

Guideline

Stabilisation and transfer of an infant with suspected necrotising enterocolitis

1 Scope

For use within the Paediatric and Neonatal Decision Support & retrieval Service for the East of England.

2 Purpose

To provide guidance on the management of infants with suspected necrotising enterocolitis (NEC) during transfer to a surgical centre.

3 Definitions and abbreviations

AXR Abdominal X-ray

CRP C-reactive protein

FBC Full blood count

IV Intravenous

Lateral 'shoot through': lateral X-ray taken with infant lying on his/her back

Left lateral decubitus view: lateral X-ray taken with infant lying on his/her left side

NEC Necrotising enterocolitis

NGT Naso-gastric tube

PIP Peak inspiratory pressure

PEEP Positive end-expiratory pressure

PR Per rectum

PVL Peripheral venous line

4 Introduction

NEC is an inflammatory disease of the gastrointestinal tract characterised by ischaemic necrosis of the intestinal mucosa. It was first described by Mizrahi et al. in 1965¹ and classified into three stages based on the severity of the clinical presentation and treatment strategies by Bell et al. in 1978². Walsh and Kliegman put forward the modified Bell's criteria, which divided each stage into A and B according to the clinical and radiologic signs and treatment strategies (Table 1)³. Gestational age and birth weight are inversely correlated with the incidence of NEC^{4,5} with a prevalence of 7-11% in neonates who weigh less than 1500g^{6,7}.

<i>Review of Bell's stages</i>	<i>Clinical findings</i>	<i>Radiographic findings</i>	<i>Gastrointestinal findings</i>
Stage I	Apnea and bradycardia, temperature instability	Normal gas pattern or mild ileus	Gastric residuals, occult blood in stool, mild abdominal distention
Stage II A	Apnea and bradycardia, temperature instability	Ileus gas pattern with one or more dilated loops and focal pneumatosis	Grossly bloody stools, prominent abdominal distention, absent bowel sounds
Stage II B	Thrombocytopenia and mild metabolic acidosis	Widespread pneumatosis, ascites, portal-venous gas	Abdominal wall edema with palpable loops and tenderness
Stage III A	Mixed acidosis, oliguria, hypotension, coagulopathy	Prominent bowel loops, worsening ascites, no free air	Worsening wall edema, erythema and induration
Stage III B	Shock, deterioration in laboratory values and vital signs	Pneumoperitoneum	Perforated bowel

The most consistent risk factor for the development of NEC is prematurity⁴⁻⁷. Immature motility, digestion, absorption and circulatory regulation predispose the preterm infant to an increased risk of intestinal injury⁸. Enteral feeding, especially with formula milk, is another important risk factor for NEC; around 90% of NEC cases reportedly occur after initiation of enteral feeding⁴. Other factors contributing to the risk of NEC are intestinal bacterial colonisation, intestinal ischaemia, use of H₂ receptor antagonists (eg Ranitidine) and postnatal steroids⁹⁻¹¹. An apparent association between blood transfusion and necrotising enterocolitis (termed transfusion-associated necrotising enterocolitis (TANEC)) is still under review. Whilst there is no definite evidence of causation¹² systematic review suggested that withholding feeds during the peri-transfusion period may reduce the risk of TANEC in preterm infants.^{13,14} A large multi-centre randomised controlled trial is currently ongoing to further investigate this¹⁶.

Diagnosis

Suspect the diagnosis if there is:

- Feed intolerance
- Abdominal distension, discolouration and/ or tenderness
- Reduced or absent bowel sounds
- Bilious/ discoloured aspirates or vomits
- PR blood
- Evidence of sepsis without another clear source

Differential diagnoses:

- Sepsis with ileus
- Bowel obstruction
- Volvulus
- Malrotation
- Spontaneous intestinal perforation
- Trauma
- Systemic candidiasis

5 Investigations

Abdominal X-ray:

- Supine antero-posterior view.
- If perforation suspected but not clear on supine view, add left lateral decubitus view or lateral 'shoot through' to better demonstrate free air in the abdomen.
- Features of NEC include pneumatosis, portal venous gas, intraperitoneal free gas.

Blood tests:

- Blood gas with lactate
- FBC: anaemia, neutropenia and thrombocytopenia often present
- Blood film: evidence of haemolysis and toxic changes
- CRP
- Urea and creatinine, electrolytes, liver function tests
- Coagulation screen
- Blood culture
- Cross match

6 Stabilisation and transfer

- **Pass large bore NGT (8-10Fr if possible)**
 - Aspirate stomach contents and leave on free drainage.
 - Keep NBM.
 - Aspirate NGT every 15-30 mins.
- **Optimise respiratory support**
 - Adjust according to work of breathing and blood gas results.
 - Low threshold for intubation in infants with significant abdominal distension and/or severe acidosis.
 - Consider increasing PEEP to 6-8cmH₂O if abdominal distension is compromising respiratory status (will need to also increase PIP to maintain tidal volume if not using volume-targeted ventilation).
 - Paralysis with muscle relaxants (e.g. rocuronium or atracurium) may be required to optimise ventilation. **Secure IV access**
 - Will need 2 x PVLs or 1 central venous line + 1 x PVL.

- IV maintenance fluids guided by age, fluid balance and electrolytes.
 - **Cardiovascular support**
 - Ensure adequate volume resuscitation as guided by heart rate, blood pressure, lactate and urine output.
 - **Infants with severe NEC have massive capillary leak and may require very large volumes of fluid to maintain their intravascular volume (in excess of 100ml/ kg over the first few hours).**
 - Fluid resuscitation can be given as 0.9% sodium chloride, but consider blood, platelets, fresh frozen plasma and cryoprecipitate as useful volume (guided by blood results). O negative blood should be given if delay in availability of x-matched blood.
 - Low threshold for inotropic support in infants with hypotension and/or lactic acidosis. Dopamine and Dobutamine can both be run peripherally if no central access is available and should be started promptly.
 - **Correction of acidosis**
 - Infants with severe NEC often develop a significant metabolic and/or respiratory acidosis. Whilst the underlying cause needs to be addressed with volume resuscitation/ inotropic support (for lactic acidosis) and adjustment of ventilator settings (for respiratory acidosis) it may be beneficial to give a half or full correction of sodium bicarbonate in order to improve the pH. This is particularly important in hypotensive infants where improving the pH may improve the efficacy of the inotropes.
 - **IV antibiotics**
 - Start IV antibiotics as per local NEC guideline.
 - **Analgesia**
 - Ensure adequate pain relief, particularly in infants with significant abdominal distension.
 - IV paracetamol as first line agent.
 - IV morphine as required (10-30mcg/kg/hr). Consider bolus of 50-100mcg/kg.
 - **Insertion of abdominal drain**
 - In cases of severe NEC where significant abdominal distension is severely compromising respiratory status, it may be beneficial to decompress the abdomen with a drain – this should only be carried out after discussion with a senior paediatric surgeon (see separate guideline).
 - **Management of perforation**
 - Low threshold for intubation, particularly if significant abdominal distension.

- Ensure the surgical teams at the receiving hospital are aware of the perforation so that urgent laparotomy can be anticipated and arranged promptly.
- Consider insertion of abdominal drain as above (after discussion with senior paediatric surgeon).

7 Monitoring compliance with and the effectiveness of this document

The PaNDR consultants will monitor compliance with this document by reviewing the paperwork of all transfers of infants with suspected NEC. Any significant deviations from the guideline will be discussed with the Lead Consultant and the team members involved.

The effectiveness of the document will be monitored by review of any reported incidents via the lead nurse for risk. These incidents will be shared with the team and consideration given to adjusting the guideline if concerns are identified.

8 References

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9 Associated documents

- Decompression of a grossly distended abdomen to facilitate neonatal transfer PaNDR guideline. <http://pandreastofengland.co.uk>

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