



2.4: Script of webinar

This script shall help you to understand the transfusion of platelets in preterm neonates. The table in the slide describes the guidelines for transfusing the platelets in preterm babies.

Table 2: Guidelines for platelet transfusion

Platelet Count	Indication for platelet transfusion
<20000	Neonates with no bleeding
<50000	Neonates with <ul style="list-style-type: none"> • Bleeding • Current coagulopathy • Before surgery • Neonates with NAIT (Neonatal alloimmune thrombocytopenia) if previous sibling has ICH (Intracranial haemorrhage)
<100000	Neonates with <ul style="list-style-type: none"> • Major Bleeding • Before major surgery (e.g. Neurosurgery)

Important considerations during platelet transfusion

- The platelet concentrates should be given at 10 ml per kg
- It is very important to transfuse the platelets immediately as soon as it is received from the blood bank
- The rate of administration of platelet transfusion should be fast, and should be over 30 minutes
- The baby may continue to feed during the transfusion
- The maintenance IV fluid may be discontinued during the platelet transfusion, which can be restarted after completion of the transfusion



2.5: Webinar

You will view and listen to webinar on monitoring of the preterm baby needing transfusion with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions.

Monitoring of a preterm baby receiving blood component transfusion

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Learning Objectives

- Monitoring of the babies receiving transfusion
 - Before transfusion
 - During transfusion
 - After transfusion

Before transfusion

- Document
 - Indication
 - Pre-transfusion Hb Platelet counts
- Identify the baby and take consent from parents
- Check and label the bag
- Prescribe the correct volume/ rate in the treatment chart of the baby
- Transfuse only through peripheral intravenous or central venous line, no other line should be used
- Do any sampling for the cause of anaemia if any

During transfusion

- Adherence of strict asepsis
- Monitor vitals every 30 minutes to 1 hr
 - Temperature
 - Spo2
 - Heart rate
 - BP / CFT
 - Urine output
 - Respiratory rate
- Rate of the administration , judge by volume left and time passed
- Local site complications

After transfusion

- Continue monitoring for 2 to 4 hrs
- Restart feeding/ Maintenance fluids if stopped
- Inform the parents about the completion of the transfusion
- Hb or platelet levels need to be repeated only if:
 - Baby is not improving
 - In case of severe anaemia or thrombocytopenia

Summary

Monitoring is a very important part of transfusion in preterm neonates it should include

- The preparation before transfusion and documentation is a vital
- Monitoring the vitals during transfusion is done frequently and aggressively in sick babies
- The monitoring should continue post transfusion for 2 to 4 hours

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



2.6: Script of webinar

This script shall help you to understand the precautions that should be taken before, during and after transfusion of blood products.

Monitoring of the preterm baby needing transfusion

Before transfusion

- What was the indication for the transfusion and what were the levels of Hb or the platelet before the transfusion?
- One should talk to the parents about the procedure and take a consent
- One should always, recheck and document the details of the lot and the bag.
- One should legibly and clearly document the rate and volume of the component to be given, and the same should also be communicated to the nursing staff taking care of the baby.
- The transfusion can be given through the peripheral intravenous or central venous line.
- Take the samples for determining the aetiology prior to transfusion, as the results will be difficult to interpret once the baby is transfused.

During transfusion

1. It is important to monitor vital signs during transfusion
Temperature
Respiratory rate every hour, or more frequently in case of sick babies
Heart rate
Capillary refill time
SpO₂
BP
Urine output
2. Always regularly check the amount of blood component left , and determine if this is appropriate for the time elapsed
3. Always look for the local site complication actively and regularly

After Transfusion

1. The monitoring should continue post transfusion for 2 to 4 hrs

2.7: Key messages

- Strict adherence to guidelines for transfusion avoids unnecessary exposure to blood products and complications related to it.
- The cut off level for hemoglobin for transfusion is higher if the neonate is more preterm (<32 weeks) or on respiratory support like CPAP
- Specific guidelines should be always followed for platelet transfusion in preterm neonates
- The platelet transfusion should be always crossmatched and given immediately and within 30 minutes
- Babies need to be monitored during and after transfusion. Do not routinely withhold feeds or give furosemide during transfusion.
- The discontinuation of feeds and the furosemide are not routinely done during the transfusion of the blood products



2.8: Poster

The facilitator shall conduct a demonstration session on

- Indications of packed cell transfusion in preterm neonates
- Indications of platelet transfusion in preterm neonates
- Indications of phototherapy and exchange transfusion in preterm neonates
- Monitoring charts
 1. Blood -letting chart
 2. Monitoring chart during blood transfusion
 3. Monitoring chart during exchange transfusion
- Standard treatment protocol on management of baby with anemia
- Standard treatment protocol on management of baby with bleeding

1. Indications of packed cell transfusion in preterm infants

Postnatal age	< 32 weeks O2 or CPAP	All other preterm neonates (<32 Wk)
<24 hrs	<12	<10
2 To 7 days	<10	<10
8 to 14 days	<9.5	<7.5
More than 15 days	<8.5	<7.5

2. Indications of platelets transfusion

Platelet Count/ μ L	Indication for platelet transfusion
<20000	Neonates with no bleeding
<50000	Neonates with <ul style="list-style-type: none"> Bleeding Current coagulopathy Before surgery Neonates with NAIT (Neonatal alloimmune thrombocytopenia) if previous sibling has ICH (Intracranial haemorrhage)
<100000	Neonates with <ul style="list-style-type: none"> Major bleeding Before major surgery (e.g. Neurosurgery)

3. Indications for phototherapy and exchange transfusion in preterm neonates

Birth weight (grams)	Indication for Phototherapy (mg/dL)		Indication for Exchange Transfusion (mg/dL)
	Healthy neonate	Sick neonate*	
<1000	5-7	4-6	10-12
1000-1500	7-10	6-8	12-15
1501-2000	10-12	8-10	15-18
2001-2500	12-15	10-12	18-20

- Use total serum bilirubin
- Discontinue phototherapy when TSB is 2 mg/ dl below the cut-off
- Target irradiance - 30 μ W / cm^2 /nm
- *Sick neonate defined as :
 - Rapidly rising TSB levels (>0.5 mg/dL/h), suggesting hemolysis
 - Neonates with clinical instability/sepsis/ asphyxia
- Use lower value of the range presented in neonates of lower birth weight/ gestational age

4a. Blood letting chart

[illegible]

4b. Monitoring chart during exchange transfusion

Cycle no.	Time	Volume Out	Volume In	Heart Rate	SpO ₂	Respiratory Rate	BP	Temp	Remarks

4c. Monitoring chart during blood transfusion

Time	Heart Rate	SpO ₂	Respiratory rate	BP	Temp	Urine output	Remarks

5. Standard treatment protocol for neonate with anemia



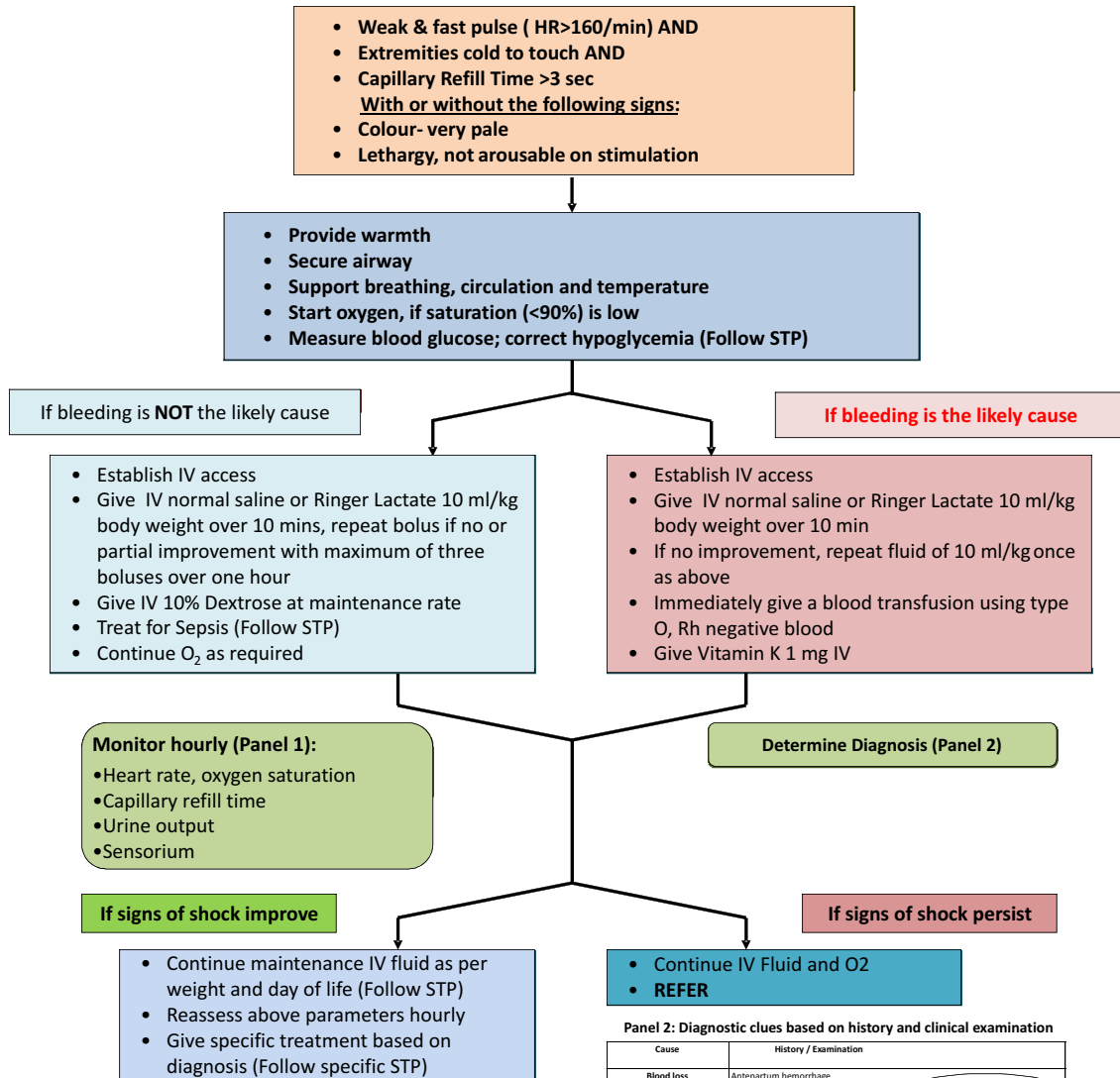
6. STP on management of a baby with bleeding



Standard Treatment Protocol for Management of Common Newborn Conditions in Small Hospitals (Adapted from WHO Guideline)



Shock in Newborn



Panel 1: Monitoring of baby with shock

Signs	At admission	1 hr	2 hr	3 hr	4 hr
Heart Rate/min					
Capillary refill time					
Urine output					
Sensorium					
Temperature difference (core-extremities)					

Panel 2: Diagnostic clues based on history and clinical examination

Cause	History / Examination
Blood loss	Antepartum hemorrhage Blood loss internal/external Age day 1 <i>Follow STP on Emergency Management - Sheet A</i>
Asphyxia	Need for Resuscitation for poor respiratory efforts at birth Hypoxic ischemic encephalopathy (See STP for Management of asphyxiated neonates)
Sepsis	Predisposing factors for infection Age > day 3 <i>Follow STP</i>
Severe dehydration	Loose stool, vomiting, failure to feed + Signs of dehydration
Cardiac	Term baby; normal at birth Age day 3-4 Look for feeble or delayed femoral pulse, cardiac murmur (Coarctation of aorta)
Persistent Pulmonary Hypertension of the Newborn (PPHN)	Meconium stained term baby Age day 1-3 <i>Refer</i>

For additional / next level management please refer to WHO Guidelines (Managing Newborn Problems and Pocket Book of Hospital Care of Children), <http://www.ontop-in.org/sick-newborn/>, <http://www.newbornwhocc.org/>



2.9: Self-check MCQs

1. In a preterm baby; the decision to transfuse would depend on
 - a) Gestational age
 - b) Age of the baby
 - c) Hemoglobin levels
 - d) Oxygen support
 - e) All of the above
2. The volume of packed red cell transfusion to be infused in a preterm baby is
 - a) 10mL/kg
 - b) 15 mL/kg
 - c) 20mL/kg
 - d) 25mL/kg
3. In a preterm baby; the decision to transfuse platelet would depend on
 - a) Gestational age
 - b) Platelet counts
 - c) Haemoglobin levels
 - d) Severity of bleeding
 - e) b and d
4. The volume of platelets to be infused in a preterm baby is:
 - a) 10mL/kg
 - b) 15 mL/kg
 - c) 20mL/kg
 - d) 25mL/kg
5. In a preterm baby who is to undergo a transfusion, following should be done
 - a) No need to recheck the details of blood product as it is done already at the blood bank
 - b) Explain the parents and take their consent
 - c) Administer furosemide 20 minutes before start of the transfusion
 - d) Stop the feeds

Learning objective 3

Use of equipment needed for treatment of jaundice.

This objective covers the use of equipment needed for treatment of jaundice in preterm neonates and is delivered as:

- Videos

After viewing the videos you shall undergo a self- evaluation based on what have you already learnt.



3.1: Video

There will be video demonstration by your facilitator on:

- Use of transcutaneous bilimeter
- Use of microcentrifuge
- Use of microbilimeter
- Use of flux meter
- Use of phototherapy and how to improve irradiance
- Supplies needed for exchange transfusion- including arranging blood and conducting exchange transfusion

The video demonstration will be followed by discussion.

1. The following aspects on the use of transcutaneous bilimeter were shown
 - i.
 - ii.
 - iii.
2. The following aspects on use of microcentrifuge were shown
 - i.
 - ii.
 - iii.
3. The following aspects on use of microbilimeter were shown
 - i.
 - ii.
 - iii.
4. The following aspects on use of flux meter were shown
 - i.
 - ii.
 - iii.
5. The following aspects on effective use of phototherapy and improving irradiance were shown
 - i.
 - ii.
 - iii.

6. The following aspects on supplies needed for exchange transfusion- including arranging blood and conducting exchange transfusion were shown

- i.
- ii.
- iii.

7. Comments on videos

Good aspect

Needs improvement

.....

.....



3.2: Self-check MCQs

1. The use of transcutaneous bilirubinometer to assess jaundice in neonates is not well established in
 - a) Neonates receiving phototherapy
 - b) Sick preterm neonates with significant clinical jaundice
 - c) Visible jaundice within 24 hours
 - d) All of the above
2. While the neonate is on phototherapy. Which of the following is correct?
 - a) Use only indirect serum bilirubin for making decisions
 - b) Monitor response clinically by visual inspection for level of jaundice
 - c) Discontinue phototherapy when TSB is 2 mg/ dL below the initiation level
 - d) TcB can be used while neonate is under phototherapy
3. What are the recommended devices for giving phototherapy in neonates?
 - a) Compact fluorescent lamps emitting blue light
 - b) Halogen lamps
 - c) White tube lights
 - d) Filtered sunlight
4. The following are ways to increase irradiance for a preterm neonate under phototherapy, except
 - a) Keep the phototherapy unit as close as possible to the baby
 - b) Cut the nappy as small as possible
 - c) Use another phototherapy unit from below or from the side
 - d) Replace blue lights by white lights
5. The target irradiance in a preterm neonate under phototherapy is
 - a) 8-10 $\mu\text{W}/\text{cm}^2/\text{nm}$
 - b) 10-15 $\mu\text{W}/\text{cm}^2/\text{nm}$
 - c) 5-8 $\mu\text{W}/\text{cm}^2/\text{nm}$
 - d) 30 $\mu\text{W}/\text{cm}^2/\text{nm}$

Learning objective 4

To manage neonatal jaundice.

This objective covers the management of neonatal jaundice and is delivered as:

- Webinar
- Script
- Key messages
- Checklist
- Self- check MCQs

After viewing the webinar, reading the script and the key messages you shall undergo a self- evaluation based on what you have already learnt.



4.1: Webinar

You will view and listen to webinar on identification of jaundice in preterm neonates with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions.

Identification of jaundice in preterm neonates

Dr. C. Aparna
MD, DM (Neonatology)
Consultant Neonatologist,
Ankura Hospital for Women and Children, Kukatpally,
Hyderabad

Identification of jaundice in preterm neonates

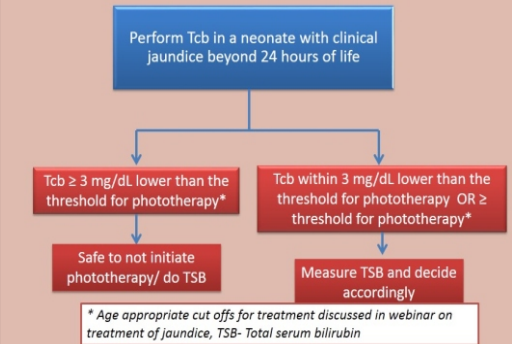
1. Visual assessment
2. Transcutaneous bilirubin (TcB)
3. Total serum bilirubin levels (TSB)

Visual assessment of jaundice in preterm neonates

- Examine the neonate in bright day light or white light
- Examine blanched skin, sclerae and palate of the neonate
- Assess frequently during every examination of the neonate, during the first week of life

Visual assessment does not reliably reflect severity of jaundice and hence, any jaundice on visual assessment in preterm neonates should be further evaluated using Tcb/ TSB

Transcutaneous bilirubin



Jaundice requiring total serum bilirubin (TSB) estimation

- Any visible jaundice in first 24 hours of life
- Beyond 24 hours, Tcb levels falling within 3 mg/dl below OR \geq the threshold for phototherapy
- Any clinical jaundice in a "sick preterm neonate"
- During phototherapy and any subsequent measurements after stopping phototherapy

* Sick preterm neonate defined as :
Rapidly rising TSB levels (>0.5 mg/dL/h), suggesting hemolysis
Neonates with clinical instability/sepsis/ asphyxia

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



4.2: Script

Identification of jaundice in preterm neonates

This script shall help you to understand the assessment of jaundice in preterm neonates.

Nearly three fourths of preterm neonates develop jaundice in the first week of life. Jaundice may be identified on clinical (visual) assessment of the neonate, by doing transcutaneous bilirubin levels or by measuring total serum bilirubin levels.

In order to identify jaundice clinically, one should examine the baby in bright day light. Alternatively, the baby can be examined in white fluorescent light. Make sure there is no yellow/ off white background. The neonate should be completely examined including the palms and soles. Examine for jaundice by 'blanching' a small area of skin (often on the nose) by pressing it against a bony prominence, and by inspecting the sclera of the eyes and palate. Visual assessment of jaundice should be carried out as frequently as possible, during every examination of the newborn, during the first week of life. It should be remembered that visual examination does not reliably identify the severity of neonatal jaundice and hence, any jaundice identified on visual examination should be further evaluated using transcutaneous bilirubin or total serum bilirubin estimation.

Transcutaneous bilirubin (TcB)

TcB measurements beyond the first 24 hours of life correlate reasonably well with the serum bilirubin estimation in premature infants, particularly for the two widely used TcB devices in practice (i.e., Bili-Check and JM-103).

A TcB reading ≥ 3.0 mg/dL below the phototherapy threshold for an infant (discussed in a separate webinar on treatment of jaundice in preterm neonates) could be considered safe for not initiating phototherapy in an otherwise well preterm, without the need for TSB estimation from the laboratory. On the other hand, a TcB reading falling within 3 mg/dl below the threshold or a TcB reading greater than or equal to the phototherapy threshold needs to be followed up with total serum bilirubin estimation. For eg., if a neonate's bilirubin threshold to start phototherapy is 15 mg%, and the TCB value is 11.5 mg%, one does not have to evaluate further or start phototherapy. On the other hand, if the TCB value is more than 12 mg%, one has to evaluate further using TSB and decide accordingly. Decision to start phototherapy would then be based on the TSB value. TCB performed with both common devices Minolta JM 103 and Bilicheck are reasonably accurate.

It is recommended to obtain serum bilirubin level in the following situations:

- a) Any visible jaundice in first 24 hours of life
- b) Beyond 24 hours, any clinical jaundice evaluated with Tcb and when Tcb levels falling within 3 mg/dl below OR \geq the threshold for phototherapy, needs to be followed up with total serum bilirubin estimation
- c) Any clinical jaundice in a sick preterm neonate also requires testing
- d) During phototherapy and any subsequent measurements after stopping phototherapy to look for rebound jaundice



4.3: Webinar

You will view and listen to webinar on guidelines to deliver safe and effective phototherapy with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions.

Guidelines for safe and effective phototherapy

Dr. C. Aparna
MD, DM (Neonatology)
Consultant Neonatologist,
Ankura Hospital for Women and Children, Kukatpally,
Hyderabad

Guidelines for optimising phototherapy – equipment factors

- Use special blue tubes or LED light source
 - Using only white tube lights is less effective
- Monthly irradiance check with flux meter is a must
 - Ideal irradiance of at least 30 microW/cm²/nm
- Pic of CFL blue light phototherapy / flux meter

Guidelines for optimising phototherapy – equipment factors

- Keep the phototherapy unit as close as possible [up to 15 cms] ensuring that the neonate maintains normal temperature
- Align the phototherapy unit so that the neonate lies directly beneath the centre of the unit
- Pic of PT unit placed close to the baby

Measures to increase effectiveness of phototherapy

- Increase the exposed body surface area of the infant under phototherapy
 - by placing another phototherapy unit beneath/ by the side of the neonate
 - reflecting material around the incubator or radiant warmer bed is optional
 - Keep the diapers as short as possible
- Pic of double surface PT
- Reflecting white cloth around the PT unit not occluding the fan/ reflecting material

Supportive care

- Ensure adequate hydration- Continue breast feeding/ breast milk feeding
- No role of routine intravenous fluids or supplemental feeds, unless baby is clinically dehydrated
- May interrupt for feeding/ clinical care procedures provided total serum bilirubin is lower than exchange threshold
- Monitor urine output

Supportive care

- Cover the eye with opaque eye patches
- Monitor temperature every 2 hours
- Routine position changing is not recommended
- Pic of neonate with eye patch

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



4.4: Script of webinar

Guidelines to deliver safe and effective phototherapy

This script shall help you to understand the guidelines to deliver safe and effective phototherapy.

Few general guidelines for optimising phototherapy equipment are listed below:

Phototherapy can be delivered by special blue fluorescent tubes or light - emitting diode (LED) with similar efficacy. Only white lights are not recommended. Do not use sunlight as treatment for hyperbilirubinemia.

Irradiance is a measure of the efficacy of phototherapy. In simple words, higher the irradiance, better is the efficacy of phototherapy. It is not necessary to measure irradiance before each use of phototherapy; however it is important to perform periodic checks of phototherapy units to make sure that an adequate irradiance is being delivered. The target irradiance while giving phototherapy is at least 30 micro W/cm²/nm. Keep the phototherapy unit as close as possible [up to 15 cms] ensuring that the neonate maintains normal temperature. Align the phototherapy unit so that the neonate lies directly beneath the centre of the unit.

Increase the body surface area of the infant exposed to phototherapy by placing another phototherapy unit beneath/ by the side of the neonate. The use of reflecting material like white cloth or aluminium foil around the incubator or radiant warmer bed is optional, making sure not to impede the airflow that cools the tube. There is no role of routine intravenous fluids or supplemental feeds, unless the neonate is clinically dehydrated. Phototherapy can be briefly interrupted for feeding / clinical care procedures provided the neonate's bilirubin level is less than the exchange threshold. Routine position changing has not been found to increase the efficacy of phototherapy and is not recommended.

Some precautions while the baby is under phototherapy.

1. Keep the baby naked keeping the diapers as short as possible, to cover the genitalia. Cover the eye with eye patches
2. It is safe to continue breast feeding/ breast milk feeding while the neonate is on phototherapy
3. It is important to ensure adequate hydration while the neonate is on phototherapy
4. Ensure that the neonate has an adequate urine output of at least 1 ml/kg/hr
5. Monitor temperature every 2 hours



4.5: Webinar

You will view and listen to a webinar on the investigations that are required in a preterm neonate with jaundice needing treatment with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions

Investigations in a preterm neonate with jaundice requiring treatment

Dr. C. Aparna
MD, DM (Neonatology)

Consultant Neonatologist,
Ankura Hospital for Women and Children, Kukatpally,
Hyderabad

Investigations in preterm neonate with jaundice requiring treatment

- Total serum bilirubin
 - At baseline
 - 12-24 hourly; 6-8 hrly in setting of hemolysis
- Blood packed cell volume (PCV) or hemoglobin
- Blood group (mother and baby)
- DCT (Coombs' test), if mother is O group or Rh negative.
- Reticulocyte count and peripheral blood smear for evidence of hemolysis
- Glucose-6-phosphate dehydrogenase levels

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



4.6: Script of webinar

The investigations that are required in a preterm neonate with jaundice needing treatment

This script shall help you to understand the investigations that are required in a preterm neonate with jaundice needing treatment.

In addition to a full clinical examination, carry out all of the following tests in babies with significant jaundice requiring treatment:

- a) Total serum bilirubin for baseline level and to assess response to treatment. In general, TSB can be repeated every 12-24 hrs.
- b) A neonate with a setting for hemolysis such as Rh or ABO isoimmunisation would require TSB measurement every 6-8 hours during initial 24 to 48 hours or so.

In addition, the neonate should be investigated for

- c) Blood packed cell volume (PCV) or haemoglobin
- d) Blood group (mother and baby)
- e) DCT (Coombs' test), if mother is O or Rh negative.
- f) Reticulocyte count and peripheral blood smear for evidence of haemolysis



4.7: Webinar

You will view and listen to webinar on the management of jaundice in preterm neonates with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions.

Treatment of jaundice in preterm neonates

DR. ASHISH JAIN
MD,DNB,DM (Neonatology)
Assistant Professor
Department of Neonatology
Maulana Azad Medical College
New Delhi

Total serum bilirubin (TSB) thresholds for treatment of jaundice in preterm neonates

Birth weight (grams)	Indication for Phototherapy (TSB in mg/dL)		Indication for Exchange Transfusion (TSB in mg/dL)
	Healthy neonate	Sick neonate*	
<1000	5-7	4-6	10-12
1000-1500	7-10	6-8	12-15
1501-2000	10-12	8-10	15-18
2001-2500	12-15	10-12	18-20

*Sick neonate defined as :

Rapidly rising TSB levels (>0.5 mg/dL/h), suggesting hemolysis
Neonates with clinical instability/sepsis/ asphyxia

Important considerations while managing a preterm neonate with jaundice

- Neonates with any of the following conditions in the previous 24 hours are considered to have clinical instability:
 - (a) apnea requiring bag and mask ventilation ; (b) hypotension requiring pressors and (c) mechanical ventilation at the time of blood sampling
- Use total serum bilirubin; Do not subtract the direct fraction unless > 50% of the total
- Use lower value of the range presented in neonates of lower birth weight/ gestational age

Important considerations to decide need for exchange transfusion

- Exchange transfusion (ET) is recommended if the TSB exceeds the threshold for exchange transfusion or if the neonate shows signs of suspected acute bilirubin encephalopathy (signs can be non specific in preterm neonates) irrespective of the level
- Recommendations apply to neonates who are receiving intensive *double surface phototherapy* to the *maximal* surface area but whose TSB levels continue to increase
- Start intensive PT pending arrangement for ET

Management of a neonate receiving phototherapy

- No role for clinical assessment or TcB while under phototherapy
- Repeat total serum bilirubin
 - Q12-24 hourly
 - More frequently if there is a setting for hemolysis
- Discontinue phototherapy when TSB is 2 mg/ dL below the threshold for phototherapy

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



4.8: Script of webinar

The management of jaundice in preterm neonates with jaundice

This script shall help you to understand the management of jaundice in preterm neonates with jaundice. The management of neonatal jaundice in preterm infants is unclear. Most recommendations for treatment in this population, are essentially consensus-based rather than evidence based. The second slide in webinar summarises the recommendations by the National neonatology Forum for TSB thresholds at, or above which, treatment is recommended. The second and third column show the TSB thresholds for starting phototherapy in a healthy and sick preterm newborn, respectively. The last column shows the TSB thresholds for exchange transfusion. The following preterm neonates are considered to be sick (1) neonates with rapidly rising TSB levels which is taken as greater than 0.5 mg/dL/hr, suggesting hemolysis, and (2) neonates with clinical instability/sepsis/ asphyxia. Let us take an example. A neonate with birthweight of 1100 grams with septic shock and metabolic acidosis has a bilirubin value of 7 mg%. This neonate would be labelled as "sick" and thereby, the neonate would require phototherapy at this level of serum bilirubin. Now let us consider a stable preterm neonate with birth weight of 2200 grams with a bilirubin value of 10.5 mg% - this neonate will not require phototherapy. Neonates with any of the following conditions in the previous 24 hours are considered to have clinical instability:

- (a) Apnea requiring bag and mask ventilation
- (B) Hypotension requiring pressors
- (c) Mechanical ventilation at the time of blood sampling.

While deciding the need for treatment, it is important to remember that one should use total serum bilirubin; there is no need to subtract direct fraction of bilirubin unless > 50% of the total. We recommend the use of lower value of the range presented in the table in neonates of lower birth weight/ gestational age.

BET is recommended if the TSB levels are above the birth weight specific thresholds for exchange OR if the neonate shows signs of suspected acute bilirubin encephalopathy irrespective of the bilirubin value.

Remember that recommendations for ET in hospitalised neonates apply to those receiving intensive double surface phototherapy to the maximal surface area but whose TSB levels continue to increase despite intensive PT. For readmitted infants, if the TSB level is above the exchange level, intensive PT should be started pending arrangement for BET. One may consider a repeat TSB measurement just prior to the procedure to confirm the TSB levels are still above the exchange level.

Please note that the classical signs of acute bilirubin encephalopathy such as hypertonia, arching, retrocollis, opisthotonos, high pitched cry, and fever may not be

present in preterm neonates. The only signs of acute bilirubin encephalopathy in preterm neonates may be non-specific such as poor feeding, reduced tone and recurrent apnoeas. Some general principles are tabulated below:

- a) While the neonate is receiving phototherapy, there is no role for clinical assessment or TcB
- b) In general, TSB can be repeated every 12-24 hrs. As opposed to this, a baby with a setting for hemolysis such as Rh or ABO isoimmunisation would require repeat bilirubin estimation every 6-8 hours during initial 24 to 48 hours or so.
- c) Discontinue phototherapy when TSB is 2 mg/ dL below the initiation level

4.9: Key messages

1. While giving phototherapy, use special blue tubes or LED light source, as close as possible to the baby and maximize the neonate's surface area of exposure
2. Periodic irradiance check of phototherapy units is ideal, with target irradiance of 15-40 $\mu\text{W}/\text{cm}^2/\text{nm}$
3. The essential investigations needed in a preterm neonate with jaundice are PCV, blood group and direct Coomb's test if mother is O group or Rh negative, peripheral smear for evidence of hemolysis and G6PD levels
4. TSB can be monitored 12-24 hourly for a neonate under phototherapy and more frequently for a neonate with setting for hemolysis



4.10: Checklist

The facilitator shall explain the checklist step by step according to each procedure:

- Checklist for exchange transfusion
- Checklist for transfusion
- Checklist for phototherapy

Checklist for exchange transfusion

Baseline details

Baby's Name _____ M. R. No. _____ Date : _____

Gestation Age _____ (wk) Weight _____ (g) Age in hours : _____

Dr. _____ Nurse In-charge _____

Consent taken from parents: YES / NO. Indication: _____

Max TSB : _____ mg/dL TSB before Exchange : _____ mg/dL

Volume of Blood Exchange _____ ml (2 x 80 x Birth Weight in kg)

Aliquot Volume _____ ml

Number of Aliquots : _____ Baby's Blood Group : _____ Mother's Blood Group _____

ABO/Rh Incompatibility : Yes / No If YES, specify _____

Start Time : _____ End Time : _____

Donor Bag no.	Date of collection	Group	Cross checked by

Pre- exchange clinical condition

Pallor : Yes / No Bilirubin Encephalopathy : Yes / No If Yes, Stage _____

Respiratory Support : Yes / No Sickness Status : Healthy / Sick

Equipment checklist (This has to be filled and complied before the procedure us started)

Blood ordered

Mother Sample Obtained for Cross Match
Umbilical Catheter 3.5 Fr, 5 Fr, 6 Fr, 7 Fr
Gloves Latex (2 Pairs)
Dressing Set
Cap / Mask / Gown (2 Pairs)
70% Isopropyl alcohol / Povidone iodine / Chlorhexidine 2%
Drapes (2)
Syringe 5 ml (2), 10 ml (2), 2 ml (2)
IV Cannula 24 No. (1)
Three Way Stop Cock (2)
Blood Transfusion Set
IV Set (2)
Plastic or Glass Bottle for Disposal of Blood
Saline / Sterile Water
Transparent Dressing
Paper Tape / Tegaderm / Duropore
Surgical Blade
Sucrose Analgesia
Exchange Cycle Chart Prepared
Cycle Volume and Cycle Number Determined

Procedure checklist (This has to be filled and complied before the procedure is started)

Umbilical cannulation done

Umbilical Catheter in-situ
Proper Aseptic Precautions taken during Cannulation
Back Flow Checked
Need of Peripheral Artery
Phototherapy Continued During Procedure
Blood Bag No. and Blood Group Cross-checked
Three Way Connected to Umbilical Catheter
Blood Bag Sufficiently Warm
Transfusion Set and IV Set Properly Connected
Cycle Started with Pull Out
Same Volume Pushed In
Bag Mixing done Intermittently
Hemodynamics Monitored (as per monitoring chart)
Desired Number of Cycles Done
Blood Volume was Sufficient for Cycles
Last Aliquot sent for PCV, TSB
Procedure Notes Written

Complications during the procedure _____

Post Exchange Transfusion: HR _____ RR _____ SpO₂ _____ Blood Pressure _____

Respiratory Support _____ Other Remarks _____

Instructions: (after transfusion)

1. Start feeding after _____ hours
2. RBS at _____
3. TSB at _____ hours
4. Injection vitamin K 1mg IM stat
5. Any other medications : _____
6. Monitor a) HR _____ hourly b) RR _____ hourly
c) SpO₂ _____ hourly d) BP _____ hourly
7. Preserve blood sample of donor blood for a) Cross-match b) DCT and Reticulocyte Count blood (for next 24 hours); in case of reaction report to blood bank.

Checklist for blood transfusion

Baseline details

Baby's Name _____ M. R. No. _____ Date : _____

Gestation Age _____ (wk) Weight _____ (g) Time of birth : _____

Dr. _____ Nurse In-charge _____

Consent taken from parents: YES / NO. Indication: _____

Pre-transfusion hemoglobin _____

Instructions: (during/after transfusion)

1. Start feeding after _____ hours
2. RBS at _____
3. TSB at _____ hours
4. Any other medications : _____
5. Monitor a) HR _____ hourly b) RR _____ hourly
c) SpO₂ _____ hourly d) BP _____ hourly
6. Preserve blood sample of donor blood for a) Cross-match b) DCT and Reticulocyte Count blood (for next 24 hours); in case of reaction report to blood bank.

Donor Bag no.	Date of collection	Group	Cross checked by

Blood ordered
Mother's and neonate's Sample Obtained for Cross Match
IV cannula 24 G
Blood Transfusion Set
Blood warmer (optional)
Syringe pump

Procedure checklist

Peripheral IV line inserted
Aseptic precautions taken
Blood group and bag cross checked
Volume of blood to be transfused calculated and loaded in syringe pump
Blood bag sufficiently warm
Transfusion Set and intravenous set properly connected

Post transfusion complications, if any:

Checklist for phototherapy

Baby's Name _____ M. R. No. _____ Date : _____

Gestation Age _____ wks Weight _____ gm Time : _____

TSB at start of phototherapy: _____ mg/dL

Mother's blood group: _____; Peripheral smear for hemolysis _____

Baby's blood group: _____ Direct Coomb's test (if applicable) _____

Eye bandage placed
Clothes except diaper removed (diaper as small as possible)
Phototherapy equipment checked- all lights working
All/most lights are blue
Tube lights ends not blackened/ Usage <1200 hrs (if CFL lamps)
Irradiance checked monthly and above 30 $\mu\text{W}/\text{cm}^2/\text{nm}$
Distance between baby and lights adjusted to be kept as close as possible
Tilt of the phototherapy device adjusted (optional)
Phototherapy lights/ fibreoptic phototherapy kept from the undersurface
Reflecting material, if applied (optional), not covering the cooling fan
Ensure adequate hydration of the neonate
Temperature checked
Repeat TSB/ haematocrit after 12-24 hours



4.11: Self-check MCQs

1. Which of the following would not require serum bilirubin testing in a preterm neonate?
 - a) Visible jaundice in the first 24 hours
 - b) Clinical jaundice only over the face on day 5 of life
 - c) Any clinical jaundice in a sick preterm neonate
 - d) Clinical jaundice over the thighs
2. Need for phototherapy in a preterm neonate is best decided based on which of the following?
 - a) Transcutaneous bilirubin
 - b) Visual assessment
 - c) Total serum bilirubin
 - d) Based on risk factor assessment
3. For the purpose of deciding when to start phototherapy for jaundice, the following neonates are considered as sick and need to be treated at lower levels of jaundice, except
 - a) Neonate with sepsis
 - b) Neonate with hypotension requiring treatment
 - c) Neonate on CPAP and improving
 - d) Neonate with asphyxia
4. A neonate with birthweight of 1400 grams and is clinically stable, develops jaundice with serum bilirubin of 10 mg/dL on day 5 of life. There is no setting for hemolysis. What is the most appropriate treatment for this neonate?
 - a) Double surface phototherapy
 - b) Double volume exchange transfusion
 - c) Start with single surface phototherapy, can increase if required
 - d) No treatment is needed
5. A preterm neonate with birth weight of 1600 grams with asphyxia and sepsis develops jaundice on day 4 of life. On testing, the TSB level is 9.5 mg/dL. What is the ideal treatment advised for this neonate?
 - a) Double volume exchange transfusion
 - b) Double surface phototherapy
 - c) Start with single surface phototherapy, can increase if required
 - d) No treatment is needed

Learning objective 5

Use of various clinical practices which can reduce exposure to blood products.

This objective covers the use of various clinical practices which can reduce exposure to blood product and is delivered as:

- Webinar
- Script
- Key messages
- Self- check MCQs

After viewing the webinar, reading the script and the key messages you shall undergo a self- evaluation based on what you have already learnt.



5.1: Webinar

You will view and listen to webinar on the strategies for minimising blood transfusions with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions.

Strategies to minimise blood transfusions in preterm neonates

Dr. C. Aparna
MD, DM (Neonatology)
Consultant Neonatologist,
Ankura Hospital for Women and Children, Kukatpally,
Hyderabad

**The best way to treat anemia
is to prevent it!**

Delayed cord clamping



Delay cord clamping for **at least 60 seconds** in **ALL** neonates who do not require resuscitation at birth

Benefits of delayed cord clamping

- ↓ transfusions for anemia
- ↓ risk of intraventricular hemorrhage
- ↓ risk of necrotising enterocolitis
- No increase in maternal and neonatal morbidities
- No increase in jaundice requiring treatment

Minimising blood sampling losses

- Do a blood investigation only when necessary
- "Cluster" blood sampling
- Collect minimum required volume
- Standard policy for frequency of blood sampling

Early iron supplementation in preterm neonates

- How much?
 - 2-4 mg/kg/day enteral as prophylaxis
- How early?
 - 2 weeks postnatal age
- Clinical benefit
 - To reduce the incidence of iron deficiency anemia in early infancy

Strategies to minimise need for blood transfusions in neonates

- Effective phototherapy use
- Using standard guidelines for blood component transfusions

Strategies to minimise blood transfusions in preterm neonates

- Delayed cord clamping
- Minimising blood sampling losses
- Early iron supplementation
- Effective phototherapy
- Standard/ uniform transfusion policy

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



5.2: Script of webinar

The strategies for minimising blood transfusions

This script shall help you to understand the strategies for minimising blood transfusions.

1. The first and foremost strategy to prevent neonatal anaemia is delayed cord clamping. It is recommended to delay cord clamping by at least 60 seconds in all term and preterm neonates who do not require resuscitation. Delayed cord clamping is associated with reduced need for PRBC transfusions, intraventricular haemorrhage and necrotising enterocolitis without increase in maternal and neonatal complications. Notably, there is no increase in jaundice requiring treatment.

2. The second important strategy to reduce need for blood transfusions is to restrict blood sampling losses to as minimum as possible by doing a blood investigation only when absolutely essential. In this context, we need to remember that routine investigations, such as daily serum electrolytes or weekly blood counts are unnecessary. Do an investigation only when it is expected to influence clinical management.
3. Cluster blood samples wherever possible, such as combining two blood investigations, such as serum electrolytes and C-reactive protein levels in one prick
4. Use the minimum volume of blood required for an investigation. For e.g. glucose strips can be used in the place of lab sugar levels etc.
5. Follow a standard protocol for frequency of monitoring abnormal biochemical parameters such as 6 hourly monitoring of blood glucose in a hypoglycaemic neonate
6. Early iron supplementation in preterm neonates has been found to improve iron stores and may also reduce need for transfusions. Preterm neonates who are on enteral feeding can be safely begun on early iron supplementation of at least 2-4 mg/kg/day from 2 weeks of postnatal age. This decreases the incidence of iron deficiency anemia in early infancy
7. Effective and timely use of intensive phototherapy also averts the need for exchange transfusion and reduces exposure to red blood cells. Most importantly, having standard guidelines for blood component transfusions and adhering to it stringently is the most important step towards avoidance of unnecessary transfusions

5.3: Key messages

- Delay in cord clamping by 60 seconds is the first delivery room strategy to restrict need for blood transfusions
- Minimizing blood sampling losses, early iron supplementation and providing effective phototherapy are also effective in minimizing exposure to blood products
- Using standard guidelines for blood component transfusion reduces unnecessary blood transfusions



5.4: Self-check MCQs

1. What is the recommended minimum delay in cord clamping for a preterm neonate who does not need resuscitation?
 - a) 15 seconds
 - b) 30 seconds
 - c) 60 seconds
 - d) 45 seconds
2. Which of the following practices while planning blood tests in a preterm neonate is to be avoided?
 - a) Doing blood tests only when it is likely to change clinical management
 - b) Clustering blood samples
 - c) Drawing minimal volume blood needed for an investigation
 - d) Use of routine blood test like daily serum electrolytes is mandatory
3. What is the earliest postnatal age at which enteral iron supplementation can be begun?
 - a) 3 weeks
 - b) 2 weeks
 - c) 4 weeks
 - d) 6 weeks
4. Which of the following strategies may decrease the need for blood transfusions in preterm neonates in a unit?
 - a) Routine immediate cord clamping after birth
 - b) Delayed cord clamping in neonates not needing resuscitation
 - c) Using folic acid and multivitamins early
 - d) Not having a standard guideline to guide blood transfusions
5. Having a standard/ uniform policy to guide blood transfusions is very important to avoid unnecessary exposure to blood products **(TRUE/FALSE)**



Skill check (OSCE)

After you have read through the scripts, seen the videos and the webinars, you shall be asked to undergo a skill check on task trainers. The facilitator shall assess you and provide feedback. This shall include assessment of skill of:

S.No.	OSCE
1	Administering a blood product
2	Doing PCV and decision about use of PRBC transfusion
3	Measurement of serum bilirubin and decision about treatment of hyperbilirubinemia
4	Exchange transfusion
5	Measurement of jaundice using transcutaneous bilirubinometer (Minolta)

1. Administering Blood product

A 32 week, preterm neonate is to receive packed red cell transfusion in the SNCU. Demonstrate the steps you will follow to initiate blood transfusion and indicate the parameters that you would monitor during transfusion.

S.No.	Correct action	Yes	No
Before transfusion			
1	Checks the indication for the transfusion and the level of Hemoglobin or the platelet before the transfusion in the patient's file		
2	Indicates that he/she would talk to the parents about the procedure and take a consent		
3	Once the blood product is received, checks the following: <ol style="list-style-type: none"> 1. The patient ID and the ID on the blood bag should correspond 2. Checks the neonate's blood group and the blood group on the bag 3. Puts a signature on the cross-match slip 		
4	Writes instructions in the patient's file the volume of blood to be transfused and the rate of transfusion, mentioning the blood group and bag number in the order		
During transfusion			
5	Initiates transfusion via a peripheral IV observing all aseptic precautions		
6	Indicates that the following parameters should be monitored hourly during transfusion: <ul style="list-style-type: none"> • HR • RR • SpO₂ • BP • CFT 		

S.No.	Correct action	Yes	No
1	Refers the table on transfusion thresholds		
2	Identifies the correct hematocrit cut-off based on postnatal age [120 hrs], respiratory support [non-invasive support] and gestational age [<32 weeks] as <10 g%		
3	Decides that the neonate does not require blood transfusion based on above chart		

Score: (Maximum Score 3):.....

2. Measurement of total serum bilirubin (TSB) and decision about treatment of hyperbilirubinemia

A 32 weeks' preterm baby with birth weight of 1700 grams, now 72 hours old, with asphyxia on mechanical ventilation is clinically icteric up to the abdomen. How will you check serum bilirubin levels for this neonate using a micro centrifuge?

S.No.	Correct action	Yes	No
1	Washes hands and wears gloves		
2	Cleanses skin of the neonate with alcohol followed by betadine followed again by alcohol		
3	Collects capillary or venous blood sample in 2-3 heparinized capillary tubes using a 24/ 26 G needle		
4	Seals the base of the capillary by clay followed by soap		
5	Open the lid of the microcentrifuge and unscrews the cover disc		
6	Places at least 2 capillary tubes in 2 slots opposite to one another with the sealed end outwards		
7	Closes the cover disc and lid		
8	Turns on the centrifuge and sets the speed at 10000 rpm for 4-5 minutes		
9	Switches off the microcentrifuge and does not use external force to force stop it		
10	Removes the centrifuged capillary and cleans the outer surface using a sterile swab		
11	Ensures that the capillary has been well centrifuged and free of hemolysis		
12	Measure the serum bilirubin		
13	Ensures that the capillary has been well centrifuged and free hemolysis		
14	Switches on the spectrophotometer and calibrates using a blank capillary		
15	Places the sample of the neonate making sure the serum or plasma sample occupies the slit entirely		
16	Measures the serum bilirubin		
	Total Score		

Score: (Maximum Score 16):.....

Post transfusion

- 7 Indicates that the following parameters should be monitored hourly for 2 hours post transfusion:
- HR
 - RR
 - SpO₂
 - BP
 - CFT
- 8 Documents the completion of blood transfusion in patient records

Score: (Maximum Score 8):.....

3. Doing PCV and decision about use of PRBC transfusion

A 31 weeks' preterm baby with birth weight of 1600 grams, now 120 hours old, is supported with CPAP for respiratory distress. The baby looks pale on examination. How will you check packed cell volume (PCV) for this neonate using a micro centrifuge?

S.No.	Correct action	Yes	No
1	Washes hands and wears gloves		
2	Cleanses skin of the neonate with alcohol followed by betadine followed again by alcohol		
3	Collects capillary or venous blood sample in 2-3 heparinized capillary tubes using a 24/ 26 G needle		
4	Seals the base of the capillary by clay followed by soap		
5	Opens the lid of the microcentrifuge and unscrews the cover disc		
6	Places at least 2 capillary tubes in 2 slots opposite to one another with the sealed end outwards		
7	Closes the cover disc and lid		
8	Turns on the centrifuge and sets the speed at 10000 rpm for 4-5 minutes		
9	Switches off the microcentrifuge and does not use external force to force stop it		
10	Places the centrifuged capillary over the microhematocrit reader and measure PCV		
Total Score			

Score: (Maximum Score 10):.....

PCV is 34%. Corresponding Hb level is considered as 11.3 g/dL. What would you like to do?

4. Exchange transfusion


A preterm neonate born at 33 weeks' GA and birth weight of 1900 grams requires an exchange transfusion. Demonstrate the procedure of administration of exchange transfusion and the required monitoring

S.No.	Correct action	Yes	No
1	Does hand washing and wears gloves		
2	Cleans skin and cord with antiseptic solution		
3	Drapes appropriately		
4	Flushes the umbilical catheter with normal saline		
5	Identifies umbilical vein and cannulates it		
6	Catheter back flow checked		
7	Connect 2-3 way stop cocks to Umbilical Catheter		
8	Phototherapy continued during procedure		
9	Blood bag number and blood group cross-checked		
10	Blood bag sufficiently warm		
11	Connect blood bag to the three way proximal to the neonate with transfusion set and waste receptacle (empty IV bottle or bag) to the distal three way with IV set		
12	Cycle started with pull out keeping each cycle volume between 5- 8 mL		
13	Same volume pushed in		
14	Bag mixing done intermittently		
15	Hemodynamics monitored in a monitoring chart		
	Total Score		

Score: (Maximum Score 15):.....

5. Measurement of jaundice using transcutaneous bilirubinometer (Minolta)

A preterm neonate born at 36 weeks' GA and birth weight of 2400 grams appears jaundiced. Demonstrate the procedure of checking bilirubin using a transcutaneous bilirubinometer

S.No.	Correct action	Yes	No
1	Performs hand hygiene		
2	Before use, cleans the measuring probe with an alcohol wipe (in reusable probes)		
3	Sets the power switch to the ON position		
4	Ensures that the ready lamp illuminates		
5	Places the instrument vertically on the infant's sternum or on forehead. Takes care to avoid bruises or discolored skin		
			
6	Pushes the measuring probe gently until a click sounds. The instrument's xenon lamp should flash momentarily, and the measured value should appear on the display		
7	Presses the reset button and takes 2 more reading, pressing reset button before each new measurement		
8	Takes the average of above 3 readings		
9	Knows situations where TCB measurements may not be reliable and where decisions are to be made based on TSB alone <ul style="list-style-type: none"> • Infant less than 35 completed weeks gestation • Jaundice in the first 24 hours of life • Infant aged 14 days or older. • TCB measurement greater than 13 mg% • TCB measurement at or above the baby's age and gestation-specific treatment threshold (and TSB should also be used in place of TCB for all subsequent measurements) • Neonate under phototherapy or post phototherapy 		

Score: (Maximum Score 9):.....



Simulation

An essential pre-requisite before reaching this stage in each module is that the learner should have undergone the entire module, seen the videos and webinars facilitated by the facilitator, attempted the evaluation questionnaire, and demonstrated the skill check.

This session brings out learning and practice in a realistic environment for less exposure to blood products and prevention of exchange transfusion for prevention of ROP. The emphasis is on working together as a team and not on individual skills.

You shall be asked by the facilitator to participate as a team for the management of the following conditions.

- Baby with jaundice
- Baby with anemia

This shall be followed by feedback and debriefing.