Original Article

Epidemiology of necrotizing enterocolitis in newborns: surgical analysis of data from kazakhstan for 2020–2024

Khuzhakhmedova Rimma[1], Kemelbekov Kanatzhan[2], Erekeshov Asylzhan[3], Anartayeva Mariya[4], Tanabayev Baimakhan[5], Seitkhanova Bibigul[6], Shapambayev Nasriddin[7], Japarov Akhmadkul[8], Yernazarov Adilet[9]

ABSTRACT

Background

Necrotizing enterocolitis (NEC) remains a major challenge in neonatology, particularly affecting premature infants and those with very low birth weight. This study analyzes trends in NEC incidence in Kazakhstan from 2020 to 2024, highlighting regional disparities and comparing them with international benchmarks. Data from perinatal centers and neonatal intensive care units (NICUs) indicate a significant increase in NEC cases, particularly in urban areas. Key recommendations include improving early diagnosis, standardizing feeding protocols, and promoting the use of breast milk to reduce NEC incidence and associated mortality rates.

Objective

The aim of this study was to examine surgical necrotizing enterocolitis in newborns.

Materials and Methods

This retrospective study analyzed data on NEC cases from neonatal intensive care units (NICUs) and perinatal centers across Kazakhstan from 2020 to 2024. Cases were categorized by region and year, with additional analysis focusing on neonatal characteristics such as birth weight and gestational age. Comparative analysis with international data was conducted to contextualize findings and identify potential areas for improvement in neonatal care practices.

Results

The analysis revealed a significant increase in NEC incidence in Kazakhstan, particularly in urban regions such as Almaty and Almaty Region. The number of cases peaked in 2023, with a 1.7-fold increase compared to 2020. Regional disparities were evident, with higher incidence rates in areas with better healthcare infrastructure. In less developed regions, such as Akmola and Turkestan, the growth was less pronounced but still present.

Conclusion

This study underscores the rising trend of NEC in Kazakhstan and the associated regional disparities. Adopting evidence-based preventive measures, enhancing healthcare infrastructure, and standardizing neonatal care protocols are essential for reducing NEC incidence and improving outcomes for this vulnerable population.

Keywords

newborn; surgery; necrotizing enterocolitis; data analysis.

INTRODUCTION

Necrotizing Enterocolitis (NEC) remains one of the most serious and life-threatening conditions among newborns, particularly preterm infants [1,2]. The problem with this disease lies in the high risk of severe complications, including the need for surgical intervention and significant mortality, which can also lead to long-term

1. Khuzhakhmedova Rimma, Candidate of PhD, neonatal surgeon assistant of the Department "Pediatrics -1", South Kazakhstan Medical Academy, Shymkent, Kazakhstan,
2. Kemelbekov Kanatzhan, PhD, Head of the Department of Pediatrics -1, South Kazakhstan Medical Academy, Shymkent, Kazakhstan,
3. Erekeshov Asylzhan, Associated professor of Medical Sciences, Neonatal surgeon, Almaty, Kazakhstan, "Scientific Center of Pediatrics and Pediatric surgery",
4. Anartayeva Mariya, Doctor of Medical Sciences, Associate Professor, Vice-rector for educational and methodical work PhD., South Kazakhstan Medical Academy, Shymkent, Kazakhstan,
5. Tanabayev Baimakhan, Candidate of Medical Sciences, associate professor, Head of the Department "Morphophysiology", South Kazakhstan Medical Academy, Shymkent, Kazakhstan,
6. Seitkhanova Bibigul, Doctor of Medical Sciences, Associate Professor, Head of the Department of Microbiology, Allergology, and Immunology, South Kazakhstan Medical Academy, Shymkent, Kazakhstan,
7. Shapambayev Nasriddin, PhD in Medical Sciences, Head of the Department of "General Practitioner - 1", Khoja Akhmet Yassawi International Kazakh-Turkish University, Shymkent, Kazakhstan,
8. Japarov Akhmadkul, Head of the Department of "Surgical emergency room", City Children`s Clinical hospital Shymkent, Kazakhstan,
9. Yernazarov Adilet, PhD, Head of the Department of Special Surgical Disciplines, Khoja Akhmet Yassawi International Kazakh-Turkish University, Shymkent, Kazakhstan.

Correspondence

Kemelbekov Kanatzhan, Department of Pediatrics-1, South Kazakhstan Medical Academy, Shymkent, Kazakhstan, E-mail: kanat-270184@mail.ru

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disability [3-6]. In recent years, there has been a trend toward an increasing incidence of NEC in many countries, including the United States, Europe, and other regions with developed neonatal care systems [1,7].

In Kazakhstan, according to the conducted study, the incidence of NEC among newborns increased during the period from 2020 to 2024. The highest number of cases was recorded in large cities and regions with more advanced medical infrastructure, such as Almaty and the Almaty region, with a peak in 2023. The overall growth in incidence reached 1.7 times among preterm infants compared to the beginning of the study period [3,5, 8-11].

The purpose of this informational and analytical study was to track how the incidence of necrotizing enterocolitis (NEC) among newborns in Kazakhstan changed between 2020 and 2024. The analysis was based on annual reports from perinatal centers and neonatal intensive care units, which allowed for a closer look at regional differences in both the frequency and severity of the condition.

Findings showed that the overall incidence of NEC steadily increased across the country during this period. The sharpest rise occurred in major urban areas, particularly in Almaty and the Almaty region, where cases reached their peak in 2023. Among preterm infants and babies with low birth weight, the incidence of NEC rose by 1.7 times compared to the beginning of the study. Regions with more limited healthcare infrastructure, such as Akmola and Turkestan, also experienced growth in NEC cases, though the increase there was less dramatic [1,12].

Additionally, a comparative analysis of NEC incidence between urban and rural populations was conducted. An increase was noted in both populations, with a slight predominance in urban areas, possibly due to better medical diagnostics and reporting in these regions. A comparative analysis of NEC incidence across Central Asian countries showed a growth trend in Kazakhstan similar to that observed in other countries of the region. [1,13-17].

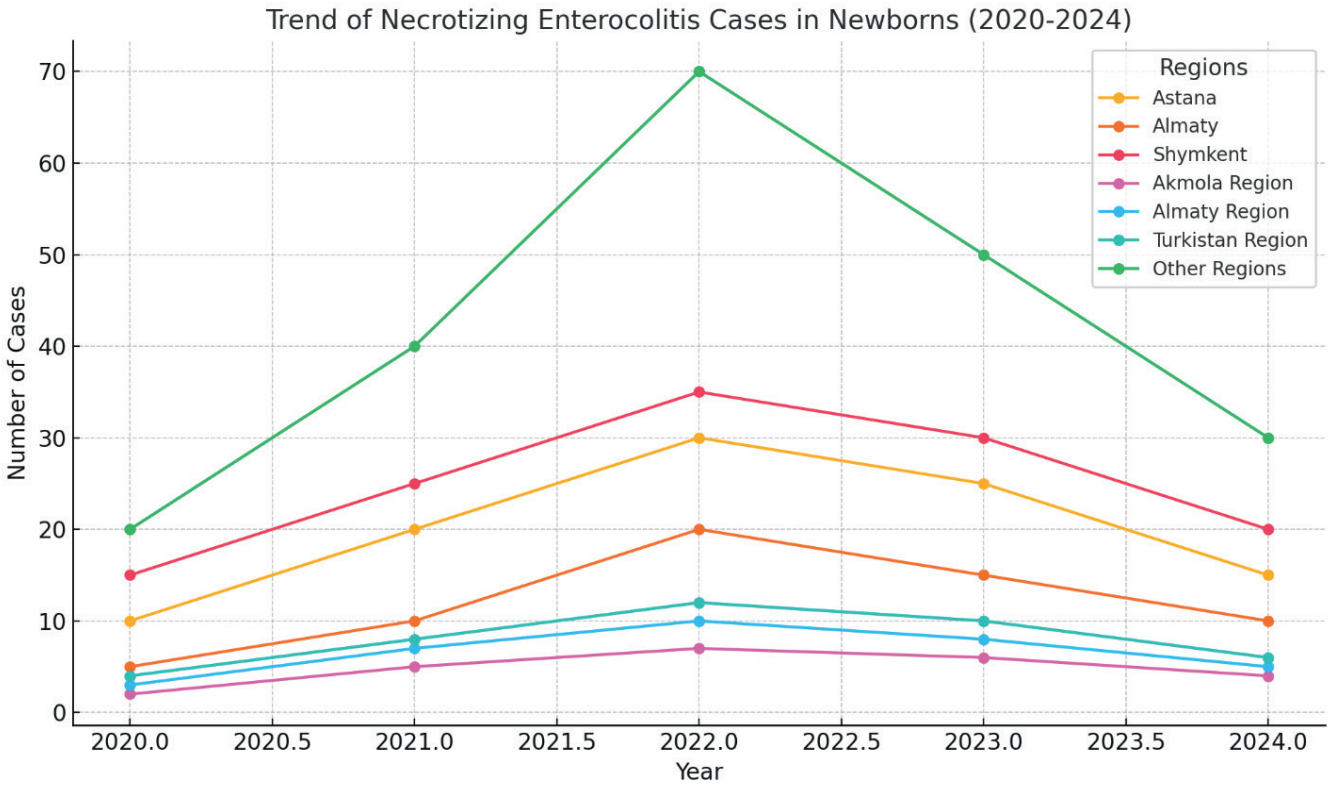
This study indicates a steady increase in the incidence of NEC among newborns in Kazakhstan, requiring attention from the scientific and medical communities for the development and implementation of effective prevention measures and treatment standards. There is a need for improved early diagnosis and the unification of protocols for managing newborns at risk of developing NEC to reduce incidence and improve outcomes for this vulnerable group. Comparisons show that Kazakhstan, like other countries, has seen an increase in NEC incidence, especially among preterm newborns. In countries with more developed neonatal care systems (e.g., the United States, Canada, Australia), the frequency of cases can be reduced through advanced preventive methods such as the use of breast milk, probiotics, and standardized feeding protocols. Regional differences in the availability and quality of medical care remain a key factor determining NEC incidence [18-20].

MATERIAL AND METHODS

The frequency of necrotizing enterocolitis (NEC) detection averages 1–5 cases per 1,000 live births, with 80–90% of cases occurring in preterm infants and newborns with low birth weight (less than 2,500 g). Approximately 7% of infants weighing 500–1,500 g and with a gestational age of less than 32 weeks develop NEC. Surgical stages of NEC are observed in about 50% of affected children. The mortality rate from NEC varies widely: from 20–30%, reaching up to 50% among children undergoing surgical intervention.

The retrospective study included data on cases of NEC with perforation in newborns from various regions of Kazakhstan during the period from 2020 to 2024. Data were collected from medical institutions, including regional and city perinatal centers, and presented annually for each region. The analysis revealed significant regional differences in NEC incidence. The highest number of cases was recorded in Almaty: 7 cases in 2020, with a sharp increase to 42 cases in 2021, and fluctuations in 2022 (32 cases) and 2023 (31 cases), followed by a decrease to 11 cases in 2024. The Almaty region also showed a rise in incidence, from 4 cases in 2020 to a peak of 78 cases in 2023, with a subsequent decline to 29 cases in 2024. In Astana, the incidence remained relatively stable, ranging from 2 to 4 cases over the study period. In Shymkent, a moderate increase was observed, from 1 case in 2020 to 6 cases in 2022 and 2023, with no changes in 2024. Overall, Kazakhstan saw a rise in NEC cases in 2021, followed by a decline by 2024. The overall increase in 2021 is likely related to the COVID-19 pandemic and changes in access to medical care, which may have affected timely diagnosis and treatment.

The data highlight the need to improve preventive measures and early diagnosis of NEC, especially in



regions with high incidence levels. Almaty and the Almaty region show the most pronounced fluctuations in the number of cases, which may reflect variability in risk factors such as access to medical care and differences in approaches to managing preterm newborns.

The graph shows a significant increase in the number of cases in the Almaty region, peaking in 2023, followed by a decline in 2024. Almaty also experienced a considerable rise in 2021, followed by a gradual decrease. In other regions, such as Astana, Shymkent, and Akmola region, the changes are less pronounced.

Regional differences in the incidence of necrotizing enterocolitis (NEC) among newborns can be attributed to a variety of factors. Below are some key aspects that may explain these disparities:

Differences in NEC incidence among newborns are linked to several factors. The availability and quality of healthcare, including the equipment of neonatal intensive care units and the level of training of medical staff, play a key role in outcomes. Regions with better-equipped facilities and access to specialized care generally report lower NEC incidence rates.

Socioeconomic conditions, such as income levels and population education, also affect NEC frequency. A higher level of health literacy facilitates early recognition and treatment of the disease, thereby reducing its prevalence. Regional health policies and resources play a significant role. Implementing effective protocols, ensuring funding, and equitable distribution of medical resources, including advanced equipment, contribute to improved outcomes. Regional differences in NEC incidence may result from variability in the implementation of such policies.

Demographic factors are also important: regions with higher rates of premature births and low-birth-weight infants are more likely to face NEC cases. Urbanization and population density influence access to healthcare services, which can reflect on disease frequency. Infection control practices, such as hygiene and sanitation measures in hospitals and communities, significantly affect NEC rates. Strict infection control protocols in intensive care units usually reduce disease prevalence. At the same time, excessive or inappropriate use of antibiotics can disrupt gut microbiota, increasing the risk of NEC. Feeding practices, particularly the use of breast milk, play a key role in NEC prevention. Access to donor milk and reliance on formula, especially among preterm infants, can also influence disease incidence. Maternal health factors, such as the quality of prenatal care and the use of corticosteroids

during pregnancy to promote lung maturity in preterm infants, can also affect NEC outcomes.

Finally, geographic and environmental factors, including climate conditions and seasonal variations, may also contribute to NEC incidence. Understanding and addressing these factors through targeted public health interventions, improving access to healthcare, and increasing health literacy can help reduce regional disparities in NEC incidence.

Ethical clearance

This study was conducted in accordance with ethical standards. Ethical approval was obtained from the appropriate institutional review board, and informed consent was secured from all participants prior to data collection.

RESULTS

An analysis of data from 2020 to 2024 revealed a significant increase in the incidence of necrotizing enterocolitis (NEC) among newborns in Kazakhstan, particularly in major cities and regions with more developed medical infrastructure, such as Almaty and the Almaty region. In 2023, NEC incidence reached peak levels, highlighting the need for enhanced preventive measures and early diagnosis. Among preterm infants and those with low birth weight, NEC incidence increased 1.7 times compared to the beginning of the study period. The smallest increase was observed in regions with limited medical infrastructure, such as Akmola and Turkestan regions, although these areas also experienced a general rise in cases.

DISCUSSION

Differences in NEC incidence across regions are largely linked to unequal access to quality neonatal care. Areas with well-equipped hospitals and specialized neonatal intensive care units tend to report fewer cases, highlighting how vital strong medical infrastructure and well-trained staff are in preventing the disease. Socioeconomic conditions also play an important role. Communities with higher income levels and better health literacy are more likely to recognize the warning signs of NEC early and seek timely treatment, which helps lower the overall prevalence.

Additionally, feeding practices, particularly the use of breast milk and probiotics, play a key role in NEC prevention. Comparative analysis shows that countries with strong governmental support for breastfeeding and standardized feeding protocols, such as Australia and Canada, have lower NEC rates compared to Kazakhstan. Moreover, the implementation of standardized infection control protocols in neonatal intensive care units has proven to be effective in reducing NEC incidence. International comparison showed that NEC incidence in Kazakhstan remains higher than in developed countries such as the USA, Canada, and Australia. This is attributed to differences in healthcare policies, including the use of breast milk, probiotics, and standardized feeding protocols.

Country	NEC Incidence (%)	Key Preventive Measures
Kazakhstan	6–9%	Limited breast milk use, emerging standards
USA	5–10%	Early breast milk, probiotics
Canada	7%	Donor milk, standardized protocols
Australia	4–5%	Government support for breastfeeding
Sweden/ Norway	2–7%	Strict infection control, feeding protocols

The findings highlight the urgent need to address regional disparities and improve neonatal care in Kazakhstan. Lessons from developed countries emphasize the importance of breastfeeding support, the use of donor milk, and rigorous infection control measures. Standardizing care protocols could significantly reduce NEC incidence and improve neonatal.

CONCLUSIONS

The findings indicate the need to further strengthen preventive measures and improve the quality of neonatal care in Kazakhstan to reduce NEC incidence. Special attention should be given to developing infrastructure in less-resourced regions and unifying approaches to treating preterm newborns at risk of developing NEC. The introduction of advanced preventive methods, such as the use of breast milk and probiotics, as well as standardized feeding and infection control protocols, could significantly improve outcomes for newborns in Kazakhstan and reduce regional disparities in NEC incidence.

Conflict of Interest: The authors declare no conflict of interest.

Authors' contribution:

Data gathering and idea owner of this study: **[1]Khuzhakhmedova Rimma, Kemelbekov Kanatzhan*,**

Study design: **Erekeshov Asylzhan, Anartayeva Mariya,**

Data gathering: **Tanabayev Baimakhan, Seitkhanova Bibigul,**

Writing and submitting manuscript: **Shapambayev Nasriddin, Kemelbekov Kanatzhan*,**

Editing and approval of final draft: **Japarov Akhmadkul, Yernazarov Adilet**

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