GUIDELINE

Sepsis: Neonatal

Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA

CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations.

Read the full statement here:
CAHS Child Safe Organisation Commitment Statement

This document should be read in conjunction with this disclaimer

Also refer to:

- Early-Onset Sepsis Management Quick Reference Guide (QRG)
- Recognising and Responding to Clinical Deterioration

Aim

To provide a consistent, evidence-based approach to the assessment and management of suspected sepsis.

Risk

Neonatal sepsis has a high risk of morbidity and mortality.

Infection in the Neonate

Bacterial infection is a leading cause of morbidity and mortality in the newborn period. For unwell infants consider sepsis as a possible cause and refer to Recognising and Responding to Clinical Deterioration.

Every effort must be taken to prevent, recognise and treat infection. Treatment must be both specific and supportive.

Blood cultures are required prior to commencing antibiotic therapy. Cultures should be obtained 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).

Early-Onset Sepsis (EOS)

Background and Rationale

EOS risk assessment should be based primarily on perinatal risk factors, clinical evaluation, and blood culture results.

For infants ≥35 weeks' gestation, EOS Calculator-based management safely reduces unnecessary investigations and antibiotic exposure while maintaining patient safety.

For infants <35 weeks' gestation, delivery characteristics identify a subgroup at low risk of EOS.

Blood culture is the diagnostic standard for EOS. Reliable blood culture performance depends on adequate blood volume. Collection of at least 1mL blood optimises pathogen recovery.

Principles

EOS management is based on:

- Perinatal risk factors
- Clinical evaluation
- Blood culture when indicated

Infants ≥35 Weeks Gestation

Assess EOS risk using the Kaiser Permanente Early-Onset Sepsis Calculator.

Refer to the Neonatal Clinical Guideline Sepsis Calculator.

Management should follow the EOS Calculator recommendation:

- Routine care
- Blood culture and clinical observation

Infants <35 Weeks Gestation	
Low EOS Risk	**NOT Low EOS Risk**

• No preterm labour
• Rupture of membranes ≤1 hour
• No suspected or confirmed chorioamnionitis

• Clinical observation only
• No routine blood culture
• No routine empiric antibiotics
	• Presence of:
	  ○ Preterm labour **OR**
	  ○ ROM >1 hour **OR**
	  ○ Chorioamnioitis
	• The infant's clinical course is not as expected for gestational age
	
	• Obtain blood culture
	• Consider empiric antibiotics

Empiric Antibiotic Therapy

First-line empiric antibiotic therapy for suspected EOS is:

- Benzylpenicillin
- Gentamicin

For infants with severe or life-threatening illness: Consider early antimicrobial escalation following senior neonatal review and consultation with microbiology/ infectious diseases.

Blood Culture Collection

Obtain blood culture before commencing antibiotics whenever feasible.

For all neonatal blood cultures:

- Collect at least 1mL blood
- Weigh bottle before inoculation
- Weigh bottle after inoculation
- Document inoculum volume in the medical record and on the laboratory request form

Refer to Appendix 3: Screening Procedures - Blood Culture

Lumbar Puncture

Lumbar puncture should be performed as early as feasible when meningitis is suspected clinically or when a blood culture becomes positive for a pathogenic organism.

Antibiotic therapy should not be delayed soley to obtain cerebrospinal fluid.

Refer to Appendix 3: Screening Procedures – Lumbar Puncture

Antibiotic Review

Review requirement of empiric EOS antibiotics at 36 hours of blood culture incubation.

If blood culture remains negative and the infant is clinically stable, discontinue antibiotic therapy.

Further management should be guided by the infant's clinical course and consideration of alternative diagnoses.

Ancillary Investigations

Ancillary biomarkers are not routinely required for EOS risk assessment or determination of antibiotic initiation or duration.

Monitoring & benchmarking

- Proportion of blood cultures with documented inoculum volume and at least 1 mL blood collected
- EOS antibiotic treatment rate
- Culture-confirmed EOS cases

Late Onset Sepsis (LOS)

Background and Rationale

Investigations

- Blood culture
- CRP, FBC, U&Es, PGL for baseline
- LP (should be performed in all cases of proven bacteraemia and clinical suspicion of meningitis)
- CXR (if indicated)
- Suprapubic urine (especially when infant >3 weeks of postnatal age)
- If central line present (UVC, CVC) a blood sample drawn from the line for culture as well as a peripheral blood culture.

General Management and Antimicrobial Treatment

In all cases, close monitoring and supportive management is essential

Hospital acquired Late-Onset Sepsis

This section refers to the management of patients who were in the NICU/SCN when they developed late-onset sepsis.

- Common organisms include Gram-positives (CoNS; esp. *S. epidermidis, and S. aureus*) 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. CoNS are almost uniformly Flucloxacillin and Cephalosporin resistant.
- **If antibiotic therapy is started on an infant who has been in close proximity to another infant colonised or infected with a resistant organism (such as ESBL or MRSA) the initial antibiotic choice should be discussed with a clinical microbiologist/infectious diseases specialist.**
- If a there is evidence of a GI cause (NEC with intramural gas, perforation, peritonitis or an intra-abdominal collection), a combination of Vancomycin AND Piperacillin/Tazobactam maybe considered.
    - If meningitis is associated or suspected, then consult clinical microbiologist/infectious diseases specialist for advice on antibiotic choice as Pipericillin/Tazobactam has poor CNS penetration.
    - 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 clinical failure of treatment. 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. In babies that require longer term PN nutrition, this should be discussed with the consultant how best to manage with a set time frame documented for reinsertion of a long line.

Length of treatment is based on laboratory and clinical findings. If 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

Laboratory and Clinical Findings	Duration
Suspected but unproven sepsis (negative blood culture)	2 days
More definite diagnosis such as pneumonia, with negative blood culture	5-7 days
Positive blood culture	7-10 days
Meningitis	2 to 3 weeks

Ultimate duration of antibiotics will depend on the pathogen, clinical progress and complications.

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 investigation should be immediately placed on contact precautions +/- droplet or airborne precautions

- Isolated in an incubator
- Place in cohort management
- Or if unable to isolate in incubator discuss with CNC /CNC Infection Prevention Management/SNR On-Call to consider use of the Isolation Room.

Refer to Infection Prevention and Management Policy - Neonatal Viral Infections for screening and isolation management.

References and related external legislation, policies, and guidelines

1. Stocker M, Rosa-Mangeret F, Agyeman PKA, et al. Management of neonates at risk of early onset sepsis: a probability-based approach and recent literature appraisal. Update of the Swiss national guideline of the Swiss Society of Neonatology and the Pediatric Infectious Disease Group Switzerland. Eur J Pediatr. 2024.
2. Puopolo KM, Benitz WE, Zaoutis TE, et al. Management of neonates born at ≤34 6/7 weeks' gestation with suspected or proven early-onset bacterial sepsis. Pediatrics. 2018.
3. Puopolo KM, Benitz WE, Zaoutis TE, et al. Management of neonates born at ≥35 0/7 weeks' gestation with suspected or proven early-onset bacterial sepsis. Pediatrics. 2018.
4. Escobar GJ, Puopolo KM, Wi S, et al. Stratification of risk of early-onset sepsis in newborns ≥34 weeks' gestation. Pediatrics. 2014.
5. Kuzniewicz MW, Puopolo KM, Fischer A, et al. A quantitative, risk-based approach to the management of neonatal early-onset sepsis. JAMA Pediatrics. 2017.

Related CAHS internal policies, procedures and guidelines *(if required)*

Benzylpenicillin

Gentamicin

Recognising and Responding to Clinical Deterioration

Sepsis Calculator

This document can be made available in alternative formats on request.

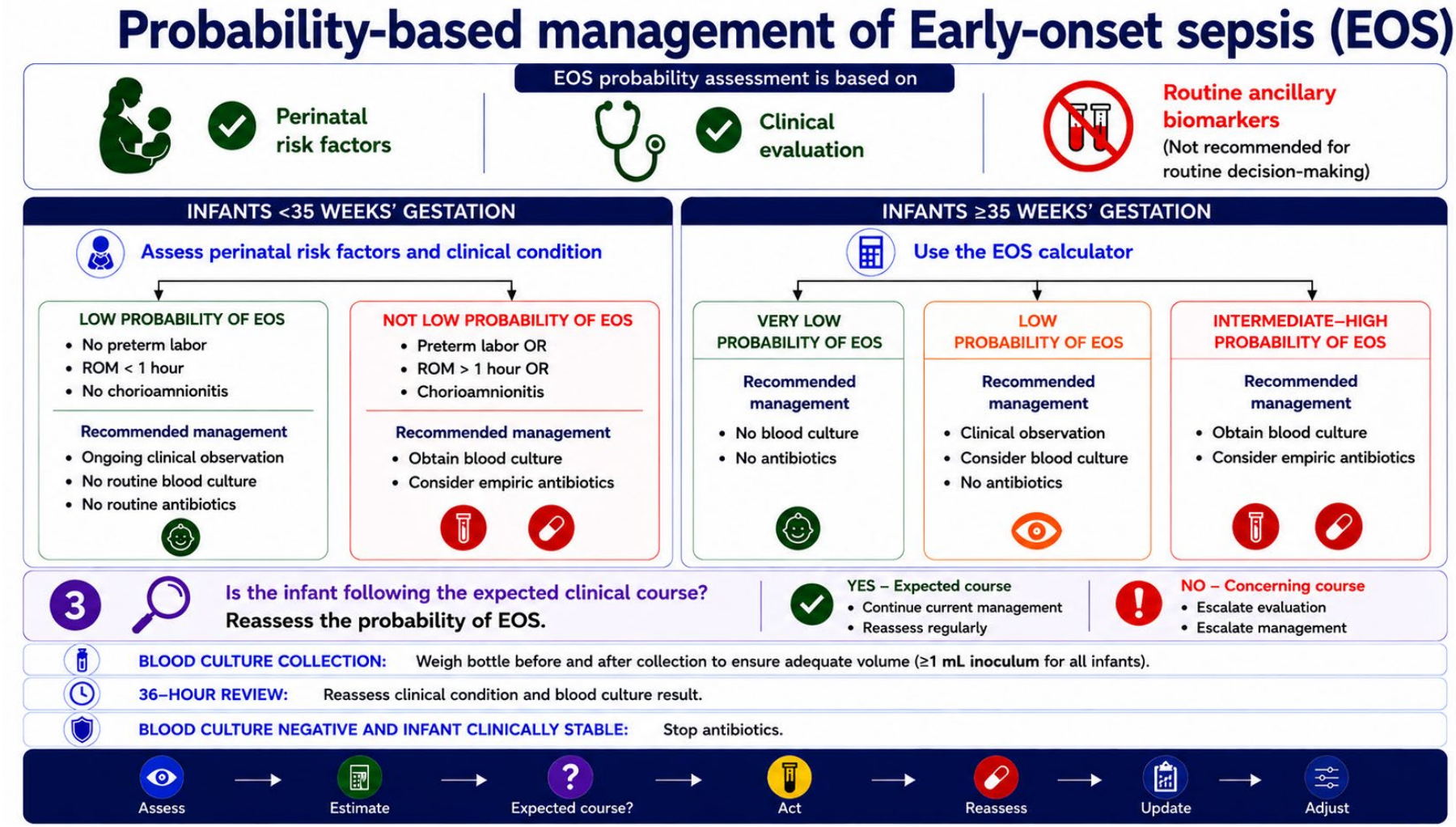
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Compassion | Excellence | Collaboration | Accountability | Equity | Respect

Appendix 1: Early-Onset Sepsis Management Quick Reference Guide



Appendix 2: Screening Procedures

Blood Cultures

To obtain a blood sample for microbiological examination where clinically indicated. All blood cultures require inoculation of at least 1ml. Blood culture bottles are to be weighed before and after inoculation and the inoculated volume documented in the medical notes and on the blood culture request form.

Equipment

Blood culture collection is a standard aseptic two person 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 plastic cannula
- Intravenous cannula
- Skin cleansing swabs (Chlorhexidine 1% Alcohol/ 70% Swab > 27 weeks gestation or Povidone-iodine 10% Swab ≤ 27 weeks gestation)
- Chlorhexidine 1% Alcohol 70% swab for top of blood culture bottle
- Precision scale (located next to blood gas machines in SCN2 and SCN3 at KEMH)

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.
2. Remove seal from culture bottle.
3. Weigh culture bottle without seal cap before inoculation.
4. Clean top of culture bottle with chlorhexidine 1% Alcohol 70% swab.
5. Inject blood into blood culture bottle.
6. Weigh culture bottle post-inoculation. Document inoculated volume in the medical notes and the blood culture request form.
7. 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. Inoculated blood volume to be documented on the sample request form and in the patient notes.

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

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. Place swab into charcoal medium.
5. 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 Tube Feeding in the NICU 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 / sterile gown / sterile 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

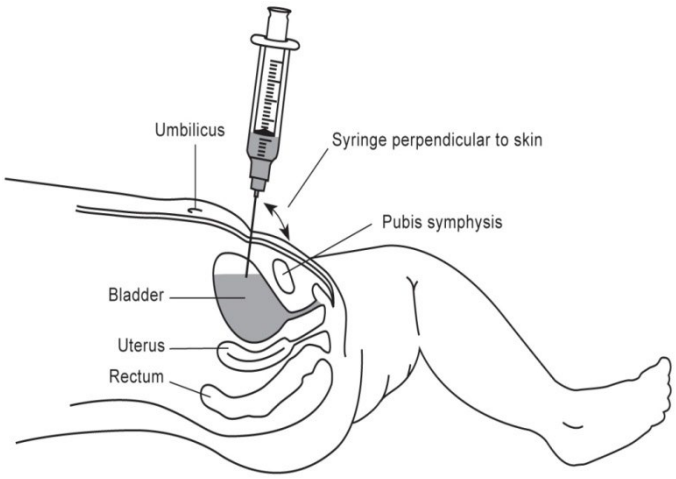
1. Hold the infant firmly in the lateral position, keeping the head and trunk well flexed. This allows for easy detection of landmarks.
2. Observe infant's tolerance closely for possible airway obstruction, apnoea, bradycardias, hypoxia.
3. Identify the L4-L5 interspace as site for lumbar puncture. The 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 beside.

Supra Pubic Urine

Supra-pubic urine aspirate is performed by medical staff using standard aseptic technique. Ultrasound assessment of the bladder is useful prior to procedure.

Equipment

- Dressing Pack
- 2mL syringe
- 23G needle
- Sterile container
- Skin prep swab



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 Tube (ETT) 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. This is a 2- person standard aseptic procedure

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

Equipment

Appropriate size suction catheter (6, 8, 10fr)

Specimen collection Pot (White Lid)

Sterile gloves

Normal Saline ampoule

Procedure

- Turn off continuous milk feed prior to performing the procedure to prevent aspiration of milk.
- Non- sterile assistant turns suction apparatus on at a set pressure (-80 to -100) Connect suction catheter to suction tubing.
- Sterile user to apply sterile gloves and remove specimen collection pot and keep white lid in sterile packaging.
- 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.
- Non-sterile assistant to disconnect ventilator circuit from ETT and remove flow sensor. A 10% increase FiO_2 prior to suctioning may be needed.
- Sterile user to 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.
    - If the sample is small and remains in the catheter 0.5mL of N/S can be aspirated to clear the catheter so the secretions are collected in the specimen trap.
- Non-sterile assistant turns suction apparatus off and disconnects suction catheter and tubing from specimen pot
- Sterile user connects sterile white lid to top of specimen pot
- Ensure all monitoring parameters have returned to normal. ETT position secure and noted, and ventilator tubing secure.
- Label specimen immediately at bedside.

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

Equipment

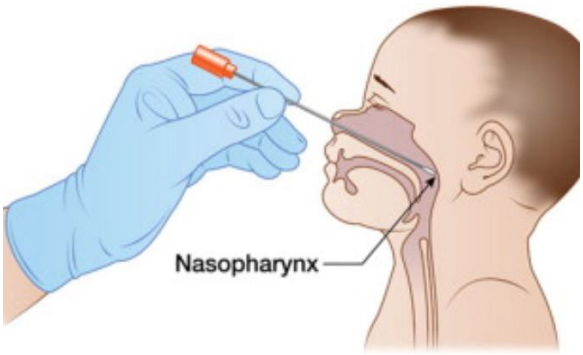
- Flocked Swab with transport medium (UTM™)
- Completed pathology request form
- Stating Full Respiratory Panel, urgent results required.
- Biohazard specimen transport bag
- PPE: Standard - gloves, consider mask and eye protection

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. Measure distance from ear to nose
2. Perform hand hygiene and don gloves (PPE).
3. Open swab packaging and remove ready for specimen collection.
   - Check expiry date on kit packaging.
4. Immobilise the infant's head in the sniffing position.
   - You may require another staff member to assist.



5. Insert flocked swab into the anterior nare 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.

6. Hold the swab in the nasopharynx for approximately 5 seconds.
7. Gently rotate 2-3 times before withdrawing swab.
8. Remove swab slowly and place it (without touching) into the transport medium.
9. Break swab stick at designated marked breakpoint.
10. Replace tube cap securely.
11. Ensure specimen is correctly labelled and place into biohazard bag.
12. Remove PPE and perform hand hygiene.

Eye Swabs

To obtain an eye swab for microbiological examination in an infant with persistent discharging eyes. For ongoing care, refer to Eye Care: Eye Infections and Conjunctivitis

Key Points

- An eye swab for bacterial examination should always be the first line of action. If the eye fails to respond to treatment, 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

- Dressing Pack

Bacterial examination:	**Chlamydial examination:**	**Viral examination:**
• Normal saline • Charcoal swab • Glass slide/slide carrier	• Normal saline • Aluminium wire shafted swab • Teflon coated slide and slide carrier • Sterile scissors	• Saline • Swab stick • Viral transport medium (VTM) • Sterile scissors

Procedure

1. Perform hand hygiene and don gloves.
2. 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.
3. Moisten swab stick with normal saline to provide optimum medium for bacterial / viral / chlamydial growth.

4. 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.
5. Avoid causing trauma to eye mucosa.
6. Smear swab along glass slide if applicable and place into transport medium.
7. The chlamydial swab and viral swab will need to be cut with sterile scissors.
8. Remove gloves and perform hand hygiene.