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Improving Treatment and Diagnostic Measures for Pneumonia in Infants with Dyspeptic Syndrome

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Abstract

Background. Pneumonia in infants remains one of the leading causes of hospitalization and mortality. A distinct group consists of children in whom the disease is accompanied by dyspeptic syndrome, which significantly worsens the course of the illness, contributes to dehydration and impaired nutritional status, and prolongs treatment.

Objective. To evaluate the effectiveness of a comprehensive treatment and diagnostic approach for pneumonia in infants with dyspeptic syndrome.

Materials and methods. A prospective study included 120 children aged 1 to 12 months with clinically and radiographically confirmed community-acquired pneumonia, treated at the pediatric department of the Regional Multidisciplinary Children's Center. Group I comprised 50 children with pneumonia and dyspeptic syndrome who received modified therapy including Hilak Forte; Group II comprised 50 children with pneumonia and dyspeptic syndrome who received standard therapy; the control group consisted of 20 apparently healthy children. All patients underwent clinical examination, complete blood count, C-reactive protein and procalcitonin measurement, chest radiography and lung ultrasound. Fecal calprotectin and coprological examination were used to assess intestinal inflammation.

Results. Combination therapy was followed by a significant reduction in systemic inflammatory markers (leukocytes 15.8±2.9 to 8.7±1.8 ×109/L; CRP 48.6±10.4 to 8.2±3.1 mg/L; procalcitonin 2.3±0.8 to 0.42±0.15 ng/mL; ESR

27.5±6.2 to 11.3±3.7 mm/h; all p<0.001) and by a decline in fecal calprotectin. In Group I, temperature normalization (2.7±0.8 vs. 3.6±1.0 days), diarrhea relief (2.5±0.7 vs. 4.4±1.2 days), appetite recovery (3.0±0.8 vs. 5.1±1.3 days) and length of hospitalization (8.3±1.4 vs. 10.5±1.6 days) were significantly shorter than in Group II.

Conclusion. The results confirm the value of a comprehensive approach to the management of infants with pneumonia. Combining clinical, laboratory and instrumental examination with gastrointestinal assessment permits timely identification of associated disorders and individualized treatment. This is particularly important in young patients, in whom even moderate dyspeptic disorders may lead to dehydration, electrolyte imbalance and deterioration of nutritional status.

Keywords: Pneumonia; infants; dyspeptic syndrome; fecal calprotectin; Hilak Forte; intestinal microbiota.

Introduction

Pneumonia is one of the most common infectious and inflammatory diseases of the respiratory system in young children and remains a leading cause of hospitalization and mortality during the first years of life. Despite considerable advances in modern pediatrics — the introduction of vaccination, improved diagnostic methods and expanded options for antibacterial therapy — the incidence of severe forms of the disease in children in the first year of life remains high [1,2].

The anatomical and physiological features of the respiratory system in infants, the immaturity of the immune system and the insufficient activity of local protective factors in the mucous membranes create favorable conditions for the rapid spread of infection and the development of respiratory failure. At the same time, the systemic inflammatory response exerts a pronounced influence on the functional state of the gastrointestinal tract. In infants, pneumonia is frequently accompanied by dyspeptic syndrome, manifested by loss of appetite, frequent regurgitation, vomiting, loose stools, intestinal colic and digestive disorders. The development of dyspeptic syndrome results from the combined effects of infection, intoxication, tissue hypoxia, microcirculatory disturbances and changes in the intestinal microbiota [4,5].

The use of systemic antibacterial drugs constitutes an additional risk factor. Despite their high efficacy against pneumonia pathogens, antibiotics may alter the quantitative and qualitative composition of the intestinal microflora, leading to antibiotic-associated diarrhea, aggravation of dyspeptic symptoms and reduced treatment effectiveness [6,7,8].

In recent years, increasing attention has been paid to the state of the intestinal microbiota as a factor determining the effectiveness of the immune response. Disruption of the microbiome is accompanied by changes in the production of short-chain fatty acids, decreased intestinal barrier function, increased mucosal permeability and intensified systemic inflammation. Correction of these disturbances is considered an important component of comprehensive therapy in children with infectious diseases [4,5,9].

One of the agents used to restore the physiological state of the intestinal microbiota is Hilak Forte, which contains metabolic products of normal intestinal flora. The drug helps to restore physiological acidity of the intestinal contents, improve the nutrition of the intestinal epithelium, normalize water and electrolyte balance and reduce the severity of dyspeptic symptoms. Its use within combination therapy may improve the tolerability of antibacterial treatment and accelerate clinical recovery. Although individual publications have addressed intestinal microbiota disorders in children, a comprehensive treatment and diagnostic approach to the combination of pneumonia and dyspeptic syndrome in infants remains insufficiently studied, and further refinement of diagnostic and treatment algorithms for this category of patients is required [6,7,8].

Accordingly, the aim of the present study was to evaluate the effectiveness of a comprehensive treatment and diagnostic approach for pneumonia in infants with dyspeptic syndrome, incorporating modern methods for diagnosing inflammation, monitoring of clinical and laboratory parameters, appropriate antibacterial therapy, correction of fluid and electrolyte imbalance, and the administration of Hilak Forte to reduce the manifestations of dyspeptic syndrome.

Methods

1. Study design and setting

A prospective comparative study was conducted at the pediatric department of the Regional Multidisciplinary Children's Center. The study included 120 infants aged 1 to 12 months with clinically and radiographically confirmed community-acquired pneumonia.

2. Participants and group allocation

All children were divided into three groups. Group I (main group) consisted of 50 children with pneumonia and dyspeptic syndrome who received modified therapy including Hilak Forte. Group II (comparison group) consisted of 50 children with pneumonia and dyspeptic syndrome who received standard therapy. The control group consisted of 20 apparently healthy children of the corresponding age.

3. Clinical and instrumental examination

On admission, all children underwent a comprehensive clinical, laboratory and instrumental examination. The clinical examination included assessment of general condition, determination of the degree of respiratory failure, measurement of oxygen saturation by pulse oximetry, physical examination of the lungs, assessment of the degree of dehydration, and analysis of stool character and frequency of bowel movements. Instrumental diagnostics comprised chest radiography in two projections and lung ultrasound [3].

4. Laboratory assessment

Laboratory examination included a complete blood count and determination of C-reactive protein and procalcitonin levels.

To assess the severity of inflammatory changes in the intestinal mucosa, all children in the study group underwent fecal calprotectin testing. Stool samples were collected within the first 24 hours after hospitalization and on days 10–12 of treatment. Fecal calprotectin concentrations were determined by enzyme-linked immunosorbent assay (ELISA) using certified diagnostic kits in accordance with the manufacturer's instructions. Fecal calprotectin was regarded as a non-invasive biomarker of intestinal inflammation, permitting indirect assessment of the severity of the intestinal mucosal inflammatory response and of the effectiveness of therapy [9]. Because physiological calprotectin values are higher and more variable in infants than in older children, results were interpreted with reference to age-specific values [10].

A coprological examination was additionally performed to assess the character of food digestion and the presence of mucus, leukocytes, neutral fat and fatty acids.

5. Therapeutic intervention

Hilak Forte was included in the combination therapy of Group I patients at an age-appropriate dosage of 15–20 drops three times daily before feeding for 10–14 days. The drug was used to correct intestinal microbiota disturbances, reduce the severity of dyspeptic symptoms, improve the tolerability of antibacterial therapy and restore gastrointestinal function, consistent with its known properties in supporting the intestinal microbiota.

Results

1. Clinical characteristics on admission and clinical dynamics

On admission, the most common symptoms were cough, fever, tachypnea and signs of respiratory failure. Patients in the main group additionally presented with dyspeptic disturbances of varying severity, most frequently diarrhea, regurgitation, decreased appetite and intestinal colic.

Following combination therapy, a gradual reduction in the severity of gastrointestinal disturbances was observed. By the third day of treatment, the frequency of regurgitation decreased, the intensity of intestinal colic subsided and appetite improved. By the end of the first week, most patients showed normalization of stool patterns and restoration of enteral nutrition. These data indicate a marked improvement in clinical gastrointestinal symptoms during treatment. Concurrently, an improvement in general condition, increased physical activity and normalization of sleep were noted.

2. Dynamics of laboratory markers of inflammation

Laboratory tests performed before treatment revealed signs of a systemic inflammatory process in most children, manifested by leukocytosis, a neutrophilic shift and elevated levels of C-reactive protein and procalcitonin. Follow-up examination after completion of treatment revealed a significant reduction in laboratory markers of inflammation (Table 1).

Table 1. Dynamics of laboratory parameters (M±SD)

Parameter	Before treatment	After treatment	p
Leukocytes (×10⁹/L)	15.8±2.9	8.7±1.8	<0.001

Parameter	Before treatment	After treatment	p
CRP (mg/L)	48.6±10.4	8.2±3.1	<0.001
Procalcitonin (ng/mL)	2.3±0.8	0.42±0.15	<0.001
ESR (mm/h)	27.5±6.2	11.3±3.7	<0.001

Note: CRP — C-reactive protein; ESR — erythrocyte sedimentation rate.

3. Dynamics of fecal calprotectin

Particular attention was paid to fecal calprotectin levels as a marker of inflammatory changes in the intestinal mucosa. On admission, most children in the main group showed elevation of this indicator. After completion of the course of combination therapy a downward trend was observed, accompanied by clinical improvement and a reduction in the severity of dyspeptic syndrome. The results demonstrate a decrease in the severity of inflammatory changes in the intestine in parallel with resolution of the clinical symptoms of the disease. In children under one year of age, fecal calprotectin levels were interpreted with reference to age-specific values.

4. Timeframes for resolution of the main clinical manifestations

During treatment, a more rapid resolution of clinical symptoms was observed in the main group. In most patients, body temperature normalized within the first three days of treatment. Concurrently, signs of respiratory failure decreased, oxygen saturation improved, and the severity of cough and intoxication syndrome declined. The duration of the main clinical symptoms is presented in Table 2.

Table 2. Timeframes for resolution of the main clinical manifestations, days (M±SD)

Indicator	Group I (n=50)	Group II (n=50)	p
Temperature normalization	2.7±0.8	3.6±1.0	<0.05
Cough resolution	7.1±1.3	8.5±1.6	<0.05
Diarrhea relief	2.5±0.7	4.4±1.2	<0.001
Appetite recovery	3.0±0.8	5.1±1.3	<0.001
Duration of hospitalization	8.3±1.4	10.5±1.6	<0.01

Note: Group I — modified therapy including Hilak Forte; Group II — standard therapy.

Thus, the integrated treatment and diagnostic approach was associated with positive clinical dynamics, a reduction in the severity of the systemic inflammatory response, decreased fecal calprotectin levels and more rapid recovery of gastrointestinal function.

Discussion

Pneumonia in infants remains one of the most pressing problems in modern pediatrics owing to the high rate of hospitalization, the risk of complications and the specific course of the disease in this age group. Immaturity of the immune system, imperfect local mucosal defense mechanisms and high susceptibility to infectious agents contribute to the rapid development of inflammation and the formation of a systemic inflammatory response. At the same time, children in the first

year of life often experience gastrointestinal dysfunction manifested by dyspeptic syndrome, which may be caused both by the infectious process itself and by antibacterial therapy.

The present study evaluated a comprehensive diagnostic and treatment approach for infants with community-acquired pneumonia accompanied by dyspeptic syndrome. The proposed algorithm included not only standard diagnostic and treatment methods for pneumonia but also assessment of intestinal function using fecal calprotectin levels, together with interventions aimed at correcting dyspeptic disorders.

The results showed that on admission most patients exhibited pronounced signs of systemic inflammation, accompanied by elevated C-reactive protein and procalcitonin levels and changes in the complete blood count. Children with dyspeptic syndrome additionally experienced varying degrees of gastrointestinal disturbance, including diarrhea, frequent regurgitation, decreased appetite and intestinal colic. These observations are consistent with the concept of a close relationship between pulmonary inflammation and gastrointestinal function in young children, described within the framework of the gut–lung axis [4,5].

Of particular interest was the assessment of fecal calprotectin levels. This protein is one of the most extensively studied non-invasive markers of intestinal inflammation and is widely used in the diagnosis of inflammatory bowel diseases [9]. In recent years its application in assessing inflammatory changes of the intestinal mucosa in various infectious diseases associated with disruption of the intestinal barrier has been discussed. Fecal calprotectin concentrations in infants are physiologically higher and more variable than in older children, and interpretation of results therefore requires the use of age-specific reference values [10].

In the present study, positive changes in fecal calprotectin levels were observed during treatment, accompanied by a reduction in the severity of dyspeptic syndrome. These data suggest that monitoring of this indicator may be useful in the comprehensive assessment of the gastrointestinal tract in children with infectious pathology. Confirmation of its prognostic value, however, requires further studies with a larger number of observations and standardized assessment criteria.

A distinctive feature of the study was the inclusion of Hilak Forte in the treatment regimen for dyspeptic disorders. This preparation contains metabolic products of normal intestinal microbiota and is used to maintain a physiological intestinal environment. Its use as part of combination therapy resulted in a more rapid reduction in the clinical manifestations of dyspeptic syndrome and improved tolerance of enteral nutrition. These findings are in line with published data on the role of agents supporting the intestinal microbiota in children with respiratory infections [6,7,8].

Conclusion

The results obtained confirm the value of a comprehensive approach to the management of infants with pneumonia. The combined use of clinical, laboratory and instrumental examination methods together with assessment of the gastrointestinal tract enables timely detection of concomitant disorders and individualization of treatment. This is especially important in young patients, in whom even moderate dyspeptic disorders may lead to dehydration, electrolyte imbalance and deterioration of nutritional status. The inclusion of Hilak Forte in combination therapy was accompanied by more rapid relief of dyspeptic manifestations, a shorter duration of the main clinical symptoms and a reduced length of hospitalization.

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