

Early Infection Risk in Newborns

Key Points

- This cross-site guideline aligns with NICE NG195 and uses a modified Kaiser-Permanente EOS calculator for local risk assessment
- Major change from previous guidelines includes removal of absolute CRP threshold for lumbar puncture
- The EOS pathway must be initiated regardless of KP calculator recommendations if any red flag risk factor or clinical indicator is present, as per NICE guidance
- If a baby with clinical signs (indicators) is not commenced on the EOS pathway, the reasons for NOT starting should be documented by a senior doctor
- Babies whose mothers received only erythromycin should be managed as if they received no intrapartum antibiotics
- Babies can change from Intravenous to oral antibiotics at 36 hours if criteria are met

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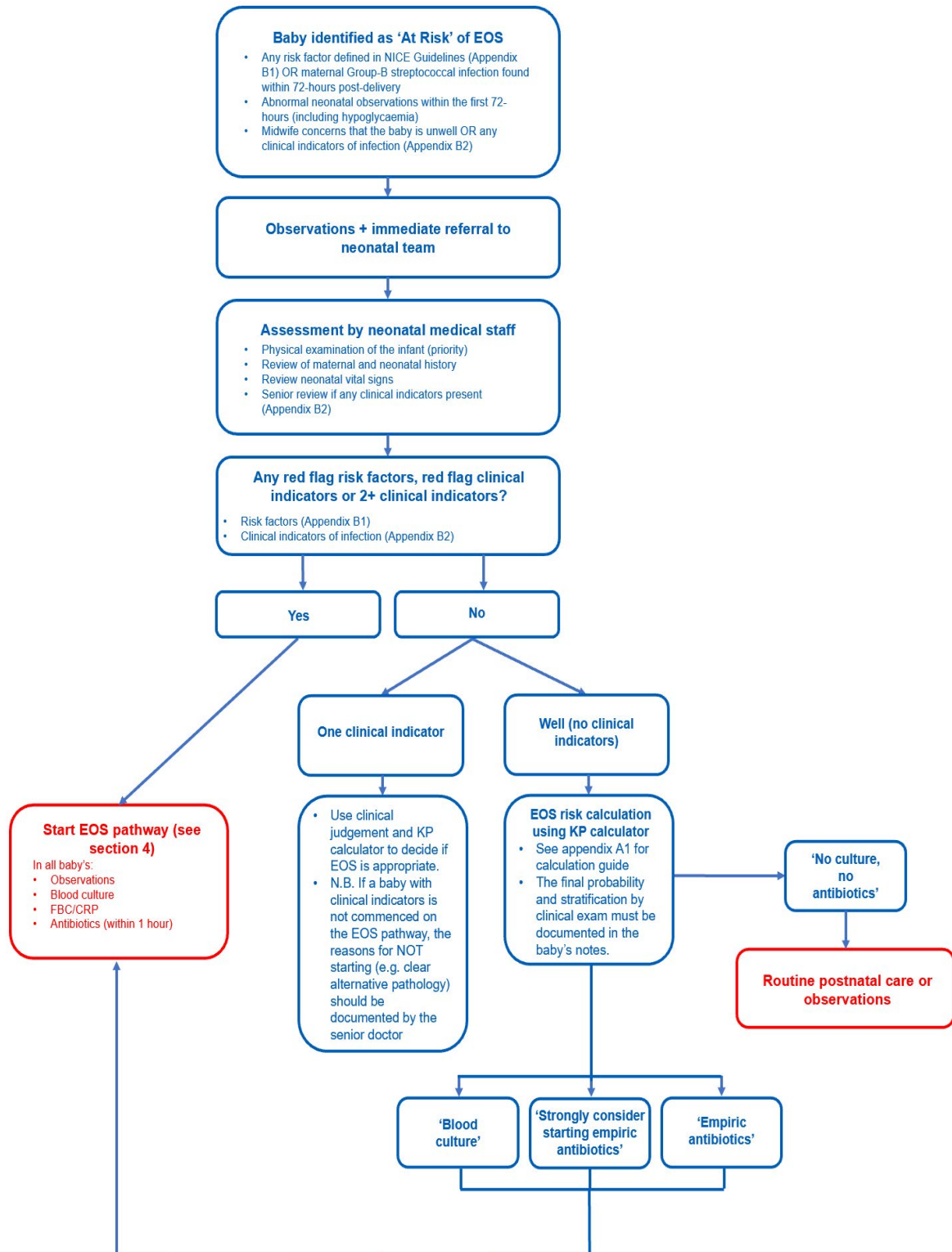
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Abbreviations

CRP	C-Reactive Protein
CSF	Cerebro-spinal fluid
EOS	Early onset sepsis
FBC	Full blood count
FHFT	Frimley Health NHS Foundation Trust
IV	Intravenous
LP	Lumbar puncture
KP	Kaiser-Permanente
NICU	Neonatal Intensive Care Unit
NICE	National Institute for Health and Care Excellence

Assessment Algorithm

The following flow chart outlines the recommended pathway for assessing and managing neonates identified as 'At Risk' of EOS. It is based on current NICE guidelines and incorporates risk stratification using the Kaiser Permanente (KP) calculator, clinical examination findings, and the presence of red flag indicators. This pathway supports prompt referral, structured assessment and evidence-based decision-making regarding investigations and empiric antibiotic therapy, ensuring appropriate and timely care for newborns.



Contents

1. Early Onset Sepsis in Neonates (Overview)	4
2. Intrapartum Antibiotics	4
3. Assessment of 'At Risk' Infants	4
3.1 Assessment by maternity staff	4
3.2 Assessment by neonatal medical staff (junior/middle-grade doctor)	5
4. Early-onset sepsis pathway (EOS pathway)	6
4.1 Observations	6
4.2 Investigations	6
4.3 Clinical review	7
4.4 Antibiotics	7
References	8
Appendix A: Guideline to the KP calculator	9
Appendix B: Risk Factors and Clinical Indicators	12
APPENDIX C. NEONATAL ORAL ANTIBIOTICS SWITCH.	14
Full version control record	15

1. Early Onset Sepsis in Neonates (Overview)

- **Definition:** Sepsis presenting within 72 hours of birth.
- **Incidence:**
 - 0.9/1000 live UK births overall (N.B an incidence of 1/1000 is recommended when utilising the KP calculator at FHFT).
- **Aetiology:** Most common causative organisms are Group B Streptococcus in term infants and Escherichia Coli in preterm infants.
- **Mortality (from Group B Streptococcus):**
 - Preterm infants: 18%.
 - Term infants: 8%.
- **Mortality (from Escherichia Coli):**
 - Preterm infants: 25-40% (non-UK studies).
 - Term infants: Rare, with lower reported mortality in literature.
- **Risk Factors:**
 - See appendix B1.
- **Clinical Presentation:**
 - Symptoms and signs including, but not limited to those in appendix B2.
- **Diagnosis:**
 - Clinical indicators: Risk factors (appendix B1) and neonatal signs (appendix B2).
 - Key investigations: Blood culture (gold standard), CRP, FBC, lumbar puncture.
- **Management:**
 - Prompt administration of antibiotics if sepsis is suspected.
 - Ongoing monitoring of vitals.
 - Reassessment of antibiotics at 36 – 48 hours, stop if sepsis deemed unlikely.

2. Intrapartum Antibiotics

- Very effective as long as administered at least 2 hours prior to delivery
- NICE currently recommends use in women who:
 - Are in **pre-term labour**
 - Have Group B Streptococcal colonisation, bacteriuria or infection during the **current pregnancy** OR in a previous pregnancy and have not had a negative test in this pregnancy between 35-37 weeks (or 3-5 weeks before the anticipated delivery)
 - Have had a previous baby with an invasive group-B streptococcal infection
 - Have a clinical diagnosis of chorioamnionitis

3. Assessment of 'At Risk' Infants

3.1 Assessment by maternity staff

Any baby that is determined to be **"at risk"** of early-onset infection within the first 72 hours of life must be **immediately** referred to the neonatal team (neonatal junior (SHO) in the first instance, followed by the neonatal middle-grade (registrar)). All babies should be assessed by maternity staff for possible risk factors for early-onset infection, both before delivery and postnatally.

Babies can become “At Risk” **at any point** in the first 72 hours of life, and this should trigger immediate referral. The target for delivery of antibiotics is within 1 hour from identification of possible infection in any neonate.

Any **one** of the following mean a baby is **‘At Risk’ and may have a serious infection**, and must trigger an urgent referral to the neonatal team:

- Any risk factor defined in NICE Guidelines (Appendix B1) OR maternal Group-B streptococcal infection found within 72-hours post-delivery
- Abnormal neonatal observations within the first 72-hours (including hypoglycaemia)
- Midwife concerns that the baby is unwell OR any clinical indicators of infection (Appendix B2)
-

In addition to referral to the neonatal team, these babies should have a baseline set of observations (including oxygen saturations) prior to arrival of the neonatal team.

3.2 Assessment by neonatal medical staff (junior/middle-grade doctor)

Any baby that is determined to be “**at risk**” of early-onset infection within the first -72 hours of life must be **urgently** assessed by the neonatal team. This will include:

- Physical examination of the infant (priority)
- Review of maternal and neonatal history
- Review neonatal vital signs
- **If any** clinical indicators present (Appendix B2) then discuss with senior (middle-grade) +/- senior review
- Calculation of the probability of neonatal early-onset infection, using the Kaiser-Permanente calculator. See Appendix A for calculation. The final probability and stratification by clinical exam **must** be documented in the baby’s notes.

Treatment should be guided by the KP calculator as follows:

KP Calculator recommendation	FHFT recommendation (Actual Actions)
Clinical recommendation:	Neonatal team actions:
No culture, no antibiotics	No investigations
Blood culture	Start EOS pathway
Empiric antibiotics	Start EOS pathway
Strongly consider starting empiric antibiotics	Start EOS pathway
Vitals:	Midwife actions:
Routine vitals	Routine postnatal care
Vitals every 4 hours for 24 hours	Observations as-per EOS pathway
Vitals per NICU	Observations as-per EOS pathway

If a baby with clinical indicators (Appendix B2) is not started on EOS pathway (including antibiotics), this decision should be made by a middle grade (or above) doctor who has reviewed the baby and reasons for NOT starting (e.g. clear alternative pathology) should be documented

Any baby with **any** red flags for EOS (as per NICE guidelines) should be started on the EOS pathway regardless of the KP calculator recommendations. Red flags are as follows:

Red flag risk factor:

- Suspected or confirmed infection in another baby in the case of a multiple pregnancy

Red flag clinical indicators:

- Apnoea (temporary stopping of breathing)
- Seizures
- Need for cardiopulmonary resuscitation
- Need for mechanical ventilation
- Signs of shock

4. Early-onset sepsis pathway (EOS pathway)

4.1 Observations

All infants on the EOS pathway must have full vital sign observations (colour, heart rate, respiratory rate, temperature, oxygen saturations) as follows:

- At the time of starting the pathway
- Every 2-hours for the first 12 hours
- Every 4-hours for minimum of 24-hours OR as long as on IV antibiotics
- Additionally, as determined by neonatal team

Any abnormal investigations should be reported to the neonatal junior (SHO) and prompt a clinical review of the infant.

4.2 Investigations

Prior to starting antibiotics, the following samples should be collected, in priority order.

PLEASE NOTE – Antibiotic administration should not be delayed, particularly if it is not possible to perform a lumbar puncture (e.g., baby unstable, other clinical demands).

1. Blood culture
2. CRP & FBC
3. Lumbar puncture for cerebrospinal fluid specimen if:
 - Any signs of meningitis
 - Strong clinical suspicion of early-onset neonatal infection

Subsequent investigations

- CRP 18-24 hours after 1st CRP
- LP for CSF if not done prior to starting antibiotics if:
 - Positive blood culture (excluding coagulase-negative staphylococcus)
 - Unsatisfactory response to antibiotic treatment, including rise in CRP
 - Clinical signs of meningitis
 - Strong clinical suspicion of early-onset neonatal infection

Additional investigations:

- Do not routinely perform urine microscopy or culture
- If purulent eye discharge:
 - Take swab samples urgently, specifically stating neonatal conjunctivitis on the swab request (should be tested for gonococcal or chlamydial infection – with parental consent)
 - Start systemic antibiotics that provide gonococcal cover (even if not on EOS pathway). First line antibiotic treatment with **IV Cefotaxime**
- If clinical signs of umbilical infection or localised skin infection:
 - Take a swab for microscopy and culture
 - Start antibiotic treatment with **IV flucloxacillin** and gentamicin (unless already on EOS pathway, see section 5)
 - If microbiology results show that the infection is not caused by a Gram-negative bacterium, stop gentamicin.

4.3 Clinical review

All babies on the EOS pathway should be reviewed by the neonatal team daily. In addition, new abnormalities in observations should prompt a clinical review of the baby.

4.4 Antibiotics

The first dose of antibiotics should be given within 1 hour of decision to treat.

Empiric treatment:

- Benzylpenicillin and gentamicin – See [Neonatal Anti-Infectives](#) for doses and checking levels etc.
- Suggested durations
 - Stop at 36 hours if
 - Initial suspicion not strong and clinical condition reassuring
 - CRP trend reassuring
 - Blood cultures negative and LP microscopy normal (if LP was done)
 - When continuing longer than 36 hours despite negative blood cultures, for instance because the initial clinical suspicion was strong, consider switching from intravenous to oral antibiotics. See Appendix C
 - 7/7 intravenous for proven sepsis or very strongly suspected without meningitis (longer course if baby is not recovered)
 - 14/7 for proven meningitis (minimum)

- Consider alternative causes for sepsis such as viraemia if no clinical response.
- Consider changing antibiotics if response not adequate OR if blood cultures show a causative organism (discuss with neonatal consultant)

References

1. National Institute for Health and Care Excellence (NICE) (Neonatal infection: antibiotics for prevention and treatment NG195.) last updated May 2026
<https://www.nice.org.uk/guidance/ng195>
2. Royal College of Obstetricians & Gynaecologists (RCOG) (2017) Prevention of early-onset neonatal group B streptococcal disease (Green-top Guideline no. 36)
<https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg36/>
3. National Institute for Health and Care Excellence (NICE) (2014) Intrapartum Care Pathway available at:
<http://pathways.nice.org.uk/pathways/intrapartum-care#content=view-node%3Anodes-prelabour-rupture-of-membranes-at-term>
4. Stoll B.J. et al. (2020) Early-Onset Neonatal Sepsis 2015 to 2017, the Rise of *Escherichia coli*, and the Need for Novel Prevention Strategies. *JAMA Pediatr*; 174(7); e200593. Available at: <https://jamanetwork.com/journals/jamapediatrics/fullarticle/2765163>
5. Vatne A. et al. (2021) Early-Onset Sepsis in Neonates - A Population-Based Study in South-West Norway From 1996 to 2018. *Front Pediatr*; 9. Available at:
<https://www.frontiersin.org/article/10.3389/fped.2021.634798>
6. Polin, R.A. and Wynn, J.L. (2023) Early-Onset Sepsis in Newborns. *Pediatrics in Review*; 44(1): 14–25. Available at: <https://doi.org/10.1542/pir.2020-001164>
7. Sturgeon J.P. et al. (2018) C-Reactive Protein (CRP) levels in neonatal meningitis in England: an analysis of national variations in CRP cut-offs for lumbar puncture. *BMC Pediatr*; 18. Available at: <https://doi.org/10.1186/s12887-018-1354-x>

Appendix A: Guideline to the KP calculator

The KP calculator, along with background evidence, can be found using the following link, or alternatively by searching the internet for “KP EOS calculator”.

<https://neonatalepisiscalculator.kaiserpermanente.org/>

Please enter details below.

Predictor	Scenario
Calculator Version ?	☒ Original (2017) - No Universal GBS Screening ☐ Updated (2024) - Universal GBS Screening

When using the KP calculator please select "No Universal GBS Screening" version, as we do not do Group B Streptococcus screening of pregnant women at Frimley Health Foundation Trust.

The first step is to input risk factor details into the calculator (see A1). This gives you the EOS risk before clinical exam, and then three separate EOS risks depending on clinical exam (see A2).

A1 – Entering risk factors:

Incidence of EOS = 1/1000

Gestational age:

- Must be 34 weeks or above. **Cannot** use if younger than this

Highest maternal antepartum temperature:

- Note this is **antepartum**
- Change to Celsius!

ROM (Hours):

- If unsure double check with midwives and mother.
- If longer than 240 hours then put 240 hours AND discuss with neonatal middle-grade (registrar) as the risk may be elevated)

Maternal GBS status:

- Unknown in most cases
- Negative ONLY if had GBS-specific swab in this pregnancy (not urine MC&S)
- Positive if genital swab or urine/blood culture positive this pregnancy

Type of intrapartum antibiotics:

- Broad spectrum = Cephalosporin and Metronidazole (mostly)
- GBS-specific = Penicillin alone (such as benzylpenicillin), Cephalosporin alone (often used in non-severe penicillin allergy), Vancomycin alone (often used in penicillin allergy)
- No antibiotics or any antibiotics < 2 hrs prior to birth = Includes oral erythromycin (often used in PPROM)

A2 – Assessing clinical status

Assessment of clinical status relies on stratifying the baby into one of three categories based on clinical exam (see table below)

Clinical Exam	Description
Clinical Illness	Prolonged need for respiratory support such as CPAP, high-flow oxygen therapy, or mechanical ventilation (outside of the delivery area). Cardiovascular instability necessitating vasopressor support. Neurological issues, including: ○ Seizures. ○ Low Apgar score (<5 at 5 minutes of age). ○ Requirement for supplemental oxygen for ≥2 hours to maintain saturations >90% (beyond delivery room care).
Equivocal Findings	Single physiological abnormality persisting for ≥4 hours: ○ Elevated heart rate (≥160 bpm). ○ Increased respiratory rate (≥60 breaths per minute). ○ Temperature irregularity (≥38°C or <36.5°C). ○ Mild respiratory distress (e.g., nasal flaring, grunting, or chest retractions) without the need for additional oxygen. Presence of two or more physiological abnormalities lasting ≥2 hours: ○ Elevated heart rate (≥160 bpm). ○ Increased respiratory rate (≥60 breaths per minute). ○ Temperature irregularity (≥38°C or <36.5°C). ○ Mild respiratory distress (e.g., nasal flaring, grunting, or chest retractions) without the need for additional oxygen. ○ Note: Intermittent abnormalities may also be relevant.
Well Appearing	No persistent physiological abnormalities detected.

Appendix B: Risk Factors and Clinical Indicators

B1 - Risk factors for early-onset neonatal infection, including 'red flags'

Red flag risk factor

- Suspected or confirmed infection in another baby in the case of a multiple pregnancy

Other risk factors:

- Invasive group B streptococcal infection in a previous baby or maternal group B streptococcal colonisation, bacteriuria or infection in the **current pregnancy**
- Pre-term birth following spontaneous labour before 37 weeks' gestation
- Confirmed rupture of membranes for more than 18-hours before a pre-term birth
- Confirmed rupture of membranes for more than 24 hours before a term birth
- Suspected or confirmed maternal sepsis in the intrapartum or early postpartum period
- Suspected or confirmed chorioamnionitis

B2 - Clinical indicators of possible early-onset neonatal infection (observations and events in the baby), including 'red flags'

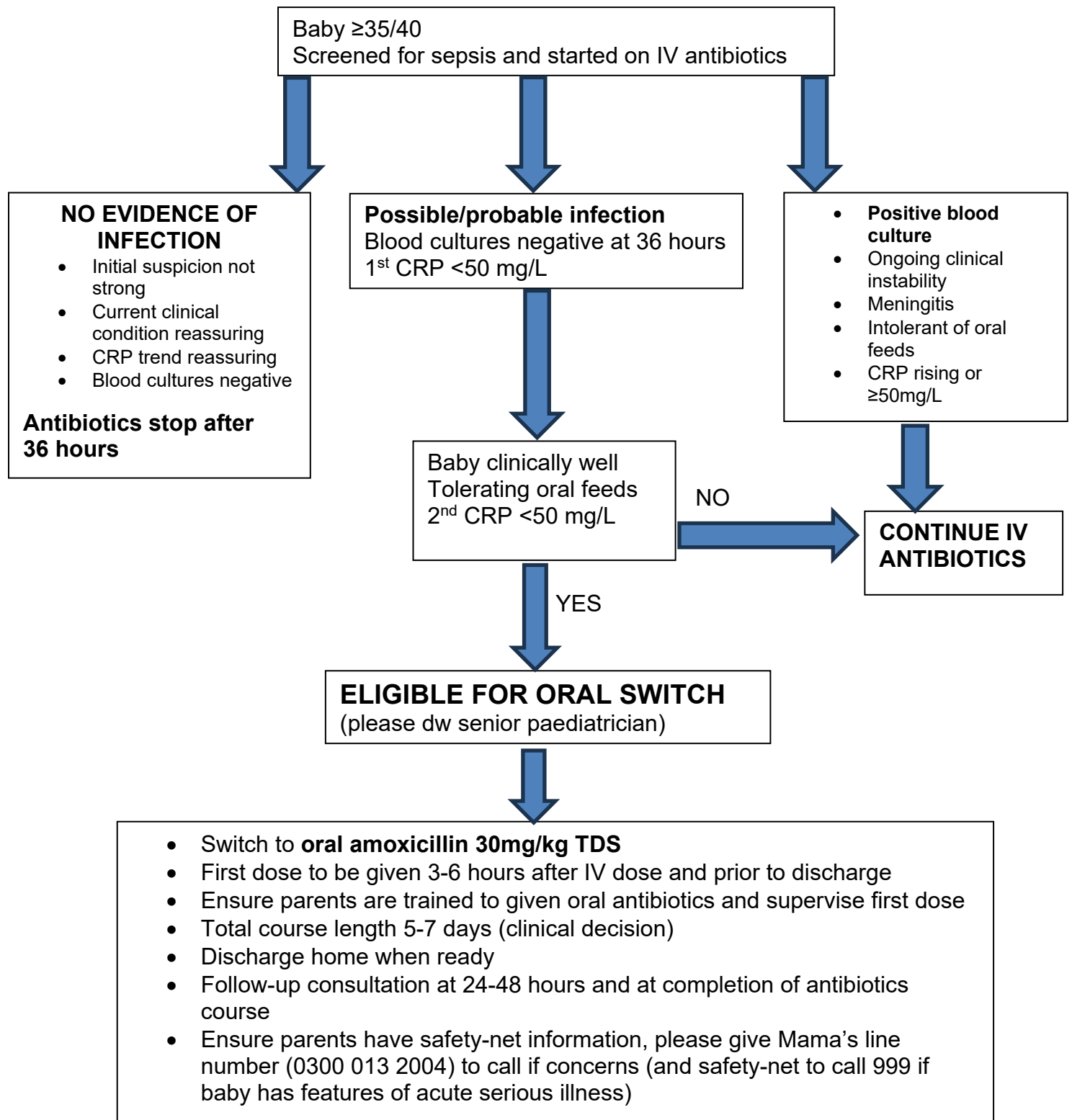
Red flag clinical indicators

- Apnoea (temporary stopping of breathing)
- Seizures
- Need for cardiopulmonary resuscitation
- Need for mechanical ventilation
- Signs of shock

Other clinical indicators

- Altered behaviour or responsiveness
- Altered muscle tone (for example, floppiness)
- Feeding difficulties (for example, feed refusal)
- Feed intolerance, including vomiting, excessive gastric aspirates and abdominal distension
- Abnormal heart rate (bradycardia or tachycardia)
- Signs of respiratory distress (including grunting, recession, tachypnoea)
- Hypoxia (for example, central cyanosis or reduced oxygen saturation level)
- Persistent pulmonary hypertension of newborns
- Jaundice within 24 hours of birth
- Signs of neonatal encephalopathy
- Temperature abnormality (lower than 36°C or higher than 38°C) unexplained by environmental factors
- Unexplained excessive bleeding, thrombocytopaenia, or abnormal coagulation
- Altered glucose homeostasis (hypoglycaemia or hyperglycaemia) – see trust guidelines on neonatal hypoglycaemia
- Metabolic acidosis (base deficit of 10 mmol/litre or greater)

APPENDIX C. NEONATAL ORAL ANTIBIOTICS SWITCH.



Full version control record

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Guidelines Lead(s):	Dr Claire Oclee-Brown, Consultant Paediatrician Dr Charles Beresford, ST3, Paediatrics
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Key words:	Early onset sepsis, newborns

This guideline has been registered with the Trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt, contact a senior colleague or expert. Caution is advised when using guidelines after the review date.

This guideline is for use in Frimley Health NHS Foundation Trust hospitals only. Any use outside this location will not be supported by the Trust and will be at the risk of the individual using it.

Version History

Version	Date	Guideline Lead(s)	Status	Comment
1.0	June 2021	Dr A Yannoulis	Final	First cross-site guideline for FH.
2.0	September 2025	Dr A Yannoulis	Final	Scheduled review
2.1	October 2025	Dr Claire Oclee-Brown, Consultant Paediatrician	Interim	Appendix A, image added calculator and text to signpost to select the 2017 Original not universal GBS screening.
2.2	July 2026	Dr Claire Oclee-Brown, Consultant Paediatrician	Interim	Updated in line with NG195 2026 update Cross site Paediatric Clinical Governance 15/07/2026

Related Documents

Document Type	Document Name
Neonatal Medicines Guide	Neonatal Anti-Infectives
EOS calculator	Infection Probability Calculator - Neonatal Sepsis Calculator