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Features of Escherichiosis in Young Children: Hygienic and Microbiological Aspects

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Abstract: Escherichiosis caused by pathogenic strains of *Escherichia coli* remains an important infectious disease affecting young children. The high susceptibility of infants and toddlers is associated with physiological and immunological factors such as immature immunity, low gastric acidity, and the lack of protective antibodies, particularly in artificially fed children. This study aims to analyze the microbiological, epidemiological, and hygienic aspects influencing the occurrence of escherichiosis in young children. The study was conducted through a literature review of scientific publications from 2016–2026 obtained from international databases and official health organization sources. The results indicate that different pathogenic strains of *E. coli*, including EPEC, ETEC, EIEC, and EHEC, present varied clinical manifestations ranging from secretory diarrhea to severe complications such as hemolytic uremic syndrome. In addition, the increasing level of antibiotic resistance among pathogenic *E. coli* strains has become a significant challenge in infection management, emphasizing the need for rational use of antimicrobial therapy based on susceptibility testing. Modern diagnostic methods such as polymerase chain reaction (PCR) play an important role in the rapid and accurate detection of virulence genes. Effective prevention strategies should focus on strict hygiene practices, including proper hand hygiene, environmental sanitation, and hygiene control in families and childcare institutions. An integrated approach combining microbiological, clinical, and hygienic measures is essential to reduce the incidence of escherichiosis among young children.

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1. Introduction

Escherichiosis caused by pathogenic strains of *Escherichia coli* represents a significant global infectious problem that particularly affects the health of young children. According to estimates, up to 111 million cases of diseases caused by diarrheagenic *E. coli* are reported worldwide each year, with tens of thousands of deaths recorded annually [1]. In Russia, the incidence rate remains consistently high, especially among infants during the first year of life [2].

The high susceptibility of infants and young children to escherichiosis is determined by a complex combination of physiological and immunological factors. These include the immaturity of local and humoral immunity, low gastric acidity, increased permeability of the intestinal barrier, as well as the absence of protective antibodies in artificially fed children that are normally transmitted through breast milk [1,9]. These factors not only

facilitate infection but also contribute to the development of severe and generalized forms of the disease (sepsis, meningitis), particularly in premature and immunocompromised infants [3].

The most severe complication of enterohemorrhagic escherichiosis is hemolytic uremic syndrome (HUS), which is the leading cause of acute renal failure in young children [4].

The mechanism of pathogen transmission is fecal–oral, and its implementation is particularly effective in children’s groups and organized collectives [5]. Pathogenic *Escherichia coli* can persist in the external environment for long periods: in water and soil for months, on toys for up to 3–5 months, and they actively multiply in milk and infant formula [6]. This determines the leading role of the contact-household transmission route through contaminated hands, household items, and toys, as well as the foodborne route through thermally untreated dairy and meat products [6].

The aim of this review is to provide an expanded analysis of modern microbiological and epidemiological features of escherichiosis in young children, focusing on specific risk factors, clinical course, the problem of antibiotic resistance, and evidence-based hygienic preventive measures in families and organized children’s groups.

2. Materials and Methods

To prepare this review, a comprehensive search and analysis of scientific literature published between 2016 and 2026 was conducted in the databases PubMed, Google Scholar, eLibrary, CyberLeninka, as well as on the official websites of the World Health Organization (WHO) and Rospotrebnadzor.

The following keywords were used in the search process:

“escherichiosis”, “young children”, “*Escherichia coli*”, “diarrhea”, “hygiene”, “prevention”, and “pathogenic strains”.

Publications in Russian and English containing data on the epidemiology, clinical manifestations, microbiology, and prevention of escherichiosis were selected. Priority was given to systematic reviews, original research articles, and clinical guidelines.

3. Results

1. Clinical and Epidemiological Features in the Pediatric Population

The epidemiological process of escherichiosis is largely determined by the type of pathogen. Enteropathogenic *E. coli* (EPEC) is the primary cause of sporadic morbidity among children under one year of age, especially those receiving artificial feeding, whereas enterotoxigenic (ETEC) and enteroinvasive (EIEC) strains more frequently cause group outbreaks among children aged 1–3 years [6].

The clinical manifestations vary significantly depending on the strain. Young children demonstrate several clinical features that distinguish the course of the disease from that observed in adults.

In newborns and premature infants, the disease often has an atypical course. The clinical picture may be dominated by regurgitation, vomiting, symptoms of general intoxication, and the development of septic conditions such as coli-sepsis and purulent meningitis, even in the absence of pronounced diarrhea [7].

Enterohemorrhagic escherichiosis (EHEC/STEC) poses the greatest danger. It is characterized by a biphasic clinical course: the initial stage includes watery diarrhea and moderate intoxication, which by the 3rd–5th day is replaced by severe abdominal pain and hemorrhagic colitis manifested by bloody stools [8]. In 5–10% of children who develop symptomatic disease, hemolytic uremic syndrome occurs on the 7th–10th day of illness [8].

Enterotoxigenic (ETEC) and enteropathogenic (EPEC) escherichiosis usually manifest as secretory diarrhea (“cholera-like syndrome”) with abundant watery stools, which rapidly leads to dehydration that is particularly dangerous for infants [7-8].

Enteroinvasive escherichiosis (EIEC) clinically resembles shigellosis (dysentery) and is characterized by distal colitis syndrome, including fever, abdominal pain, and frequent scanty stools containing mucus and blood [9].

2. New Data on Antibiotic Resistance of the Pathogen

Recent studies demonstrate an alarming increase in antibiotic resistance among pathogenic *Escherichia coli* strains isolated from children. A large retrospective study conducted in China between 2014 and 2018 analyzed 4,148 *E. coli* isolates obtained from pediatric patients and revealed the following findings [9]:

The highest burden of infection occurred in the age group of 0–1 year.

Extremely high resistance levels to first-line antibiotics were observed:

- 82% of isolates were resistant to ampicillin
- 52.36% to cefazolin
- 47.46% to trimethoprim/sulfamethoxazole.

Extended-spectrum beta-lactamase (ESBL) production was detected in 49.54% of isolates.

- Approximately 60% of strains demonstrated a multidrug-resistant phenotype.
- High sensitivity to carbapenems (ertapenem and imipenem) was preserved.
- These findings confirm that antibiotic resistance is a serious issue even among *E. coli* strains causing intestinal infections, highlighting the need to reconsider approaches to empirical antimicrobial therapy.

3. Modern Approaches to Laboratory Diagnosis

Differential diagnosis of escherichiosis remains challenging due to its clinical similarity with other acute intestinal infections [9]. The “gold standard” remains the bacteriological method, which involves culturing biological material on selective media to identify the pathogen and determine its antibiotic susceptibility [10].

However, molecular genetic diagnostic methods are becoming increasingly important. Polymerase chain reaction (PCR) diagnostics aimed at detecting virulence genes, such as shiga toxin genes *stx1* and *stx2* for EHEC strains, allow rapid and accurate identification of pathogenic strains. This is critically important for predicting the risk of hemolytic uremic syndrome and for selecting appropriate treatment strategies [11].

4. Discussion

The obtained data emphasize that escherichiosis in young children is not merely an “intestinal infection,” but rather a multifaceted problem situated at the intersection of microbiology, epidemiology, clinical pediatrics, and hygiene. The key conclusions and practical implications can be summarized as follows.

First, the severity and outcome of the infection are determined by the complex interaction between the “microbe–host–environment” system. As demonstrated in the study by Burdet et al., the main predictors of severe *E. coli* bacteremia in children include age ≤ 3 months and an extra-urinary portal of entry of infection, most often intestinal [12]. This finding confirms the particular vulnerability of infants and highlights the need for careful clinical monitoring of this patient group even when gastroenteritis initially appears mild.

Second, the growing problem of antibiotic resistance represents a major challenge for modern pediatrics. Evidence of the high prevalence of extended-spectrum β -lactamase

(ESBL)-producing and multidrug-resistant *E. coli* strains requires a significant reconsideration of the routine approach to antibacterial therapy in intestinal infections [13]. Considering that the majority of escherichiosis cases—especially those caused by ETEC and EPEC—are self-limiting, and that antibiotic use in EHEC infections may trigger the development of hemolytic uremic syndrome (HUS), etiological antimicrobial therapy should be strictly justified. The basis of treatment for mild and moderate forms is pathogenetic therapy, including oral rehydration (and intravenous rehydration when necessary), enterosorbent therapy, and dietary management [14]. Antibiotics should be prescribed only on the basis of antimicrobial susceptibility testing results and are appropriate primarily in severe or generalized infections or in children belonging to high-risk groups.

Third, hygienic prevention must be comprehensive, evidence-based, and supported by regulatory measures. Preventive strategies in children's institutions should aim to interrupt all possible routes of pathogen transmission. Analysis of guidelines for the prevention of infections with similar transmission mechanisms, such as shigellosis, allows the development of a systematic set of preventive measures [15].

Restrictive measures include the mandatory exclusion of an infected child from attendance in organized groups. In the case of EHEC infection, stricter criteria apply: return to childcare institutions is allowed only after complete clinical recovery and two negative bacteriological stool tests [16].

Strict hand hygiene control is essential. Both children and staff must wash their hands thoroughly with soap after using the toilet or changing diapers, before meals, and after outdoor activities. In younger children, supervision of proper handwashing practices is required [17].

Compliance with sanitary and hygienic regulations is also critical. Daily cleaning and, in outbreak situations, repeated disinfection of surfaces, door handles, and sanitary facilities must be performed. Particular attention should be given to toys, which must be regularly washed with detergents, and in groups with children under three years of age, disinfected regularly [18]. The use of soft toys in daycare settings is not recommended due to the difficulty of proper sanitation.

Proper organization of space and caregiving processes is also important. A designated area or room should be allocated specifically for diaper changing, with mandatory disinfection of the changing table afterward. Personnel responsible for diaper changing should be strictly separated from those involved in food preparation and distribution [19].

Control of water-related activities should also be considered. During outbreaks, the use of inflatable pools and water-based games should be temporarily prohibited. Swimming in communal pools is recommended no earlier than two weeks after the cessation of diarrhea symptoms [20].

Thus, effective control of escherichiosis among young children requires an integrated approach that includes: heightened clinical awareness among physicians regarding the specific features and risk of severe complications in infants; rational use of antimicrobial therapy based on laboratory evidence in order to limit the development of antibiotic resistance; and strict implementation of comprehensive hygienic and epidemiological preventive measures both in families and in organized childcare settings. Only such a strategy can reduce the high burden of escherichiosis in pediatric practice.

5. Conclusion

Escherichiosis in young children remains a significant medical and social problem. Its characteristics are determined, on the one hand, by the spectrum of circulating pathogenic *Escherichia coli* strains with varying virulence potential, and on the other hand by the ease of transmission through the fecal–oral route within this age group.

A reduction in disease incidence can only be achieved through the integration of microbiological knowledge regarding the pathogen and strict adherence to hygienic preventive measures at all levels: within the family, in childcare institutions, and in society as a whole.

Future research should focus on monitoring circulating strains, developing effective vaccines, and improving approaches to sanitary education and public health awareness.

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