STM JOURNALS

Research & Reviews: A Journal of
Medical Science and Technology

ISSN: 2319-3417 (Online)
ISSN: 2349-1272 (Print)
Volume 13, Issue 2, 2024
May–August
DOI (Journal): 10.37591/RRJoMST

https://journals.stmjournals.com/rrjomst/

Review RRJoMST

Necrotizing Enterocolitis (NEC): A Devastating Neonatal Gastrointestinal Disorder

Kamini Sao*

Abstract

Necrotizing enterocolitis (NEC) represents a formidable challenge in neonatal medicine, particularly afflicting premature infants with its characteristic features of severe intestinal inflammation and necrosis. Despite advancements in neonatal care, NEC continues to exact a heavy toll, standing as a prominent cause of morbidity and mortality in this vulnerable population. Its multifaceted etiology, encompassing prematurity, enteral feeding practices, alterations in microbial colonization, and episodes of intestinal ischemia, underscores the complexity of its management. Clinical manifestations of NEC span a spectrum, ranging from subtle signs of feeding intolerance to profound systemic illness with signs of sepsis and bowel perforation. Given the potentially rapid progression of the disease, early recognition and prompt initiation of treatment are imperative. Diagnostic modalities include a combination of clinical assessment, laboratory investigations (such as inflammatory markers and blood cultures), and radiographic imaging (notably abdominal X-rays and ultrasound). Treatment strategies for NEC involve a multidisciplinary approach, integrating supportive measures such as fluid resuscitation and respiratory support, antimicrobial therapy targeted against likely pathogens, judicious use of bowel rest and parenteral nutrition, and surgical intervention for cases of severe bowel necrosis or perforation. Preventive strategies are crucial in mitigating the incidence and severity of NEC, emphasizing the promotion of human milk feeding, optimization of enteral nutrition protocols, meticulous attention to infection control practices, and judicious use of antibiotics. This comprehensive review aims to provide an encompassing overview of NEC, elucidating its epidemiology, pathophysiology, clinical manifestations, diagnostic approaches, therapeutic interventions, and preventative measures. Enhanced understanding of the intricate mechanisms underlying NEC pathogenesis is essential for refining preventative strategies and improving outcomes in this high-risk patient population.

Keywords: Necrotizing enterocolitis, NEC, neonate, prematurity, intestinal necrosis, gastrointestinal disorder

INTRODUCTION

Necrotizing enterocolitis (NEC) stands as one of the most dreaded and enigmatic disorders in neonatology. This devastating condition primarily affects premature infants, striking with alarming swiftness and leaving a trail of devastation in its wake. As medical science continues to unravel its complexities, understanding NEC is paramount for neonatal healthcare providers striving to combat its deleterious effects. Necrotizing enterocolitis (NEC) stands as one of the most feared and devastating gastrointestinal emergencies in the neonatal population. This condition, characterized by inflammation and necrosis of the intestinal mucosa, predominantly affects preterm infants, with mortality rates ranging from 20 to 30%. Despite

***Author for Correspondence**
Kamini Sao
E-mail: kaminisao@gmail.com

Assistant Professor, Child Health Nursing Kasturba Nursing College, Sevagram, Maharashtra, India

Received Date: April 04, 2024
Accepted Date: June 22, 2024
Published Date: August 13, 2024

Citation: Kamini Sao. Necrotizing Enterocolitis (NEC): A Devastating Neonatal Gastrointestinal Disorder. Research & Reviews: A Journal of Medical Science and Technology. 2024; 13(2): 78–83p.

significant advancements in neonatal care, NEC continues to pose a significant challenge to healthcare providers worldwide [1–4].

UNDERSTANDING NEC: A COMPLEX SYNDROME

NEC is a multifactorial disorder characterized by inflammation and necrosis of the intestines, particularly the terminal ileum and colon, in neonates. While its exact etiology remains elusive, several contributing factors have been identified, including prematurity, formula feeding, intestinal ischemia, altered gut microbiota, and immune dysregulation [5].

Premature infants, with their immature gastrointestinal tracts and compromised immune systems, are particularly susceptible to NEC. The switch from parenteral to enteral feeding, a critical milestone in neonatal care, poses a significant risk, as immature intestines may struggle to handle the nutritional load, leading to mucosal injury and bacterial translocation [6].

Risk factors for necrotizing enterocolitis (NEC) include a combination of prenatal, perinatal, and postnatal factors (Figure 1) [7–9].

1. *Prematurity*: Premature infants, particularly those born before 32 weeks gestation or with a birth weight less than 1500 gm, are at significantly higher risk for NEC.
2. *Enteral feeding*: Early introduction of enteral feeds, especially formula feeding, has been associated with an increased risk of NEC compared to exclusive human milk feeding.
3. *Hypoxia and hypotension*: Episodes of hypoxia or hypotension during the perinatal period have been implicated as risk factors for NEC.
4. *Intestinal ischemia*: Reduced blood flow to the intestines, either due to hypoperfusion or thromboembolic events, increases the risk of NEC.
5. *Prenatal factors*: Maternal factors such as chorioamnionitis and maternal hypertension have been associated with an increased risk of NEC in preterm infants.
6. *Gastrointestinal immaturity:* Underdeveloped gastrointestinal tract function, including impaired mucosal barrier function and immature immune response, predisposes premature infants to NEC.
7. *Antibiotic use*: Prolonged or inappropriate antibiotic therapy has been linked to alterations in gut microbiota composition, potentially increasing the risk of NEC.

These risk factors underscore the multifactorial nature of NEC and highlight the importance of preventive measures targeting modifiable factors where possible.

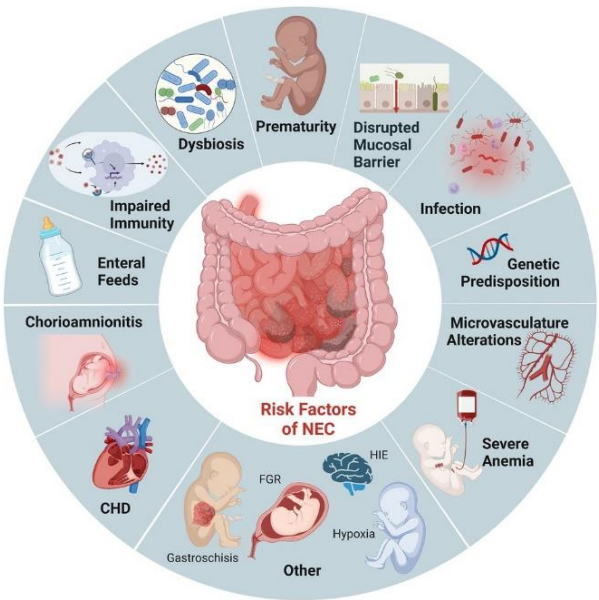

Figure 1. Established risk factors NEC.

Pathophysiology of NEC

The pathophysiology of necrotizing enterocolitis (NEC) is intricate and involves multiple factors. Premature infants, with their underdeveloped gastrointestinal tract, compromised mucosal barrier function, and immature immune system, are especially vulnerable. NEC arises from a complex interplay of factors including intestinal immaturity, alterations in microbial colonization, and mucosal injury. Additionally, disruptions in intestinal blood flow, stemming from conditions such as hypoxia, hypoperfusion, or vascular instability, escalate mucosal damage, ultimately resulting in tissue necrosis and bowel perforation.

Clinical presentation and diagnosis

The clinical presentation of NEC can vary widely, ranging from subtle gastrointestinal symptoms such as feeding intolerance, abdominal distension, and bloody stools to fulminant sepsis and multiorgan failure (Table 1). Early recognition of NEC is paramount, as prompt intervention can significantly impact outcomes.

Table 1. Modified Bell's staging criteria for necrotizing enterocolitis, adapted from [10].

Bell's stages	Clinical signs	Radiologic signs
I (Suspected NEC)	Apnoea Lethargy Emesis Mild abdominal distention Bloody stool	Normal or intestinal dilation Mild ileus
II (Proven NEC)	Stage I signs, plus: Mild metabolic acidosis/thrombocytopenia Absent bowel sounds with or without abdominal tenderness	Intestinal dilation Ileus Pneumatosis intestinalis Portal venous gas
III (Advanced NEC)	Stage II signs, plus: Severe apnoea Hypotension Disseminated intravascular coagulation Neutropenia Generalised peritonitis Abdominal distention	Stage II signs, plus: Definite ascites Pneumoperitoneum

DIAGNOSTIC EVALUATION

Diagnosing NEC often involves a combination of clinical assessment, laboratory studies, and imaging modalities. Abdominal radiography may reveal pneumatosis intestinalis, a hallmark sign of NEC, along with signs of bowel wall thickening, pneumatosis, and portal venous gas. However, diagnosing early-stage NEC remains challenging, as radiographic findings may be subtle or nonspecific [11].

Diagnosing NEC presents considerable challenges for healthcare providers, as the clinical presentation can mimic other common neonatal conditions, such as sepsis or feeding intolerance. Diagnostic modalities such as abdominal radiography, ultrasound, and laboratory tests, including inflammatory markers and metabolic panels, play a crucial role in confirming the diagnosis and assessing disease severity. However, distinguishing between early-stage NEC and other gastrointestinal disorders remains a clinical conundrum, often requiring a high index of suspicion and close monitoring [12].

Management Strategies: Navigating a Complex Landscape

The management of NEC entails a multidisciplinary approach involving neonatologists, pediatric surgeons, nurses, and nutritionists. Treatment strategies vary depending on the severity of the disease but typically include bowel rest, intravenous fluids, broad-spectrum antibiotics, and supportive care. In cases of intestinal perforation or necrosis, surgical intervention may be necessary to resect necrotic bowel segments and mitigate life-threatening complications [13].

The management of NEC presents a formidable challenge for neonatal healthcare providers, requiring a delicate balance between aggressive intervention and judicious restraint. Treatment strategies often involve a multidisciplinary approach, encompassing neonatologists, pediatric surgeons, nutritionists, and other allied health professionals [14].

Initial management typically includes bowel rest, broad-spectrum antibiotics, and supportive care to stabilize the infant's condition. In severe cases, surgical intervention may be necessary to resect necrotic bowel segments, alleviate bowel obstruction, or manage complications such as perforation or peritonitis [15].

Necrotizing enterocolitis (NEC) requires a comprehensive and coordinated approach for optimal management, involving various medical specialties and healthcare professionals. Below is a protocol outlining key steps in the management of NEC, including diagnosis, treatment, and ongoing care:

1. Clinical Assessment and Diagnosis
   - Prompt recognition of clinical signs suggestive of NEC, including feeding intolerance, abdominal distension, bloody stools, and systemic manifestations such as temperature instability and lethargy.
   - Perform a thorough physical examination, including abdominal assessment and vital signs monitoring.
   - Utilize diagnostic modalities such as abdominal radiography, ultrasound, and laboratory tests (e.g., complete blood count, inflammatory markers) to confirm the diagnosis and assess disease severity.

2. Severity Stratification
   - Classify NEC severity based on clinical and radiographic findings, using established staging criteria such as the Modified Bell's Staging Criteria.
   - Stratify patients into mild, moderate, or severe NEC categories to guide treatment decisions and prognostication.

3. Medical Management
   - Initiate supportive care measures, including bowel rest (nil per os), intravenous fluid resuscitation, and correction of electrolyte abnormalities.
   - Begin empiric antibiotic therapy targeting common causative pathogens, such as Gram-negative bacteria and anaerobes, with broad-spectrum antibiotics (e.g., ampicillin, gentamicin, metronidazole).
   - Monitor clinical response to treatment closely, with serial assessments of vital signs, abdominal examination, and laboratory parameters.

4. Nutritional Support
   - Implement strategies for parenteral nutrition to meet the nutritional needs of infants with NEC, ensuring adequate calorie and protein intake.
   - Consider enteral feeding advancement cautiously, guided by clinical response, bowel function, and abdominal distension.

5. Surgical Intervention
   - Consult pediatric surgery early for patients with severe NEC, intestinal perforation, or evidence of pneumoperitoneum on imaging.
   - Consider surgical exploration and intervention, including bowel resection, ostomy formation, and peritoneal drainage, in cases of advanced disease or clinical deterioration.

6. Ongoing Monitoring and Follow-Up
   - Monitor patients closely for clinical improvement, resolution of symptoms, and complications such as sepsis, intestinal strictures, or short bowel syndrome.
   - Coordinate multidisciplinary care involving neonatologists, pediatric surgeons, nurses, nutritionists, and other allied health professionals.

- Provide ongoing support to families, including education about NEC, treatment options, and potential long-term sequelae.

7. Prevention Strategies
   - Implement preventive measures to reduce the risk of NEC, including human milk feeding, probiotic supplementation, and strict adherence to infection control practices.
   - Educate healthcare providers about early recognition of NEC symptoms and the importance of timely intervention.

Prevention: A Holy Grail in NEC Management

Preventing NEC remains the ultimate goal for neonatal healthcare providers, as the adage "prevention is better than cure" rings especially true in this context. Several preventive measures have shown promise in reducing the incidence and severity of NEC, including human milk feeding, probiotics, and strict adherence to evidence-based feeding protocols [16].

Human milk, with its myriad immunomodulatory and antimicrobial properties, has emerged as a cornerstone in NEC prevention. Initiatives promoting breast milk expression, donor milk banking, and lactation support play a pivotal role in ensuring optimal nutrition and immunological protection for vulnerable neonates [17].

Probiotics, live microorganisms administered to confer health benefits, have garnered considerable attention for their potential role in reducing NEC incidence. While evidence supporting their efficacy is promising, questions regarding optimal strain selection, dosing regimens, and safety profiles persist, necessitating further research and standardization [18, 19].

CONCLUSION

Necrotizing enterocolitis remains a formidable foe in the neonatal intensive care unit, testing the mettle of healthcare providers and striking fear into the hearts of parents. As we continue to unravel its mysteries and refine our management strategies, a unified approach grounded in evidence-based practice, interdisciplinary collaboration, and unwavering dedication to neonatal health is paramount. By embracing the principles of prevention, early recognition, and comprehensive care, we can strive to mitigate the impact of NEC on vulnerable neonates and their families. As we march forward in our quest to conquer this relentless adversary, let us stand united in our commitment to safeguarding the most precious among us, our newborn infants. Necrotizing enterocolitis remains a significant cause of morbidity and mortality in the neonatal population, emphasizing the need for ongoing research, early recognition, and multidisciplinary management approaches to improve outcomes for affected infants.

To protect the most vulnerable infants from necrotizing enterocolitis (NEC), targeted preventive measures can be implemented. These measures emphasize the enhancement of innate immunity through the use of human milk and the avoidance of practices that could disrupt the natural microbial balance and diversity, such as the overuse of antibiotics. Although progress in preventing and treating NEC has been slow for many years, recent developments offer promising tools that may lead to the eradication of this disease.

REFERENCES

1. Neu J, Walker WA. Necrotizing enterocolitis. N Engl J Med. 2011 Jan 20; 364(3): 255–64.
2. Patel RM, Kandefer S, Walsh MC, *et al*. Causes and timing of death in extremely premature infants from 2000 through 2011. N Engl J Med. 2015; 372(4): 331–340. doi:10.1056/NEJMoa1403489
3. Gordon PV, Swanson JR, Attridge JT, Clark R. Emerging trends in acquired neonatal intestinal disease: is it time to abandon Bell's criteria? J Perinatol. 2007; 27(11): 661–671. doi:10.1038/sj.jp.7211808

4. Frost BL, Modi BP, Jaksic T, Caplan MS. New medical and surgical insights into neonatal necrotizing enterocolitis: a review. JAMA Pediatr. 2017; 171(1): 83–88. doi:10.1001/jamapediatrics.2016.2708
5. Shah P, Shah V. Necrotizing enterocolitis: a practical guide to its prevention and management. Paediatr Drugs. 2003; 5(1): 1–11.
6. Hintz SR, Kendrick DE, Stoll BJ, *et al*. Neurodevelopmental and growth outcomes of extremely low birth weight infants after necrotizing enterocolitis. Pediatrics. 2005; 115(3): 696–703.
7. Hsueh W, Caplan MS, Qu XW, Tan XD, De Plaen IG, Gonzalez-Crussi F. Neonatal necrotizing enterocolitis: clinical considerations and pathogenetic concepts. Pediatr Dev Pathol. 2003; 6(1): 6–23.
8. Gephart SM, McGrath JM, Effken JA, Halpern MD. Necrotizing enterocolitis risk: state of the science. Adv Neonatal Care. 2012; 12(2): 77–87.
9. Groner JI, Wang P, Hoecker C, Keller MS. Necrotizing enterocolitis: an update. Pediatr Rev. 2019; 40(5): 261–270.
10. Cho SX, Berger PJ, Nold-Petry CA, Nold MF. The immunological landscape in necrotising enterocolitis. Expert Rev Mol Med. 2016; 18: e12. https://www.cambridge.org/core/services/aop-cambridge-core/content/view/3B1E3A0A51C84DC117CBF3335A224CEE/S1462399416000132a.pdf/the-immunological-landscape-in-necrotising-enterocolitis.pdf
11. Berman L, Moss RL. Necrotizing enterocolitis: an update. Semin Fetal Neonatal Med. 2011 Jun 1; 16(3): 145–150. WB Saunders.
12. Guthrie SO, Gordon PV, Thomas V, Thorp JA, Peabody J, Clark RH. Necrotizing enterocolitis among neonates in the United States. J Perinatol. 2003 Jun; 23(4): 278–85.
13. Llanos AR, Moss ME, Pinzòn MC, *et al.* Epidemiology of neonatal necrotising enterocolitis: a population-based study. Paediatr Perinat Epidemiol. 2002; 16(4): 342–349.
14. Lucas A, Cole TJ. Breast milk and neonatal necrotising enterocolitis. Lancet. 1990; 336(8730): 1519–1523. doi:10.1016/0140-6736(90)93304-8
15. Coalson JJ. Pathology of newborn chronic lung disease. Semin Neonatol. 2003; 8(1): 73–81. doi:10.1016/s1084-2756(02)00189-9
16. Olver RE, Walters DV, Wilson SM. Developmental regulation of lung liquid transport. Annu Rev Physiol. 2004; 66: 77–101. doi:10.1146/annurev.physiol.66.032102.155824.
17. Halpern MD, Denning PW. The role of intestinal epithelial barrier function in the development of NEC. Tissue Barriers. 2015; 3(1–2): e1000707. doi:10.4161/21688370.2014.1000707.
18. Cotten CM, Taylor S, Stoll B, *et al*. Prolonged duration of initial empirical antibiotic treatment is associated with increased rates of necrotizing enterocolitis and death for extremely low birth weight infants. Pediatrics. 2009; 123(1): 58–66. doi:10.1542/peds.2007-3423.
19. Bautista GM, Cera AJ, Chaaban H, McElroy SJ. State-of-the-art review and update of in vivo models of necrotizing enterocolitis. Front Pediatr. 2023 Apr 4; 11: 1161342. Available from: https://www.frontiersin.org/journals/pediatrics/articles/10.3389/fped.2023.1161342/full

