Neonatal sepsis

Definition / Supporting Information

Early-onset neonatal infection is bacterial infection with onset within 72 hours of birth.

Babies may present with early-onset infection in different settings:

- Delivery suite
- Postnatal ward
- Neonatal unit
- Midwife-led unit
- At home
- Via 999 emergency call
- Emergency Department

Keywords / also known as: blood infection, neonatal infection, sepsis neonatorum

Essential History

Ask about:

- Risk factors for infection
  - Invasive Group B Streptococcal infection in a previous baby
  - Maternal Group B Streptococcal infection of the genital tract, bacteriuria or systemic infection in this pregnancy
  - Prolonged (> 18 hours) pre-labour rupture of membranes
  - Pre-term birth following spontaneous labour before 37 weeks of gestation
  - Maternal fever during labour > 38°C
  - Confirmed or suspected chorioamnionitis
- Clinical indicators of potential infection in the baby
  - Changed behaviour or responsiveness
  - Lethargy, abnormal tone
  - Poor feeding and poor suck
  - Vomiting
  - Abdominal distension
  - Change in colour
    - Pallor
    - Duskiness
    - Mottling
  - Jaundice within 24 hours of birth
  - Apnoea, unexplained respiratory distress

  - Local signs of infection
  - Poor temperature control (< 36°C or > 38°C)
    - Unexplained by environmental factors
  - Poor urine output more than 24 hours after birth

‘Red Flag’ Symptoms and Signs

Ask about:

- Risk factors:
  - Administration of intravenous antibiotics for confirmed or suspected invasive bacterial infection during labour, or within 24 hours before or after the birth
  - Suspected or confirmed infection in one of the other babies in multiple pregnancies

Look for:

- Clinical indicators:
  - Respiratory distress starting more than 4 hours after birth
  - Seizures
  - Signs of shock
  - Need for mechanical ventilation in a term baby
  - Fever > 38°C

Differential Diagnosis / Conditions

NB: any of the following may co-exist with sepsis

- Transient tachypnoea of the newborn (TTN)
  - Respiratory distress usually resolves within 24–48 hours, but must be treated as potential sepsis initially
    - Symptoms may occasionally last up to 72 hours
- Respiratory distress syndrome (RDS)
  - Respiratory distress soon after birth as a result of surfactant deficiency
    - Must initially be treated as potential sepsis
    - Chest x-ray shows diffuse opacification
  - More common in pre-term infants < 37 weeks of gestation and infants of mothers with diabetes
- Meconium aspiration syndrome
  - History of meconium at delivery
  - Patchy changes on x-ray
- Congenital heart disease (duct-dependent lesions)
  - Collapse at around the time of closure of the ductus arteriosus

Investigations

NB: If neonatal sepsis is suspected, treatment should not be delayed while investigations are being performed.

To be undertaken by non-specialist practitioners (eg, Primary Care, Midwifery Team(s)) or specialist practitioner (eg, Paediatric Emergency Department Team(s)):

- Before commencing further investigations:
  - Assess ABC (Airway, Breathing, Circulation)
  - Resuscitate if necessary according to the Newborn Life Support (NLS) algorithm [Resuscitation Council (UK)]

To be undertaken by specialist practitioners (eg, Paediatric Emergency Department, Paediatric or Neonatal Team(s)):

- In babies with 'red flag' symptoms or signs, or with two or more non 'red flag' risk factors / clinical indicators:
  - Blood cultures
  - Full blood count (FBC)
    - Both high and low white blood count are significant
  - C-reactive protein
  - Chest x-ray if indicated
    - Looking for signs of respiratory distress
  - In case of suspected chorioamnionitis
    - Placenta (if still available) should be sent for histopathology
  - Take swabs for microbiology in case of:
    - Purulent umbilical discharge or periumbilical cellulitis
    - Purulent eye discharge
    - Obvious localised skin lesions
  - Do not routinely perform urine microscopy for early-onset neonatal infection
- Lumbar puncture to obtain cerebrospinal fluid (CSF) may be indicated in early-onset sepsis if safe and the baby is stable
- Lumbar puncture to be done in all cases of late-onset sepsis
  - > 72 hours after delivery

Treatment Approach

To be undertaken by specialist practitioner (eg, Paediatric Emergency Department, Paediatric or Neonatal Team(s)):

- In babies without 'red flag' symptoms signs, and only one non 'red flag' risk factor / clinical indicator, consider:
  - Whether safe to withhold antibiotics

  - Whether temperature, heart rate, respiratory rate and clinical condition should be monitored
    - If monitoring is required, perform for at least 12 hours (at 0, 1 and 2 hours and 2 hourly thereafter)
- In babies with 'red flag' symptoms or signs, or with two or more non 'red flag' risk factors / clinical indicators:
  - Start intravenous antibiotics as soon as possible and always within 1 hour of the decision to treat
  - Do not delay antibiotics pending test results
- Antibiotic choice, dosage and frequency:
  - Recommended choice of antibiotic therapy is based on the most likely infecting pathogens in the first few days of life
    - Group B *Streptococcus* is the commonest
  - Empirical treatment of suspected infection:
    - Intravenous benzylpenicillin 25 mg/kg every 12 hours and gentamicin 5 mg/kg starting dose
    - A second dose can be given after 36 hours
    - Subsequent doses depend on therapeutic monitoring of gentamicin levels
  - Clinical evidence of umbilical infection
    - Intravenous flucloxacillin and gentamicin
  - Suspected bacterial meningitis in a baby on a neonatal unit:
    - If causative organism not known, treat with intravenous amoxicillin and cefotaxime
    - If CSF Gram staining or culture shows Gram-negative organism
      - Stop amoxicillin and treat with cefotaxime alone
    - If CSF Gram stain shows Gram-positive organism
      - Continue treatment with amoxicillin and cefotaxime pending culture results and seek microbiological advice
    - If CSF culture is positive for Group B *Streptococcus*, consider changing to benzylpenicillin 50 mg/kg every 12 hours and gentamicin starting dose of 5 mg/kg every 36 hours
      - Subsequent doses adjusted according to monitoring of gentamicin levels
      - Continue benzylpenicillin for 14 days and gentamicin for 5 days
    - If blood culture or CSF culture shows *Listeria*
      - *Consider stopping cefotaxime and treating with amoxicillin (50 - 100 mg/kg every 12 hours) and gentamicin*
    - If CSF culture shows a Gram-positive organism other than Group B *Streptococcus* or *Listeria*, seek microbiological advice

  - Suspected bacterial meningitis in a baby not on a neonatal unit (see Meningitis (bacterial) and meningococcal septicaemia in under 16s [NICE clinical guideline CG102])
- Regular reassessment
  - Continuous assessment and monitoring of the baby may be required until condition is stable
  - Regularly reassess the baby's condition and results of investigations
  - Consider changing antibiotics:
    - If condition deteriorates or does not improve
    - If results of microbiological investigations suggest that antibiotic cover is suboptimal
    - Based on expert microbiological advice, taking local surveillance data into account
  - If microbiological evidence of Gram-negative bacterial sepsis present, add an antibiotic active against Gram-negative bacteria (eg, cefotaxime)
  - If Gram-negative infection is confirmed, stop benzylpenicillin
- Further investigations during antibiotic treatment
  - In babies receiving antibiotics because of risk factors for or clinical indicators of infection, repeat C-reactive protein at 18–24 hours after presentation
  - Consider performing a lumbar puncture in a baby receiving antibiotics if this was not done at presentation, if it is safe to do so and if the baby:
    - Has a C-reactive protein concentration of 10 mg/L or greater
    - Has a positive blood culture
    - Does not respond satisfactorily to antibiotic treatment
- Duration of antibiotic treatment
  - In babies given antibiotics for risk factors or clinical indicators of possible infection, consider stopping antibiotics at 36 hours if:
    - The blood culture is negative
    - The initial clinical suspicion was not strong
    - The baby's condition is reassuring with no clinical indicators of infection
    - The levels and trend of C-reactive protein are reassuring
- Early-onset neonatal infection without meningitis
  - In case of positive blood cultures or a strong clinical suspicion of sepsis, treat for 7 days
  - Consider continuing antibiotics for more than 7 days
    - If the baby has not fully recovered
    - If, based on the pathogen isolated on blood culture, microbiological advice suggests this is advisable

- Monitoring for possible infection in babies not receiving antibiotics
  - If clinical concern increases, consider performing investigations and starting antibiotics as above
  - If no further concerns arise during the period of observation, reassure, and give advice to the parents or carers

When to Refer

Refer to paediatric / neonatal specialist if:

- Suspected or confirmed early-onset neonatal sepsis, and baby requires observation or treatment
  - Depending on condition, consider admission to a neonatal unit
- Maternal colonisation with Group B *Streptococcus* is first identified after birth, but within 72 hours of birth
  - Ask the person directly involved with the baby's care (eg, parent, carer or healthcare professional) if they have any concerns and whether other risk factors and/or clinical indicators are present
  - Use this information to guide further assessment and management

'Safety Netting' Advice

- If concerns about early-onset infection before hospital discharge, give verbal and written advice to parents or carers to seek medical help if they are concerned that the baby:
  - Is showing abnormal behaviour (eg, inconsolable crying, lethargy)
  - Is floppy
  - Is feeding poorly or not tolerating feeds
  - Has an abnormal temperature (< 36°C or > 38°C) unexplained by environmental factors
  - Has rapid breathing
  - Has change in skin colour

Patient / Carer Information

Please note: whilst these resources have been developed to a high standard they may not be specific to children.

- Child Sepsis Safety Net (Web page), Patient
- Group B Streptococcus (GBS) in pregnancy and newborn babies (Web page), Royal College of Obstetricians and Gynaecologists
- Group B Streptococcus (GBS) (Web page), National Childbirth Trust
- Sepsis (Web page), the NHS website

Resources

National Clinical Guidance

Group B Streptococcal Disease, Early-onset: (Green-top Guideline No. 36) (Web page), Royal College of Obstetricians and Gynaecologists

Neonatal infection (early onset): antibiotics for prevention and treatment (Web page), NICE clinical guideline CG149, National Institute for Health and Care Excellence

Meningitis (bacterial) and meningococcal septicaemia in under 16s: recognition, diagnosis and management (Web page), NICE clinical guideline CG102, National Institute for Health and Care Excellence

Sepsis: recognition, diagnosis and early management (Web page), NICE clinical guideline NG51, National Institute for Health and Care Excellence

Medical Decision Support

Paediatric basic life support (Web page), Resuscitation Council (UK)

Newborn life support algorithm (Web page), Resuscitation Council (UK)

Suggested Resources

Please note: these resources include links to external websites. These resources may not have national accreditation and therefore PCO UK cannot guarantee the accuracy of the content.

Kassab M, Khriesat WM, Anabrees J. Diuretics for transient tachypnoea of the newborn. *Cochrane Database of Systematic Reviews* 2015;11 [PubMed]

Standards for assessing, measuring and monitoring vital signs in infants, children and young people (Web page), Royal College of Nursing

Transient tachypnea of the newborn (Web page - log-in required), Medscape

Paediatric sepsis (Podcast), RCPCH

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Content Editor: Dr Elaine Boyle

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Nurse Reviewer: Mrs Doreen Crawford

Health Visitor Reviewer: Ms Julie Carter-Lindsay

Paediatric Trainee Reviewer: Dr Sian Copley

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