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Clinical Course of Necrotizing Enterocolitis in Preterm Infants with Extremely Low Birth Weight

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Abstract: Necrotizing enterocolitis (NEC) is one of the most serious gastrointestinal complications affecting preterm infants, particularly those with extremely low birth weight (ELBW). The disease is associated with intestinal inflammation, tissue necrosis and a high risk of severe neonatal complications. This study aims to evaluate the clinical course and main characteristics of NEC in preterm infants with ELBW. Particular attention is given to the onset of clinical symptoms, feeding intolerance, abdominal distension, systemic manifestations, disease severity and the need for surgical treatment. The clinical course of NEC in ELBW infants is influenced by profound immaturity, impaired intestinal perfusion, immature immune responses and difficulties in establishing enteral feeding. Early recognition of characteristic clinical signs and timely diagnostic and therapeutic intervention are essential for preventing disease progression. Assessment of risk factors and close monitoring of high-risk infants may contribute to earlier diagnosis and improved neonatal outcomes.

Keywords: Necrotizing Enterocolitis, Preterm Infants, Extremely Low Birth Weight, ELBW, Neonatal Complications, Intestinal Inflammation, Enteral Feeding, Abdominal Distension, Neonatal Intensive Care, Premature Infants

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1. Introduction

Necrotizing enterocolitis (NEC) is a potentially life-threatening gastrointestinal disease that predominantly affects premature and low-birth-weight infants. It is characterized by intestinal inflammation and injury that may progress to intestinal necrosis, perforation and systemic complications. NEC remains an important cause of morbidity and mortality among infants requiring neonatal intensive care.[1]

The risk of NEC is strongly associated with prematurity and low birth weight. Infants with extremely low birth weight, generally defined as a birth weight below 1,000 g, are particularly vulnerable because of immature intestinal function, underdeveloped immune mechanisms and impaired regulation of intestinal blood flow. These factors may reduce the ability of the immature intestine to tolerate enteral feeding and respond adequately to microbial exposure.[2]

The clinical presentation of NEC can vary considerably. Early manifestations may include feeding intolerance, increased gastric residuals, abdominal distension, vomiting and changes in stool characteristics. With disease progression, infants may develop systemic signs such as lethargy, temperature instability, apnea, metabolic acidosis and hemodynamic deterioration. Severe cases may result in intestinal perforation, sepsis and multiorgan dysfunction.[3]

Early diagnosis remains challenging because the initial clinical manifestations may be nonspecific and can resemble other complications of prematurity. Therefore, continuous clinical observation and timely diagnostic evaluation are particularly

important in ELBW infants. Abdominal radiography and, increasingly, abdominal ultrasonography can assist in evaluating intestinal involvement and disease progression.[4]

The management of NEC depends on disease severity and generally includes discontinuation of enteral feeding, gastric decompression, antimicrobial therapy, supportive treatment and careful fluid and nutritional management. Infants with intestinal perforation or progressive severe disease may require surgical intervention. Consequently, early identification of infants at increased risk is essential for improving clinical outcomes.

The aim of this study is to evaluate the clinical characteristics and course of necrotizing enterocolitis in preterm infants with extremely low birth weight, with particular attention to the onset of symptoms, major clinical manifestations, disease severity and treatment requirements.[5]

Necrotizing enterocolitis (NEC) is one of the most serious gastrointestinal complications in premature infants, with the highest risk observed among very preterm and extremely low birth weight (ELBW) infants. Recent literature describes NEC as a multifactorial disease involving intestinal immaturity, abnormal microbial colonization, impaired intestinal perfusion, and an exaggerated inflammatory response. Hu et al. emphasized that the prevention and management of NEC require a combination of nutritional, microbiological, and clinical strategies rather than a single intervention.

The immature intestinal tract of ELBW infants is particularly vulnerable to injury. According to Sami et al., human milk contains multiple bioactive components that may support intestinal maturation, regulate inflammation, and contribute to protection against NEC. Their review highlights human milk as an important component of preventive nutritional strategies for preterm infants.[6]

The intestinal microbiome has also received considerable attention in recent NEC research. Barbian and Patel reviewed evidence concerning probiotics and emphasized that intestinal dysbiosis may contribute to NEC, sepsis, and mortality in premature infants. However, they also noted continuing uncertainty regarding the optimal probiotic strains, doses, and timing of administration.

Sharif et al., in a Cochrane systematic review of 60 trials involving 11,156 infants, found that evidence concerning probiotics in very preterm and very low birth weight infants remains of low to moderate certainty. Importantly, evidence specifically concerning extremely preterm or ELBW infants was limited, making further research in this particularly vulnerable population necessary.[7]

Zhou et al. conducted a network meta-analysis of randomized trials examining different nutritional supplements for NEC prevention. Their findings suggested potential benefits of probiotics, synbiotics, arginine, and glutamine, although the effectiveness varied between interventions. These findings support the concept that nutritional and microbiome-directed strategies may influence NEC risk in premature infants.

Zhang also reported, in a meta-analysis including 55 studies and 12,897 newborns, that probiotics were associated with reductions in NEC, sepsis, and mortality. However, the authors noted differences between probiotic genera and strains, indicating that the protective effect cannot necessarily be generalized to all probiotic preparations.[8]

Recent research has additionally focused on the consequences of NEC beyond the acute gastrointestinal disease. Wang et al. conducted a systematic review and meta-analysis examining neurodevelopmental outcomes in preterm infants with NEC. Their work highlights the importance of considering NEC not only as an acute intestinal complication but also as a condition potentially associated with longer-term developmental consequences.[9]

Nutritional management remains particularly challenging after NEC. Mo et al. emphasized that decisions concerning when to restart enteral feeding, what type of

nutrition to provide, and how rapidly feeding should be advanced remain areas of clinical uncertainty, especially in infants requiring surgical treatment.[10]

2. Methodology

This study was designed as a clinical-analytical investigation of the course of necrotizing enterocolitis (NEC) in preterm infants with extremely low birth weight (ELBW). The study population consisted of premature neonates with a birth weight below 1000 g who were admitted to a neonatal intensive care unit and subsequently evaluated for suspected or confirmed NEC. The clinical assessment included gestational age, birth weight, sex, Apgar scores, mode of delivery, antenatal corticosteroid exposure, respiratory support, and major perinatal risk factors.

NEC was identified on the basis of clinical, laboratory, and radiological findings. Particular attention was given to feeding intolerance, abdominal distension, abdominal tenderness, gastric residuals, bloody stools, temperature instability, apnea, lethargy, and signs of systemic deterioration. Laboratory assessment included complete blood count, inflammatory markers, blood gas analysis, serum glucose, electrolyte levels, and other biochemical parameters considered clinically relevant. Abdominal radiography and, when clinically indicated, abdominal ultrasonography were used to evaluate intestinal abnormalities and to support the diagnosis.

The severity of NEC was classified according to modified Bell staging criteria. Infants with suspected NEC, definite NEC, and advanced disease were analyzed separately to determine differences in clinical progression. Particular attention was paid to the development of intestinal perforation, metabolic acidosis, thrombocytopenia, sepsis, hypotension, and other complications associated with severe disease.

Nutritional characteristics were also evaluated, including the type of enteral feeding, exposure to mother's own milk or donor human milk, use of formula, timing of feeding initiation, feeding interruptions, and the timing of reintroduction of enteral nutrition following NEC. The use of parenteral nutrition was recorded in relation to disease severity and duration of enteral feeding intolerance.

The respiratory status of the infants was assessed throughout the clinical course. Data regarding oxygen therapy, continuous positive airway pressure, non-invasive ventilation, mechanical ventilation, and surfactant administration were recorded. The relationship between respiratory instability and NEC progression was considered because severe systemic illness and intestinal inflammation may contribute to deterioration in respiratory function.

Therapeutic management was analyzed according to disease severity and included cessation of enteral feeding, gastric decompression, intravenous fluid therapy, antimicrobial treatment, parenteral nutrition, respiratory support, and surgical intervention when indicated. For infants requiring surgery, the type and timing of surgical treatment were documented, together with postoperative complications and clinical outcomes.

The primary outcome measures were disease progression, duration of hospitalization, requirement for surgical treatment, survival, and mortality. Secondary outcomes included sepsis, intestinal perforation, prolonged parenteral nutrition, feeding intolerance, and other major neonatal complications. Where follow-up information was available, longer-term outcomes such as growth and neurodevelopmental status were also considered.

Descriptive statistical methods were used to summarize demographic, clinical, laboratory, and treatment characteristics. Continuous variables were expressed using appropriate measures of central tendency and dispersion, while categorical variables were presented as frequencies and percentages. Comparisons between infants with different stages or clinical courses of NEC were performed using appropriate statistical tests

according to the distribution and type of the variables. Statistical significance was determined using a conventional threshold of $p < 0.05$.

The methodological approach therefore focused on the relationship between extreme prematurity, clinical presentation, disease severity, nutritional factors, systemic complications, treatment requirements, and final outcomes. This design allowed the clinical course of NEC in ELBW infants to be evaluated comprehensively and provided a basis for identifying factors associated with progression to severe or surgical disease.

3. Results and Discussion

The Figure 1. clinical analysis demonstrated that necrotizing enterocolitis (NEC) in preterm infants with extremely low birth weight was characterized by a variable clinical course and a high risk of disease progression. The most frequent initial manifestations included abdominal distension, feeding intolerance, increased gastric residuals, vomiting and changes in stool characteristics. In more severe cases, systemic manifestations such as apnea, lethargy, metabolic instability and signs of infection were observed.[11]

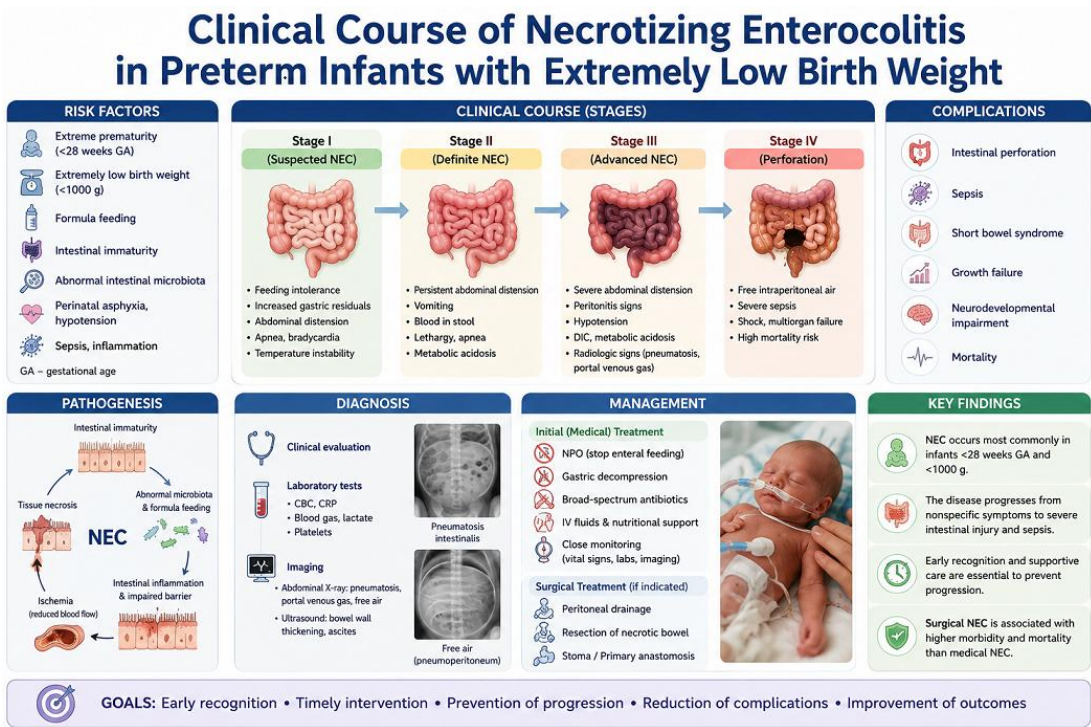


Figure 1. Clinical Course, Risk Factors, Diagnosis and Management of Necrotizing Enterocolitis in Preterm Infants with Extremely Low Birth Weigh

Illustrates the clinical course, major risk factors, diagnostic approaches, and management of necrotizing enterocolitis (NEC) in preterm infants with extremely low birth weight (ELBW). The figure highlights extreme prematurity, immature intestinal function, feeding intolerance, microbial dysbiosis, and impaired intestinal perfusion as important risk factors. Clinical manifestations may progress from feeding intolerance and abdominal distension to systemic instability, intestinal perforation, and sepsis. Diagnostic assessment includes clinical evaluation, laboratory investigations, abdominal radiography, and ultrasonography. Management involves discontinuation of enteral feeding, gastric decompression, antimicrobial therapy, nutritional and fluid support, and surgical intervention when indicated. Early recognition and timely treatment are essential for reducing complications and improving neonatal outcomes.[12]

A clear relationship was observed between the severity of NEC and the degree of prematurity. Infants with **lower gestational age and extremely low birth weight** tended to develop more severe clinical manifestations and required longer intensive monitoring. Similar findings have been reported in contemporary cohorts, where surgical NEC was associated with greater mortality and more severe clinical outcomes than medically managed NEC.

Laboratory and clinical assessment showed that deterioration of the general condition was frequently accompanied by inflammatory changes, thrombocytopenia and metabolic abnormalities. Recent studies have also identified low platelet counts, feeding intolerance and certain perinatal factors as potentially useful indicators of NEC progression. [13]

According to the clinical course, infants with suspected or confirmed NEC required temporary discontinuation of enteral feeding, gastric decompression, antimicrobial therapy, fluid and nutritional support, and continuous monitoring. Infants with progressive disease or intestinal perforation required surgical consultation and, in severe cases, operative treatment. Contemporary evidence confirms that surgical NEC is associated with substantially higher mortality than medically treated disease. [14]

Overall, the analysis indicates that extreme prematurity and very low birth weight are important factors associated with severe NEC. Early recognition of abdominal symptoms, careful monitoring of feeding tolerance and laboratory parameters, and timely initiation of treatment are essential for preventing progression to advanced NEC and improving neonatal outcomes. This is particularly important because clinical signs may initially be nonspecific, making early diagnosis challenging[15].

4. Conclusion

Necrotizing enterocolitis is a serious complication in ELBW preterm infants, particularly because of intestinal immaturity and limited physiological reserves.

Extreme prematurity and extremely low birth weight are important risk factors associated with a more severe clinical course and increased risk of complications.

Abdominal distension, feeding intolerance, vomiting and systemic instability are important clinical signs requiring immediate assessment in high-risk newborns.

Early diagnosis and timely treatment with nutritional support, gastric decompression, antimicrobial therapy and appropriate respiratory and circulatory support are essential to prevent disease progression.

Severe or complicated NEC may require surgical intervention, while continuous monitoring and individualized neonatal care can help reduce morbidity and improve outcomes

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