Publication.UZ

Article

Diagnosis and surgical treatment of spontaneous perforations of the gastrointestinal tract in newborns

Abdurashid J.Khamraev [1‡], Ihtiyor M.Karimov [2†].

[1] DSc, Professor of the Faculty Hospital of Pediatric Surgery of Tashkent Pediatric Medical Institute, Uzbekistan; abdurashid19560506@gmail.com

[2] PhD, Assistant of the Department of Hospital Pediatric Surgery of the Tashkent Pediatric Medical Institute, Uzbekistan; ixtiyor.70@mail.ru

Abstract: This study analyzed the diagnosis and surgical treatment of spontaneous gastrointestinal perforations in 52 newborns, including 39 cases of necrotizing enterocolitis (NEC) and 13 cases of spontaneous perforations. Key risk factors were birth asphyxia and respiratory distress syndrome, requiring tracheal intubation in all cases. Surgical approaches included perforation closure in 11 cases and interintestinal anastomoses in 2 cases with larger defects. Mortality was 50% in NEC and 26% in spontaneous perforations, mainly among premature infants with low birth weight and severe comorbidities. Early diagnosis and individualized surgical strategies are essential for improving outcomes.

Materials and methods of research: This study included 52 newborns with perforating peritonitis (PP)—39 (75%) with necrotizing enterocolitis (NEC) and 13 (25%) with spontaneous perforations (SPC). Premature infants made up 75% of cases. The average gestational age was 32 weeks for NEC and 33 weeks for SPC, with birth weights below 1700 g. Boys outnumbered girls 2:1. Diagnosis was based on clinical, radiological, ultrasound, and laboratory tests, which revealed anemia in 85% and hypoproteinemia in 79%. Concomitant conditions included CNS hypoxia (48%), TORCH infections (5.8%), Hirschsprung's disease (7.5%), and others. Two groups were identified intraoperatively—NEC-related PP and SPC.

Results of the study: In newborns with necrotizing enterocolitis (NEC), perforating peritonitis (PP) was easier to diagnose, whereas spontaneous perforations (SPC) required careful assessment due to distinct risk factors, including birth asphyxia, respiratory distress syndrome, and impaired mesenteric blood flow. SPC was typically localized with minimal inflammation, and surgical treatment involved perforation closure in 11 cases and interintestinal anastomoses in 2 cases with larger defects. Postoperative findings revealed muscle layer depletion, vascular abnormalities, and ulcerative defects without necrosis. Mortality was 50% in NEC and 26% in SPC, primarily among premature infants with low birth weight and severe comorbidities.

Conclusion: The causes of SPC are linked to circulatory changes during neonatal adaptation, influenced by medications, infections, hypoxia, and abnormalities in the intestinal wall, with respiratory distress syndrome being a key risk factor. Diagnosis of NEC and SPC relies on clinical, radiological, ultrasound, and laboratory studies. Surgical tactics depend on the perforation site, extent of pathology, and the child's overall condition. Preferred treatments include perforation suturing, direct anastomoses for localized defects, and stomas for larger defects without widespread peritonitis.

Keywords: spontaneous intestinal perforation, isolated intestinal perforation, newborns, prematurity.

Citation: Abdurashid J.Khamraev, Ihtiyor M.Karimov. Diagnosis and surgical treatment of spontaneous perforations of the gastrointestinal tract in newborns. *Herald of the National Children's Medical Center* **2024, *4, 18-22***

Received: 10.06.2024
Revised: 18.06.2024
Accepted: 25.07.2024
Published: 30.07.2024

1. Relevance. Necrotizing enterocolitis (NEC) in newborns is a severe intestinal disease that occurs against the background of acute hypoxia, impaired normal colonization of the intestine by microflora, leading to necrosis and perforation of the intestinal wall, peritonitis. The frequency of occurrence is 1-5:1000 live births.

To date, NEC problems in newborns are more due to the tendency to an increase in the disease; the risk of serious pre- and postoperative complications; high mortality; lack of a generally accepted concept of etiopathogenesis of spontaneous intestinal perforation (SPC) and ineffective treatment strategies [1,6,9,10,].

In recent years, according to the literature, new information has been presented demonstrating changes in the diagnosis of NEC, which affected various aspects of intestinal PCOS related to treatment and prognosis of outcomes. Newborns with PCOS tend to have a lower birth weight and are less likely to develop severe manifestations of the disease in the form of multiple organ disorders [13, 15]. According to the authors, SPC occurs in 1:5,000 live-born infants [3-8]. Recently, SPC in newborns has been recognized as an independent disease.

Scientific reports on the epidemiology of SPC in newborns have appeared relatively recently. The true spread of the disease among premature newborns remained unknown until recently. The Vermont Oxford online database, which covers more than 80% of newborns born with ONMT in the United States over a five-year period [18], found that PCOS occurs in 1.1% of premature infants, and demonstrated an increase in the incidence of SPC among newborns with ONMT. Mortality was 19% of cases, less than NEC and 2 times lower than mortality in NEC (38%). This relationship was observed in all weight categories of patients from 400 gy to 1500 gy.

Other scientific papers presented studies in which the mortality rate of patients as a result of SPC was 12%-57% [2,4, 13, 17, 19, 20, 21]. A study of a large group consisting of 156 newborns from the National Institute of Child Health and Human Development found that the mortality rate associated with SPC was 22% and was also significantly lower than in patients with NEC [22]. Therefore, a feature of the mortality data for SPC is the paradoxically low mortality of newborns in comparison with NEC. The absence of severe body reactions (systemic inflammatory response and multiple organ disorder syndrome) in patients with SPC is fully justified.

Researchers report that most SPC occur in the small intestine, with predominant lesions of the ileum, which accounts for 64% of all observations [23]. All patients from the studied groups were premature, whose gestational age ranged from 25 to 33 weeks. It has been proven that SPC occurs mainly in children of gestational age, from 25 weeks to the full term of pregnancy, occurring in all parts of the gastrointestinal tract, but most often observed in the ileum [2, 8, 24-26].

According to A.Y. Kozlov (2016), during laparotomy, if NEC is suspected, the surgeon can detect any degree of intestinal lesion from local perforation to total, accompanied by an infarction of the entire intestine. Among the variety of morphological forms of intestinal perforation in newborns, it is necessary to distinguish SPC, which is manifested by focal perforation of the intestinal wall and is characterized by a normal structure of tissues surrounding the site of perforation of the intestinal wall [1, 2]. In the CPC (Cooperative Patent Classification) (J. Attridge et al., 2012) There are two types of clinical treatment: early- 72 hours of life; later - 72 hours from birth. The average age of patients is usually between the 7th and 10th days of life [9].

According to the authors, in the etiology of SPC in newborns, it is often associated with changes in the circulatory system of infants with ONMT during the transition of the body's adaptation from intrauterine life to new living conditions, which are enhanced by angiogenic (medications, infection, hypoxia) and local (abnormality of the muscular layer of the stomach and intestinal wall) factors. A number of studies have proposed the causes of intestinal SPC, including antenatal and postnatal factors [8,9,14,15]. Prenatal anatomical abnormalities are considered: congenital diverticula, remnants of the omphalo-mesenteric duct, invagination, congenital absence or hypoplasia of the muscular layer of the intestinal wall at the site of perforation; physiological disorders (fetal asphyxia); infections (chorioamnionitis); and the use of certain drugs before childbirth: non-periodical anti-inflammatory drugs (NSAIDs), steroids, cyclooxygenase inhibitors (ibuprofen, indomethacin) [2,3,4,6,7,10,13,14].

Paradoxically, any forms of NEC are much more complicated and are accompanied by multivisceral disorders – arterial hypotension, metabolic acidosis, hyponatremia, neutropenia, thrombocytopenia [12,14,15]. Therefore, some authors, taking into account clinical differences and pathomorphological features of the development of SPC, consider it as a separate nosological form and consider it as one of the varieties of peritonitis in newborns [2,5,6,7].

SPC in premature infants has its own clinical features that differ from NEC. If the SPC on the review radiographs only has free air, and the NEC is accompanied by the appearance of intestinal pneumatosis, which is always absent in SPC. Despite these differences, the diagnosis of SPC may be unclear until laparotomy is performed. Studies that include a small number of patients suggest that SPC may have a more favorable prognosis than NEC [11].

Mortality in SPC in newborns is 30-60% and in premature infants with low body weight (BMI) and severe concomitant pathology can reach 100%. Among them, SPC in NEC occur in 2% of newborns with ONMT (1500g and below) and in 5-8% of children with extremely low body weight (ENMT) (less than 1000g) [8,3, 5,10].

In this study, we sought to present new reports on SPC in premature newborns, to introduce issues of modern diagnosis and treatment that are still being debated and have not found specific answers. All this requires its own scientific justification.

2. The purpose of the work: to analyze the own results of treatment of newborns with SPC and NEC, to develop an optimal algorithm of therapeutic tactics to improve treatment results.

3. Material and methods.

The work is based on the results of examination and treatment over the past 5 years, 52 newborns with perforating peritonitis (PP), among whom 39 (75%) patients with NEC, 13 (25%) had SPC. There were 13 full–term newborns (25%), 39 premature (75%). The average gestational age of patients with NEC was 32 weeks, newborns with SPC – 33 weeks. The average birth weight of children with NEC was 1.700g, children with SPC was below 1.700g. Among the patients, there is a twofold predominance of boys over girls.

The diagnosis of NEC and SPC was established on the basis of clinical, radiological (overview and contrast radiography according to indications), ultrasound and laboratory studies. Laboratory tests revealed 85% of patients with anemia and 79% with hypoproteinemia.

Concomitant diseases were identified: hypoxic lesions of the central nervous system - in 48%; intrauterine infection with TORCH infection - in 5.8%; Hirschsprung's disease – in 7.5% of children; embryonic umbilical hernia - in 5%; fistulous forms of atresia of the anus and rectum - in 4.1%; pylorostenosis – in 1.6% of patients[4].

During intraoperative diagnosis, two groups of patients were identified in newborns with perforated diffuse peritonitis: the first group who had PP, which arose against the background of NEC, and the second group who had SPC.

4. Results and discussion.

The typical clinical picture of PP in newborns with NEC did not cause diagnostic difficulties. At the same time, it was necessary to identify the type and localization of the perforation, which led to the development of diffuse peritonitis in a newborn.

In the preoperative period, based on clinical studies of newborns, we identified clinical features of SPC in comparison with intestinal perforations that occurred during NEC. At the same time, sections of the digestive tube in newborns in the antenatal period helped to identify risk factors for SPC. At the same time, in the anamnesis, acute asphyxia in childbirth, respiratory pathology and respiratory distress syndrome were often noted. At the same time, the main pathogenetic link of SPC is a violation of regional mesenteric blood flow. Hemodynamic disorders in the mesenteric vessels of an infant are associated with a high rate of postpartum intestinal adaptation in the first days of birth to new living conditions. These changes may be supported by external factors. Some drugs from the NSAID groups are indomethacin and ibuprofen, as well as hormones dexamethasone, which often led to selective disorders of blood circulation in various organs of the newborn - intestines, brain, lungs, and main vessels. Intestinal ischemia can also occur under the influence of non-drug factors and occurs before or during childbirth, contributing to the development of SPC. In the SPC group, placental infection in the form of chorionamnionitis, oligohydramnion and fetal asphyxia were more often detected.

In the initial diagnosis of SPCin newborns, X-ray methods were used: overview and contrast radiography (according to indications), ultrasound of the abdominal cavity in the postoperative period, morphological examination of the macropreparation - the resected intestine.

The effectiveness of the X-ray method of investigation in our observations was high, false results were found only in 3 cases when the perforations were hidden by the intestinal wall of a nearby loop or SEC next to a large omentum (covered perforation). A large amount of free gas in the abdominal cavity (pneumoperitonitis) led to serious respiratory and cardiac disorders.

Ultrasound examination of the abdominal organs revealed free fluid in the abdominal cavity between the intestinal loops, a decrease in intestinal pneumatization, and adhesions of the intestinal loop.

Often, intraoperatively, macroscopically, the intestines and stomach had a normal appearance, with moderate inflammation of the peritoneum. SPC looked like a local lesion (perforation) of a hollow organ, with a local pathological process, without spreading the latter over large areas of the hollow organ. SPC is manifested by selective, focal perforation of the intestine and is characterized by a normal structure of tissues surrounding the site of perforation of the intestinal wall, moderate inflammation of the peritoneum, and a favorable course.

Localization of a single perforation of the intestinal wall against the background of NEC was determined mainly in the stomach-8, iliac-3 and transverse colon-2. By the nature of the perforations in

the stomach, they were in 5 cases long in size, linear in nature along a large curvature and in 3 cases rounded in shape, relatively small in diameter along the back and front walls of the stomach. In the jejunum, multiple perforating lesions were present in two cases, necrosis occurred in one newborn. The characteristic features of the joint venture in the transverse colon were a complete rupture.

Surgical tactics in SPC were determined by the level of localization of the perforation, the prevalence of the pathological process in the wall of the hollow organ and the general condition of the child.

In SPC, the surgery of choice was the suturing of a perforated hole in 11 children. In 2 patients with SPC, direct interstitial anastomoses were applied with a limited pathological process and the absence of widespread peritonitis, with large defects of the intestinal wall, a double iliostomy and a colostomy were applied to the small and large intestine.

In the postoperative period, the results of morphological studies showed that the features of PCOS in newborns are: a sharp depletion of the muscular layer of the wall of the hollow organ, sometimes with the absence of separate muscle fragments, vascular aneurysms or vascular malformations in the submucosal layer of the wall of the hollow organ; ulcerative defect with extensive hemorrhages in perifocal tissues without necrotic changes; absence of pneumatosis of the intestinal wall.

Mortality was 50% among newborns with PP in NEC (19 newborns died) and among patients with SPC (5 newborns died). Among the deceased children, the absolute majority were premature newborns with NHMT and ONMT and serious concomitant pathology (cardiopulmonary dysfunction, congenital malformations, neonatal sepsis with signs of multiple organ failure).

5. Conclusions:

1. The causes of PCOS may be associated with changes in the circulatory system of infants with ONMT during the transition of the body's adaptation from intrauterine life to new living conditions, which are enhanced by the influence of angiogenic (medications, infection, hypoxia) and local (abnormality of the muscular layer of the intestine) factors, also in the postnatal period, a risk factor - respiratory distress syndrome, as a leading one, early onset, local lesions of the hollow organ.

2. The diagnosis of NEC and SEC is established on the basis of clinical, radiological (overview and contrast radiography according to indications), ultrasound and laboratory studies.

3. Surgical tactics in SPC were determined by the level of localization of the perforation, the prevalence of the pathological process in the wall of the hollow organ and the general condition of the child.

4. The operation of choice for SPC newborns is excision of the edges of the perforation and suturing of the perforated opening on the stomach, the imposition of direct intestinal anastomoses with a limited pathological process and the absence of widespread peritonitis, with large defects of the intestinal wall, double iliostomy and colostomy were applied on the small and large intestines.

Author Contributions:

Abdurashid J.Khamraev. - Обоснование рукописи или проверка критически важного интеллектуального содержания - Окончательное утверждение для публикации рукописи - Согласие быть ответственным за все аспекты работы, и предполагает, что должным образом исследованы и разрешены вопросы, касающиеся тщательности и добросовестном выполнении любой части представленного исследования.

Ihtiyor M.Karimov- Разработка концепции и дизайна или анализ и интерпретация данных - Согласие быть ответственным за все аспекты работы, и предполагает, что должным образом исследованы и разрешены вопросы, касающиеся тщательности и добросовестном выполнении любой части представленного исследования.

Informed Consent Statement: От всех субъектов, участвовавших в исследовании, было получено информированное согласие.

Data Availability Statement: Оригинальные материалы, представленные в исследовании, включены в статью. Дополнительные запросы могут быть направлены к корреспонтдент автору.

Conflicts of Interest: Конфликт интересов не заявляется.

References: (Литература)

1. Горбатюк О.М., Мартынюк Т.В. /Перфоративные перитонит новорожденных.// Российский вестник детской хирургии, анестезиологии и реаниматологии. М. 2011. С – 27.
2. Дамиров О.Н. /Обоснование тактики хирургического лечения язвенно некротического энтероколита у новорожденных. //Дис. ... канд. мед наук 14.00.35. Волгоград. 2015. С- 127.
3. Караваева С.А. Диагностика и особенности клинического течения некротического энтероколита у детей

/Вестник хирургии,2002,161,4. С.41-44
4. Карпова И.Ю., Паршиков В.В. /Некротический энтероколит у новорожденных. //Детская хирургия. 2011; № 6: С. 47-50.
5. Качанов А.В. /Оптимизация лечения некротического энтероколита у новорожденных. //Дис. …канд мед наук. Ставрополь -2015
6. Козлов Ю.А., Новожилов В.А., Тимофеев А.Д./Спонтанная перфорация кишечника у недоношенных детей //Российский вестник 2016 том vi № 4. С-35-42
7. Разумовский А.Ю., Полунина Н.В., Саввина В.А., Яковлева А.И., Варфоломеев А.Р., Николаев В.Н. /Некротический энтероколит в свете изменения критериев живорождённости. //Вопросы практической педиатрии. 2014; (3): 56-9.
8. Щербинин Р.Л., Вечеркин В.А., и др. /Заболеваемость, исходы и летальность при некротизирующем энтероколите у новорожденных. //Вестник новых медицинских технологий. 2012; (2): 103-4.
9. Adant I., Miserez M., Naulaers G., Carkeek K., Ortibus E., Aerts R., Rayyan M. Long-term ontcomes of very low birth weight infants with spontaneous intestinal perforation: a retrospective case-matched cohort study. J. Pediatr. Surg. 2019; 54 (10): 2084 – 2091.
10.Xiong T., Maheshwari A., Neu J., Ei-Saie A., Pammi M. An overview of systematic reviews of randomized-controlled trials for preventing necrotizing enterocolitis in preterm infants // Neonatology. 2020. Vol. 117, N 1. P. 46-56. DOI: https://doi.org/10.1159/000504371
11. Meister A.L., Doheny K.K., Travagli R.A. Necrotizing enterocolitis: it's not all in the gut // Exp. Biol. Med. 2020. Vol. 245, N 2. P. 85-95. DOI: https://doi.org/10.1177/1535370219891971
12. Olaloye O., Swatski M., Konnikova L. Role of nutrition in prevention of neonatal spontaneous intestinal perforation and its complications: a systematic review. Nutrients. 2020; 12 (5).
13. Jin YT, Duan Y, Deng XK, Lin J. Prevention of necrotizing enterocolitis in premature infants - an updated review. World J Clin Pediatr. 2019;8(2):23-32. Published 2019 Apr 9. doi:10.5409/wjcp.v8.i2.23
14. Jones IH, Hall NJ. Contemporary Outcomes for Infants with Necrotizing Enterocolitis-A Systematic Review.J Pediatr. 2020; 220: 86-92.e3. doi:10.1016/j.jpeds.2019.11.011
15. Han S.M., Knell J., Henry O., Riley H., Hong C.R., Staffa S.J. et al. Long-term outcomes of severe surgical necrotizing enterocolitis // J. Pediatr. Surg. 2020.Vol. 55, N 5. P. 848-851. DOI: https://doi.org/10.1016/j.jpedsurg.2020.01.019
16. Matei A., Montalva L., Goodbaum A., Lauriti G., Zani A. Neurodevelopmental impairment in necrotising enterocolitis survivors: systematic review and metaanalysis // Arch. Dis. Child. Fetal.Neonatal.Ed. 2020.Vol. 105, N 4. P. 432-439.
17. Campos-Martinez A.M., Expósito-Herrera J., Gonzalez-Bolívar M., Fernández-Marin E., Uberos J. Evaluation of risk and preventive factors for necrotizing enterocolitis in premature newborns. A systematic review of the literature // Front. Pediatr. 2022. Vol. 17, N 10. P. 874976.
18. Duci M., Frigo A. C., Visentin S., Verlato G., Gamba P., Fascetti-Leon F. Maternal and placental risk factors associated with the development of necrotizing enterocolitis (NEC) and its severity // J. Pediatr. Surg. 2019.Vol. 54, N 10. P. 2099-2102.
19. Martini S., Annunziata M., Della Gatta A.N., Aceti A., Brunetti M., Pilu, G. et al. Association between abnormal antenatal doppler characteristics and gastrointestinal outcomes in preterm infants //Nutrients.2022.Vol.14,N 23. P. 5121.
20. Huang Y., Zhang L., Sun H., Liu C., Yang Y., Lee S. K. et al. Neonatal outcome of small for gestational age infants born at 26-33 weeks' gestation in Chinese neonatal intensive care units // Transl.Pediatr.2021.Vol.10,N 4.P. 754-764.
21. Tan X, Zhou Y, Xu L, Zhang L, Wang J, Yang W. The predictors of necrotizing enterocolitis in newborns with low birth weight: A retrospective analysis. Medicine (Baltimore). 2022;101(7):e28789. doi:10.1097/MD.0000000000028789
22. Garg P.M., Paschal J.L., Ansari M., Block D., Inagaki K., Weitkamp J.H. Clinical impact of NEC-associated sepsis on outcomes in preterm infants // Pediatr. Res. 2022. PMID: 35352003.
23. Nikitina I., Donnikov A., Krogh-Jensen O., Krasheninnikova R., Lenyushkina A. Necrotizing enterocolitis in neonates: early genetic markers. 4th Congress of Joint European Neonatal Societies: Nutrition // Pediatr.Res.2021.Vol. 90. P. 29-30.
24. Battarbee A.N., Ros S.T., Esplin M.S., Biggio J., Bukowski R., Parry S. et al. Optimal timing of antenatal corticosteroid administration and preterm neonatal and earlychildhood outcomes //Am. J.Obstet.Gynecol.MFM..2020.Vol.2,N1.P. 100077.
25.Elgendy M.M., Othman H.F., Heis F., Qattea I., Aly H. Spontaneous intestinal perforation in premature infants: a national study. J. Perinatol. 2021; 41 (5): 1122- 1128.