IJN
Iranian Journal of Neonatology
http://ijn.mums.ac.ir

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Original Article

Neonatal Abdominal Distension: A Spectrum of Causes and Clinical Outcomes in a Tertiary NICU

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ABSTRACT

Background: Abdominal distension is a common and potentially serious presentation in neonatal intensive care units (NICUs). This study aimed to investigate the etiologies, management, and outcomes of neonates with abdominal distension in a tertiary referral center in southern Iran.

Methods: This retrospective cross-sectional study included all neonates admitted with abdominal distension to Namazi Hospital, Shiraz, from September 2021 to September 2024. Data were obtained from hospital records using a structured checklist and analyzed with SPSS version 26. The Mann–Whitney U test was used for continuous variables and the Chi-square test for categorical variables, with $p < 0.05$ considered significant.

Results: A total of 171 neonates were included, 109 (63.7%) male and 62 (36.3%) female, with a mean age at presentation of 10.5 ± 12.1 days, gestational age of 35.6 ± 4.5 weeks, and birth weight of 2775.5 ± 781.6 g. Obstructive causes were found in 84 (49.1%) cases and non-obstructive in 87 (50.9%). The most frequent etiologies were unknown (19.9%), imperforate anus (19.9%), and Hirschsprung disease (18.1%). Congenital anomalies were present in 35.7%, mainly congenital heart disease (81.9%). Compared with non-obstructive cases, the obstructive group presented earlier (5.0 ± 8.3 vs. 14.0 ± 13.6 days, $p < 0.001$), had higher birth weight (2889.6 ± 711.1 vs. 2597.0 ± 725.1 g, $p = 0.043$), and longer hospital stay (10.9 ± 10.3 vs. 7.4 ± 6.7 days, $p = 0.007$). Overall mortality was 12.1%, with no significant group difference ($p = 0.28$).

Conclusion: Neonatal abdominal distension was nearly equally due to obstructive and non-obstructive causes, with congenital malformations being major contributors. Early diagnosis, screening for anomalies, and timely intervention are essential to improve outcomes.

Keywords: Abdominal distension, Infant, Neonatal intensive care unit, Newborn, Treatment outcome

Introduction

Abdominal distension is one of the most common and concerning clinical presentations in neonatal intensive care units, particularly in preterm infants (1). Its causes range from benign and transient conditions to life-threatening emergencies requiring urgent surgical intervention (2). Congenital malformations are the most frequent cause of abdominal distension in neonates, accounting for 44.6% of cases in preterm infants and 61.8% in term infants (2). Sepsis is identified as the leading cause in preterm infants (35.4%) and the second most common cause in term infants (21.3%) (2). In addition, several functional disorders contribute to this presentation, including necrotizing enterocolitis (NEC)—a major cause of morbidity in preterm

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Please cite this paper as:
Oboodi R, Erfani B, Barzegar H, Hashemi Z, Razavinejad SM, Rezaei M, Bahrami R, Najib KhS, Hemmati F. Neonatal Abdominal Distension: A Spectrum of Causes and Clinical Outcomes in a Tertiary NICU. Iranian Journal of Neonatology. 2026 Oct: 17(4). DOI: 10.22038/ijn.2026.91135.2769

infants with a strong association with low birth weight and prematurity (1); meconium-related disorders such as meconium ileus and meconium plug syndrome, particularly in very low birth weight infants (3); chronic intestinal pseudo-obstruction (CIPO), a rare but severe condition characterized by feeding intolerance, bilious vomiting, and abdominal distension (4, 5); and congenital hypothyroidism, which may present solely with abdominal distension due to markedly reduced intestinal motility (6).

Therefore, the present study was conducted to comprehensively evaluate the etiologies, associated congenital anomalies, management strategies, and short-term outcomes of neonates presenting with abdominal distension in a tertiary referral center over a three-year period. Although individual causes such as necrotizing enterocolitis or specific congenital malformations have been widely investigated, fewer studies have simultaneously examined the full etiologic spectrum of abdominal distension and compared the clinical characteristics and outcomes between obstructive and non-obstructive causes within a single NICU population. Moreover, regional variations in referral patterns, availability of diagnostic modalities, surgical expertise, and neonatal intensive care resources may significantly influence both disease distribution and outcomes. Given the limited comprehensive data from our region, this study aims to provide locally relevant epidemiological and clinical insights to support earlier differentiation, optimized management strategies, and improved neonatal prognosis.

Methods

This retrospective cross-sectional study was conducted at Namazi Hospital, a tertiary referral center affiliated with Shiraz University of Medical Sciences in Shiraz, Iran. The study included all neonates admitted with abdominal distension between September 23, 2021, and September 22, 2024.

Neonates who presented with abdominal distension were included. Cases with incomplete medical records or missing essential clinical, diagnostic, or outcome data were excluded.

Data were collected from hospital records using a structured checklist. The recorded variables included demographic characteristics (sex, age in days, gestational age in weeks, birth weight in grams, and duration of hospital stay in days); clinical features (type of abdominal distension classified as obstructive or non-obstructive, and associated symptoms such as vomiting, constipation, and respiratory distress); underlying etiology of the abdominal distension (e.g., Hirschsprung disease, necrotizing enterocolitis [NEC], sepsis, imperforate anus, etc.); associated congenital anomalies (with a focus on congenital heart disease and other structural anomalies); diagnostic evaluations performed (abdominal X-ray, abdominal ultrasound, contrast studies, and rectal full-thickness biopsy); treatment modalities (antibiotic therapy, warm saline enema, botulinum toxin injection, and types of surgical interventions such as colostomy); complications (including intestinal perforation, fistulas, sepsis, and short bowel syndrome); and final outcomes (discharge in good condition, discharge with complications, discharge on parental request, and death).

Obstructive abdominal distension was defined as distension caused by mechanical gastrointestinal obstruction, confirmed through clinical and/or radiological findings. Non-obstructive abdominal distension referred to distension without evidence of anatomical obstruction, typically due to sepsis, prematurity, metabolic disorders, or unknown causes.

Statistical analysis was performed using SPSS software version 26 (IBM Corp., Armonk, NY, USA). Continuous variables were reported as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. The Mann–Whitney U test was used to compare continuous variables between neonates with obstructive and non-obstructive abdominal distension due to non-normal distribution of data, which was checked using the Shapiro–Wilk test. The Chi-square test was used to compare categorical variables between the two groups. A p-value less than 0.05 was considered statistically significant.

Ethical approval

The study protocol confirmed the ethical guidelines of the 1975 Helsinki Declaration. The publication of this case was approved by the ethics committee of Shiraz University of Medical Sciences (Ethics code: IR.SUMS.MED.REC.1403.700).

Results

Among 171 neonates presenting with abdominal distension, 109 (63.7%) were male and 62 (36.3%) were female. The mean age at presentation was 10.46 ± 12.12 days, with a mean gestational age (GA) of 35.57 ± 4.48 weeks and a mean birth weight of 2775.5 ± 781.6 grams. The

Table 1. Comparison between neonates with obstructive and non-obstructive abdominal distension

	Obstructive (N=84)	Non-obstructive (N=87)	p-value *
Age (day)	5.01±8.29	13.98±13.55	<0.001
GA (week)	37.81±3.72	37.23±4.74	0.059
Weight (gram)	2889.6±711.1	2597.0±725.12	0.043
Hospital duration(day)	10.92±10.26	7.38±6.68	0.007

*Assessed by the Mann-Whitney test. GA: gestational age

average duration of hospital stay was 8.94 ± 9.5 days.

Abdominal distension was categorized as non-obstructive in 87 neonates (50.9%) and obstructive in 84 (49.1%). Table 1 presents a comparison of demographic and clinical parameters between the two groups.

The most common underlying causes of abdominal distension were unknown etiology (n=34, 19.9%), imperforate anus (n=34, 19.9%), Hirschsprung disease (n=31, 18.1%), necrotizing enterocolitis (NEC) (n=15, 8.8%), sepsis (n=18, 10.5%), duodenal atresia (n=14, 8.2%), annular pancreas (n=8, 4.7%), meconium plug (n=8, 4.7%), jejunal atresia (n=7, 4.1%), cecal perforation (n=7, 4.1%), and less frequently, malrotation, mechanical obstruction, metabolic diseases, hydrops fetalis, meconium ileus, diaphragmatic hernia, and bowel perforation (each n=1–2, <2%).

Associated congenital anomalies were present in 61 patients (35.7%), with congenital heart disease being the most common (n=50, 81.9% of those with anomalies). Other anomalies included clubfoot (n=3), cleft palate (n=2), vertebral anomalies (n=2), and one case each of choanal atresia, cleft lip, CNS anomaly, ear anomaly, omphalocele, polydactyly, and posterior urethral valves.

The most frequently observed accompanying clinical symptoms were vomiting (n=60, 35.1%), constipation (n=9, 5.3%), and respiratory distress (n=9, 5.3%).

Diagnostic tools included abdominal X-ray in 112 patients (65.5%), abdominal ultrasound in 13 (7.6%), contrast study in 6 (3.5%), and rectal full-thickness biopsy in 20 (11.7%).

Empirical antibiotic therapy was administered in 156 neonates (91.2%). Surgical intervention was required in 64 patients (37.4%), with colostomy being the most commonly performed procedure (n=32, 18.7%). Warm saline enemas were used in 33 patients (19.3%), and botulinum toxin injection was administered in 2 (1.2%).

Complications included intestinal perforation in 2 cases (3.1%), perineal fistula in 1 (1.6%), and vestibulovaginal fistula in 1 (1.6%). Postoperative complications included sepsis in 4 patients (2.4%) and short bowel syndrome in 1 (0.6%).

Regarding outcomes, 115 patients (73.2%) were discharged in good condition, 17 (10.8%) were discharged upon request, and 6 (3.8%) were discharged with some health issues. The overall mortality rate was 12.1% (n=19). There was no statistically significant difference in outcomes between the obstructive and non-obstructive groups (p = 0.28).

Discussion

In this three-year review of neonates presenting with abdominal distension, we found an almost equal distribution between obstructive and non-obstructive etiologies, highlighting the diverse spectrum of underlying conditions encountered in the NICU. Although the demographic profile was broadly comparable, neonates with obstructive causes tended to present earlier, with higher birth weights and longer hospital stays, suggesting a more acute clinical course and the need for prolonged management. The etiological pattern was dominated by congenital gastrointestinal malformations, particularly imperforate anus and Hirschsprung disease, whereas necrotizing enterocolitis and sepsis accounted for a substantial proportion of non-obstructive cases. Notably, over one-third of affected neonates had associated congenital anomalies, most commonly congenital heart disease, underscoring the importance of a thorough systemic evaluation. Vomiting emerged as the most frequent accompanying symptom, while imaging—predominantly plain abdominal radiography—remained central to initial evaluation. Nearly two-fifths of patients required surgical intervention, with colostomy being the most frequent procedure. Despite the complexity of cases, most neonates were discharged in good condition, although the overall mortality rate exceeded 10%, reflecting the potentially severe course of abdominal distension in this population.

In our cohort, congenital gastrointestinal malformations—particularly imperforate anus and Hirschsprung disease—were the most

common identifiable causes of abdominal distension, emphasizing the major role of structural anomalies in the neonatal population. This finding aligns with previous literature, which reports that congenital malformations account for a large proportion of neonatal abdominal distension, with rates ranging from 44.6% in preterm infants to 61.8% in term infants (2). In the same study, congenital megacolon (Hirschsprung disease) was identified as the leading cause in term newborns (33.8%) and the second most common cause in preterm newborns (13.8%) (2). Hirschsprung disease typically manifests in the neonatal period, with over 80% of affected infants becoming symptomatic during this time (7). While delayed passage of meconium is the hallmark sign (34), abdominal distension is also a common presentation, reported in 83.3% of cases in one study, followed by constipation in 77.8% (8).

The relatively high proportion of cases with undetermined etiology in our series mirrors findings from other NICU-based studies and may be attributed to the transient nature of some functional gastrointestinal disorders or limitations in available diagnostic resources. Among the non-obstructive causes, necrotizing enterocolitis (NEC) and sepsis were most frequently encountered, consistent with their well-documented role in neonatal gastrointestinal pathology. Sepsis has been reported as the leading cause of abdominal distension in preterm infants (35.4%) and the second most common cause in term infants (21.3%) (2). This association is multifactorial, involving intestinal dysmotility induced by inflammatory mediators, progression to NEC with subsequent perforation and systemic infection, and the interplay between microbial colonization, immature immune function, intestinal ischemia, and systemic inflammation (9, 10).

In our study, neonates with obstructive causes presented at a younger age, had higher birth weights, and experienced longer hospital stays compared to those with non-obstructive etiologies. These differences likely reflect the acute onset, urgent surgical requirements, and more intensive perioperative care associated with obstructive conditions.

A noteworthy finding in our series was the high prevalence of associated congenital anomalies, present in over one-third of neonates with abdominal distension, with congenital heart disease (CHD) being by far the most frequent. The predominance of CHD among affected infants is consistent with prior studies demonstrating a strong association between gastrointestinal malformations and cardiac defects, which may arise from shared embryological pathways or syndromic conditions (11-13). Recognition of this association is clinically important, as the presence of cardiac anomalies can significantly influence perioperative risk, timing of surgical intervention, and overall prognosis. Other anomalies in our cohort included musculoskeletal, craniofacial, genitourinary, and central nervous system malformations, reflecting the broad spectrum of multisystem involvement seen in some congenital syndromes. Previous reports have also highlighted the need for comprehensive evaluation of neonates with gastrointestinal malformations to detect concomitant anomalies early, allowing for coordinated multidisciplinary management and optimization of outcomes (14). In this context, routine screening—particularly echocardiographic assessment—should be considered a standard component of the diagnostic workup in neonates presenting with abdominal distension, especially when structural gastrointestinal pathology is suspected.

A major practical challenge in neonatal intensive care is the early differentiation of abdominal distension caused by NEC, sepsis-associated ileus, and mechanical obstruction, particularly in preterm infants (15). These conditions frequently share overlapping and initially subtle clinical manifestations, including feeding intolerance, increased gastric residuals, abdominal distension, lethargy, and temperature instability (16). Early-stage NEC may present solely with progressive distension before radiographic hallmarks such as pneumatosis intestinalis or portal venous gas become apparent (17). Similarly, sepsis may lead to functional ileus and bowel dilation without primary intestinal pathology, often accompanied by nonspecific laboratory abnormalities (18). In contrast, obstructive etiologies may manifest with bilious vomiting, failure to pass meconium, asymmetric abdominal distension, or characteristic radiographic findings such as multiple air–fluid levels or a gasless abdomen. However, clinical overlap is common, and definitive differentiation often requires serial physical examinations, repeated imaging, and close hemodynamic monitoring (19, 20).

Management approaches in our cohort reflected the broad etiological spectrum of neonatal abdominal distension, ranging from conservative treatment to urgent surgical intervention. Empirical antibiotic therapy was

initiated in 91.2% of cases, a rate comparable to that reported in other NICU-based series, where early antimicrobial coverage is routinely employed to prevent rapid deterioration from sepsis while awaiting microbiological confirmation (9). Surgical intervention was required in over one-third of our patients, with colostomy being the most common procedure, a finding consistent with previous reports from centers with a high prevalence of anorectal malformations and Hirschsprung disease (7, 11). Non-surgical interventions, such as warm saline enemas and, in rare cases, botulinum toxin injection, were selectively applied for functional or partial obstructions, mirroring practices described in other studies (21).

The overall mortality rate in our study was 12.1%, which lies within the range reported for neonatal surgical and critical care populations (8–20%) in similar low- and middle-income settings (22, 23). Mortality was highest in neonates with NEC, severe sepsis, or complex congenital anomalies, reinforcing the well-documented role of these conditions in adverse outcomes (14, 24). We observed no statistically significant difference in survival between obstructive and non-obstructive groups in our cohort; however, a targeted comparison of survival between these two etiologic categories is not well represented in the published literature, and direct comparative data are scarce.

A major strength of this study is its well-defined cohort collected over a three-year period in a tertiary referral NICU, providing a comprehensive overview of the etiological spectrum, management approaches, and outcomes of neonatal abdominal distension in our setting. The inclusion of both obstructive and non-obstructive cases allowed for direct comparison between these two major categories, which is seldom reported in the literature. Another strength is the detailed capture of associated congenital anomalies, enabling analysis of systemic involvement and highlighting the need for multidisciplinary evaluation.

This study is subject to several limitations. Its single-center design may limit the generalizability of the findings to other settings with different patient demographics, referral patterns, or resource availability. The retrospective nature of data collection could have led to incomplete documentation of clinical features, diagnostic workup, or follow-up outcomes. Some cases remained of unknown etiology, which may reflect limitations in available diagnostic tools or lack of long-term follow-up to confirm transient or functional causes. Additionally, the absence of systematic long-term follow-up prevented assessment of important outcomes such as neurodevelopmental status and post-surgical complications, which are critical determinants of long-term neonatal prognosis.

Conclusion

Neonatal abdominal distension encompasses a wide range of etiologies, with congenital gastrointestinal malformations and infectious or inflammatory processes being the most prominent causes in our cohort. The high prevalence of associated congenital anomalies, particularly congenital heart disease, highlights the need for comprehensive systemic evaluation in affected neonates. Future multicenter prospective studies with long-term follow-up are warranted to better delineate prognostic factors, refine management strategies, and reduce morbidity and mortality in this vulnerable population.

Acknowledgments

The authors would like to thank Shiraz University of Medical Sciences for supporting this project. This paper is relevant to BE's thesis, project no. 32058.

Conflicts of interest

The authors declare no conflict of interest related to this study.

References

1. Cheromcha DP, Hyman PE. Neonatal necrotizing enterocolitis. Inflammatory bowel disease of the newborn. Dig Dis Sci. 1988;33(3 Suppl):78S-84S.
2. Chen A, Du J, Du LZ. [Clinical characteristics of abdominal distention in early newborns]. Zhongguo Dang Dai Er Ke Za Zhi. 2013;15(12):1074-1078. Chinese.
3. Mimouni F, Hirsh M, Ovadia J, Reisner SH. Abdominal distension in very low birth weight, small for gestational age infants. Clin Pediatr (Phila). 1984;23(9):526.
4. Khan MR, Maheshwari A, Robertson DJ, Khlevner J, Kapur RP, Sood MR. Persistent abdominal distension, bilious emesis, and feeding intolerance in an infant without anatomical bowel obstruction. JPGN Rep. 2024;6(1):65-68.
5. Huang H, Huang J, Huang W, Huang N, Duan M. Breast milk jaundice affects breastfeeding: From the perspective of intestinal flora and SCFAs-GPR41/43. Front Nutr. 2023;10:1121213.
6. Antezana VLE, Dorado JPH, Justiniano WM, Colque DMT, Parada VU, Arias PAC. ODP374 Abdominal Distention as a Unique Sign of Congenital

Hypothyroidism. J Endocr Soc. 2022;6(Suppl 1): A598.
7. Puri P, Nakamura H. Epidemiology and clinical characteristics of Hirschsprung's disease. InHirschsprung's Disease and Allied Disorders. 2019;167-174. Cham: Springer International Publishing.
8. Ali A, Haider F, Alhindi S. The Prevalence and Clinical Profile of Hirschsprung's Disease at a Tertiary Hospital in Bahrain. Cureus. 2021; 13(1):e12480.
9. Shane AL, Sánchez PJ, Stoll BJ. Neonatal sepsis. Lancet. 2017;390(10104):1770-1780.
10. Duess JW, Sampah ME, Lopez CM, Tsuboi K, Scheese DJ, Sodhi CP, et al. Necrotizing enterocolitis, gut microbes, and sepsis. Gut Microbes. 2023; 15(1):2221470.
11. Davenport M, Spitz L, Coran A. Operative pediatric surgery: CRC press; 2013.
12. Orun UA, Bilici M, Demirçeken FG, Tosun M, Ocal B, Cavusoglu YH. Gastrointestinal system malformations in children are associated with congenital heart defects. Anadolu Kardiyol Derg. 2011;11(2):146-149.
13. Gokhroo RK, Gupta S, Arora G, Bisht DS, Padmanabhan D, Soni V. Prevalence of congenital heart disease in patients undergoing surgery for major gastrointestinal malformations: An Indian study. Heart Asia. 2015;7(1):29-31.
14. Neu J, Walker WA. Necrotizing enterocolitis. N Engl J Med. 2011;364(3):255-264.
15. Garg PM, Paschal JL, Ansari MAY, Block D, Inagaki K, Weitkamp JH. Clinical impact of NEC-associated sepsis on outcomes in preterm infants. Pediatr Res. 2022;92(6):1705-1715.
16. Kariniotaki C, Thomou C, Gkentzi D, Panteris E, Dimitriou G, Hatzidaki E. Neonatal Sepsis: A Comprehensive Review. Antibiotics. 2025;14(1):6.
17. Esposito F, Mamone R, Di Serafino M, Mercogliano C, Vitale V, Vallone G, et al. Diagnostic imaging features of necrotizing enterocolitis: a narrative review. Quant Imaging Med Surg. 2017;7(3):336-344.
18. Yoseph BP, Klingensmith NJ, Liang Z, Breed ER, Burd EM, Mittal R, et al. Mechanisms of intestinal barrier dysfunction in sepsis. Shock. 2016;46(1):52-59.
19. Gilfillan M, Bhandari V. Biomarkers for the diagnosis of neonatal sepsis and necrotizing enterocolitis: Clinical practice guidelines. Early Hum Dev. 2017;105:25-33.
20. Hull NC, Kurian J, Garg H, Winant AJ, Lee EY, editors. Neonatal Bowel Emergencies: Practical Approach to Diagnosis. Seminars in Roentgenology; 2024: Elsevier.
21. Roorda D, Abeln ZA, Oosterlaan J, van Heurn LW, Derikx JP. Botulinum toxin injections after surgery for Hirschsprung disease: Systematic review and meta-analysis. World J Gastroenterol. 2019; 25(25):3268-3280.
22. Hasan MS, Islam N, Mitul AR. Neonatal Surgical morbidity and mortality at a single tertiary center in a low- and middle-income country: A retrospective study of clinical outcomes. Front Surg. 2022;9:817528.
23. Wella H, Farahat S. Pattern and Management Outcomes of Neonatal Acute Surgical Conditions in Alexandria, Egypt. East and Central African Journal of Surgery. 2015;20(2):69-79.
24. Ali I, Mufti GN, Bhat NA, Baba AA, Sheikh KA, Hamid R, et al. Assessment of predictors of mortality in neonatal intestinal obstruction. J Neonat Surg. 2018;7(1):2.