Chapter 12: Necrotizing Entercolitis

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- Inflammation of the bowel wall leading to necrosis
- Most common GI emergency in preterm infants
- Affects 1-3 per 1000 live births
  - >90% of cases occur in infants ≤ 1500 grams
  - Occurs in 1-7% of infants ≤ 1500 grams
  - Affected term infants may have experienced asphyxia or have congenital heart disease including PDA (due to impaired intestinal perfusion)
- High risk until 35-36 weeks postmenstrual age
- Most commonly affects the distal ileum and proximal colon

Pathophysiology

- Unknown but hypothesized to be multifactorial
  - Mucosal intestinal injury (hypoxia/ischemia) + enteral nutrition + abnormal bacterial colonization → activation of inflammatory cascade → further bowel injury, invasion of bacteria into bowel wall → bowel necrosis
- Risk Factors
  - Prematurity
  - Enteral feeds
  - Intestinal ischemia: Clinically significant PDA, IUGR, birth asphyxia, CHD, exchange transfusion, indomethacin, maternal cocaine abuse
  - Absence of maternal antenatal steroid treatment
  - Recent blood transfusion, particularly of cells that are not type specific. Some evidence to suggest the anemia itself predisposes to NEC, not the actual transfusion
  - Prolonged antibiotic usage – impacts on microbiome of GI tract
  - Abdominal wall defects
  - Use of H2 blockers

Measures to Prevent NEC

- Feedings
  - Use human milk (EBM or DBM for high-risk patients)
  - Disciplined approach with NICU feeding protocols
- Limit use of antibiotic therapy
- Hold feedings 3 hours before and 3 hours after blood transfusion
- Do not use H2 blockers or PPIs until ≥ 35 weeks CGA

linical Presentation

- Temperature instability, lethargy, increased apnea/bradycardia/desaturation episodes
- Abdominal distension/tenderness/firmness, feeding intolerance with emesis (usually bilious), bloody stools, abdominal wall discoloration
- Laboratory: neutropenia, thrombocytopenia, coagulation abnormalities (platelet consumption), metabolic acidosis, electrolyte abnormalities, glucose instability
- Radiographic: ileus, dilation and thickening of bowel loops, fixed and/or dilated loop(s) of bowel, pneumatosis intestinalis, portal venous gas, free air

Modified Bell Staging Criteria for NEC

Stage	Systemic signs	Abdominal signs	Radiographic signs
I (Suspected NEC)	Temperature instability, apnea, bradycardia, lethargy	Gastric residuals, mild abdominal distention, occult blood in stool	Normal or mild ileus
IIA (Mild NEC)	Same as above	Prominent abdominal distension + tenderness, absent bowel sounds, grossly bloody stools	Ileus, dilated bowel loops, focal pneumatosis intestinalis
IIB (Moderate NEC)	Mild metabolic acidosis and thrombocytopenia	Abdominal wall edema & tenderness + palpable mass	Extensive pneumatosis intestinalis, early ascites, + portal venous gas
IIIA (Advanced NEC)	Hypotension, respiratory & metabolic acidosis, oliguria, DIC, mechanical ventilation	Worsening wall edema & erythema with induration	Prominent ascites, fixed bowel loops
IIIB (Advanced NEC)	Shock	Evidence of perforation (tense abdomen, bluish discoloration)	Free Air

Differential Diagnosis

- Spontaneous intestinal perforation (SIP): usually in terminal ileum or colon
  - Mostly in VLBW infants
  - Distinguished from NEC by absence of pneumatosis, hypotension and abdominal distention; can occur in the first week of life (earlier than NEC); independent of feeding
- Cow's milk protein allergy: rare in preterm; rarely occurs before 6 wks of age
- Infectious enteritis
- Anal fissures resulting in rectal bleeding

Management*

- NPO, replogle to low intermittent suction
  - After 7-14 days* feeds should be started gradually
- Serial abdominal circumferences and serial abdominal examinations (both imaging and physical exam)
- Maintenance IVFs until TPN can be started
- Labs: CBC with differential, CRP, blood gas, electrolytes, glucose, blood culture, consider coagulation studies
  - Repeat labs every 6-12 hours (except blood culture) until infant clinically stable
  - Cultures positive in only 20-30% of cases
- Radiographs: AP KUB & left lateral decubitus (for free air)
  - Repeat every 6-12 hours for first 24-48 hours
  - Abdominal US: to assess for pneumatosis, fluid collections, bowel wall thickness and peristalsis
- Broad-spectrum antibiotics to include anaerobic coverage*
  - Usually ampicillin or vancomycin, cefotaxime or gentamicin, and metronidazole
  - Treat for 7-14 days
- Monitor and manage homeostasis, DIC, and respiratory status as needed
- Pediatric Surgery Consult especially with x-ray or US diagnosis of NEC

(*See "Wisconsin State Guideline for Staging and Management of NEC)

rognosis

- 27-63% of cases need surgical intervention (laparotomy with resection or peritoneal drain)
- Mortality: Overall 20-30%; Increases after perforation to 35-55%
- Survivors have a high prevalence of adverse GI sequelae (9-36% have strictures, short gut, TPN cholestasis)
  - Also increases risk of adverse neurodevelopmental outcomes

Reference

1. Neu J, Walker AW. **Necrotizing Enterocolitis.** *NEJM*. 2011; 364 (3) 255-64.
2. Chu A, Hageman JR and. Caplan MS. **Necrotizing Enterocolitis: Predictive Markers and Preventive Strategies.** *Neoreviews* 2013; 14; e113. DOI: 10.1542/neo.14-3-e113
3. Kim JH, Abrahms SA. Diagnosis, **Management and Prevention of necrotizing enterocolitis in newborns.** *UpToDate*, 2018.

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https://www.dynamed.com/condition/necrotizing-enterocolitis-19

Wisconsin State Guideline for Staging and Management of NEC

Table 1: Guidelines for Staging and Management of Necrotizing Enterocolitis*

Babies may progress during first 48-72 hours and stage may need to be modified

STAGE	ILLNESS SEVERITY	SYSTEMIC SIGNS	INTESTINAL SIGNS	RADIOLOGIC SIGNS	SURGERY CONSULT	XRAY FREQ.	ANTIBIOTI
I. Suspected – No radiographic evidence. Differential includes ileus, other system infections and cows milk protein aller							
Ia.	Suspicious, mildly ill	Temperature instability, apnea, bradycardia, feeding intolerance	Residuals,mild distension,occult blood	Normal or mild ileus	No	Q6-8 hrs x 24-48 hours	Ampicil Gentan
Ib.	Suspicious, mildly ill	Same as IA	Same as IA – gross blood	Same as IA	No	Same as IA	Ampicil Gentan
II. Definite – Must have radiographic/ultrasound diagnosis							
IIa.	Mildly ill	Same as IA, mild lab changes	Same as I, plus abdominal tenderness	Pneumatosis Intestinalis +/- fixed dilated loops	Yes	Q 6 hrs x 48 hours	Ampicil Gentan
IIb.	Moderately ill	Same as IA with more lab changes, needs more support	Same as IIA, plus abdominal cellulitis	IIA ± portal venous gas ± ascites	Yes	Q 6 hrs x 48 hours	Ampicil Gentan Flagyl
III. Advanced: Infants are severely ill with radiographic evidence (without or without evidence of perforation)							
IIIa.	Severely ill, bowel intact [1]	*Severe* metabolic and/or resp acidosis, electrolyte & CBC abnormalities, shock	As above plus peritonitis, marked tenderness and distension	Same as IIB May see persistent ileus, abdominal distension, absent bowel gas	Yes	Q6 x 48 hours	Ampicil Gentan Flagyl
IIIb.	Severely ill, perforated (not SIPs)[2]	Same as IIIA	Same as IIIA	Pneumoperitoneum	Yes	X-rays prn	Ampicil Gentan Flagyl

NOTES

1. Surgical intervention may be warranted if no clinical improvement after 48-72 hours and abdominal exam/x-rays remain co paracentesis/ultrasound as a diagnostic study if NEC diagnosis unclear
2. *Spontaneous intestinal perforation (SIP) is not included in this guideline.
3. NPO Duration For non-surgical NEC—Feed on the day after antibiotic completion.

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