



**CLINICAL PRACTICE GUIDELINE**

Guideline coverage includes NICU KEMH, NICU PCH and NETS WA

**Sepsis: Neonatal**

This document should be read in conjunction with the [Disclaimer](#)

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## Infection in the Neonate

Bacterial infection is a leading cause of morbidity and mortality in the newborn period. Every effort must be taken to prevent, recognise (with a high level of suspicion) and treat infection. Treatment must be both specific and supportive.

Blood cultures are required prior to commencing antibiotic therapy. Cultures should be obtained from a superficial vein under aseptic technique. Cord blood cultures are not recommended as they have a high rate of bacterial contamination.

There are a wide range of organisms that cause infection and they can be acquired in 2 ways:

- Early-onset sepsis (EOS; transplacental or perinatally acquired; onset <72h).
- Late-onset sepsis (LOS; postnatally acquired / nosocomial; onset >72h).

## Group B Streptococcal (GBS) Disease

Early-onset Group B Streptococcal (GBS) disease is the leading cause of EOS. Colonisation of the maternal lower genital tract is common, with 10-30% of pregnant women having positive vaginal or rectal cultures. EOS is vertically transmitted, either before or at the time of delivery. The vertical transmission rate from a GBS colonised mother is approximately 40-70%, with 1-2% of colonised neonates developing invasive disease. EOS usually presents with respiratory symptoms rapidly developing to septicaemia and shock with or without meningitis. Untreated the condition is usually fatal.

Routine screening of all women at 35-37 weeks gestation for recto-vaginal GBS colonisation is performed at our hospital. Intrapartum prophylactic antibiotics are administered to all women whose genital tracts are colonised with GBS.

Also refer to [Obstetrics & Gynaecology Clinical Practice Guideline - Group B Streptococcal Disease](#).

## Group A Streptococcus

Group A Streptococcus (also called Streptococcus pyogenes or GAS) is an organism of particular significance in an obstetric health setting as it may cause severe, potentially fatal, post-partum sepsis. Exposed neonates are at risk of severe sepsis.

Refer to the [Group A Streptococcus \(GAS\)](#) guideline for more information and management.

## Clinical Presentation of Infection

### General or Non-Specific:

- Hypotonia, lethargy.
- Pyrexia, hypothermia, temperature instability.
- Poor skin perfusion.
- Poor feeding, intolerance of feeds.
- Unexplained jaundice.
- Metabolic acidosis.
- Unstable plasma glucose homeostasis.
- Apnoea and seizures.

- Neutropenia, serial counts may help to establish a trend.
- Thrombocytopenia may occur but is usually a late sign, can occur with or without disseminated intravascular coagulation.

### Suggestive or Specific:

- Respiratory distress.
- Gastrointestinal: vomiting (may be bile-stained), diarrhoea, abdominal distension.
- Central Nervous System: irritability, seizures, and full fontanel.
- Skin: septic lesions.
- Eyes, umbilicus: discharge.

### Risk Factors

Preterm labour and birth	Resuscitation required at birth
Premature rupture of the membranes	Ongoing respiratory disease
Clinical chorioamnionitis and / or discoloured liquor.	Colonisation with pathogens
Maternal peripartum pyrexia (> 38°C).	Invasive procedures and presence of catheters, cannulae, long lines, endotracheal tubes, chest drains etc.
Maternal group B Streptococcal colonisation	Inadequate hand washing
Maternal UTI	Parenteral nutrition
Multiple gestation	Nursery colonisation with pathogens

### Consequences of Infection

Extremely preterm infants are at high risk of mortality and significant short and long-term morbidity from infection. The site of infection is an important consideration.

**Septicaemia** may run a fulminant course, as in Group B Streptococcal (GBS) and Gram-negative sepsis.

Sepsis secondary to Coagulase-negative staphylococci (usually late-onset infections) tends to be less severe.

Congenital **pneumonia** is usually due to GBS or Gram-negatives. These neonates often require ventilation, and persistent pulmonary hypertension of the newborn (PPHN) can occur. Nosocomial pneumonia depends on the organism with which the neonate is colonised. **Meningitis** has a high (up to 50%) mortality rate in preterm infants, with survivors at risk of long-term neurological abnormalities.

## Investigations of Suspected Sepsis

For all infants  $\geq 35$  weeks gestation refer to the Neonatal Clinical Guideline – Early-onset [Sepsis Risk Calculator: Assessment of Early-Onset Sepsis in Infants  \$\geq 35\$  weeks Gestation](#)

### Early Onset Sepsis (BE AWARE OF ANY MATERNAL CULTURES)

- Blood cultures
- Gastric aspirate (if has not fed)
- Ear swab
- Tracheal aspirate (if intubated)
- FBC, U&Es, PGL, CRP
- Consider LP
- CXR (if indicated)

### Late-onset sepsis

- Blood culture
- CRP, FBC, U&Es, PGL for baseline
- Consider LP (should be performed in all cases of proven septicaemia)
- CXR (if indicated)
- Suprapubic urine

## Septic Screening Procedures

### Blood Cultures

To obtain a blood sample for microbiological examination where clinically indicated. A single blood culture bottle is all that is normally required. However, if an intra-abdominal collection or necrotising enterocolitis is suspected, blood for aerobic and anaerobic pathogens should be sent in separate bottles.

### Equipment

Blood culture collection is a standard aseptic procedure, performed by medical staff or nursing staff deemed competent in the insertion of an intravenous catheter.

- Sterile dressing pack
- Blood culture bottle
- 2 mL syringe
- Blunt needle
- Intravenous cannula
- Skin cleansing swabs (Chlorhexidine 1% Alcohol/ 70% Swab  $> 27$  weeks gestation or Povidone-iodine 10% Swab  $\leq 27$  weeks gestation)

### Procedure

1. Refer to procedure for intravenous line insertion if collecting blood from an intravenous cannula. When there is blood flowing back into the hub, insert blunt needle into the hub and aspirate blood for transfer into culture bottle. For infants  $\leq 28$  weeks 0.5mL; infants  $> 28$  weeks 1mL.
2. Remove seal from culture bottle.
3. Inject blood into blood culture bottle.

4. Ensure bottle is correctly labelled at the bedside. It is important not to attach the patient label to the neck of the bottle as this interferes with processing of the sample.

### **Ear Swab**

The ear folds may reflect microbiological colonisation acquired from amniotic fluid and/or birth canal; this can persist after birth and may indicate the microorganism causing perinatal infection.

#### **Equipment**

- Charcoal medium
- Sterile swab stick
- Agar plate - If the swab is collected out of office hours, then a smear of the swab should be placed on the agar plate as this allows the process of incubation to begin immediately.

#### **Procedure**

1. Do not collect ear swab if infant has been bathed.
2. Remove swab stick from packet, taking care not to touch the tip.
3. Swab in a circular motion, around the first curvature of the ear.
4. Smear onto agar if required (out of hours). Avoid smearing the edges of the plate as contamination can occur, smearing an S shape down the centre of the plate is recommended.
5. Place swab into charcoal medium.
6. Label immediately at the bedside.

### **Gastric Aspirate**

To take a gastric fluid specimen for microbiological examination on all newborn infants admitted to the unit with suspected sepsis. The aspirate may reflect microbiological colonisation acquired from amniotic fluid and/or birth canal; this can persist after birth and may indicate the microorganism causing perinatal infection.

#### **Equipment**

- Gastric tube
- PH/litmus test strip
- 10mL syringe
- Yellow lid specimen container

#### **Procedure**

1. Refer to [Gastric Tubes: Placement and Testing](#) guideline for instructions on insertion of a gastric tube.
2. Gastric aspirate must be collected prior to the infant's first feed.
3. Once tube has been inserted, connect 10 mL syringe and gently aspirate gastric tube to obtain secretions for microbiological examination, the fluid swallowed during birth may reveal organisms of the maternal genital tract that may cause perinatal infections.
4. If the infant requires a gastric tube, leave the tube in and secure it. Ensure the position is checked.
5. Label specimen immediately at the bedside.

## Lumbar Puncture

Obtain cerebrospinal fluid (CSF) for:

- Infants with suspected meningitis or sepsis.
- Drainage of CSF in communicating hydrocephalus.
- Diagnoses of metabolic disorder.
- Diagnostic procedure in seizure activity.

### Key Points

- Depending on the level of experience, only **two** attempts should be made to obtain CSF before handing over to another medical officer.
- Needles without a stylet should not be used because of the risk of an intraspinal dermoid.
- The position adopted for a lumbar puncture can cause physiological instability. Throughout the procedure the infant must be monitored for tolerance and stability and the procedure should be stopped if at any time the infant's condition deteriorates
- The infant must have continuous oxygen saturation and heart rate monitoring throughout the procedure and resuscitation equipment should be available.

### Equipment

- Skin cleansing solution. Chlorhexidine 1% Alcohol/ 70% solution > 27 weeks gestation or Povidone-iodine 10% solution ≤ 27 weeks gestation)
- Dressing pack / gown / gloves / sterile drapes.
- Lumbar puncture needle - 25G to be used (22G available if required).
- Sterile specimen bottles - appropriate bottles for specific tests.
- Non-occlusive dressing (Tegaderm 4cm x 4cm).

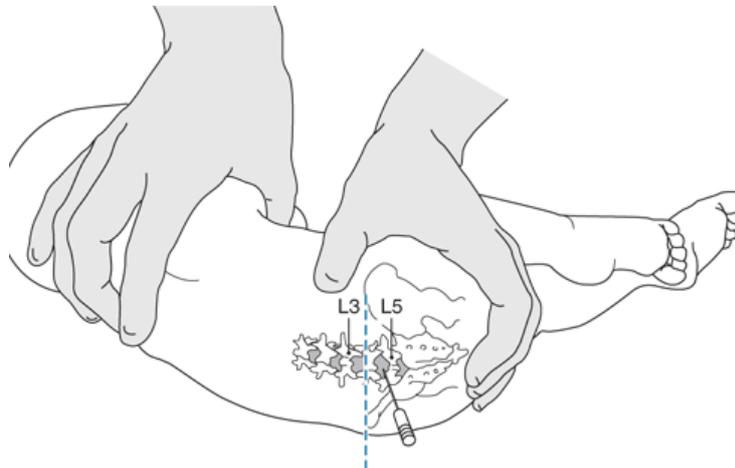


Diagram demonstrating area of puncture and position of infant during the procedure

### Procedure

1. Hold the infant firmly in the lateral position, keeping the head and trunk well flexed. This allows for easy detection of landmarks.
2. Observe infant's tolerance closely for possible airway obstruction, apnoea, bradycardias, hypoxia.

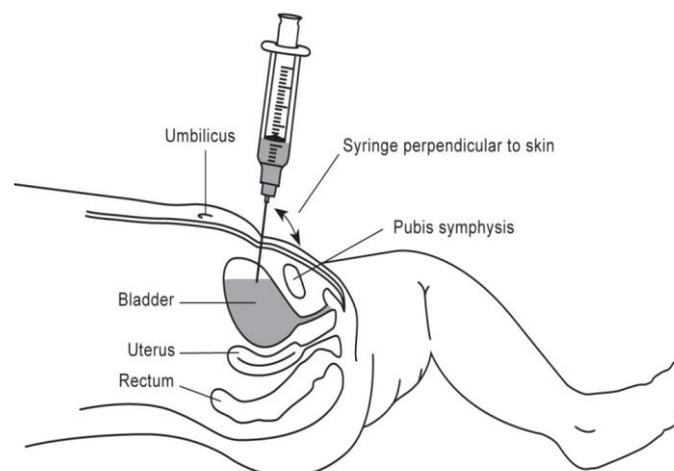
3. Identify the L4-L5 interspace as site for lumbar puncture. The space above L4 should **not** be penetrated as this can lead to spinal cord and spinal nerve damage.
4. Clean wide area thoroughly.
5. Insert the needle in the midline with steady force aimed towards the umbilicus.
6. Advance the needle slowly and then remove the stylet to check for appearance of fluid.
7. Collect at least 10 drops in each sterile container.
8. Maintain pressure on the area with sterile gauze until the site has stopped leaking.
9. Wash off povidone-iodine solution, or chlorhexidine solution.
10. Place non-occlusive dressing over site (if skin integrity allows) and leave intact for 24 hours.
11. Label immediately at the bedside.

### Supra Pubic Urine

Obtain a sterile sample of urine for a septic or metabolic screen. Supra-pubic urine aspirate is performed by medical staff using standard aseptic technique. Ultrasound assessment of the bladder is useful prior to procedure.

#### Equipment

- 2 mL Syringe
- 23G Needle
- Skin preparation swab
- Sterile container



#### Procedure

1. Position infant supine. Hold legs in frog-like position.
2. Check infant has not just voided.
3. Locate site of bladder puncture: 0.5 cm-2 cm above the pubic symphysis in the midline of the lower abdomen.

4. Prepare skin (Chlorhexidine 1% Alcohol/ 70% solution > 27 weeks gestation or Povidone-iodine 10% ≤ 27 weeks gestation)
5. Advance needle perpendicular to abdomen to ensure correct anatomical position and avoid bowel perforation.
6. Advance the syringe whilst applying minimal negative pressure.
7. Do not advance any further once urine is obtained to avoid trauma to the posterior bladder wall.
8. Remove needle and apply pressure until bleeding has stopped.
9. Label specimen immediately at the bedside.

### **Endotracheal Aspirate**

To obtain pulmonary secretions for microbiological examination in ventilated infants. ETT aspirate is to be collected as part of septic screen on admission or for any other subsequent septic screen for ventilated infant.

Routine ETT aspirates are collected for every ventilated infant on Mondays.

#### **Equipment**

- Appropriate size suction catheter or specimen collection trap.

#### **Procedure**

1. Turn off continuous milk feed prior to performing the procedure to prevent aspiration of milk.
2. Turn suction apparatus on at a set pressure, as per suction procedure. Connect suction catheter to suction tubing.
3. Measure the depth of the catheter insertion required by noting the length the endotracheal tube is cut at and adding 7cm. Correct measurement prevents deep suctioning which causes mucosal trauma.
4. Remove flow sensor. If applicable, increase FiO<sub>2</sub> by 10% prior to suctioning.
5. Insert catheter to predetermined length. Apply suction to T-piece. Withdraw catheter while maintaining suction pressure, this should not take longer than 10secs to minimise the risk of cerebral and pulmonary vasoconstriction.
6. Person assisting should then turn suction apparatus off.
7. Disconnect suction catheter from tubing, wind catheter around the T-piece and place catheter back into packaging.
8. Ensure patient safety, SaO<sub>2</sub>, heart rate, ventilator tubing, position of ETT.
9. Label specimen immediately at bedside.

### **Nasopharyngeal Specimen - Swab Collection**

To collect respiratory secretions containing epithelial cells from the nasopharynx to assist in the diagnosis of viral respiratory tract infections.

#### **Key Points**

- Nasopharyngeal swabs are the preferred method of sample collection for detection of respiratory viruses.
  - Using polymerase chain reaction (PCR) for respiratory virus detection, nasopharyngeal flocked swabs have been shown to be as sensitive as nasopharyngeal aspirates.

- Nasopharyngeal swab collection is considered safer for sample collectors as there is less risk of aerosol generation than with aspirate collection

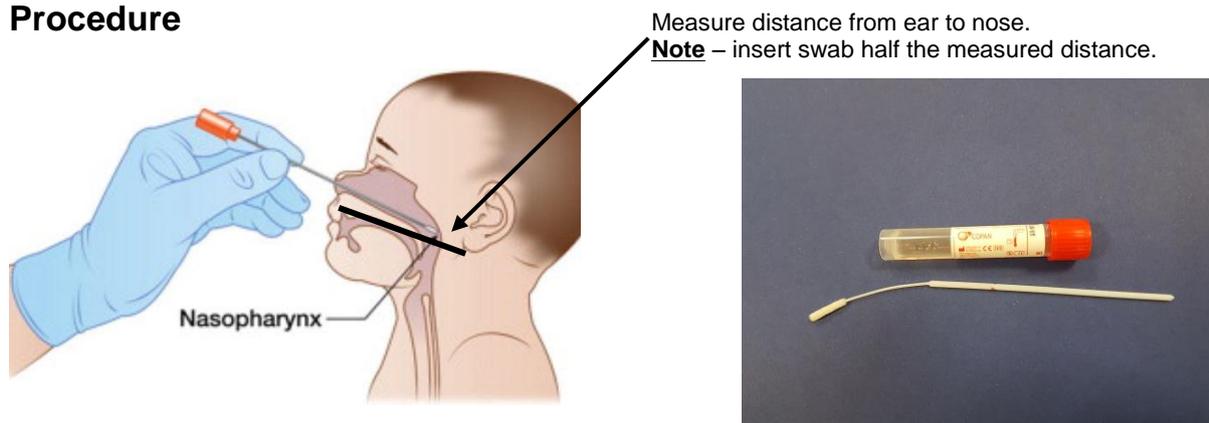
### Equipment

- Swab with transport medium (UTM™)
- Completed pathology request form
- Biohazard specimen transport bag
- PPE: Standard (gloves, consider mask and eye protection if baby not in incubator)

### Patient Preparation

- Confirm patient identity against pathology request form.
- Consider administration of sucrose prior to procedure.
- Swaddle infant.
- Measure distance from base of ear to nose (**Note** – swab to be inserted half the measured distance).

### Procedure



1. Perform hand hygiene and don gloves (PPE).
2. Open swab packaging and remove ready for specimen collection.
  - Check expiry date on kit packaging.
3. Immobilise the infant's head in the sniffing position.
  - You may require another staff member to assist.
4. Insert flocked swab into the anterior nares and gently direct backwards along the base of the nostril as far as possible; but **not more than half** the measured distance from the base of ear to nose.
  - If resistance is encountered during swab insertion, remove it and attempt insertion into other nostril.
  - Ensure swab is **not** directed in an upward direction.
5. Hold the swab in the nasopharynx for approximately 5 seconds.
6. Gently rotate 2-3 times before withdrawing swab.

7. Remove swab slowly and place it (without touching) into the transport medium.
8. Break swab stick at designated marked breakpoint.
9. Replace tube cap securely.
10. Ensure specimen is correctly labelled and place into biohazard bag.
11. Remove PPE and perform hand hygiene.

## Eye Swabs

To obtain an eye swab for microbiological examination in an infant with persistent discharging eyes.

### Key Points

- An eye swab for bacterial examination should always be the first line of action. If the eye fails to respond to treatment then a swab for chlamydial and viral examination should be sent. The incubation period for Chlamydia is from day 4 up to 2 weeks of age; therefore a sticky eye in the first 4 days of life is unlikely to be indicative of chlamydial infection.
- If the infant is delivered vaginally through active genital herpes lesions, an eye swab in viral medium should be sent on admission as part of the septic screen.
- Viral transport medium (VTM) contains antibiotics to keep the virus stable on transport to the laboratory; therefore it is important **not** to use VTM for chlamydial or bacterial examination.

### Equipment

Bacterial examination:	Chlamydial examination:	Viral examination:
<ul style="list-style-type: none"> <li>• Normal saline</li> <li>• Charcoal swab</li> <li>• Glass slide and slide carrier</li> </ul>	<ul style="list-style-type: none"> <li>• Normal saline</li> <li>• Aluminium wire shafted swab</li> <li>• Teflon coated slide and slide carrier</li> <li>• Sterile scissors</li> </ul>	<ul style="list-style-type: none"> <li>• Saline</li> <li>• Swabstick</li> <li>• Viral transport medium (VTM)</li> <li>• Sterile scissors</li> </ul>

### Procedure

1. Perform eye toilet to remove exudate from eye. If both eyes are discharging, a swab from each eye should be sent separately ensuring they are correctly labelled.
2. Moisten swab stick with normal saline to provide optimum medium for bacterial / viral / chlamydial growth.
3. Gently fold down lower eyelid and run swab stick across the inner surface rotating swab to ensure specimen collection. If for chlamydial examination continue on to the inner canthus and rotate the swab across the inner canthus - cells need to be collected not just exudate.
4. Avoid causing trauma to eye mucosa.
5. Smear swab along glass slide if applicable and place into transport medium.
6. The chlamydial swab and viral swab will need to be cut with sterile scissors.

## Sepsis: General Management and Antimicrobial Treatment

In all cases, close monitoring and supportive management is essential

### Early-onset sepsis

- Antibiotics should be administered to any neonate with clinical signs of sepsis.
- The presence of risk factors for sepsis may indicate investigation, but are not in themselves an indication for antibiotic administration if the neonate is well.
- Common pathogens include Group B Streptococci (*S. agalactiae*) and Gram-negative organisms, esp. *E. coli* and *H. influenzae*.
- Parenteral therapy with Penicillin and Gentamicin should be started immediately after the septic screen.
- If the infant is ill, speed of intervention is of the essence.

### Late-Onset sepsis

- Common organisms include Coagulase-Negative Staphylococci (CoNS; esp. *S. epidermidis*) and Gram-negatives.
- Septic work-up includes blood culture, LP and suprapubic urine collection.
- Antibiotic therapy must be targeted to the sensitivities of the likely causative organism. When considering antibiotic therapy, it is important to take into account the microbiological colonisation (and sensitivity) of the NICU, as well as previous colonisation or infection of the infant.
- Empiric therapy is Vancomycin plus an aminoglycoside (Gentamicin or Tobramycin.) CoNS are almost uniformly Flucloxacillin and Cephalosporin resistant.
- If there is evidence of a GI cause (NEC with intramural gas, perforation, peritonitis or an intra-abdominal collection), a combination of Vancomycin AND Piperacilin/Tazobactam AND Gentamicin would be the first choice.
- Addition of further anti-anaerobe cover (i.e. Metronidazole or Meropenem) should be considered individually, e.g. in cases of intra-abdominal collection and/or failure of CRP resolution. These cases should be discussed with the clinical microbiologist.
- In cases of CoNS sepsis where a central line is **in situ**, consideration should be given to removal of the line.

Length of treatment is based on laboratory and clinical findings. If deep cultures are negative and 2 CRPs taken 24 hours apart are normal and the infant has improved, antibiotics may be discontinued.

The typical course of antibiotics would be 2 days for suspected but unproven sepsis, 5-7 days for a more definite diagnosis, such as pneumonia, 7-10 days for a positive blood culture, and 3 weeks for meningitis.

To reduce development of antibiotic resistance, third generation Cephalosporins and Meropenem are restricted to infections with proven sensitive organisms unresponsive to first-line antibiotics or to overwhelming infections or meningitis. Discuss with neonatologist and a clinical microbiologist.

Refer to Infection Prevention and Management Manual – [Micro-Alerts and Multi-Resistant Organisms](#)

### **Antibiotic Administration to Neonates of Mothers with Antibiotic Allergy**

Penicillin G, other semisynthetic Penicillins and Cephalosporins are used frequently in the neonatal period for both therapy and prophylaxis. These antibiotics are exceedingly well tolerated in neonates. Anaphylaxis secondary to their use is rare, even when administered to neonates born of mothers with Type I hypersensitivity reactions to penicillin and related agents. Further, there is no evidence that use of Penicillin and related agents in the neonatal period predisposes to subsequent beta-lactam allergy. As neonatal administration of Penicillin and related agents may be lifesaving, their use should not be delayed because of concerns of maternal antibiotic allergy.

### **Viral Infections**

Any symptomatic infant requiring a PNA should be immediately placed on contact precautions:

- Isolated in an incubator
- Place in cohort management
- Or if unable to isolate in incubator discuss with CNC /CNC Infection Prevention Management to discuss if isolation room required.

Refer to Infection Prevention and Management Policy - [Neonatal Viral Infections](#) for screening and isolation management.

### **[Cytomegalovirus \(CMV\) Neonatal Pathway](#)**

### **[Candida Infections](#)**

#### Related WNHS policies, procedures and guidelines

##### Infection Prevention and Management Policies

- [Micro Alerts and Multi-Resistant Organisms](#)
- [Neonatal Respiratory Viral Infections](#)
- [Group A Streptococcus](#)

##### Neonatal Clinical Guidelines

- [Sepsis Calculator: Assessment of Early On-set Sepsis in Infants  \$\geq\$  35 weeks Gestation](#)
- [Cytomegalovirus \(CMV\) Neonatal Pathway](#)
- [Candida Infections](#)

##### Obstetrics & Gynaecology Clinical Practice Guideline

- [Group B Streptococcal Disease](#)

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