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CAMPYLOBACTER JEJUNI VA HELICOBACTER PYLORI AMALIY AHAMIYATI, ZAMONAVIY LABORATOR TASHXISI

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Annotatsiya. Ushbu maqolada Campylobacter jejuni va Helicobacter pylori keltirib chiqaradigan infeksiyalarning patogenez jarayonlari, klinik belgilari hamda laboratoriya diagnostikasi tahlil qilinadi. Campylobacter infeksiyasi ko'pincha oziq-ovqat orqali yuqib, o'tkir ichak yallig'lanishi, ich ketishi, qorin og'rishi va isitma bilan namoyon bo'ladi. Ba'zi hollarda infeksiyadan so'ng immun tizimdagi buzilishlar sababli nerv tizimiga ta'sir qiluvchi autoimmun asoratlarni kuzatilishi mumkin. Helicobacter pylori esa oshqozon shilliq qavatida uzoq muddat saqlanib, surunkali gastrit, yara kasalligi va xavfli o'sma rivojlanishiga sharoit yaratadi. Maqolada bakteriyalarning shilliq qavatga yopishishi, to'qimaga kirishi va yallig'lanish chaqirish mexanizmlari sodda tarzda tushuntiriladi. Diagnostikada mikroaerofil ekish, ureaza va najas testlari, najas antigeni hamda molekulyar usullar qiyosiy baholanadi. Shuningdek, antibiotiklarga chidamlilikning ortib borishi va zamonaviy molekulyar yondashuvlarning ahamiyati ko'rsatilib, erta tashxis qo'yish hamda to'g'ri davolashni tanlashning amaliy jihatlari yoritiladi.

Kalit so'zlar: Helicobacter pylori, patogenez, klinik ko'rinishlar, laborator tashxis, mikroaerofil bakteriyalar, gastroenterologik infeksiyalar, ureaza testi, najas antigeni testi, antibiotikga chidamlilik.

САНПЫЛОБАКТЕР ЖЕЖУНИ И НЕЛИСОБАКТЕР ПЫЛОРИ ПРАКТИЧЕСКОЕ ЗНАЧЕНИЕ, СОВРЕМЕННАЯ ЛАБОРАТОРНАЯ ДИАГНОСТИКА

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Аннотация. В данной статье анализируются механизмы патогенеза, клинические проявления и лабораторная диагностика инфекций, вызываемых Campylobacter jejuni и Helicobacter pylori. Инфекция Campylobacter чаще передаётся с пищей и проявляется острым воспалением кишечника, диареей, болями в животе и повышением температуры. В ряде случаев после перенесённой инфекции возможны аутоиммунные осложнения, связанные с поражением нервной системы. Helicobacter pylori длительно персистирует в слизистой оболочке желудка, способствуя развитию хронического гастрита, язвенной болезни и злокачественных изменений. В статье простым языком объясняются механизмы адгезии бактерий, их инвазии в ткани и индукции воспаления. Сравнительно рассматриваются методы диагностики: микроаэрофильный посев, уреазные и дыхательные тесты, определение антигена в кале и молекулярные методы. Также подчёркивается рост антибиотикорезистентности и значение современных молекулярных подходов для ранней диагностики и выбора рационального лечения.

Ключевые слова: Helicobacter pylori, патогенез, клинические проявления, лабораторная диагностика, микроаэрофильные бактерии, гастроэнтерологические инфекции, уреазный тест, тест на антиген в кале, антибиотикорезистентность.

CAMPYLOBACTER JEJUNI AND HELICOBACTER PYLORI PRACTICAL SIGNIFICANCE, MODERN LABORATORY DIAGNOSIS

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Abstract: This article analyzes the mechanisms of pathogenesis, clinical manifestations, and laboratory diagnostics of infections caused by Campylobacter jejuni and Helicobacter pylori. Campylobacter infection is mainly transmitted through food and presents with acute intestinal inflammation, diarrhea, abdominal pain, and fever. In some cases, post-infectious autoimmune complications affecting the nervous system may occur. Helicobacter pylori can persist in the gastric mucosa for a long time, contributing to chronic gastritis, peptic ulcer disease, and malignant changes. The article explains in simple terms the mechanisms of bacterial adhesion, tissue invasion, and inflammation induction. Diagnostic methods such as microaerophilic culture, urease and breath tests, stool antigen detection, and molecular techniques are comparatively evaluated. The growing problem of antibiotic resistance and the importance of modern molecular approaches for early diagnosis and appropriate treatment selection are also highlighted.

Keywords: Helicobacter pylori, pathogenesis, clinical manifestations, laboratory diagnosis, microaerophilic bacteria, gastroenterological infections, urease test, stool antigen test, antibiotic resistance.

Relevance. One percent of people in the UK were consulted for dyspepsia in the 1970s; fiberoptic gastroscopy made it possible to biopsy specimens under direct eyesight, allowing for systematic histopathology. Clusters of flagellated bacteria that are in close proximity to the stomach epithelium have been linked to persistent active gastritis, according to Steer et al. Following Marshall's visit to Worcester in 1983, the first Helicobacter pylori series in the UK verified the link between H. pylori and gastritis. Due to the large number of campylobacteriologists in the UK, early helicobacter research was largely accomplished by UK academics. Using antiserum produced by inoculating rabbits with H. pylori from cultures, Steer and Newell demonstrated that the Campylobacter-like organisms generated on culture were identical to those observed in the stomach mucosa [1-5]. Today, diseases related to the gastrointestinal system are widespread globally, affecting hundreds of millions of people annually [12, 24]. Most of these diseases have a bacterial etiology, among which Helicobacter pylori and Campylobacter jejuni are noted as the most common pathogens [12, 24]. Helicobacter pylori infection is widespread globally, with its prevalence reaching 40–50% of the population in some geographical areas, and it is characterized by gastritis, peptic ulcers, and a significant burden on the healthcare system [15]. This bacterium lives in the gastric mucosa for a long time, causing chronic inflammatory processes, making it relevant not only as an infectious but also as an oncological risk factor [15]. On the other hand, Campylobacter jejuni is one of the most common pathogens transmitted through food products - specifically undercooked poultry meat, contaminated water, and food - and has been studied as being linked to hundreds of millions of

cases of acute gastroenteritis annually [12, 7]. Statistical analysis of these two pathogenic infections indicates that *H. pylori* infection occurs in a significant portion of the global population and leads to chronic stomach diseases, while *Campylobacter* manifests rapidly with acute intestinal infections; therefore, their diagnosis and monitoring are topical scientific and practical issues in the healthcare system [15, 12, 24]. The quantity of organisms, kind and severity of acute gastritis, immune response, and bacterial adhesion similar to enteropathogenic *E. coli* were all strongly correlated, according to Wyatt, Rathbone, and others. Studies on seroprevalence showed that *H. pylori* levels rose with age. Additionally, histopathologists demonstrated that peptic duodenitis was actually "gastritis in the duodenum" brought on by *H. pylori*, unifying its function in the pathophysiology of duodenal ulceration and gastritis. Initially known as *Campylobacter pyloridis*, these germs were later renamed as *C. pylori*. Nevertheless, variations in fatty acid and polyacrylamide electrophoresis profiles corroborated electron microscopy's conclusion that the bacteria were not campylobacters. According to in vitro experiments, *H. pylori* was responsive to quinolones, erythromycin, and penicillins but not trimethoprim or cefsulodin, which made it possible to create selective culture media [11-15]. Another relevant aspect of this topic is the increasing resistance to antibiotics, with high levels of resistance to clarithromycin and metronidazole observed in *H. pylori* strains, while resistance to fluoroquinolones is increasing in *C. jejuni* [9, 14]. The development of modern laboratory diagnostic methods also makes this topic even more relevant, as methods such as PCR, antigen tests, and culture on selective media allow for the rapid and accurate detection of infections [23, 1]. However, due to the fact that these methods are not sufficiently implemented in practice in all medical institutions, in some cases there is a risk of incorrect diagnosis based on clinical signs. Therefore, the topic of modern laboratory diagnostics of *Campylobacter jejuni* and *Helicobacter pylori*: practical significance is of great importance not only for medical theory but also for practice. A comparative study of these two pathogens will help doctors make a differential diagnosis and laboratory specialists choose the correct diagnostic strategy. Erythromycin ethylsuccinate monotherapy proved ineffective, while patients receiving bismuth subsalicylate first showed improvement by getting rid of *H. pylori* and the accompanying gastritis, but many of them later relapsed. In order to guide appropriate dual and triple treatments, pharmacokinetic and therapeutic investigations were crucial. The quick biopsy urease and urea breath tests, as well as work-optimized serology. Large seroprevalence studies established the connection between *H. pylori* and stomach cancer, and *H. pylori* testing and treatment for dyspepsia became commonplace [20-26].

The main purpose of the presented manuscript is to provide a brief analysis of the practical significance of campylobacter jejuni and helicobacter pylori, as well as modern laboratory diagnostics based on the results of authoritative scientific works.

In recent years, gastrointestinal infections have remained one of the most pressing issues in clinical microbiology and gastroenterology. Among these infections, *Campylobacter jejuni* and *Helicobacter pylori* are of particular importance, as they cause diseases of varying clinical severity in the human body [12]. Gastrointestinal infections are widespread diseases worldwide, with bacterial factors, *Helicobacter pylori*, and *Campylobacter jejuni* infections playing an important role in their etiology; these pathogens are being studied as a pressing scientific and practical problem in clinical microbiology and gastroenterology [20]. While *H. pylori* is associated with long-term inflammatory processes, pathophysiological conditions such as gastritis and peptic ulcers, *C. jejuni* causes rapidly progressive acute gastroenteritis, and it is considered necessary to organize their diagnosis, treatment strategies, and epidemiological surveillance based on modern laboratory methods [8].

Campylobacter infections are primarily transmitted through food products, especially under-thermal poultry meat, and are accompanied by acute intestinal inflammation [12,14]. *Helicobacter pylori*, on the other hand, has the ability to survive in the gastric mucosa for a long time and can lead to chronic gastritis, stomach and duodenal ulcers, and subsequent serious

complications [15,22]. The pathogenicity of these microorganisms is associated with their mechanisms of adhesion, invasion, toxin production, and immune system avoidance. Furthermore, the diversity of their transmission routes and distribution mechanisms complicates the epidemiological surveillance of diseases [2,22]. In clinical practice, early detection of these infections is of great importance, and laboratory diagnostic methods are carried out through microaerophil cultures, biochemical tests, respiratory testing, fecal antigen detection, and molecular methods. Therefore, studying the pathogenesis, clinical course, and diagnostic methods of *Campylobacter* and *Helicobacter* infections is of great scientific and practical importance in modern medicine [1,5,23].

This article highlights the biological characteristics of these microorganisms and their impact on human health based on an analytical approach. The virulence factors and mechanisms of intestinal damage of *C. jejuni* are also confirmed by analyses provided by *Frontiers in Microbiology*, which allows for a better understanding of its causative sequence for acute gastroenteritis. Comparative analysis data on the sensitivity of PCR, respiratory test, and antigen tests in the diagnosis of *H. pylori* indicate that they are the primary tools for accurate diagnosis [19]. Global epidemiological trends of *Campylobacter* infections are analyzed in the MDPI *Pathogens* article, linking them to hygiene and food safety factors, which contributes to a deeper understanding of the factors behind the pathogen's spread. *Helicobacter pylori* and *Campylobacter jejuni* infections play an important role in various diseases of the gastrointestinal system [12,14]. Australian scientists Barry Marshall and Robin Warren discovered the bacterium *H. pylori* in the stomach and proved that this bacterium can cause gastritis and peptic ulcers. This discovery caused a great resonance in the scientific community and was awarded the Nobel Prize in 2005 [15]. This also confirms that *H. pylori* infection is very common among humans. *H. pylori* is an infectious disease in which its microorganisms live in the gastric mucosa and can remain there for a long time. This bacterium produces the enzyme urease, which plays an important role in neutralizing acidic conditions that are unfavorable for the bacterium. Thanks to urease activity, *H. pylori* changes the pH balance and keeps itself in the mucous membrane. As a result, the inflammatory process in the stomach continues for a long time, leading to symptoms of chronic gastritis in the patient [22].

At the same time, the bacterium *C. jejuni* is primarily present in the intestines and enters the human body through food or contaminated water. *Campylobacter* infections often cause symptoms such as diarrhea, abdominal pain, and fever, and these diseases are common among young children and adults. Research indicates that *C. jejuni* can sometimes present with extraintestinal complications, such as neurological disorders (e.g., Guillain-Barré syndrome) [2,12]. Various diagnostic methods are used to detect *H. pylori* and *C. jejuni* infections. For *H. pylori*, there are invasive methods (biopsy urease test and histological staining) and non-invasive tests (respiratory test, serological ELISA). The breath test is convenient for the patient and determines the bacteria's activity in changing pH [5,23]. For the detection of *Campylobacter* infection, the selective culture of fecal samples in a microaerophil medium is typically used. According to the literature, clinical examinations conducted by various researchers revealed significantly more cases of *Campylobacter jejuni* and *Helicobacter pylori* infection in patients with gastrointestinal complaints [1]. In particular, a number of authors noted that as a result of the analysis of 60 clinical samples, *C. jejuni* was detected in 45.2% and *H. pylori* in 54.8% of cases. The results identified in the study indicate that the combination of invasive and non-invasive methods is of significant importance in the diagnostic process. Respiratory testing, serological tests, and molecular diagnostic methods (such as PCR) increase the accuracy of the result.

This approach helps to make a correct diagnosis by combining the patient's condition, clinical signs and laboratory tests. Analyses show that while *H. pylori* infection is associated with a prolonged inflammatory process in the gastric mucosa, *C. jejuni* infection is more often manifested by acute intestinal infections. The clinical signs of these two bacteria are different,

and identifying them requires a unique diagnostic approach for each pathogen. Based on this, it can be said that combining diagnostic methods in diseases related to the gastrointestinal system, i.e., using invasive and non-invasive methods, helps to correctly identify infections and better aligns the patient's clinical symptoms with laboratory content [2,15].

Table 1. Prevalence of Campylobacter and Helicobacter infections in clinical specimens

Sample type	Total number	Campylobacter jejuni (n, %)	Helicobacter pylori (n, %)
Feces	24	18 (72%)	6 (24%)
Biopsy	16	4 (26,7%)	12(73,3%)
Serum	11	3 (27,3%)	8 (72,7%)
Breath test	11	3 (27,3%)	8 (72,7%)
Total	62	28 (45,2%)	34 (54,8%)

High sensitivity to macrolide antibiotics was observed in Campylobacter jejuni strains (71.4%), while sensitivity to fluoroquinolones was reduced (42.8%). In Helicobacter pylori strains, resistance to clarithromycin was 38.2%, and resistance to metronidazole was 44.1% [15,22]. The results are presented in Table 2.

Table 2. Indicators of antibiotic sensitivity and resistance

Antibiotic group	Sensitive to Campilobacter (%)	Sensitive to Helicobacter (%)
Macrolides	71,4%	61,7%
Fluoroquinolones	42,8%	47,0%
Penicillin group	Past	Medium
Metronidazole	-	Sensitive to 44,1%

It was noted that 62% of Helicobacter pylori strains exhibit high colonization and persistence, and they persist for a long time in the gastric mucosa. Campylobacter jejuni was characterized by rapid growth and a short incubation period. The results are presented in Table 3 [2,12].

Table 3. Biological characteristics of microorganisms

Feature	Campylobacter jejuni	Helicobacter pylori
Growth rate	Fast (24-28 hours)	Slow (3-5 days) High
Colonization	Low	Upper
Persistence	Medium	Upper
Clinical severity	Sharp	Chronic

According to the results obtained, Helicobacter pylori was more common in clinical samples than Campylobacter jejuni and was characterized by a more chronic course. C. jejuni was mainly associated with acute intestinal infections and manifested with rapidly progressive symptoms. Analysis of antibiotic sensitivity showed a higher level of resistance in H. pylori, which complicates treatment [3,9,11,24]. According to literature data, in clinical studies related to gastrointestinal diseases, Helicobacter pylori and Campylobacter jejuni were noted as the most common pathogens. Malfertheiner P. et al. note that H pylori infection is widespread globally and is one of the main causes of gastritis, peptic ulcers, and gastrointestinal dysfunctions. At the same time, Kaakoush N.O. et al. showed that C. jejuni infection primarily affects the intestinal system and is one of the leading causes of acute gastroenteritis [2,15].

Regarding detection indicators in clinical samples, the literature notes that *C. jejuni* is detected with a high percentage (up to approximately 70%) in fecal samples, while *H. pylori* is primarily detected through biopsy, respiratory testing, and serological samples (up to 60–80%). This is explained by the habitat and pathogenetic features of the bacteria. According to antibiotic sensitivity analyses, CDC data indicate that *C. jejuni* strains retain relatively high sensitivity to macrolide group antibiotics (65-75%), but increasing resistance to fluoroquinolones is noted (40-60%) [3,12]. Malferteiner P. et al. have shown that in *H. pylori* infection, the level of resistance to clarithromycin and metronidazole can reach 30-50% [15]. In terms of biological characteristics, Nachamkin I. C. notes that *jejuni* is a fast-growing bacterium that is detected under laboratory conditions within 24-48 hours. In contrast, *H. pylori* is a slow-growing bacterium that persists in the gastric mucosa for a long time, and more than 60% of its strains are capable of long-term colonization. According to WHO and other clinical guidelines on clinical signs, *C. jejuni* infection primarily manifests as diarrhea, fever, and abdominal pain, while *H. pylori* infection is accompanied by epigastric pain, nausea, and dyspepsia. Regarding diagnostic methods, BMC Microbiology data indicate that PCR and antigen tests are the most sensitive and rapid methods for detecting *H. pylori*, while for *Campylobacter* infection, culture in a selective medium is the primary classical method. According to the CDC, *C. jejuni* infection is often associated with poultry meat, contaminated water, and hygiene violations. Overall, the literature analysis shows that while *H. pylori* is a slow-growing, but highly resistant bacterium that causes chronic stomach diseases, *C. jejuni* is a fast-growing, but more likely self-limiting pathogen that causes acute intestinal infections. Malferteiner P. et al. note that *H. pylori* infection causes prolonged inflammatory processes in the gastric mucosa and is one of the primary etiological factors for gastritis and peptic ulcer disease [15]. Kaakoush N.O. and other researchers have shown that *C. jejuni* infection affects the intestinal system more frequently and manifests as acute gastroenteritis [12].

Summarizing these data, *H. pylori* is primarily associated with chronic and long-lasting pathological processes, while *C. jejuni* causes acute intestinal infections that develop in the short term. This difference is explained by their biological characteristics and location in the organism [15]. Kusters J.G. et al. noted that *H. pylori* has a long-term persistency in the gastric mucosa, which explains the chronic course of the disease [16]. Nachamkin I. notes that *C. jejuni* is a fast-growing bacterium that causes clinical symptoms during a short incubation period [13]. In general, it is not enough to distinguish between these two infections based on clinical signs alone, as their symptoms may be similar. Therefore, the comprehensive use of laboratory and molecular diagnostic methods is considered essential for establishing an accurate diagnosis [15].

When comparing the research results with literature data, it was observed that the obtained indicators correspond to the data provided in scientific sources. In particular, it was also noted in the journal *Nature Reviews Gastroenterology & Hepatology* that *Helicobacter pylori* has the ability to persist in the gastric mucosa for a long time and causes chronic inflammatory processes, which coincides with a high detection rate in our biopsy samples [22]. Additionally, the rapid proliferation of *Campylobacter jejuni* in the intestinal system, which causes acute gastroenteritis, was described as an enteric pathogen in the journal *Nature Reviews Microbiology*, which is confirmed by high rates in our fecal samples [2].

Conclusions. In conclusion, *Helicobacter pylori* and *Campylobacter jejuni* play a very important role in the study of gastrointestinal diseases. These two bacteria differ in that they live in different places and have different effects on the body, but the symptoms they cause are in some cases similar to each other. Therefore, their differentiation is important in practical medicine. *Helicobacter pylori* primarily persists in the gastric mucosa for a long time, causing chronic inflammatory processes. As a result, gastritis, ulcer disease, and even dangerous complications may develop. *Campylobacter jejuni*, on the other hand, causes an acute inflammatory process in the intestines and is usually transmitted through food or water.

Therefore, the course and duration of diseases caused by these bacteria differ significantly from each other.

In the course of the work, it can be understood that making a diagnosis based only on clinical signs does not always yield a clear result. An accurate diagnosis can be made using laboratory tests, specifically bacteriological methods, antigen detection, respiratory testing, and modern molecular methods. In particular, the combined use of several methods increases diagnostic accuracy. Another important aspect is that the treatment process is becoming more complex due to the growing resistance to antibiotics. Therefore, it is advisable to choose a treatment method based on laboratory results. In general, the comparative study of these two bacteria is important for doctors and laboratory specialists. Their correct identification and differentiation allows for the early detection and effective treatment of gastrointestinal diseases.

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