American Journal of Medicine and Medical Sciences 2026, 16(1): 241-242
DOI: 10.5923/j.ajmms.20261601.53

Clinical, Diagnostic, and Pathogenetic Aspects of Gastrointestinal Disorders in Infants with Hypoxic–Ischemic Central Nervous System Injury

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Abstract The article presents the results of implementing scientific research findings into the clinical practice of a healthcare institution. The aim of the study was to identify the characteristics of the disease course and to develop methods for the early diagnosis of gastrointestinal disorders (GIDs) in infants during the first year of life with perinatal central nervous system injuries (PCNSI). A total of 20 children aged from 1 month to 1 year were examined. It was established that the leading risk factor for gastrointestinal disorders (GIDs) is hypoxic–ischemic injury of the central nervous system, which results in autonomic–visceral dysfunctions. A differentiated diagnostic algorithm was proposed, including the analysis of maternal and intranatal risk factors, assessment of autonomic status, and ultrasound examination of the upper gastrointestinal tract. The clinical and economic effectiveness of the proposed approach has been demonstrated, as it allows a reduction in the duration of hospitalization and the volume of pharmacological therapy.

Keywords Infants, Perinatal central nervous system pathology, Gastrointestinal disorders, Functional intestinal disorders, Autonomic–visceral dysfunctions, Differentiated diagnosis

1. Introduction

One of the pressing problems of modern pediatrics is the high prevalence of comorbid pathology, particularly gastrointestinal disorders in children with perinatal central nervous system injury (PCNSI). According to the literature, perinatal nervous system injuries account for 60–80% of all neurological pathology in infants, while 65–85% of children with perinatal central nervous system injury (PCNSI) exhibit various functional disorders of the gastrointestinal tract (GIT) [1,2]. The mechanism underlying the development of gastrointestinal disorders in perinatal central nervous system injury is complex and is associated with impaired autonomic regulation of digestive system functions against the background of hypoxic–ischemic damage to brain structures. Early diagnosis and correction of these conditions are crucial for preventing delays in physical and cognitive development, chronicity of pathology, and for improving the child's quality of life. Despite their importance, issues of differentiated diagnosis and management of gastrointestinal disorders in infants with perinatal central nervous system injury remain insufficiently studied.

Objective of the study: To identify the characteristics of the disease course and to develop criteria for the early diagnosis of gastrointestinal disorders in infants during the first year of life with perinatal central nervous system pathology.

Received: Dec. 29, 2025; Accepted: Jan. 17, 2026; Published: Jan. 22, 2026
Published online at http://journal.sapub.org/ajmms

2. Materials and Methods

The study involved 20 children aged from 1 month to 1 year who were hospitalized at Clinic No. 22 of TSMU with the following diagnoses: unspecified functional intestinal disorder (K59.9) – 7 patients (35%), functional diarrhea (K59.1) – 6 patients (30%), and constipation (K59.0) – 7 patients (35%). All children underwent a comprehensive examination, which included:

1. Analysis of the perinatal history: maternal age, maternal somatic pathology during pregnancy, and complications of pregnancy and childbirth.
2. Clinical and neurological examination with assessment of autonomic status.
3. Anthropometry (weight, height, BMI) according to WHO standards.
4. Instrumental methods: neurosontography (NSG), ultrasound examination of the brain and abdominal organs, and ultrasound of the upper gastrointestinal tract before, during, and after feeding.
5. Laboratory investigations: complete blood count and stool analysis.

For statistical data processing, MS Excel 2007 and Statistica 6.0 software were used. Mean values (M), standard error (m), and Student's t-test were calculated. Differences were considered statistically significant at $p < 0.05$.

3. Results and Discussion

Analysis of Maternal Risk Factors. The study revealed significant differences between the groups. Among mothers of children with perinatal central nervous system injury (PCNSI), the majority were over 30 years of age (66.92% vs. 13.34% in the control group, $p < 0.01$). Maternal somatic pathology during pregnancy was observed in 80.83% of cases in the study group (compared to 33.33% in the control group), with anemia (62%), gastrointestinal diseases (44%), and endocrine disorders (12%) predominating. Features of the Intranatal Period. In the study group, spontaneous delivery occurred in only 28.57% of cases (compared to 73.33% in the control group), cesarean section was performed in 41.35%, and labor stimulation in 30.08%. Acute intranatal hypoxia (Apgar score <7 at 1 minute) was significantly more frequently observed in children with severe forms of perinatal central nervous system injury (PCNSI). Neurological Status and Autonomic Disorders. All children in the study group exhibited a syndrome of autonomic–visceral disorders in combination with a predominant neurological syndrome (muscle dystonia – 67.3%, increased neuro-reflex excitability – 20.5%). The severity of autonomic disturbances (changes in dermographism, acrocyanosis, pulse lability, sleep disturbances) correlated with the severity of perinatal central nervous system injury (PCNSI).

Characteristics of Gastrointestinal Disorders. Clinically, gastrointestinal disorders (GIDs) manifested in two main forms: 1) predominance of regurgitation and vomiting syndrome; 2) predominance of abdominal pain syndrome. All patients exhibited a combination of dyspeptic and pain syndromes along with autonomic lability.

Ultrasound Diagnostics. Dynamic ultrasound examination of the upper gastrointestinal tract (before, during, and after feeding) proved to be highly informative. In children with predominance of sympathetic tone, reduced gastric motility, cardia insufficiency, and gastroesophageal reflux were observed. In cases of vagotonia, accelerated gastric emptying, narrowing of the pyloric canal, and duodenogastric reflux were characteristic.

Differentiated Diagnostic Algorithm. Based on the obtained data, criteria for the early diagnosis of gastrointestinal disorders (GIDs) in children with perinatal central nervous system injury (PCNSI) were developed, including:

1. Identification of a complicated perinatal history (maternal age >30 years, somatic pathology, complicated childbirth).
2. Assessment of the severity and type of autonomic disturbances.
3. Performance of dynamic ultrasound examination of the upper gastrointestinal tract to determine the nature of motor dysfunctions and the type of autonomic imbalance.

This approach allows for the differential diagnosis of functional gastrointestinal disorders against the background of cerebral ischemia as early as the first year of life.

4. Conclusions

1. Gastrointestinal disorders in infants during the first year of life with perinatal central nervous system injury (PCNSI) are predominantly functional in nature and are pathogenetically associated with autonomic–visceral dysfunctions resulting from hypoxic–ischemic CNS injury.
2. The key risk factors for the development of gastrointestinal disorders (GIDs) are maternal age over 30 years, the presence of maternal somatic pathology during pregnancy (particularly anemia and gastrointestinal diseases), and complicated labor with the development of acute hypoxia.
3. Dynamic ultrasound examination of the upper gastrointestinal tract is a highly informative, non-invasive method that allows for the identification of the type of motor dysfunction (hypomotility or hypermotility) and provides indirect assessment of the nature of autonomic imbalance (sympathicotonia or vagotonia).
4. The proposed differentiated diagnostic algorithm, based on a comprehensive assessment of medical history, clinical and neurological status, and ultrasound data, facilitates the early detection and targeted management of gastrointestinal disorders (GIDs), improving prognosis, reducing the risk of chronicity, and proving to be economically feasible.

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