

Less Systemic Infections

This module is designed to improve knowledge, skills and clinical practice of all stakeholders involved in the care of preterm neonates in “less systemic infections”

Learning objectives

The participants will learn:

- To understand the importance of preventing infection and its role in neonatal mortality, morbidity, antibiotic resistance, duration of stay and cost of care
- To be able to perform correct house-keeping practices
- To be able to maintain asepsis during various procedures performed on neonates
- To be able to identify neonates at-risk of or with suspected sepsis
- To be able to treat neonates with sepsis following principles of antibiotic stewardship program
- To be able to follow clinical practices which prevent sepsis
- To be able to monitor and improve sepsis related practices and outcomes following the quality improvement methodology in the local context

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 summarizes the important learning points in the webinar and the script
- **Video demonstration:** The videos in this module cover the “disinfection of different equipments used in neonatal intensive care unit and ward (NICU) and asepsis which needs to be observed during procedures in NICU”
- **Webinar:** The webinar in this module shall help the participant to gain knowledge of “potential harms resulting from systemic infection, sources of systemic infection in neonates, interpreting the sepsis screen, management of neonatal sepsis, cord and skin of a preterm neonate, bundle care approach and barrier nursing”
- **Poster demonstration:** The participant shall learn about “moments and steps of hand hygiene, neonatal sepsis scoring and biomedical waste management”
- **Checklist:** There will be a checklist on antibiotic prescription chart and infection control checklist
- **Self-assessment:** This will be done at the end of each objective, based on what participant has already learnt. The participant is free to consult the reading material if any help in recapitulation is required
- **Skill check:** The skill check includes evaluation of skills on disinfection of different equipments used in neonatal intensive care unit and ward (NICU) and asepsis which needs to be observed during procedures in NICU
- **Clinical case scenario:** After reading through the text material, viewing videos, webinars and pictorial posters with messages, the participant shall be asked to reply to different case scenarios while performing as a team; and individual feedback and debriefing of the team will be done

Learning Objective 1

Understanding the importance of preventing infection and its role in neonatal mortality, morbidity, antibiotic resistance, duration of stay and cost of care.

This objective covers the importance of preventing infection and its role in neonatal mortality, morbidity, antibiotic resistance, duration of stay and cost of care and will be delivered as:

- Webinar
- Script
- Key messages
- Self-check MCQ's

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

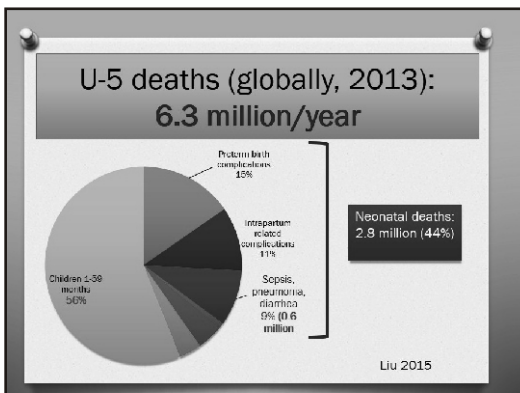


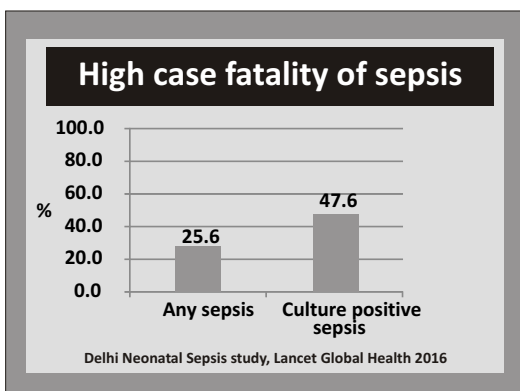
1.1: Webinar

You will view and listen to webinar on potential harms resulting from systemic infection along with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions. The power point slides of the webinar are given here.

**Infections in neonates:
How can it harm the babies?**

DR. Ramesh Agarwal
MD, DM (Neonatology)
Professor
Department of Pediatrics
AIIMS, New Delhi





Potential harms

- Longer stay in the hospital
- Care and management related complications (iatrogeneses)
- Increased cost
- Long term neurological complications

Key messages

- Neonatal sepsis is a devastating illness causing many neonates to die.
- Additionally, it is associated with increased hospital stay, cost, therapy-related complications and neurological disability

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

Potential harms resulting from systemic infection

This script shall help you to understand the potential harms resulting from systemic infection.

- Infection in the neonates or neonatal sepsis is a devastating condition
- We have a huge burden of child death - 6.3 million children every year. Over 99% of these deaths happen in developing countries. Over two thirds of them are preventable by simple interventions
- Of 6.3 million under-5 deaths, 2.8 million are neonates- that is nearly 44% of under-5 deaths. This means so many U-5 deaths happen within just a month of birth. The three most important causes i.e. preterm birth complication, intrapartum events (asphyxia) and sepsis together account for two thirds of neonatal deaths
- It is therefore very clear that infections are a major cause of neonatal death and therefore prevention and optimum management of them is really very important for us
- Given figure shows, the case fatality of neonatal sepsis in hospitalized neonates as observed in a recently published Delhi Neonatal Sepsis Registry study in Lancet Global Health. A quarter of babies die when there is any sepsis in the baby- either culture positive or culture negative. When the sepsis was culture positive- nearly half of the babies died despite adequate treatment in these hospitals
- The other potential harms in the babies include longer stay in the hospitals. Treatment of sepsis itself results in a variety of harms in the baby- what is known as iatrogenesis. There is increased cost on part of families as well as hospitals. Moreover, sepsis results in long term neurodevelopment disabilities also

1.3:Key messages

- Neonatal sepsis is a devastating illness causing many neonates to die
- Additionally, it is associated with increased hospital stay, cost, therapy-related complications and neurological disability
- Important for us to prevent and optimally manage this condition



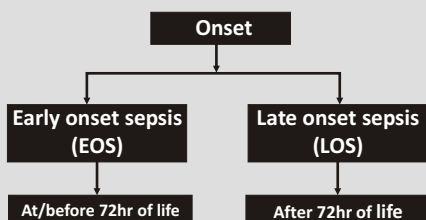
1.4: Webinar

You will view and listen to webinar on sources of systemic infection in neonates along with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions. The power point slides of the webinar are given here

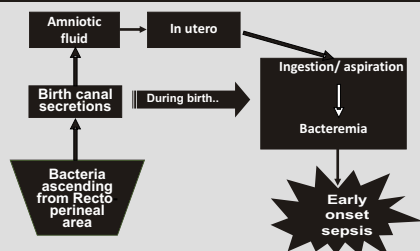
Neonatal Sepsis: Where does the infection come from?

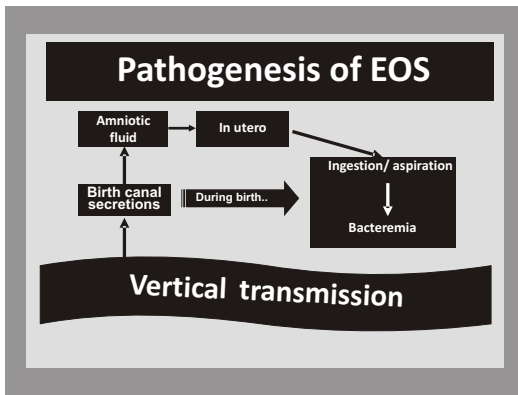
DR. Ramesh Agarwal
MD, DM (Neonatology)
Professor
Department of Pediatrics
AllIMS, New Delhi

Types of neonatal sepsis



Pathogenesis of EOS





Maternal risk factors for EOS

- Rupture of membrane >24 hours
- Spontaneous preterm labor
- Chorioamnionitis
 - Maternal fever (>100.4°F) and
 - Two of: maternal tachycardia, fetal tachycardia, foul smelling liquor, uterine tenderness, maternal leukocytosis (>15,000 cells/mm³)
- Prolonged labor (>24hr)
- Unclean or multiple PV examination
- Maternal UTI or diarrhea

Risk factors of LOS in hospitalized neonates (Healthcare associated infections; HAI)

- Lack of adequate hand hygiene
- Procedures and investigations
- Suboptimal asepsis routines
- Infection occurring during ventilation particularly during ET suction
- Overcrowding in the unit and low nurse-patient ratio
- Lack of breastmilk feeding
- Use of IV fluids and unnecessary drugs and antibiotics

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- Overcrowding in the unit and low nurse-patient ratio
- Lack of breastmilk feeding
- Use of IV fluids and unnecessary drugs and antibiotics

Horizontal transmission

Risk factors of LOS in neonates in the community (Community acquired infections; CAI)

- Contaminated environment
- Lack of hygiene practices
- Superficial infections such as umbilical sepsis and many pustules
- Lack of breastfeeding

Horizontal transmission

In developing countries

EOS in hospitalized neonates is like LOS

Perhaps due to:

- Horizontal transmission due to unhygienic practices during birth, resuscitation and first few hours
- Colonization of maternal genital tract with resistant pathogens

Preventive strategies

- **Early onset sepsis**
 - Must be directed towards preventing maternal risk factors
 - Hygienic birthing and resuscitation and early care giving practices
- **Late onset sepsis**
 - Good NICU practices in hospitals
 - Hygienic practices in homes
 - Breast milk feeding

Key messages

- **Source of infection**
 - Early onset sepsis: maternal genital tract (vertical transmission)
 - Late onset sepsis: environment, suboptimal care giving practices (horizontal transmission)
- **Prevention of sepsis therefore must be directed towards risk factors of respective type of sepsis**

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.

**1.5: Script****Sources of systemic infection in neonates****This script shall help you to understand the sources of systemic infection in neonates**

- The classification of neonatal sepsis, which is based on age of neonate at the onset of sepsis. If sepsis manifests at or before 72 hours of life- it is known as early onset sepsis; while that manifesting after 72 hours, is known as late onset sepsis. This classification is important as the two types of sepsis are supposed to have different sources, causative pathogens, clinical manifestations, the management as well as the outcomes
- The bacteria from the rectum and perineum of the mother ascend to her genital tract. The baby contracts infection while passing thru the birth canal. Alternatively, the pathogens ascend to the amniotic cavity through the ruptured membrane and reaches to the baby. Through the ingestion or aspiration, the bacteremia sets in and some of these bacteremic babies develop what is known as early onset sepsis. Therefore, the source of infection in early onset sepsis is often maternal genital tract and it transmits from the mother to the baby- a form of vertical transmission
- Though the early onset sepsis can happen without any risk factor, it generally happens in the setting of a variety of maternal risk factors. These risk factors include: rupture of membrane >24 hours, spontaneous preterm labor, and presence of chorioamnionitis. Chorioamnionitis has been defined as presence of maternal fever of $>100.4^{\circ}\text{F}$ AND any two of five factors namely maternal tachycardia, fetal tachycardia, foul smelling liquor, uterine tenderness, and maternal leucocytosis defined as TLC of $>15,000$ cells/mm³
- Other risk factors include prolonged labor defined as duration of labor for >24hr, and unclean or multiple PV examination. Some studies identify maternal UTI and diarrhea as the risk factors also but these factors have not been consistently reported as important ones and therefore we have not included them in the list

- The late onset sepsis in hospitalized neonates is known as healthcare associated infection (HAI). As the name indicates, HAI occurs during the process of providing healthcare. A variety of risk factors increase the probability of occurrence of HAI. The most important one is the lack of adequate hand hygiene by the care providers. The hands of providers get colonised with resistant pathogens in the process of care giving and if proper hand hygiene is not practiced, the contaminated hands can transmit pathogens to the neonates under their care. The other risk factors include - too many procedures, investigations, suboptimal asepsis during procedures, infection occurring during ventilation particularly during ET suction, overcrowding in the unit and low nurse-patient ratio, lack of breast milk feeding, use of IV fluids, unnecessary drugs and antibiotics. The infection in late onset sepsis therefore transmits from the environment to the neonate- and this is known as horizontal transmission
- The late onset sepsis can occur in the homes or the community- also labeled as community acquired infection. The source in this type is again the environment, and the infection passes through horizontal transmission of pathogens. The risk factors include: lack of hygienic practices in the homes or community, occurrence of superficial infections such as umbilical sepsis, or skin pustules and lack of breastfeeding
- While the early and late onset sepsis are pretty distinct entities in the developed nations but that is not the case in the developing countries. Bacterial pathogens and their antimicrobial resistance, manifestation and outcomes of these two types of sepsis quite resemble those of late onset sepsis in the setting of developing nations. This suggests that early onset sepsis in developing countries may be transmitted through horizontal transmission due to unhygienic practices during birth, resuscitation and first few hours of life - a pathogenesis similar to that of late onset sepsis. Alternatively, colonization of maternal genital tract with late onset sepsis types pathogens also contributes
- Prevention of early onset sepsis therefore involves preventing and managing maternal risk factors as outlined in previous slides as well as providing hygienic care during birthing and resuscitation as well as during early few hours of birth. Late onset sepsis can be prevented by good NICU practices in the hospitals and hygienic practices in homes. We have a separate webinar on this issue.
- Breast milk feeding prevents both early onset sepsis (EOS) as well as late onset sepsis (LOS)

1.6:Key messages

- Neonates suffer from two types of sepsis namely early onset and late onset depending on age of neonate at the onset of sepsis. The source of infection in early onset sepsis is the maternal genital tract and there is vertical transmission of pathogens from the mother to the baby
- Late onset sepsis on the other hand is acquired through horizontal transmission from the home or hospital environment. It is facilitated by unhygienic care practices and asepsis routines in the hospitals
- Prevention of sepsis therefore must be directed towards risk factors of the respective type of sepsis



1.7: Self-check MCQ's

1. Which of the following is a possible serious harm due to neonatal sepsis?
 - a. Neurodevelopment delay
 - b. Malnutrition
 - c. Cardiomyopathy
 - d. Blood dyscrasias

2. What proportion of global deaths in neonates occurs in low- and middle income countries?
 - a. 25%
 - b. 50%
 - c. 75%
 - d. Over 90%

3. The three most important causes of neonatal death are all '**EXCEPT**'
 - a. Preterm birth complication
 - b. Asphyxia
 - c. Sepsis
 - d. Congenital malformations

4. State if '**true or false**';
 - a. Culture positive sepsis is associated with a higher risk of mortality
 - b. Sepsis can result in long term neurodisability

Learning Objective 2

Performing the correct house-keeping practices

This objective covers the performing the correct house-keeping practices and is delivered as:

- Videos
- Self-check MCQ's

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



2.1:Video

There will be video demonstrations on, 'cleaning of different equipments used in NICU' by your facilitator on:

1. SNCU floors and walls
2. Radiant warmer
3. Pulse oximeter
4. Phototherapy units
5. Suction machine
6. CPAP machine and circuit
7. Feeding utensils
8. Syringe pumps
9. Oxygen delivery equipment
10. Resuscitation equipment
11. Waste disposal

The video demonstration will be followed by discussion

1. The following aspects of SNCU floors and walls were shown:
 - i.
 - ii.
 - iii.
2. The following aspects of radiant warmer were shown:
 - i.
 - ii.
 - iii.
3. The following aspects of pulse oximeter were shown:
 - i.
 - ii.
 - iii.
4. The following aspects of phototherapy units care were shown:
 - i.
 - ii.
 - iii.

5. The following aspects of suction machine were shown:
 - i.
 - ii.
 - iii.
6. The following aspects of CPAP machine and circuit were shown:
 - i.
 - ii.
 - iii.
7. The following aspects of feeding utensils were shown:
 - i.
 - ii.
 - iii.
8. The following aspects of syringe pumps' were shown:
 - i.
 - ii.
 - iii.
9. The following aspects of oxygen delivery equipment were shown:
 - i.
 - ii.
 - iii.
10. The following aspects of resuscitation equipment were shown:
 - i.
 - ii.
 - iii.
11. The following aspects of waste disposal were shown:
 - i.
 - ii.
 - iii.

Comments on video:

Good aspect

.....

.....

.....

Need improvement

.....

.....

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2.2:Self-check MCQ's

1. Which solutions should not be used for cleaning the oxygen hoods?
 - a. Alcohol containing solutions
 - b. Soap solutions
 - c. Formaldehyde
 - d. Warm water

2. For biomedical waste disposal, which colored container should be used to dispose off expired medicines
 - a. Blue
 - b. Yellow
 - c. Red
 - d. Black

3. Antibiotic stewardship includes all '**EXCEPT**'
 - a. Initiate narrow spectrum antibiotics
 - b. Send blood culture at start of antibiotics
 - c. Consult microbiology and clinical pharmacology before upgrading the antibiotics
 - d. Start anti-meningitis dose in all cases and later modify the dose based on CSF analysis

4. For effective sterilization of feeding utensils, the following should be done
 - a. Dip in boiling water for 10 minutes
 - b. Roll boil for 15 minutes
 - c. Roll boil for 15 minutes with the container covered
 - d. Use medicated soap to effectively clean and sterilize the utensils

5. Which of the following is '**true**' regarding resuscitation equipment cleaning
 - a. Self inflating bags are best sterilized by autoclaving
 - b. Laryngoscope blades need wiping with 50% alcohol once a day
 - c. Dismantling the self inflating bags is mandatory before cleaning
 - d. Dipping in glutaraldehyde removes organic waste from the equipment

Learning Objective 3

Maintaining the asepsis during various procedures performed on neonates

This objective covers the maintaining the asepsis during various procedures performed on neonates and is delivered as:

- Videos
- Poster
- Self-check MCQ's

After viewing and listening to the videos and posters, you shall undergo a self- evaluation based on what you have already learnt.



3.1: Video

There will be video demonstrations on, 'aseptic technique used during procedures in NICU' by your facilitator on:

1. Hand wash
2. Hand rub
3. Bed preparation and baby belongings
4. Intravenous fluid preparation
5. Intravenous cannula insertion
6. Intravenous injections
7. Blood sampling
8. Feed preparation and administration
9. Endotracheal suction
10. Oral and nasal suction
11. Resuscitation
12. Blood sugar estimation
13. Use of sterile gloves
14. Use of disposables

The video demonstration will be followed by discussion

1. The following aspects of hand wash were shown:
 - i.
 - ii.
 - iii.
2. The following aspects of hand rub were shown:
 - i.
 - ii.
 - iii.
3. The following aspects of bed preparation and baby belongings were shown:
 - i.
 - ii.
 - iii.
4. The following aspects of intravenous fluid preparation were shown:
 - i.
 - ii.
 - iii.
5. The following aspects of intravenous cannula insertion and injection were shown:
 - i.
 - ii.
 - iii.

6. The following aspects of intravenous injections were shown:

- i.
- ii.
- iii.

7. The following aspects of blood sampling were shown:

- i.
- ii.
- iii.

8. The following aspects of feed preparation and administration were shown:

- i.
- ii.
- ii.

9. The following aspects of endotracheal suction were shown:

- i.
- ii.
- iii.

10. The following aspects of oral and nasal suction were shown:

- i.
- ii.
- iii.

11. The following aspects of resuscitation were shown:

- i.
- ii.
- iii.

12. The following aspects of blood sugar estimation were shown:

- i.
- ii.
- iii.

13. The following aspects of use of sterile gloves were shown:

- i.
- ii.
- iii.

14. The following aspects of use of disposables were shown:

- i.
- ii.
- iii.

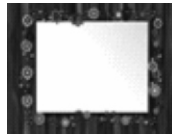
Comments on video:

Good aspect

.....

Need improvement

.....



3.2:Poster

Hand Hygiene – Moments And Steps

The facilitator shall conduct a demonstration session on hand washing- moments and steps

How to Handwash?

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB



Duration of the handwash (steps 2 - 7): 15-20 seconds

Duration of the entire procedure: 40- 60 seconds



Wet hands with water:



Apply enough soap to cover all hand surfaces:



Rub hands palm to palm:



Right palm over left dorsum with interlaced fingers and vice versa:



Palm to palm with fingers interlaced:



Backs of fingers to opposing palms with fingers interlocked:



Rotational rubbing of left thumb clasped in right palm and vice versa:



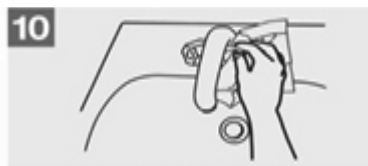
Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa:



Rinse hands with water:



Dry hands thoroughly with a single use towel:



Use towel to turn off faucet:



Your hands are now safe.



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Based on the 'How to Handwash', URL: http://www.who.int/gpsc/5may/How_To_HandWash_Poster.pdf © World Health Organization 2009. All rights reserved

How to Handwash?

RUB HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED



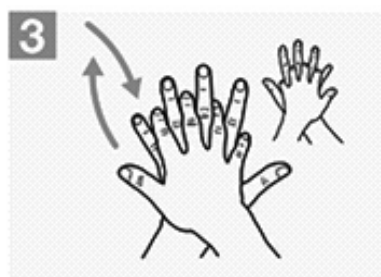
Duration of the entire procedure: 20-30 seconds



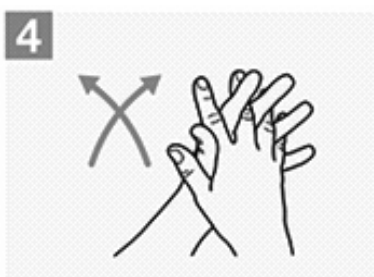
1a Apply a palmful of the product in a cupped hand, covering all surfaces:



2 Rub hands palm to Palm:



3 Right palm over left dorsum with interlaced fingers and vice versa:



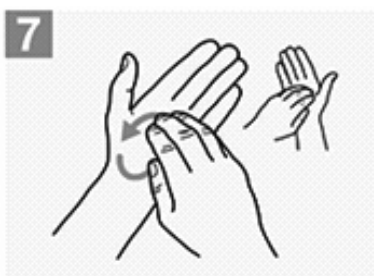
4 Palm to palm with fingers interlaced:



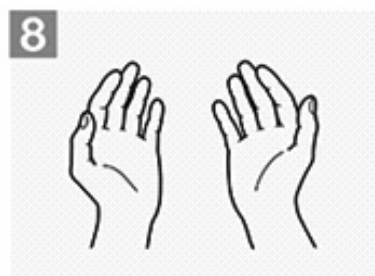
5 Backs of fingers to opposing palms with fingers interlocked:



6 Rotational rubbing of left thumb clasped in right palm and vice versa:



7 Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa:



8 Once dry, your hands are safe.



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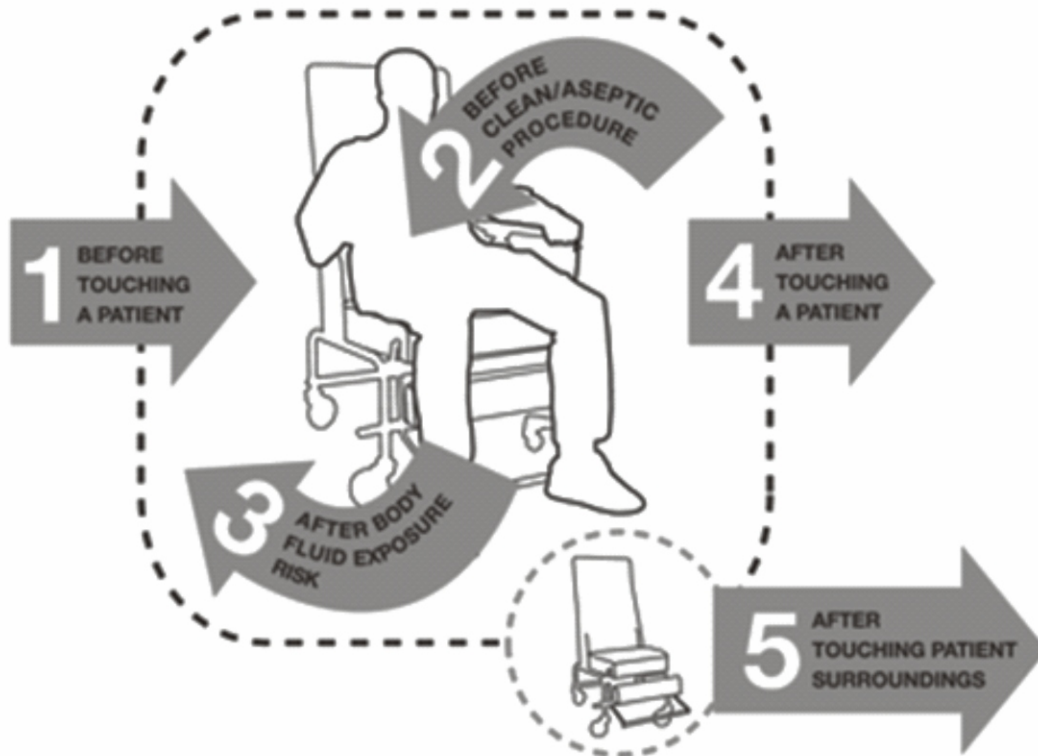
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May 2009

Your 5 Moments for Hand Hygiene



1 BEFORE TOUCHING A PATIENT	WHEN? Clean your hands before touching a patient when approaching him/her. WHY? To protect the patient against harmful germs carried on your hands.
2 BEFORE CLEAN/ASEPTIC PROCEDURE	WHEN? Clean your hands immediately before performing a clean/aseptic procedure. WHY? To protect the patient against harmful germs. Including the patient's own, from entering his/her body.
3 AFTER BODY FLUID EXPOSURE RISK	WHEN? Clean your hands immediately after an exposure risk to body fluids (and after glove removal). WHY? To protect yourself and the health-care environment from harmful patient germs.
4 AFTER TOUCHING A PATIENT	WHEN? Clean your hands after touching a patient and her/his immediate surroundings, when leaving the patient's side. WHY? To protect yourself and the health-care environment from harmful patient germs.
5 AFTER TOUCHING PATIENT SURROUNDINGS	WHEN? Clean your hands after touching any object or furniture in the patient's immediate surroundings, when leaving - even if the patient has not been touched. WHY? To protect yourself and the health-care environment from harmful patient germs.



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May 2009



3.3: Self-check MCQ's

1. The alcohol content of a good alcohol base hand rub is
 - a. 35%
 - b. 40%
 - c. 55%
 - d. 70%
2. According to recent WHO-CDC guidelines, the alcohol based hand rub should be applied to the hands for how many seconds after touching the baby
 - a. 20-30 seconds
 - b. 45-60 seconds
 - c. 90 seconds
 - d. 2 minutes
3. For bed preparation the warmer of the baby, the plastic transparent side walls should be cleaned by. (1) Alcohol swabs, (2) Soap and water, (3) Bacillocid, (4) Cidex
 - a. 1, 2, & 3
 - b. 1 & 4
 - c. 2 & 3
 - d. Any of the above
4. For blood glucose sampling the sequence of events should be
 - a. Clean the foot with spirit swab, open the strip, attach the strip to glucometer, prick the sole, squeeze the foot to get the drop
 - b. Open the strip, attach the strip to glucometer, Clean the foot with spirit swab, prick the sole, squeeze the foot to get the drop
 - c. Clean the foot with spirit swab, prick the sole, open the strip, attach the strip to glucometer, squeeze the foot to get the drop
 - d. Any of the above
5. During ET suction of preterm neonates which one for the following is '**CORRECT**'
 - a. Increase to 100% FiO₂ for around 10 min before the procedure
 - b. Increase to 100% FiO₂ for around 1-2 min before the procedure
 - c. Increase FiO₂ by 5-10% during the procedure
 - d. Any of the above

Learning Objective 4

Identifying the neonates at-risk of or with suspected sepsis

This objective covers the identifying the neonates at-risk of or with suspected sepsis and is delivered as:

- Webinar
- Script
- Key messages
- Videos
- Poster
- Self-check MCQ's

After viewing and listening to the videos, webinars, posters and reading the script and 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 interpreting the sepsis screen along with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions. The power point slides of the webinar are given here.

Sepsis screen

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Sepsis screen

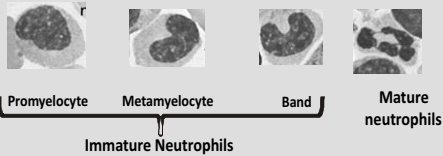
1. Absolute neutrophil count (ANC;
<1800/mm³)
2. Immature to total neutrophil (I/T) ratio
(>20%)
3. Micro-ESR (>15 mm 1st hour)
4. CRP +ve (>10 mg/L)

*If two or more criteria are present, we label
sepsis screen as positive

Absolute neutrophil count (ANC)

- o Do TLC and differential
leukocyte count

Neutrophils



Count all neutrophils-mature and immature

Absolute neutrophil count

- o ANC is calculated by
 - o $\text{TLC} \times \% \text{ neutrophils (immature + mature) } / 100$
- o TLC-10,000/Cmm ; mature neutrophils - 40, Immature: 10, lymphocyte-48, Eosinophil-2
- o $\text{ANC} = 10000 \times (40+10)/100 = 5000$

Immature to total neutrophil ratio (IT ratio)

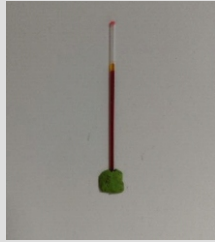
- o mature neutrophils - 40, band-5, Prometamyelocyte-3, metapromyelocyte-2, lymphocyte-48, Eosinophil-2
- o $\text{IT: } 10/50 = 20\%$

Sepsis screen

- o Serum CRP: quantitative or semi-quantitative: >10 mg/dL
- o A separate video on how to do CRP

Micro ESR

- o Take 75 mm microcapillary
- o Heparinize, close one end and suspend vertically on the wall
- o Measure fall of RBC column in first hr



Key message

- o Sepsis screen is panel of 4 tests namely ANC, IT ratio, Micro ESR and S. CRP levels
- o if two or more criteria are positive, screen is said to be positive

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

Interpreting the sepsis screen

This script shall help you to understand and interpreting the sepsis screen.

Sepsis screen has four components

- No 1 Absolute neutrophil count <1800 per cubic milliliter
- No 2 immature to total ratio more than 20%,
- No 3, micro-ESR more than 15 mm fall in first hour and
- No 4 serum CRP level more than 10 mg/L. When two or more components are present, the sepsis screen is said to be positive

For doing absolute neutrophil count (ANC), we do total and differential leucocyte count (TLC and DLC)

- Whenever there is sepsis and inflammation, there is shift to left in the blood cells seen in peripheral smear. 'shift to left' means that apart from mature neutrophils, immature neutrophils from bone marrow move to peripheral blood
- Mature neutrophils have a nucleus which is multiplied and segmented. While different immature cells have a single nucleus that is still unsegmented as the process of lobulation has not been completed as yet. We count both immature as well as mature neutrophils while doing differential count
- From TLC and DLC we calculate ANC and IT ratio. For ANC, we take all neutrophils mature as well as immature and multiply it with TLC and divide by 100. For e.g. if TLC is 10000. In differential, we find mature neutrophils - 40, band- 5, promyelocyte - 3, metamyelocyte-2, lymphocyte- 48, eosinophil-2. The ANC would be $10000 \times \frac{\text{total neutrophils}}{100}$ i.e. $(40+5+3+2)/100$ which equals to 5000. So, ANC in this example is 5000
- To calculate immature to total neutrophil ratio in previous example. We calculate immature neutrophils which is band- 5, prometamyelocyte - 3, metapromyelocyte-2, that add up to 10 and total neutrophil is 50 so the ratio comes out to be 20%
- Serum CRP can be performed as a quantitative test in which we get precise level of CRP in the serum or it could qualitative which gives us different cut offs. We will see a separate video on how to do CRP test
- Micro-ESR is done by taking a 75 mm capillary, heparinizing it, filling it with blood and suspending it on the wall for one hour. We take measurement after one hour and see amount of fall in blood. We will see a different video on it

4.3:Key messages

- Sepsis screen is panel of 4 tests namely ANC, IT ratio, Micro-ESR and S. CRP level
- If two or more criteria are positive, screen is said to be positive



4.4: Webinar

You will view and listen to webinar on approach to neonatal sepsis along with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions. The power point slides of the webinar are given here.

Neonatal sepsis: An approach

DR. Ramesh Agarwal
MD, DM (Neonatology)
Professor
Department of Pediatrics
AllIMS, New Delhi

Objectives

- To learn a broad approach to management

Details of antimicrobial therapy in a different webinar

Sepsis

EOS

1. Risk factors or
2. Symptoms, or
3. Both

LOS

- Symptoms

The baby could be in community or in the hospital for some other reason

Perinatal risk factors

- o **Extreme:**
 - o Rupture of membrane >72 hours
 - o Chorioamnionitis
 - o Foul smelling liquor
- o **Others**
 - o Spontaneous preterm labor
 - o Prolonged labor (>24 hours but <72 hr)
 - o Rupture of membrane 24 to 72 hours
 - o An unclean or multiple PV examination

Symptoms suggestive of sepsis in a neonate

- Lethargy, poor feeding
(mother/nurse reports 'baby does not look well')
- Respiratory distress, apnea
- Fever, hypothermia
- Vomiting, diarrhea, abdominal distension
- Seizures, encephalopathy
- Poor perfusion, shock
- Rare- bleeding, sclerema, renal failure

Scenarios

EOS

1. Risk factors AND no symptoms
2. Risk factors AND symptoms
3. No risk factors and symptoms

LOS

- 4. Symptoms*

The baby could be in community or in the hospital for some other reason

What do you do in scenario 1:

(Risk factors AND no symptoms)

- ① **Extreme risk factors:**
 - o Initiate antibiotics
 - ② **Other risk factors:**
 - o Observe vitals/signs of sepsis every 6 to 12 hr for 72hr
 - o Start antibiotics if the baby develops signs of sepsis
 - o No need for sepsis screen
- Perform blood culture before antibiotics
 - Perform LP if culture comes positive

What do you do in scenario 2:

(Risk factors AND symptoms)

- ① **Start antibiotics**
- ② **No need for sepsis screen**

- **Perform blood culture before antibiotics**
 - **Perform LP**

What to do in scenario 3 & 4: Symptomatic baby

- ① **If too sick or obvious infection**
(such as presence of shock, sclerema, bleeding tendency, respiratory failure requiring ventilation, seizures in absence of asphyxia, or severe hypothermia or obvious infection such as cellulitis)
- ② **If not too sick**
(such as a single apnea, occasional vomiting, transient temperature instability, some reduced activity, mild tachypnea)

- **Initiate antibiotics**
- **Perform sepsis screen:**
 - Positive: initiate antibiotics therapy
 - Negative: look for alternate cause; follow up closely

- **Perform blood culture and LP before antibiotics**

Key messages

1. **Suspect:**
 - EOS: maternal risk factors or symptoms
 - LOS: symptoms
2. **EOS: manage the baby as per risk factors and symptoms**
 - Risk factors and no symptoms:
 - Extreme: start antibiotics
 - Others: close monitoring; antibiotics if symptoms
 - Risk factors and symptoms: start antibiotics
 - No risk factors and symptoms: manage as LOS
3. **LOS: Symptoms**
 1. too sick or obvious infection: antibiotics
 2. not-so sick : sepsis screen; treat if positive; look for alternate cause if negative and monitor

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



4.5: Script

Approach to neonatal sepsis

This script shall help you to understand the approach to neonatal sepsis

There are two different types of sepsis in neonates

- Early onset and late onset depending upon the age at onset of sepsis
- In general we suspect early onset sepsis when there are maternal risk factors, or the baby is symptomatic within first 72 hours, or has the both, while late onset sepsis is suspected only if the baby is symptomatic

The different maternal risk factors are divided into extreme risk factors and other risk factors. Extreme risk factors include

- Rupture of membrane for >72 hours
- Presence of chorioamnionitis
- Foul smelling liquor

Other risk factors include

- Spontaneous preterm labor, prolonged labor for >24 hours but less than 72 hr, an unclean or multiple PV examination
- Some studies identify UTI and maternal diarrhea as the risk factors. However, these factors have not been consistently identified and are not included in this list

List of signs and symptoms that can suggest sepsis in neonates include:

- Lethargy or poor feeding - particularly in a baby who has been feeding normally. Sometimes a care giver- the mother or a nurse- may report that 'baby does not look well'
- Respiratory distress, apnea
- Fever, hypothermia
- Vomiting, diarrhea, abdominal distension
- Seizures, encephalopathy
- Poor perfusion, shock
- Rare causes like bleeding, sclerema, renal failure

Both types of sepsis can occur in the homes or the hospitals. These symptoms are not specific to sepsis and may be present in other illnesses also

We can broadly identify four different scenarios of sepsis presentation: three for early onset and one for late onset sepsis. Early onset sepsis can be suspected either because of maternal risk factors or symptoms in the baby while late onset can only be suspected if the baby has some symptoms suggestive of sepsis

- In scenario 1, there are maternal risk factors but the baby does not have any symptoms
- In scenario 2, includes babies with maternal risk factors as well as the babies having symptoms
- In scenario 3, there are no maternal risk factors but the baby has symptoms of sepsis and the fourth scenario pertains to late onset sepsis. And this occurs in a baby older than 72 hours and having symptoms suggestive of sepsis

In scenario 1: If there are extreme risk factors, as the likelihood of sepsis is very high- we straight away start antibiotics without any delay. While in presence of other risk factors, the baby is monitored closely for vital signs and for development of symptoms every 6 to 12 hours for 72 hours. If the baby develops any sign or symptoms suggestive of sepsis or hemodynamic instability during this period, the antibiotics are initiated. We should always take blood culture before starting antibiotics under both the circumstances and perform lumbar puncture (LP) if culture comes positive. Additionally, LP always needs to be performed in the presence of clinical symptoms

In scenario 2: that is presence of maternal risk factors as well as symptoms in a baby, we start antibiotics. We send blood culture before starting antibiotics. Perform LP also

In scenario 3: pertains to a symptomatic neonate within 72 hours that is early onset sepsis, however, there are no maternal risk factors

In scenario 4: the baby is symptomatic after 72 hours that means the baby is suspected of late onset sepsis

If the baby is too sick as evidenced by presence of shock, sclerema, bleeding tendency, respiratory failure requiring ventilation, seizures in absence of asphyxia, severe hypothermia, or if obvious signs of sepsis such as cellulitis are present, we start antibiotics without waiting for anything. However, If the baby is assessed not to be too sick like the baby having an isolated episode of apnea, or occasional vomiting or a baby with transient temperature instability, some reduced activity, or mild tachypnea, we can hold on antibiotics for some time and perform sepsis screen. The baby is treated with antibiotics if sepsis screen comes positive. If the sepsis screen is negative, we look for alternate explanation for symptoms and of course follow the baby

And again, if we start antibiotics, we always send blood culture before starting antibiotics.

4.6:Key messages

- Manage early onset sepsis based on presence of maternal risk factors and symptoms. If there are risk factors and no symptoms, we assess severity of risk factors
- With extreme risk factors, we start antibiotics without any delay
- While in presence of other risk factors, we closely monitor and start antibiotics if the baby develops any symptoms
- With risk factors and symptoms, we treat the babies with antibiotics. The babies without risk factors but presence of symptoms are managed as late onset sepsis
- In such babies suspected of early onset sepsis as well as those suspected of late onset sepsis, we assess the level of sickness. In a baby that is too sick or has obvious infection, antibiotics are started at once
- The babies who are not too sick, we can perform sepsis screen and treat if it is positive



4.7: Video

There will be video demonstrations by your facilitator on:

1. How to do c-reactive protein (CRP)?
2. How to do micro-erythrocyte sedimentation rate (μ -ESR)?
3. How to prepare a peripheral smear?

The video demonstration will be followed by discussion

1. The following aspects of how to do CRP were shown:

- i.
- ii.
- iii.

2. The following aspects of how to do μ -ESR were shown:

- i.
- ii.
- iii.

3. The following aspects of how to prepare a peripheral smear were shown:

- i.
- ii.
- iii.

Comments on video:

Good aspect

.....

.....

.....

Need improvement

.....

.....

.....



4.8:Poster

There will be a poster demonstration on

- Neonatal sepsis score
- Interpretation of sepsis screen
- Biomedical waste management

Neonatal Sepsis Score

The facilitator shall conduct a demonstration session on neonatal sepsis score

❖ **Use of sepsis score**

Deciding initiation of antibiotics in asymptomatic neonates WITH presence of maternal risk factors of infections

❖ **Scenario**

All neonates <35 wks of gestation, who remain asymptomatic until 2 h of life, are assessed for the risk of EOS by following risk factors

Risk factor	Score
Intrapartum per vaginal examinations ≥ 3	6
Clinical chorioamnionitis*	6
BW <1.5kg	3
Male gender	3
Not received IP antibiotics**	2
Gestation ≤ 30 wks	2

**Clinical chorioamnionitis is defined as Intrapartum fever ($>37.8^{\circ}\text{C}$) with 2 of the following features: fetal tachycardia, uterine tenderness, malodorous vaginal discharge, maternal leucocytosis (TLC $> 15,000$)*

***Antibiotics started <4 hr prior to delivery also classified as "Not received antibiotics"*

❖ **How to use the total score**

Total score	Action
≤ 6	<ul style="list-style-type: none"> • Do not start antibiotics • Carefully monitored clinically for a period of at least 72 hr for signs of sepsis • No active monitoring if remain asymptomatic until 72 hr • Mother must be advised to bring any unusual sign to notice within first 7 days • Draw blood culture and prophylactic empirical antibiotics
≥ 7	<ul style="list-style-type: none"> • LP not required of the baby is asymptomatic

Note: This risk score does not cover neonates with extreme risk factors. Thus they should be started on empirical prophylactic antibiotics, irrespective of the score or as advised by the treating doctor.

Interpretation Of Sepsis Screen

The facilitator conducts a demonstration session on interpretation of sepsis screen

- ❖ The sepsis screen consists of: C-Reactive Protein (CRP), absolute neutrophil count (ANC), immature-to-total neutrophil ratio (ITR) and micro-erythrocyte sedimentation rate (μ -ESR)
 - **CRP:** It is done by quantitative ELISA or by a bedside semi-quantitative latex agglutination kit. More than 10 mg/L is positive
 - **ANC:** It is calculated by multiplying percentage of neutrophils with total TLC in hemogram report. It is read from Monroe's and Schelonka's charts (for term neonates), or Mouzinho's charts (for preterm neonates). For neonates born in high altitudes Christensen's nomograms, can be used. The values above and below 95% confidence interval are abnormal
 - **ITR:** ITR is defined as, immature PMN (band forms, metamyelo & myelocytes)/ Mature + immature neutrophils Value above 20% in preterm neonates are considered positive
 - **μ -ESR:** Value (in mm in first hour) > "3+age in days" in the 1st wk of life or >15 thereafter is considered positive
- **Interpretation of screen**

All the parameters of the sepsis screen are negative	Low probability of LOS, But if the baby continues to be symptomatic, repeat screen after 12- 24 hours
Any two parameters positive	Sepsis screen positive, Draw blood culture and start antibiotics
Only one parameter positive	The positive predictive value of individual test is low. Hence clinical judgement is used by combining risk factors, clinical signs & symptoms, clinical course of the neonate and screen parameters
Neonates assessed to have a high clinical probability of sepsis e.g. overtly symptomatic with presence of risk factors of sepsis	Draw blood culture and start antibiotics

Note:

- The purpose of the sepsis screen is to rule out sepsis rather than to rule in sepsis.
- There is no role of sepsis screens in first 48 hours of life for diagnosis of sepsis as there are lot of false positives and negatives in first 48 hours

Biomedical waste management

The facilitator conducts a demonstration session on biomedical waste management



बायो मेडिकल वेस्ट / BIO MEDICAL WASTE

- मानवीय अंग एवं जीव वेस्ट
(मानवीय टिशू, शारीरिक अंग वेस्ट)

- रक्त से सनी वस्तु
(पट्टी, प्लास्टर, ब्लड बैग)

- अवधि समाप्त दवाइयाँ
(एंटीबायोटिक्स दवाइयाँ)

- कैमिकल वेस्ट
(जैव-विज्ञान में इस्तेमाल कैमिकल)

- रक्त से दूषित लीनेन, बिस्तर

- लेबोरेटोरी वेस्ट
(ब्लड बैग, कल्चर, माईक्रोऑर्गेनिज्म स्पेसिमन)

पीला थैला / YELLOW BAG



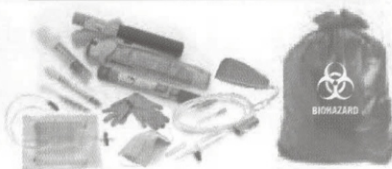
- Human & Animal Anatomical Waste
(Tissues, Organs, Body Parts, Fetus etc.)
- Soiled Waste
(Dressings, Plaster Casts, Cotton Swabs, Residual/Discarded Blood Bags)
- Expired or Discarded Medicine
(Antibiotics etc.)
- Chemical Waste
(Discarded Reagents, Disinfectants)
- Discarded Linen, Mattresses & Beddings
- Pre-Treated Microbiology, Bio-technology & Clinical Lab Waste
(Blood Bags, Cultures, Residual Toxins, Dishes & Devices, Microorganism specimen)

- साइटोटोक्सिक वेस्ट
(साइटोटोक्सिक दवाइयाँ से दूषित वायल, एम्प्यूल, प्लास्टिक इत्यादि)



- Cytotoxic Waste
(All items Contaminated with Cytotoxic drugs along with glass or plastic ampoules, vials etc.)

लाल थैला / RED BAG



- रीसायकल योग्य इन्फैक्टेड वेस्ट
(ट्यूब, बोतल, इंटरवीनस ट्यूब और सेट, कैथेटर, यूरो बैग, बिना सुई की सिरिज, वैक्यूटेनर एवं दस्ताने)

- Contaminated Waste (Recyclable)
(Tubings, Plastic Bottles, Intravenous tubes & sets, Catheters, Urine Bags, Syringes without needle, Vacutainers and Gloves)

सफेद डिब्बा / WHITE CONTAINER

(पंचर, टैम्पर और लीक प्रूफ) / (PUNCTURE, TAMPER AND LEAK PROOF)



- नुकीला एवं धातु वाला वेस्ट
(सूई, सूई लगी सिरिज, स्कालपेल्स, ब्लेड एवं अन्य नोकदार वस्तु)

- Waste Sharps Including Metals
(Needles, Syringes with fixed Needles, Needles from needle tip cutter or Burner, Scalpels, Blades, Contaminated Sharp objects)

गत्ते का डिब्बा / CARDBOARD BOX

(नीले चिन्ह के साथ) / (WITH BLUE MARKING)



- कांच का वेस्ट
(टूटा हुआ कांच, दवाई की शीशियां एवं एम्प्यूल)
- धातु वाले इम्प्लांट

- Glassware
(Contaminated Broken/Discarded Glass, Vials, Ampoules)
- Metallic Body Implants

DESIGNED BY DEPARTMENT OF HOSPITAL ADMINISTRATION, AIIMS AND BIOTIC WASTE SOLUTIONS PVT. LTD.



4.9:Self-check MCQ's

1. Which of the following is **NOT** true about neonatal sepsis in LMICs?
 - a. Early onset sepsis occurs at 72 hours of birth or before
 - b. The case fatality of culture positive sepsis is high
 - c. Late onset sepsis occurs due to perinatal transmission of the bacteria
 - d. There is a high level of antimicrobial resistance in causative pathogens
2. Which of the following is a risk factor for early neonatal sepsis?
 - a. Cesarean section
 - b. Chorioamnionitis
 - c. Lack of antenatal care
 - d. Maternal malnutrition
3. Which of the following is the single most important preventive measure to reduce burden of late onset sepsis?
 - a. Hand hygiene
 - b. Prophylactic antibiotics
 - c. Use of emollient
 - d. Early detection by appropriate sepsis screen
4. A normal birth weight newborn is born to a mother with leaking of 24 hours by vaginal delivery. The infant is asymptomatic. How would you manage this baby?
 - a. Start antibiotics
 - b. Follow the baby with examination of vital parameters and for development of any signs of sepsis every 6 hours to 12 hours for 72 hours
 - c. Perform sepsis screen and start antibiotics if culture is positive
 - d. Perform sepsis screen, blood culture and LP
5. A 36 weeks baby with a birth weight of 2000 g presented with the symptoms of lethargy and decreased feeding at 87 hours of life. On examination, the baby is hemodynamically stable but shows signs of reduced activity. He does cry on stimulation. You suspect late onset sepsis. How would you manage?
 - a. Do sepsis screen and the baby is only treated with antibiotics if sepsis screen is positive
 - b. Start antibiotics immediately
 - c. Do sepsis screen, blood culture and start antibiotics
 - d. Follow the baby with examination of vital parameters and for development of any sign of sepsis

Learning Objective 5

Treating the neonates with sepsis following principles of antibiotic stewardship program

This objective covers the treating of neonates with sepsis following principles of antibiotic stewardship program and is delivered as:

- Webinar
- Script
- Key messages
- Checklist
- Self-check MCQ's

After viewing and listening to the webinar, videos, and 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 antibiotic therapy for sepsis along with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions. The power point slides of the webinar are given here.

Antibiotics therapy in Neonatal Sepsis

DR. S. Venkateshan

Associate Professor
Department of Pediatrics,
PGIMER, Chandigarh

Learning Objectives

- Why rational use of antibiotics?
- Initial choice?
- When to upgrade?
- How long to give?
- Best practices

Harms of excessive use of antibiotics

- High risk of antibiotic resistance
- Higher risk:
 - Invasive candidiasis
 - NEC
 - Death

Initial choice of antibiotics?

- Should cover both gram + ve and - ve bacteria
- Suggested plan:
 - Community acquired sepsis
 - Ampicillin + aminoglycoside
 - Evidence of Staphylococcus infection: cloxacillin in place of ampicillin
 - Hospital acquired
 - (Cloxacillin or ampicillin)* + aminoglycoside
- Avoid: Third generation cephalosporins/ carbapenem / vancomycin

When to upgrade?

- Worsening or absence of improvement after 48 hours
- Early escalation may be considered if baby becomes extremely sick or deteriorates rapidly
- Second line antibiotics based on:
 1. Culture report (if available)
 2. Unit policy (sensitivity pattern)

Changes after culture report

- Sensitive to an antibiotic with narrower spectrum
 - **Change: even if the neonate was improving**
- Use only one antibiotic to which organism is sensitive

How long to give?

- Use parenteral antibiotics

Clinical condition	Duration
Meningitis	21 days
Blood culture positive	10-14 days
Blood culture negative	
• Severe clinical signs*	7-10 days
• Less severe clinical signs	5-7 days
Asymptomatic; risk factors alone; culture negative	Stop immediately

*Shock, sclerema, DIC, severe hypothermia, seizures

How to reduce the duration?

- Collect blood culture report on time
 - Phone / online / SMS
- Trust your lab
 - Blood culture positivity rates: 15%-35%
- Get the culture report faster - use BACTEC or other automated blood culture systems

No antibiotics

- Non-infectious conditions such as
 - Asphyxia
 - Meconium aspiration
 - Prematurity / low birth weight
- Procedures such as
 - Exchange transfusion
 - Central line / umbilical line insertion
 - Intubation
 - Phototherapy

Best practices

- Have a written antibiotic policy and FOLLOW IT
 - When, which, how & how long
 - Track organism profile
- Do not give antibiotics:
 - As prophylaxis
 - Parenteral route for superficial skin infection
- Establish correct diagnosis
 - Send blood culture before starting antibiotics
- Prescribe right dose using drug formulary

Take home messages

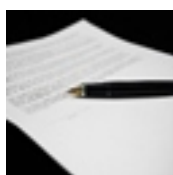
- Have a written antibiotic policy for your unit
- Send blood culture before starting antibiotics
- Based on culture and clinical signs, stop antibiotics at the earliest
- Document: indication, review date and proposed duration
- Follow right dose and frequency
- Follow instructions for drug administration

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

Antibiotic therapy for sepsis

This script shall help you to understand the rational use of antibiotic therapy for sepsis.

Excessive use of antibiotics leads to high risk of antibiotic resistance and higher risk of invasive candidiasis, NEC and death. The initial empiric choice of antibiotic should preferably cover both gram positive and negative bacteria. In India, the bacterial sensitivity profile of EOS and LOS are similar and hence no distinction is required in antibiotic choice between EOS and LOS. The suggested plan would be

- For community acquired sepsis, a combination of ampicillin plus an aminoglycoside could be the empiric choice
- If evidence of Staphylococcus infection is present such as skin lesions, cloxacillin can replace ampicillin
- For hospital acquired sepsis, a combination of cloxacillin or ampicillin and an aminoglycoside could be the empiric choice.
- The choice between cloxacillin and ampicillin would depend on the prevailing flora of the unit. However, it is crucial to avoid 3rd generation cephalosporins, carbapenems and vancomycin as first choice of antibiotics

Consider upgrading in cases of worsening or absence of improvement after 48 hours. An early escalation may be considered if the newborn becomes extremely sick or deteriorates rapidly. Second line antibiotics should be based on the blood culture report (if available) and based on the sensitivity pattern of the unit

Even though initiation and escalation may be done empirically, do not hesitate to down grade to a narrower spectrum antibiotic once the culture report is available. This de-escalation should be done even if the baby shows clinical response. Always use only one antibiotic to which the organism is sensitive

How long the antibiotics should be given:

- If meningitis is diagnosed – give for 21 days
- If blood culture is positive – administer for 10-14 days
- If blood culture is negative and the neonate presented with severe clinical signs such as shock, sclerema and DIC – consider a duration of 7-10 days
- On the other hand, if blood culture was negative and the neonate had less severe clinical signs – consider stopping antibiotics by 5-7 days
- In asymptomatic neonates with only risk factors and blood culture is negative, antibiotics should be stopped immediately

In all cases, keep in consideration, the status of clinical signs

Consider stopping antibiotics in a baby in whom the clinical signs were less severe and showed a rapid improvement within the 12-24 hours of starting antibiotics. It is vital to understand the need to reduce the duration of antibiotics

To facilitate this process, certain key steps are essential

- First step is to collect blood culture reports on time; this can be done by calling the lab or starting a system of online reporting or SMS services
- Once you get a report – trust your lab; even the best microbiology services have only up to 35% culture positivity rate; if reported negative – believe and stop ABs
- Getting a faster culture report by using BACTEC or similar automated blood culture systems may help

Do not give antibiotics in certain scenarios

- These conditions are certain non-infectious conditions like asphyxia, meconium aspiration and prematurity and low birth weight
- Certain procedures like exchange transfusion, central line insertion, endotracheal intubation and phototherapy

Remember few best practices to rationalize the use of antibiotics:

- First, have a written antibiotic policy in the unit and strictly follow it. This policy should state when to give a drug, which drug to be given, how much and how long to be given. The policy should also have the provision to track the organism profile of the unit
- Second, do not give prophylactic antibiotics and do not give parenteral antibiotics for superficial skin infections
- Establish correct diagnosis with the help of clinical and microbiological support
- Do not forget to send blood culture before starting antibiotics
- Prescribe right dose using drug formulary

5.3:Key messages

- Have a written antibiotic policy for your unit
- Send blood culture before starting antibiotics
- Based on culture and clinical signs, stop antibiotics at the earliest
- Document: indication, review date and proposed duration
- Follow right dose and frequency
- Follow instructions for drug administration



5.4: Checklist Antibiotic prescription

The facilitator shall explain the checklist step by step according to the procedure on antibiotic prescription.



PUBLIC
HEALTH
FOUNDATION
OF INDIA

FERNANDEZ
HOSPITAL
Health Care for Women & Newborn

ANTIBIOTIC CHECKLIST FOR THE PURPOSE OF AUDIT IN THE PARTICIPATING HOSPITALS

Name of the Hospital : _____ Unit No.: _____

Date of the Audit : _____ Time of the Audit : _____ Done by : _____

No. of babies in the unit at the time of the audit : _____

No. of babies on antibiotics at the time of the audit : _____

No. of babies on antibiotics for > 5 days in the units : _____

No. of babies with culture positive sepsis : _____

No. of babies with Screen positive sepsis : _____

No. of babies in the unit on Meropenam : _____

No. of babies in the unit on Cephalosporins : _____

No. of babies in the unit on Vancomycin : _____

No. of babies in the unit on Colistin : _____

The table below should be filled in at the time of the audit for each individual baby receiving antibiotics :

Sr. No.	1	2	3	4	5	6	7	8
IP No.								
Gender (M/F)								
Birth Weight (In grams)								
Gestation (in weeks)								
Inborn (I)/ Outborn (O)								
Date of birth								
Day of life on day of audit								
Provisional diagnosis								
Risk factors for EOS or LOS (Y/N)								
Indication (prophylactic/empirical/ culture based)								
Probable site of infection (blood/respiratory/ Urinary/others)								
Name of the antibiotics								
Justification for choosing antibiotics (prior antibiotic/ESBL risk/Immuno compromised/ MRSA/Others)								
Days on antibiotic								
Days planned								
Dose choosen appropriate for the condition								
Side effects monitored (Y/N)								
Culture sent (Y/N)								
Culture report								
Change in antibiotic after looking at c/s report								



5.5:Self-check MCQ's

1. Identify the **incorrect** statement
 - a. For community acquired sepsis, a combination of ampicillin plus an aminoglycoside could be the empiric choice
 - b. If evidence of Staphylococcus infection is present such as skin lesions, cloxacillin can replace Ampicillin
 - c. For hospital acquired sepsis, a combination of cloxacillin or Ampicillin and an aminoglycoside could be the empiric choice
 - d. In hospital acquired sepsis, the first line should be ceftriaxone and vancomycin

2. Identify the **correct** statement with regards to the duration of antibiotic treatment in neonatal sepsis
 - a. In meningitis, the duration of antibiotic is 14 days
 - b. In blood culture positive sepsis, the duration is 5 to 7 days
 - c. If blood culture is negative and the neonate presented with severe clinical signs such as shock, sclerema and DIC; consider a duration of 7 to 10 days
 - d. If blood culture is negative and the neonate had less severe clinical signs; consider giving antibiotic for 7 to 10 days

3. State if '**true or false**':
 - a. In asymptomatic neonates with only risk factors and blood culture is negative, antibiotics should be stopped immediately
 - b. In a baby on ventilation, ampicillin and amikacin should be started
 - c. Having a written antibiotic policy in the unit and strictly following it is a part of antibiotic stewardship and helps decrease bacteriological resistance

Learning Objective 6

Following the clinical practices which prevent sepsis

This objective covers the following of clinical practices which prevent sepsis and is delivered as:

- Webinar
- Script
- Key messages
- Checklist
- Self-check MCQ's

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



6.1: Webinar

You will view and listen to webinar on optimal cord care and care of skin of a preterm neonate along with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions. The power point slides of the webinar are given here.

Skin and cord care for infection prevention

DR. Shiv Sajan Saini

MD, DM (Neonatology)

Assistant Professor
PGIMER, Chandigarh

Introduction

- Skin-layer of natural defence
- Skin of preterm neonate
 - ✓ Immature in immediate postnatal life
 - ✓ Easily be damaged-prone to microbial invasion
- Potentially beneficial & harmful interventions affecting skin integrity
 - Important to recognize

Objectives

- Umbilical cord care
- Care of the nappy area
- Role of vernix caseosa
- Role of bathing
- Role of emollients
- Care during application of adhesives

Cord care

- Devitalized cord-culture media for bacteria
 - Use of chlorhexidine in hospital setting-No effect on outcomes
- Clamping and cut umbilical cord
 - Leave it dry
 - Nothing should be applied over it
- If umbilical stump is soiled
 - Wash with clean water and keep it dry

Diaper area

- Skin of diaper area- Moist
 - ✓ Prone to maceration, exposed to microorganisms
- Good absorbent nappy, frequent changes
- Skin- dried and aired between nappy changes
- Soiled diaper area
 - ✓ Warm water and soft cotton cloth
 - ✓ Wiped from front to back
- Napkin rash- emollient application

Vernix caseosa

- Lipid rich substance adhered to skin at birth
 - ✓ Shed automatically by 24 to 48 hrs
- Potential role
 - ✓ Decreased transepidermal water loss, temperature maintenance
 - ✓ Might play a role in innate immunity
- Attempt to remove damage superficial layers of skin
 - ✓ Increase chances of microbial invasion
- Vernixcaseosa should not be removed

Bathing

- Stable late preterm neonates
 - Initial bath- after 24 hours
 - No bathing in hospital setting
- Stable very and moderate preterm neonates
 - Only sponging
 - Bathing after cord falls off
- Soaps and cleansers - avoided in first few weeks

Emollients for the skin

- Oil application
 - Decreased transepidermal water loss
 - Improved weight gain
- Vegetable oils (like coconut oil, sunflower oil) used for oil massage
 - Mustard oil- not to be used as irritant
- Avoided in ELBW neonates in first week
 - Extremely fragile skin

Skin care during procedures

- Excessive pressure/ rubbing during skin preparation - avoided
- Fixing probes, tubes or IV catheters
 - ✓ Semipermeable dressing as base
 - ✓ Further adhesives - bulky dressings avoided
 - Skin damage during removal
- During removal of adhesive
 - Apply cotton ball soaked with warm sterile water for 10 mins
 - Can be easily removed
- Use only gel electrodes for preterm neonates

Summary

- Cord should be kept dry
- Diaper area should be kept dry, apply emollients if macerated
- Vernix caseosa should not be forcibly removed after birth
- Bathing should be avoided in first 24 hrs. and in hospitals
 - ✓ Sponging should be done instead
- Coconut oil can be used in healthy low birth weight neonates
 - ✓ Avoided in the first week of life in ELBW neonates
- Semipermeable dressings should be used as a base and bulky dressings should be avoided

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



6.2: Script

Skin and cord care for infection prevention

This script shall help you to understand the skin and cord care for infection prevention of a preterm neonate.

- Skin is an important layer of natural defense which prevents the entry of microorganisms in the body. The skin of preterm neonate is immature in immediate postnatal life. Hence, it can easily be damaged while handling the baby and during procedures. Once the skin is damaged, the microbes can easily enter the body, thus increasing the chances of neonatal sepsis
- Therefore, it is important to recognize potentially beneficial as well as harmful interventions, which can affect skin integrity, so as to optimize the outcomes and reduce the chance of infections

Cord care

After birth, the devitalized umbilical cord can be a substrate for bacterial growth and may lead to omphalitis and neonatal sepsis. However studies have shown that the application of antibacterial substances to the umbilical cord in hospital setting does not reduce the chance of neonatal sepsis or mortality. Therefore,

- The stump of the cord should be left dry in hospital settings and nothing should be applied over it
- If umbilical stump is soiled, then it should be washed with clean water and kept dry
- Additionally, the nappy should always be placed below the cord

Care of diaper area

- Diaper area is moist and therefore is prone to maceration. Moreover it is frequently exposed to microorganisms
- Therefore it is important to keep the area dry. The nappy should have good absorbent properties. Mother's should be advised to frequently change nappies, at least once in 4 hours
- The skin should be dried and aired between the nappy changes
- Soiled diaper area should be cleaned with warm water and soft cotton cloth
- Nappy area should be wiped from front to back so as to prevent soiling of urinary orifices with the faecal flora
- In presence of napkin rash, emollient like petrolatum jelly or zinc oxide containing paste can be applied

Role of vernix caseosa

- Vernix caseosa is a natural lipid rich substance adhered to skin at the time of birth. It is shed automatically from the skin in first 24 to 48 hours after birth. In first 1-2 days, it prevents water loss from the skin, and thus helps in temperature regulation. It might also have a role in immune protection of the neonate
- As it is snugly adhered to skin, any attempt to remove vernix forcibly might cause damage to the superficial layers of the skin, which increases the chances of microbial invasion through the cracked skin
- Therefore, no attempt should be done to remove vernix from the skin

Bathing

Fetus is surrounded by sterile amniotic fluid and thus does not require bathing in immediate postnatal period. It has been seen that bathing in hospital/ health facilities increases risk of neonatal infections. Therefore bathing of neonates should be avoided in SNCU/ hospitals

- When bathing is done by caregiver at home, one should ensure that the room is warm and there should not be any draft of air. Use warm water for bathing. After bathing quickly dry the baby including armpits and groin area, then dress the baby
- Very premature and moderately premature neonates, who continue to stay in the SNCU should be sponged with lukewarm water once they are stable

Emollients for the skin

- Oil application in preterm neonates is shown to decrease transepidermal water loss, and improves weight gain
- In Indian scenario, vegetable oils (like Coconut oil, sunflower oil) are used for baby massage or for emollient action. Mustard oil can cause contact dermatitis, hence it should be avoided in neonates
- However oil application should be avoided in extremely low birth weight neonates in the first week of life due to extremely fragile skin

Care of skin during procedures

- While doing procedures or during skin preparation, we should avoid putting excessive pressure or vigorous rubbing. As it may damage the skin increases the chance of infections
- For fixing temperature probes, IV cannula, feeding tubes, a semipermeable dressing e.g. Tegaderm should be used as a base, over which further adhesives can be applied. Bulky dressings should be avoided as they cause skin damage during removal
- To minimize skin trauma during removal of adhesives, they should be moistened by applying warm saline soaked cotton balls for 10 minutes, so that they can be easily removed
- Use only gel electrodes for preterm neonates as they are more skin friendly

6.3:Key messages

- Cord should be kept dry, nothing should be applied to it
- Diaper area should be kept dry, wipe gently when soiled. Emollients should be applied if the area is macerated
- Vernix caseosa should not be forcibly removed after the birth
- Bathing should be avoided in hospital setting, and sponging should be done instead
- Coconut oil can be used for massage in healthy low birth weight neonates
- Semipermeable dressings should be used as a base while applying adhesives to a neonate and bulky dressings should be avoided



6.4: Webinar

You will view and listen to webinar on bundle care approach along with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions. The power point slides of the webinar are given here

Bundle care approach

DR. Shiv Sajan Saini

MD, DM (Neonatology)

Assistant Professor
PGIMER, Chandigarh

Introduction

- Bundle care- set of evidence-based practices
 - Expected to improve patient outcomes
- Individual elements of bundles
 - Well established practices- protocolised
- Whole team agrees to the bundle care
 - Implement collectively and reliably
- Example
 - Care bundle to reduce PIVC related BSI

Objectives

- What are the elements of bundle care approach?
- How to put it into practice?

Elements of bundle care approach

- No of interventions in a bundle
 - ✓ Range usually 3 to 5
- Milestones of making care bundles
 - ✓ Identification of key steps of the procedure
 - ✓ Identification of key interventions related to these steps
- Interventions related to these critical steps noted
 - ✓ 3-5 key interventions identified
 - ✓ Evidence based - high quality
- This group of interventions - care bundle
 - ✓ Implemented together

Bundle Care for PIVC related infections

- Step 1-Enumeration of steps related to placement of PIVC
- Step 2-Identification of 3 to 5 most important steps
 - Critical for prevention of BSI related to PIVC insertion and maintenance
- Step 3-Identification of best evidence-based interventions for steps

Example of identification of critical steps

- 1) Duration of PIVC
- 2) Lapses during the procedure of PIVC insertion
- 3) Lapses during handling intravenous lines during day-to-day nursing care
- 4) Repeated puncturing of antibiotic vials/ saline ampoules

Example of identification of interventions

- 1) Daily documentation of the necessity of PIVC
- 2) ANTT while PIVC insertion
- 3) Injection ports or hubs to be cleaned with antiseptic swabs before each use
- 4) Avoidance of repeated punctures of drug vials/ IV fluid ampoules

Strategies for promoting bundle care

- Education and improve communication amongst the unit staff
 - ✓ Teams from the pool of healthcare professionals
- Periodically check for compliance and efficacy
 - ✓ Audit
- Appraisal of the unit staff
 - ✓ Reinforcement

Summary

- An attractive way of infection prevention
- Careful selection of strategies for a focused intervention
- 3-5 evidence based interventions implemented together
- Team approach, auditing and regular reporting of results

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



6.5: Script

Bundle care approach

- A bundle is a set of evidence-based practices that, when performed collectively and reliably, are expected to improve patient outcomes. The individual components of the care bundles are evidence based practices which are associated with better clinical results. The implementation of care bundle replaces the existing practices of patient care and are expected to result in better patient outcomes
- Whole clinical team agrees to these practices and is responsible for implementing them in the unit. The best results are obtained when the care bundles are implemented collectively and reliably. For example for improving intravenous line handling in a unit with high incidence of invasive bloodstream infections, the local healthcare team selects a set of evidence based interventions, combines them to make a bundle, and strives to implement it consistently and reliably in order to reduce the incidence of BSI

Elements of bundle care approach

- A care bundle for any invasive procedure consists of interventions, which usually range from 3 to 5 in number. It is seen that the compliance is best achieved when the number of interventions are limited to 3-5
- The crux of making care bundles lies in identification of key steps of performing the invasive procedure and identification of key interventions related to these steps
- The key interventions are based on the results of high-quality studies e.g. systematic reviews or randomized controlled trials
- This care bundle i.e. group of evidence-based interventions must be implemented together in order to improve the outcomes. The clinical care team takes responsibility of implementation, surveillance and auditing the execution of care bundle in order to ensure the continued change

Steps of preparing bundle care for peripheral intravascular cannula related infections

Let us discuss an example of a care bundle to prevent peripheral intravascular cannula related infections. Following steps should be undertaken to form the same

- Step one is enumerating the steps related to placement of peripheral intravascular cannula, as well as nursing care related to maintenance of peripheral intravascular cannula
- In the second step, the team identifies 3 to 5 most important steps from the step 1, which are critical for prevention of bloodstream infections related to peripherally inserted intravenous catheter (PIVC) insertion and maintenance. These critical steps may be common or may vary slightly when identified by different healthcare teams for making care bundles for their respective units. This variation may be related to existing unit practices, beliefs, equipment supplies and health care resources. One such example could be 1) duration of intravascular cannula, 2) lapses during the procedure of peripheral intravascular cannula insertion, 3) lapses during handling intravenous lines during day-to-day nursing care, 4) repeated puncturing of antibiotic vials/ saline ampoules

- In the third step the clinical care team identifies best evidence-based interventions to answer each of these four problems. Then select the most important 3-5 interventions which form the care bundle for PIVC insertion and maintenance. One such example of a care bundle related to step 2 is as follows: 1) daily documentation of the necessity of intravenous line by assessing whether the baby is eligible to be initiated on enteral feeds; 2) strict implementation of aseptic non-touch technique while placing PIVC; 3) all injection ports or hubs to be cleaned with antiseptic swabs before each use, 4) strict avoidance of repeated punctures of drug vials/ intravenous fluid ampoules

Strategies for promoting bundle care

- It is of utmost importance to provide education and improve communication amongst the unit staff for implementation of bundle care components. The bundle care cannot be adequately implemented unless all unit staff promote its operationalization. These teams can be created from the pool of healthcare professionals e.g. doctors and nurses working in the area. However the guidance can be taken from allied departments e.g. in the above case from Department of microbiology, and hospital infection control committee
- It is equally important to periodically check whether the care bundles are adequately implemented. Furthermore whether the care bundles are resulting in the desired outcome (e.g. decrease in bloodstream infections in the above case). Therefore, periodic audit of the practices and outcome indicators must be undertaken by the team members
- It's also important to regularly appraise the members of the unit about the results of the audit. It also gives an opportunity of positive reinforcement for the promotion of care bundles. A positive change increases the morale of the healthcare providers for better healthcare delivery

6.6:Key messages

- Bundle care approach can be an attractive way of infection prevention
- Careful selection of strategies of bundle care for a focused intervention is the backbone
- It allows implementation of 3-5 evidence based interventions which are implemented together
- It integrates a team approach, auditing and regular reporting of results to the healthcare staff



6.7: Webinar

You will view and listen to webinar on barrier nursing along with your facilitator. You are free to interrupt your facilitator anytime for any clarifications or suggestions. The power point slides of the webinar are given here.

Barrier nursing

DR. Shiv Sajan Saini

MD, DM (Neonatology)

Assistant Professor
PGIMER, Chandigarh

Introduction

- ✓ Routinely infected neonates
 - Universal precautions
- ✓ Under certain situations - more stringent measures needed
 - Highly contagious infections
 - Multidrug resistant organisms
 - Immuno-compromised patients
- ✓ Barrier nursing is a set of interventions consisting of stringent infection control practices so as to prevent spread of infections in such situations

Learning objectives

- The concepts of barrier nursing
- Contact prevention
- Personal protective equipment
- Respiratory prevention

Barrier nursing concept

- ✓ Set of interventions
 - Stringent infection control practices
 - Prevents spread to other neonates/healthcare workers
- ✓ Spread of infections through
 - contaminated surfaces or hands, fomites, droplets, inhaling aerosols, etc
- ✓ Aim is to prevent spread
 - from one baby to another
 - to medical staff
 - outside of unit and hospital

Universal precautions

- Standard precautions exercised during routine nursing care
- Assume everyone infected
- Includes
 - ✓ Hand hygiene
 - ✓ Use of gloves, gowns, masks during handling patients' body fluids
 - ✓ Prevention of fomites
 - ✓ Disinfection of anything which comes in contact with the baby

Cohorting

For multidrug infections

- Universal precautions - strengthened
- Neonate(s) cohorted away from rest of the neonates
- Separate health care professionals
- Appropriate PPE
- Separate biomedical waste disposal

Body substance isolation

- Body fluids handling
 - ✓ After donning appropriate PPE
 - ✓ Discard in yellow bin
- If secretions or excreta are highly contagious
 - ✓ Special way to don PPE
 - ✓ Special way to discard PPE
 - ✓ Each neonate requires separate PPE
 - ✓ Appropriate separate biomedical disposal

Donning Personal Protective Equipment

- Firstly, gown
- Mask or respirator
- Goggles or face shield
- Gloves

Personal protective equipment - Donning



Removing PPE

- Gloves
- Face shield or goggles
- Gown
- Mask or respirator

Removing PPE-steps



Airborne precautions

- In cases of airborne transmission of infectious agents
 - ✓ Airborne droplet residue (5 µm or smaller)
- Special air handling and negative pressure ventilation of the room
- Generally not available

Summary

- Barrier nursing is an effective way of preventing infection spread within SNCU
- Universal precautions should be exercised during usual SNCU care
- In case of neonates with highly contagious infections, appropriate PPE should be worn in addition. The particular sequence of donning and removal of PPE must be adhered to
- Respiratory isolation is required for infections with the risk of airborne transmission

What did you learn from this webinar?

1.
2.
3.

What are the queries which come to your mind?

1.
2.
3.



6.8: Script Barrier nursing

This script shall help you to understand the barrier nursing.

- Patients with infections are commonly admitted in hospitals become a potential source of infections for other non-infected patients as well as for the health care providers. The universal precautions are followed in these situations so as to prevent the spread of infections in the unit
- However there are some situations, where we need to take more stringent measures to prevent spread of infections than just routine universal precautions. These situations include highly contagious infections (e.g. neonatal diarrhea or neonates with suspected or proven H1N1 infections), and neonates with multi drug resistant infections. On the contrary an uninfected neonate with very immature immune system (e.g. with severe neutropenia), is vulnerable to acquire infection from health care professionals or environment and thus also needs extra precaution
- The set of interventions consisting of stringent infection control practices so as to prevent spread of infections in such situations is referred to as barrier nursing

Concepts of Barrier nursing

- It is a set of interventions consisting of stringent infection control practices used during nursing the neonate, so as to prevent the spread of infection from one neonate to another as well as to the health care staff. The spread of infection occurs in different ways, which include contact with contaminated surfaces or hands, fomites, droplets, inhaling aerosols, etc.

The aim of the barrier nursing is to

- Protect horizontal transmission of infection in SNCU i.e. from one baby to another
- Protection of medical staff against infection from patients
- Prevent spread of infection outside of unit's and hospital's boundary

Universal Precautions

- Universal Precautions are the standard precautions exercised during routine nursing care of neonates so that they do not acquire infections from healthcare professionals, other neonates or fomites. As many neonates with blood-borne infections are unrecognized at admission, every neonate is considered potentially infectious and the universal precautions are undertaken irrespective of the presumed infection status of neonates.
- Universal precautions include hand hygiene; use of gloves, gowns, masks during handling patients' body fluids; prevention of fomites and disinfection of anything which comes in contact with the baby
- Fomites play a very important role in horizontal transmission of infection. Common fomites in SNCU include items related to the day-to-day nursing care such as stethoscopes, thermometer, inch-tape etc. Each bed should have an individual stethoscope, thermometer, inch-tape, nursing tray which include spirit and betadine swabs. The sharing of such items between neonates must be strictly prohibited

Cohorting

- If one or more baby(s) with resistant organisms is identified in the SNCUs, then such patients should be given special attention
- Universal precautions should be strengthened. Such neonates should be cohorted away from rest of the neonates e.g. in the isolation room. If possible the nurse looking after such neonates should be separate, who should not be involved in care of the rest of the neonates.
- Appropriate personal protective equipments (gloves, gowns or masks) used for such a neonate should be separate
- If possible their biomedical waste disposal should be separate

Body substance isolation

- The body secretions and excreta (saliva, blood, urine, feces, wound drainage, and other body fluids) should be handled after donning appropriate personal protective equipments (gloves, gowns, masks) regardless of their infection status
- These should be discarded in yellow bin for biomedical waste disposal
- However if the body secretions or excreta are considered highly contagious (e.g. during the episodes of diarrhea), the personal protective equipments should be worn and discarded in a special way as discussed subsequently
- These equipment should be worn in such a way that the entire body of health care professional should be covered and no body secretion should come in 'direct' contact with the health care professional
- The step by step details of this procedure are available in the job aids
- All items of PPE should be discarded after handling a neonate and hand hygiene should be performed in the end. Each neonate requires separate PPE during such period
- Care must be taken to ensure separate biomedical waste of such patients

Personal protective equipment

- The purpose of personal protective equipment is to prevent exposure of healthcare professional with highly contagious body fluids of the patient. Personal protective equipments should be worn in a particular sequence i.e. gown first followed by mask or respirator, then goggles or face shield and gloves in the end

Personal protective equipment- Donning

- First, appropriate size gown with opening in the back is worn. The neck and the waste are secured. Then wear mask covering nose mouth and chin. Wear goggles and/or face shield if there is a risk of droplet spread to these areas. Wear gloves in the end such that the gloves extend over the cuffs of the gown

Personal protective equipment- Removing

- After handling the baby the personal protective equipment should be removed in a particular sequence- first gloves followed by face shield or goggles, then gown and mask or respiratory in the end. The outer front side of personal protective equipment should all be considered contaminated

Personal protective equipment- Removing steps

- For removal of gloves to grasp outside edge of the left glove near the wrist and peel away from hand turning the glove inside out. Hold the glove in right gloved hand. Now slide the ungloved index finger of the left hand under the rest of her right glove and peel it off from inside creating a bag of both the gloves. Discard in yellow bin. For removing goggles or face shield, grasp their rear end and lift them away from the face. For removing gown unfasten ties, peel it away from neck and shoulder, and start rolling it in such a way that the contaminated outside of the gown becomes inner side of the roll. Discard the fully rolled gown in the yellow bin. In the end untie the bottom followed by top tie to release the mask from the face and discard. In a similar fashion to remove the respiratory by first lifting the bottom elastic followed by top plastic. Perform hand hygiene in the end

Airborne precautions

- Airborne Precautions are designed for preventing infections which have a risk of airborne transmission of infectious agents. This occurs by either small-particle airborne droplet residue (5 µm or smaller). Because of their smaller size they remain suspended in the air for long periods or ride on dust particles
- Microorganisms carried in this manner may disperse to far places. Therefore respiratory precautions require special air handling and negative pressure ventilation of the room to prevent airborne transmission. However generally such facilities are not available even in bigger hospitals. If such facility is not available in the hospital, the nearby hospitals should be contacted for such a patient

6.9:Key messages

- Barrier nursing is an effective way of infection spread within SNCU
- Universal precautions should be exercised during usual SNCU care
- In case of neonates with highly contagious infections, appropriate PPE should be worn in addition. The particular sequence of donning and removal of PPE must be adhered to
- Respiratory isolation is required for infections with the risk of airborne transmission



6.10: Checklist

Infection control

The facilitator shall explain the checklist step by step according to the procedure on infection control.



PUBLIC
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OF INDIA

FERNANDEZ
HOSPITAL
Health Care for Women & Newborn

INFECTION CONTROL PRACTICE IN THE NICU

1. Audit to be done by the staff in the NICU or the hand holding team
2. To be done every 1-2 weeks to check the compliance
3. If a problem found during one audit, try to correct it before the next audit, otherwise there is no point in doing the audits
4. Most of the check list is yes and no but for some percentages need to be calculated
5. Some of the parameters need direct observation and some of them need random interview with one or more personnel

INFECTION CONTROL CHECKLIST FOR THE PURPOSE OF AUDIT IN THE PARTICIPATING HOSPITALS

Name of the Hospital: _____ Unit No : _____ Done by : _____

Date of the Audit: _____ Weekday / weekend : _____ Time of the audit : Shift A/B / C

Total number of babies on the unit at the time of audit : _____

Total number of nursing staff including trainees at the same time: _____

Number of experienced nurses (2years or more) : _____

Number of medical personnel available at the time of the audit : _____

ORGANISATIONAL AUDIT	YES	NO
Unit has written guidelines for infection control		
Is there enough information, education and communication material for infection control		
Any formal training for the staff on infection control		
Do healthcare personnel have appropriate supplies of gloves, handrubs etc		
Facility for hand washing available (enough sinks, water supply, soap, facility for drying hands)		
GENERAL ENVIRONMENT	YES	NO
Overall appearance of the hospital clean without any garbage around		
General appearance of the toilets - clean without any smell		
Presence of insects and pests		



6.11:Self-check MCQs

1. A preterm newborn is born by perterm vaginal delivery. The baby has cried at birth. According to WHO the cord of the baby should be cut at,
 - a. Immediately
 - b. After 3-5 min
 - c. After 1-3 min
 - d. Not earlier that 60 sec

2. How would you clean the umbilical cord, if it is soiled by stools of baby?
 - a. 2% Chlorhexidine and alcohol mixture
 - b. Alcohol/ spirit swab
 - c. Soap and water
 - d. None of these

3. Which of the following is **incorrect** about waste disposal and universal precautions?
 - a. Sterile gloves for phlebotomy and insertion of vascular catheters
 - b. Wear gloves while handling any kind of body fluids
 - c. Do not bend, break, or otherwise manipulate used needles by hand
 - d. Dispose scalpel blades and other sharp items in yellow bin

4. **Correct** sequence for hand washing is
 - a. Palm to palm, back to palm, palm to palm with fingers interlaced back of the fingers to opposing palms with interlocking
 - b. Palm to palm, back to palm, rotational thumbs rubbing, back of the fingers to opposing palms with interlocking
 - c. Palm to palm, palm to palm with fingers interlaced, rotational thumbs rubbing, back of the fingers to opposing palms with interlocking
 - d. None of the above

5. Walls of the nursery should be cleaned by
 - a. Bacillocid, once per day
 - b. Wet mopping with phenyl, once per day
 - c. Bacillocid, once per shift
 - d. Wet mopping with phenyl, once per shift



Skill Check

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.	Preparation of radiant warmer while receiving a baby to the SCNU
2.	Cleaning of resuscitation equipment after a patient use
3.	Waste disposal and segregation
4.	Cleaning feeding utensils before feeding
5.	Preparation of IV fluids for a baby receiving IV fluids in SCNU
6.	Placing peripheral intravenous line for a baby in SCNU
7.	Estimation of blood glucose for a neonate receiving IV fluids in SCNU
8.	Demonstrate the steps of hand hygiene using soap and water

Supplies required

- Radiant warmer with accessories (stethoscope, pulse oximeter, thermometer)
- Gloves, clean soap and water solution in a big bowl
- Pulse oximeter
- Laryngoscope with blade
- Self-inflating bag
- Dry cloth
- Solution of cidex (2% glutaraldehyde)
- Black, red, yellow, translucent white and blue containers
- Blood stained cotton
- Used syringes
- Intravenous cannula
- Gloves (used)
- Blades
- Feeding utensils
- Large bowl (to be used for boiling)
- Liquid soap for hand washing

1: Preparation of radiant warmer while receiving a baby to the SNCU

You are about to receive a preterm newborn infant in the SNCU for thermal support and monitoring. You have to prepare the radiant warmer and pulse oximeter for this purpose. Demonstrate the necessary steps in cleaning and disinfecting these equipment

S No	Correct Action	YES	NO
1.	Prepares a soap / disinfectant solution and a clean cloth		
2.	Washes hands using the six steps		
3.	Wears gloves		
4.	Removes the side walls and mattress		
5.	Cleans the joints and corners of the walls		
6.	Cleans the front panel		
7.	Cleans the top surface of the radiant heat source		
8.	Cleans the knobs/buttons		
9.	Says that she will allow the warmer to dry before taking the baby		
10.	Removes and wears fresh pair of gloves		
11.	Takes a fresh piece of cloth		
12.	Cleans the front panel first and then the body (in that order)		
13.	Cleans the body of the pulse oximeter		
14.	Cleans the front panel of the pulse oximeter		
15.	Cleans the knobs of the pulse oximeter		
16.	Cleans the saturation probe of the pulse oximeter		
17.	Cleans the probe starting from the patient end to the machine end with spirit		
18.	Cleans the power cord with a dry cloth		
	Total Score:		

Score : (Maximum score 18): _____

2: Cleaning of resuscitation equipment after a patient use

You have just used the resuscitation equipment (bag and mask and laryngoscope) for a sick and septic neonate. Demonstrate the necessary steps in cleaning and disinfecting these equipment

S. No	Correct Action	YES	NO
1.	Prepares a soap / disinfectant solution in a wide mouthed basin		
2.	Prepares 2% glutaraldehyde solution in a bucket		
3.	Washes hands using the six steps		
4.	Wears gloves		
5.	Dismantles the self-inflating bag – mask, patient end assembly with valves, rear end assembly with valves, reservoir		
6.	Cleans the dismantled parts in running water		
7.	Immerses all the parts in the prepared solution and cleans thoroughly		
8.	Pays special attention by cleaning the inner surface of the rim of the mask and patient end of the assembly		
9.	Rinse in running water once again to remove the soap solution		
10.	Immerses all the parts in the 2% glutaraldehyde solution		
11.	Removes the bulb from the laryngoscope blade		
12.	Cleans the blade with soap solution		
13.	Immerses the blade in 2% glutaraldehyde solution		
14.	Mentions 15 minutes and 4 hours for disinfection and sterilization (on prompt)		
15.	Removes from cidex before use, rinses in running water		
16.	Dabs and dries the parts using a dry and clean cloth		
17.	Reassembles the parts of the bag correctly		
18.	Checks the bag for functioning		
19.	Fits the bulb back on the blade		
20.	Attaches the blade to the handle and checks for functioning		
	Total Score:		

Score :(Maximum score 20): _____

3: Waste disposal and segregation

You are a nurse working in a SCNU and you have just managed a sick neonate by placing an intravenous line and have also changed the nappy and linen of the baby. You have lots of used wastes lying near the baby which are to be discarded. Demonstrate the segregation and disposal of those wastes

S. No	Correct Action	YES	NO
1.	Places the containers in sequence (Black, yellow, red, transparent, blue)		
2.	Answers as at least 10 feet away from the patient bed (on prompt)		
3.	Continues wearing gloves (from the previous activity) or freshly wears gloves		
4.	Discards blood stained cotton and soiled linen in yellow container		
5.	Discards the used/removed cannula and intravenous tubing in red container		
6.	Discards blade in the white container		
7.	Tells none of the container need to be filled with 10% Sodium hypochlorite (on prompt)		
8.	Cuts the syringe and mutilates the needle using needle cutter		
9.	Discards cut syringe and mutilated needle in white container		
10.	Removes gloves and discards in the red container		
11.	Washes hands with soap and water using six steps		
	Total Score:		

Score : (Maximum score 11): _____

4: Cleaning of feeding utensils before feeds

You are a nurse working in the SCNU and you are about to feed a preterm neonate. Demonstrate the steps of cleaning the feeding utensils for the neonate

S. No	Correct Action	YES	NO
1.	Washes hands with soap and water by following the standard steps of hand washing		
2.	Cleans the cup or paladai, lid and spoon in running tap water		
3.	Immerses the cleaned utensils in a wide mouthed utensil with warm soapy water and clean the utensils once again thoroughly		
4.	Rinses thoroughly in clean, running tap water		
5.	Fills a large pan with water		
6.	Places the cleaned utensils in water and ensures the utensils are completely covered with water and there are no air bubbles trapped between the utensils		
7.	Covers the pan with an appropriate sized lid		
8.	Answers as roll boiling for 15 minutes (on prompt)		
9.	Washes hands again with soap and water		
10.	Removes the utensil for use using a sterile forceps		
	Total Score:		

Score : (Maximum score 10): _____

5. Preparation of IV fluids for a baby receiving IV fluids in SNCU

You are managing a preterm newborn in the SNCU, who requires intravenous fluids. Demonstrate the necessary steps for making IV fluids

S.No.	Correct Action	Yes	No
1.	Collects all items needed for IV fluid preparation		
2.	Cleans the platform for the IV fluid preparation with the cotton wool soaked in bacillocid or alcohol		
3.	perform hand hygiene using alcohol based hand rubs		
4.	Wear gown and gloves		
5.	Platform for IV fluid preparation is draped with sterile sheet		
6.	Helper peels off the outer sterile cover of disposables and hand these over to nurse making IV fluids		
7.	Attach the pediaset to 500 mL bottle and fill pediaset with 12-24 hours fluid and take 5-10 cc extra fluid to flush the lines		
8.	Flush the line of pediaset after opening roller controller and stop the flow once the line is sealed		
9.	Attach other end of pediaset to threeway		
10.	Attach 50 mL syringe to second port of three way		
11.	Fill 6 hours fluids requirement in 50 mL syringe from the pediaset using 3-way		
12.	Attach a 100 cm extension tubing to the third port of 3-way and flush the line		
13.	Protect the other end of 100 cm extension to be attached to IV cannula using cover following principles of aseptic not touch technique (ANTT)		
14.	Practice aseptic non touch technique (ANTT) while transferring it to the bed of the neonate		
Total Score:			

Score :(Maximum score 14): _____

6. Placing intravenous line for a baby in SNCU

You are managing a preterm newborn in the SNCU, who requires placement of peripheral intravenous cannula (PIVC). Demonstrate the necessary steps for placing PIVC

S.No.	Correct Action	Yes	No
1.	Collects all items needed for PIVC		
2.	Perform hand hygiene using alcohol based hand rubs		
3.	Creates a sterile surface at the bedside for receiving disposables used in PIVC placement (Best opens a sterile tray)		
4.	Wear sterile/clean gloves		
5.	Helper puts spirit and butadiene in the tray (already having cotton balls) or hand over sterile cotton/spirit/betadine for swabs		
6.	Helper peels off the outer sterile cover of disposables and hand these over to nurse placing PIVC		
7.	Make sure that none of the parts of these disposables i.e. tip of PIVC, hub of the syringe, should come in contact with non-sterile surface		
8.	Nurse prepares/ cleans the anatomical site with the help of single swab applying for 30 sec OR triple swab technique using spirit swab, betadiene swab followed by a spirit swab and waiting for 30 sec after the antiseptic application		
9.	Nurse does not touch the surgical site once it is prepared and if touches it because of any reason it should be prepared again using swab for 30 sec		
10.	Nurse inserts PIVC by picking tip of PIVC at approximately 30° - 45° to the skin surface		
11.	Nurse notice blood filling the hub of the needle, withdraws trocar a bit and advances the PIVC further		
12.	After inserting PIVC fully, the nurse withdraws the needle		
13.	PIVC is flushed with 0.5-1 cc normal saline		
14.	PIVC is fixed with transparent semipermeable sticking eg Tegaderm in the front part to visualise skin insertion and tip		
15.	Fix rear end of PIVC with usual dressings like durapore/ micropore		
16.	Decides to place splint if the PIVC crosses joints		
	Total Score:		

Score :(Maximum score 16): _____

7. Estimation of blood glucose for a neonate receiving IV fluids in SNCU

You are managing a preterm newborn in the SNCU, who is receiving intravenous fluids. Demonstrate the necessary steps for estimation of blood glucose

S.No.	Correct Action	Yes	No
1.	Consider applying eutectic mixture of local anesthetic (EMLA) cream 45 min before the procedure or considers giving expressed breast milk during the procedure, KMC, non nutritive sucking for analgesia		
2.	Perform hand hygiene using alcohol based hand rubs		
3.	Asks for helper, the helper opens sterile procedure tray on a clean surface/trolley		
4.	Arranges spirit or chlorhexidine swabs		
5.	Helper strip opens a 24 G disposable hypodermic needle and hands it over to the bedside nurse		
6.	Nurse places the needle inside the tray using aseptic non-touch technique		
7.	Helper gives glucostrip to the bedside nurse in similar manner		
8.	Nurse holds glucose strip and the helper holds glucometer and the two negotiate glucostrip in the glucometer to actuate it		
9.	Helper places the glucometer- glucose strip assembly close to the tray taking care that glucose strips does not touch anywhere to protect the key part		
10.	Prepares the heel of the neonate by rubbing spirit swab for 30 seconds in a circular fashion starting from the area of interest. After that allow the area to dry for 30 sec		
11.	Performs heel lancing		
12.	Allow the drop to build up sufficiently before touching the tip of glucose strip with the blood drop		
13.	After the procedure apply a dry cotton ball to press the point of puncture		
	Total Score:		

Score : (Maximum score 13): _____

8. Demonstrate the steps of hand hygiene using soap and water

You are managing a preterm newborns in the SNCU. Demonstrate the necessary steps of hand hygiene using soap and water

S.No.	Correct Action	Yes	No
1.	Rolls up sleeves of your shirt approximately 1 inch above elbow.		
2.	Removes all ornaments, bandages, wristbands		
3.	Wets hands and forearm by keeping below the free flowing water		
4.	Takes adequate amount (approx. 5-7 mL) liquid soap in your palms		
5.	Gently rub all hand surface, including wrists, forearm and elbows,		
6.	The first step is palm to palm rub		
7.	Second step is right palm over left dorsum with interlaced fingers and vice versa		
8.	Third step is palm to palm with fingers interlaced		
9.	Fourth step is backs of fingers to opposing palms with fingers interlocked		
10.	Fifth step is rotational rubbing of left thumb clasped in right palm and vice versa		
11.	Sixth step is rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa		
12.	Wash hands using running water stating from hands		
13.	Keep hands little higher so that the water trickles down from the most clean area i.e. hands towards forearm.		
14.	Dry the hand first and move gradually from hands towards elbows. Avoid coming back from elbows to hands with the same paper as the paper might have touched the 'non-washed' area near elbows		
15.	In case we are using elbow operated tap, use elbow to turn off the tap. In case we are using other tap, use the paper in your hands to turn off the tap		
16.	Discard the papers in the bin appropriately		
	Total Score:		

Score :(Maximum score 16): _____



Clinical case scenario

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 in a realistic environment for less systemic infection. The emphasis is on working together as a team and not on individual knowledge.

You shall be asked by the facilitator to participate as a team for the management of the following case scenarios:

1. Preterm baby born to mother with leaking PV for 48 hrs / UTI
2. Preterm baby ventilated for RDS, developing respiratory deterioration and infection
3. Baby with respiratory distress at birth without any maternal risk factors of infection
4. Term baby born at small facility by vaginal delivery is discharged at 24 hrs, presents with reduced feeding and lethargy on 7th day of life

This shall be followed by feedback and debriefing.