

Listeriosis as a problem for high-risk groups: practical cases

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Aim. To analyze two clinical cases of listeriosis invasive forms in patients from risk groups that were recorded in 2024.

Material and methods. Two bacteriologically confirmed clinical cases of listeriosis in 2024, were retrospectively analyzed. They were invasive in patients from risk groups. The diagnosis of listeriosis was established according to the criteria in accordance with the Order of the Ministry of Health of Ukraine No. 905 dated 28.12.2015.

Results. Clinical observation 1 demonstrated the development of neurolisteriosis in a patient with comorbidity in the form of chronic hepatitis of mixed genesis. Neurolisteriosis manifested itself with a gradual increase in clinical symptoms with the development of febrile fever and the presence of meningeal symptom complex on the 6th day of illness. Laboratory examination of the cerebrospinal fluid confirmed the presence of purulent meningitis. The course of purulent meningitis was severe and complicated by the development of cerebral edema-swelling with impaired consciousness, seizures. This required artificial ventilation of the lungs. The correction of antibacterial therapy with the use of ampicillin gave a clear positive dynamic in achieving cerebrospinal fluid sanitation.

Clinical observation 2 demonstrated a rather rich epidemiological history of a pregnant woman regarding the high probability of *Listeria monocytogenes* infection. From the anamnesis, it is known that the woman had two short-term manifestations of enteritis without fever during pregnancy. She was not treated and did not seek medical help, which can be associated with a probable infection with *Listeria*. The pregnant woman had only short-term episodes of diarrhea, which was probably a manifestation of listeriosis enteritis. However, this caused *Listeria* to cross the blood-placental barrier and develop fetal / neonatal listeriosis with bacteremia (identified at birth) and consequently caused premature delivery and death of the newborn.

Conclusions. The presented clinical observations demonstrate the development of severe invasive forms of listeriosis in patients at risk. Case clinical analysis of listeriosis invasive forms will increase the practicing physician's awareness in the modern spectrum of infectious diseases and will contribute to increasing the efficiency of diagnosis and treatment.

Keywords:

listeriosis, bacterial infection, comorbidity, chronic hepatitis C, viral infection, risk group, meningitis, pregnancy, diagnosis, treatment.

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Лістеріоз як проблема груп ризику: випадки з практики

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Мета роботи – проаналізувати два клінічних випадки інвазивних форм лістеріозу у пацієнтів із груп ризику, які зафіксовано в 2024 році.

Матеріали і методи. Ретроспективно проаналізовано два клінічних випадки лістеріозу, бактеріологічно підтвердженого в 2024 році. У пацієнтів із груп ризику це захворювання мало інвазивний характер. Діагноз лістеріозу встановлено за критеріями, що наведені в Наказі МОЗ України від 28.12.2015 року № 905.

Результати. Клінічне спостереження 1 демонструє розвиток нейролістеріозу у пацієнта з коморбідністю, зокрема з хронічним гепатитом змішаного генезу. Нейролістеріоз манифестував поступовим наростанням клінічної симптоматики з розвитком фебрильної лихоманки та менингеального симптомокомплексу на шосту добу хвороби. Лабораторне дослідження спинномозкової рідини підтвердило діагноз гнійного менингіту, який мав тяжкий перебіг та ускладнився розвитком набряку-набухання головного мозку з порушенням свідомості та нападом судом; це зумовило необхідність проведення штучної вентиляції легень. Корекція антибактеріальної терапії з застосуванням ампіциліну сприяла чіткій позитивній динаміці щодо досягнення санації ліквору.

У клінічному спостереженні 2 епідеміологічний анамнез вагітної свідчить про високу ймовірність інфікування *Listeria monocytogenes*. Встановлено, що жінка в період вагітності двічі мала нетривалі прояви ентериту без лихоманки, не лікувалася та по медичну допомогу не зверталася. Ці епізоди можна пов'язати з ймовірним інфікуванням лістеріями: у вагітної виникали лише короточасні послаблення випорожнень, що, ймовірно, було проявом лістеріозного ентериту. Однак це спричинило долаття лістеріями гематоплацентарного бар'єра та формування лістеріозу плода з бактеріємією (ідентифікована при народженні дитини), що стала причиною передчасних пологів і летального наслідку для новонародженого.

Висновки. Наведені клінічні спостереження демонструють розвиток тяжких інвазивних форм лістеріозу у пацієнтів із групи ризику. Клінічний аналіз випадків інвазивних форм лістеріозу сприятиме поліпшенню обізнаності практичних лікарів щодо спектра інфекційних хвороб, а отже дасть змогу підвищити ефективність діагностики та лікування.

Ключові слова:

лістеріоз, бактеріальна інфекція, коморбідність, хронічний гепатит С, вірусна інфекція, група ризику, менингіт, вагітність, діагностика, лікування.

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Listeriosis is a zoonanthroponosis infectious disease caused by *Listeria monocytogenes*. The disease is characterized by a polymorphism of clinical manifestations from asymptomatic course and self-limiting gastroenteritis in immunocompetent individuals to the development of invasive forms (bacteremia, neurolisteriosis, neonatal sepsis, etc.) in risk groups [1,2,3]. The incidence of human listeriosis in modern conditions varies from 0.1 to 11.3 cases per 1 million population per year, depending on the geographical location and the epidemiological surveillance system.

Today, many developed countries are experiencing an increase in the incidence of listeriosis. This trend is associated with increased consumption of ready-to-eat foods and the growing number of susceptible individuals, particularly older adults and people with weakened immune systems [4]. According to a retrospective study, the mortality rate from listeriosis in patients from risk groups reaches 20–32 % [5,6].

Listeria monocytogenes has been considered a human foodborne pathogen since 1981, when it was identified and recognized as the etiological agent of an outbreak of listeriosis in Nova Scotia, Canada. It was associated with the consumption of coleslaw, resulting in 7 clinically significant cases in adults and 34 cases of perinatal transmission. From that time on, listeriosis began to be considered a foodborne infection [4]. The ability of *Listeria monocytogenes* to survive, adapt, and persist in a wide range of adverse physicochemical conditions during food processing and preservation is a serious problem for the food industry [7]. In the United States, the Foodborne Disease Surveillance Network (FoodNet) has been conducting laboratory surveillance of *Listeria* epidemiology since 1996. In 2002, the European Union established the European Food Safety Authority (EFSA). It has included in its responsibilities the assessment of risks associated with *Listeria monocytogenes* by monitoring the prevalence and pathogen levels in food. According to the European Surveillance System report for 2023, 30 countries reported 2,993 confirmed cases of listeriosis, the highest annual number of cases since the start of surveillance. The rate of listeriosis registration in the European region was 0.67 cases per 100,000 population [4].

Most cases of listeriosis are classified as sporadic, but thanks to the use of molecular genetic methods of pathogen identification in epidemiology, it is increasingly possible to prove outbreaks of food-borne listeriosis. Since the introduction of whole-genome sequencing, it has become possible to conduct rapid comparative analysis of *Listeria monocytogenes* isolates [4,8]. Today, based on epidemiological investigations, it is believed that up to 50 % of listeriosis cases are associated with outbreaks. Over the past 40 years, more than 80 outbreaks of listeriosis have been documented worldwide with a known source of infection, affecting 5 or more patients [4].

For example, in South Africa, a nationwide outbreak of listeriosis was documented over several months in 2017–2018, traced to processed meat sausage produced at a single facility. The source of the infection was identified through whole-genome sequencing of *Listeria monocytogenes* isolates, but this took some time. The total number of laboratory-confirmed cases of listeriosis during

this outbreak was 937, including over 400 newborns and 193 deaths [9]. A listeriosis outbreak in the United States associated with a widely distributed brand of ice cream has been identified using whole-genome sequencing. 10 cases of invasive listeriosis in adults have been confirmed, including 3 fatal cases. All patients were at risk due to comorbid conditions (cancer, including after chemotherapy, upper gastrointestinal bleeding, etc.) [10].

Today, attention is drawn to the fact that the formation of invasive severe forms of listeriosis in humans occurs in people with weakened immunity, in particular, pregnant women, people with comorbid conditions, and the elderly. A few studies [3,4,11,12] have demonstrated that 93 % of all non-pregnant patients with listeriosis had at least one concomitant immunosuppressive disease: solid tumors (31 %), diabetes mellitus (22 %), received immunosuppressive therapy within 5 years before the development of listeriosis (43 %), etc. Pregnant women, compared to the general population, have a 10–18 times higher risk of developing listeriosis with subsequent development of fetal / neonatal listeriosis [3,4].

It is believed that due to underestimation of the incidence of sepsis caused by *Listeria monocytogenes* and underreporting of cases and deaths, as well as of pathogen isolates for genotyping, the true burden of listeriosis is much higher [4,11,13].

Therefore, clinical analysis of listeriosis invasive forms confirmed cases is necessary to clarify the course features of this infectious disease in patients with comorbidities who are at risk. It is necessary to increase the practicing doctor's knowledge level on listeriosis, which is aimed at increasing the effectiveness of diagnosis and treatment, and will also contribute to effective epidemiological surveillance of this foodborne infection in modern conditions.

Aim

To analyze two clinical cases of listeriosis invasive forms in patients from risk groups that were recorded in 2024.

Material and methods

This article retrospectively analyzes two clinical cases of bacteriologically confirmed listeriosis in 2024, which had an invasive course, in patients from high-risk groups.

Clinical observation 1. We analyzed the medical history of patient T., 50 years old, who was treated in the Department of Anesthesiology and Intensive Care Unit (ICU) of Municipal Non-Profit Enterprise "Regional Infectious Disease Clinical Hospital" of the Zaporizhzhia Regional Council (MNPE "RICH" ZRC) for neurolisteriosis.

Clinical observation 2. We analyzed the medical history of a pregnant patient who received medical care at the Municipal Non-Profit Enterprise "Regional Perinatal Center of the Zaporizhzhia Regional Council" (MNE "Regional Perinatal Center" ZRC); she was hospitalized in the maternity ward due to premature birth.

When diagnosing listeriosis, criteria were used in accordance with the Order of the Ministry of Health of Ukraine No. 905 of 28.12.2015 "On approval of criteria for determining cases of infectious and parasitic diseases subject to registration" for submitting reports to the net-

work of Member States of the Community in accordance with Decision No. 2119/EU of the European Parliament and of the Council [14].

Results

Clinical observation 1. Patient T., 50 years old, was hospitalized to the ICU of the MNPE "RICH" ZRC on 14.04.2024 (6th day of illness) with complaints, according to his mother, of a fever of 38.5 °C, significant weakness, seizures and dizziness, due to which productive contact with the patient was difficult.

From the medical history it was found out that on the eve of the disease on 08.05.2024 the patient abused alcohol, there was a fall from a height of his height. From 09.05.2024 he began to be troubled by significant weakness, nausea, short-term diarrhea. During the following days, he did not seek medical help or self-medicate. On 13.05.2024, he suddenly developed dizziness, a brief loss of consciousness, and a seizure. An ambulance was called; the patient was taken to the emergency department of the city hospital. According to the results of a computed tomography scan, traumatic brain injury and stroke were ruled out. During the examination, positive meningeal signs were detected, and a lumbar puncture was performed for diagnostic purposes. After receiving the results of the cerebrospinal fluid (CSF), which confirmed the presence of purulent meningitis (cytosis 1035 cells in 1 µl with a clear predominance of neutrophils 96 %, protein 1.38 g/l, Pandy reaction +++), the patient was transferred to the ICU of the MNPE "RICH" ZRC.

During the examination on 14.04.24 (6th day of illness), at the time of admission to the ICU of the MNPE "RICH" ZRC, the patient's condition was considered severe, the level of consciousness was stunned, 12–13 points on the Glasgow coma scale (he opened his eyes at will, selectively answered questions in simple sentences, was disoriented in place and time, partially oriented in person), pronounced tremor of the limbs, meningeal signs were sharply positive (rigidity of the occipital muscles up to 8 cm, positive Kernig's symptom and positive upper and lower Brudzinski symptoms). Body temperature was 38.3 °C, oxygen saturation 97 %, breathing was independent, auscultatory in the lower parts of the lungs there was a weakening of breathing, hemodynamics was compensated (arterial hypertension 150/90 mmHg, tachycardia 94 per minute), the liver was enlarged by 3 cm, dense consistency on palpation, painless.

The patient's life history was clarified: in recent years, he denied alcohol abuse over the past few years, he was on dispensary registration at the hepatology center of the MNPE "RICH" ZRC for chronic hepatitis of mixed genesis (toxic and viral hepatitis C), liver fibrosis stage F 3–4 (by liver elastometry). Two years ago, he was treated with antiviral drugs (sofosbuvir + velpatasvir for 12 weeks) as part of the State Program. A sustained virological response was achieved for 24 weeks. From 23.05.2024, hepatitis C virus RNA determination in the blood also showed the absence of viremia.

During laboratory examination at the time of hospitalization, the presence of leukocytosis $11.0 \times 10^9/l$, neutrophilia 88 % without a left shift, thrombocytopenia

$88.4 \times 10^9/l$, hyperbilirubinemia 69.9 µmol/l, intrahepatic cholestasis with an increase in γ-glutamyl transpeptidase to 335.6 U/l, an increase in blood amylase to 163.1 U/l, hypoalbuminemia 33.6 g/l, high levels of C-reactive protein – 76.0 mg/l and procalcitonin – 6.66 ng/ml, signs of coagulopathy, namely a decrease in the prothrombin index to 65.9 % and an increase in the international normalized ratio to 1.46, attracted attention (Table 1).

Taking into account the confirmed purulent meningitis, the etiology of which at the time of admission to the ICU of the MNPE "RICH" ZRC needed to be determined (the cerebrospinal fluid was sent for bacteriological examination), and considering the medical history, there was a high probability of secondary purulent meningitis. Therefore, combined antibacterial therapy was started with intravenous ceftazidime 2 g two times a day in combination with amikacin 0.5 g two times a day. Oxygen support was provided via nasal cannula. Pathogenetic therapy included the use of anti-edematous (mannitol, furosemide, acetazolamide), anti-inflammatory and antipyretic (paracetamol, ibuprofen) agents, and the administration of low molecular weight heparin in prophylactic doses. The patient also received symptomatic therapy.

Despite the treatment initiated during the first three days, the patient's condition showed negative dynamics: febrile fever persisted, leukocytosis increased to $28.0 \times 10^9/l$, neutrophilia persisted at 82 % without a left-shift of the rod nuclei, and impaired consciousness progressed. A consultation with a neurologist was obtained, according to the conclusion: purulent meningitis of unknown etiology, severe course, cerebral edema, secondary stem syndrome; encephalopathy of mixed genesis (dyscirculatory, exogenous toxic); hypertensive disease. Considering the significantly increased level of amylase up to 889.0 U/l and the presence of pronounced diffuse changes in the pancreatic parenchyma according to ultrasound, a surgeon's consultation was obtained, according to the conclusion: exacerbation of chronic pancreatitis. From 16.05.2024, the presence of left-sided lower lobe pneumonia was recorded by chest X-ray. Due to the progression of impaired consciousness, the patient was transferred to mechanical ventilation (MV). The prescribed treatment was continued, taking into account the recommendations of the neurologist and surgeon (Table 1).

The result of the bacteriological examination of CSF was obtained on 20.05.2024: *Listeria monocytogenes* was detected, which was sensitive to ampicillin, meropenem, erythromycin. According to these data, antibacterial therapy was adjusted, intravenous ampicillin 2 g 6 times a day was prescribed (Table 1).

Against the background of treatment, a control study of CSF was conducted on 20.05.2024 to assess the effectiveness of etiotropic therapy. Clear positive dynamics were recorded, namely a significant decrease in cytosis to 120 cells per 1 µl, a clear change in the structure of cytosis with a lymphocytes prevalence to 92 %, and a decrease in CSF protein level to 0.46 g/l. The hemogram showed a clear tendency to decrease the leukocytosis level to $22.0 \times 10^9/l$. In addition, regression of infiltrative changes in the lungs was noted, a control chest X-ray was performed on 24.05.2024, according to the results of which no infiltrative changes were detected.

Table 1. Main clinical and laboratory indicators in the dynamics of neurolisteriosis treatment in patient T., 50 years old

Parameter, units of measurement	Date of examination				
	14.05	18.05	20.05	24.05	04.06
Body temperature, °C	38.3	38.1	38.3	37.8	37.0
Breath	spontaneous, oxygen support	mechanical ventilation	mechanical ventilation	mechanical ventilation	spontaneous, oxygen support
Chest X-ray	–	left-sided lower lobe pneumonia	–	without focal changes	–
Leukocytes, ×10 ⁹ /l	11.0	28.0	22.5	19.9	8.6
Neutrophils, %	88	82	87	75	72
Platelets, ×10 ⁹ /l	88.4	122.0	120.0	138.0	131.0
C-reactive protein, mg/l	76.0	–	–	48	–
Procalcitonin, ng/ml	6.66	–	6.39	3.71	–
CSF cytos, cells in 1 µl	1035	–	120	143	19
CSF neutrophils, %	96	–	8	5	0
CSF lymphocytes, %	4	–	92	95	100
CSF protein, g/l	1.38	–	0.46	0.43	0.23
CSF bacteriology	directed for research	–	result received on 14.05: <i>Listeria monocytogenes</i> sensitive to ampicillin, meropenem, erythromycin	directed for research	negative result received from 24.05
Antibacterial therapy	ceftazidime + amikacin	ceftazidime + amikacin	ampicillin	ampicillin	ampicillin
Total bilirubin, µmol/L	69.9	56.8	60.4	52.4	42.5
ALT, U/L	39.8	50.2	39.2	25.1	29.0
γ-glutamyl transpeptidase, U/l	335.6	263.6	213.9	–	201.1
Creatinine, µmol/l	113.4	153.0	165.7	99.6	89.6
Glucose, mmol/l	4.9	6.4	4.7	5.1	5.5
Amylase, U/l	163.1	889.0	311.2	280.9	175.5
Prothrombin index, %	65.9	58.5	63.7	64.4	66.6
International normalized ratio	1.46	1.63	1.50	1.49	1.44
Fibrinogen, g/l	3.2	2.3	2.9	3.4	3.0
Total protein, g/l	79.8	79.3	62.4	62.0	64.0
Albumin, g/l	33.6	26.3	26.5	26.0	26.2

The dynamics of the main clinical and laboratory data of patient T., 50 years old with neurolisteriosis in the dynamics of treatment are given in Table 1.

MV was discontinued on 04.06.2024, a control study of CSF was performed and the results were obtained, indicating in favor of CSF sanitation: cytos of 19 cells in 1 µl, 100 % lymphocytes, protein 0.23 g/l. Normalization of hemogram parameters was noted. The total course of antibacterial therapy was 21 days. Subsequently, the patient was transferred to the rehabilitation department.

Final diagnosis: listeriosis, invasive form; purulent meningitis (*Listeria monocytogenes* in CSF was isolated bacteriologically), severe course. The disease was complicated by cerebral edema (requiring MV), acute kidney injury of the second degree, community-acquired left-sided lower lobe pneumonia. Comorbidity was represented by chronic hepatitis of mixed genesis, encephalopathy of toxic genesis, exacerbation of chronic pancreatitis, hypertension.

Thus, the above clinical observation demonstrates an extremely severe course of invasive listeriosis in a patient belonging to the risk group due to the presence of comorbid pathology, primarily chronic hepatitis of mixed genesis, in particular associated with alcohol abuse. Overcoming the blood-brain barrier by the pathogen led to the formation of neurolisteriosis with the development of purulent meningitis, which was confirmed bacteriologically by the isolation of *Listeria monocytogenes* in CSF. Correction of antibacterial therapy considering the sensitivity of *Listeria*

to ampicillin allowed to obtain a clear positive dynamic and achieve CSF sanitation.

Clinical observation 2. Patient X., 25 years old, was hospitalized on 24.09.2024, to the maternity ward of the MNE "Regional Perinatal Center" ZRC due to premature birth (pregnancy II, 25 weeks). Upon admission, she complained of a rise in body temperature to 38.0 °C during the day with no effect when taking paracetamol and pain in the lower abdomen.

The patient gave birth to a live baby girl on 24.09.2024, who died 2 days later on 26.09.2024 due to respiratory failure. During life, the newborn's blood was immediately taken for bacteriological examination. The result of the bacteriological examination of the newborn's blood was obtained on 30.09.2024: *Listeria monocytogenes* was isolated, which was sensitive to ampicillin, meropenem, penicillin G and resistant to trimethoprim/sulfamethoxazole, erythromycin.

After receiving the results of the bacteriological examination, the final diagnosis was established: listeriosis of the newborn; septicemia (*Listeria monocytogenes* isolated in the blood by the bacteriological method), critical course. The established diagnosis was confirmed in accordance with the clinical, epidemiological, and laboratory criteria.

In connection with the results of the bacteriological examination of the child's blood, an infectious disease specialist was invited for a retrospective consultation. The infectious disease specialist clarified the history of the disease and the epidemiological history. It was found

that during pregnancy the woman had short-term manifestations of enteritis (defecation up to 3 times a day) without fever, was not treated and did not seek medical help twice (May and July 2024). Lives in a private house with her husband. Regularly eats meat products (often semi-finished products, sausage, ham), buys salted red fish, vegetables, fruits, herbs. During the summer of 2024, travelled to west part of Ukraine, ate in various cafes, bought a lot of ready-made food.

Thus, the presented clinical observation demonstrates an extremely severe course of fetus / newborn listeriosis invasive form, which was accompanied by septicemia and led to a fatal outcome. In the presented clinical case, the pregnant woman had a significant long-term epidemiological risk of becoming infected with *Listeria* through food, which most likely subsequently led to infection of the fetus / newborn.

Discussion

Human listeriosis presents clinically in one of three ways: maternal-fetal listeriosis/neonatal listeriosis; bacteremia with potential cerebral infections (meningitis, meningoencephalitis); and self-limiting febrile gastroenteritis [15,16]. Adverse effects of listeriosis are limited for the general population, but can be a serious problem and cause death for individuals in certain risk groups. Risk groups include pregnant women, newborns, the elderly, and patients with weakened immune systems due to comorbid condition [3,13,15,16].

Listeria infection occurs through the consumption of food contaminated with the pathogen, with the gastrointestinal tract being the main route of delivery of *Listeria monocytogenes* into the host body [17]. *Listeria monocytogenes* overcomes the intestinal epithelial barrier precisely by penetrating macrophages, which transport them, and enter the mesenteric lymph nodes. Through the bloodstream, they enter the primary target organs (liver and spleen), and from there, in patients at risk, they enter the secondary target organs (placenta or brain). In immunocompetent individuals, the liver and spleen foci of infection are effectively cleared by cellular immunity, so the disease is either subclinical or presents as a mild febrile gastroenteritis. In individuals at risk, infection can cause invasive disease because an effective T-cell-mediated immune response is not possible, and the primary foci of infection are not sufficiently cleared, and *Listeria monocytogenes* is then released into the bloodstream. This leads to bacteremia with fever and to the formation of invasive forms with damage to the brain or placenta. *Listeria monocytogenes* has a significant ability to overcome four key human protective barriers: gastrointestinal enzymes, intestinal epithelium, blood-brain barrier and blood-placental barrier in pregnant women [18]. The risk of developing an invasive form is determined by three main factors: the amount of *Listeria* ingested with food, the virulence of the strain, and, especially, the patient's immunological status [4].

Clinical observation 1 demonstrates the development of neurolisteriosis in a patient with comorbidity in the form of chronic hepatitis of mixed genesis (toxic and viral C in the state after antiviral treatment). Literature data

indicate that, compared with other pathogens, the risk of neuroinfection caused by *Listeria monocytogenes* is five times higher in patients with chronic liver disease than in the general population [4,11]. There is currently a certain pathogenetic explanation for why the risk of developing invasive listeriosis is high in conditions of liver damage. After overcoming the intestinal epithelial barrier, *Listeria monocytogenes* is transported to the liver through the blood and/or lymphatic system. In the liver, Kupffer cells are responsible for capturing and destroying bacteria. However, due to chronic comorbidity, they are unable to destroy *Listeria*, which can multiply even inside hepatocytes [19,20]. During internalization and multiplication, some *Listeria*s interact with neutrophils, leading to the formation of microabscesses and necrosis of individual liver cells. This creates conditions for the development of bacteremia with subsequent overcoming of other protective barriers by *Listeria* [13,21].

Listeria monocytogenes can enter the brain through intercellular spread from infected phagocytes through direct penetration of *Listeria* into the endothelial cells of the brain microvessels due to pathogenicity factors such as internalins A and B. *Listeria* penetration into brain vessels endothelial cells is further facilitated by the interaction of the internalin F protein of the *Listeria* internalin family with receptors on the endothelial cell membrane [22]. In the development of neurolisteriosis, meningitis formation is quite often accompanied by damage to the brain tissue with the formation of listeriosis meningoencephalitis. Cases of ventriculitis and small periventricular abscesses have also been reported [4,22,23].

In the given clinical observation 1, neurolisteriosis manifested itself with a gradual increase in clinical symptoms with the development of febrile fever and the presence of meningeal syndrome on the 6th day of illness. CSF laboratory examination confirmed the presence of purulent meningitis (cytosis of 1035 cells in 1 µl with a clear predominance of neutrophils 96 %). Purulent meningitis course was severe and complicated by the development of cerebral edema-swelling with impaired consciousness, seizures, which required MV. It should be noted that the correction of antibacterial therapy with the use of ampicillin gave a clear positive dynamic in achieving CSF sanitation.

Literature data indicate that the rapid use of adequate antimicrobial therapy is key to preventing the development of complications, death and long-term consequences of neurolisteriosis. Literature data indicate that *Listeria monocytogenes* is naturally sensitive to β -lactam antibiotics, primarily ampicillin, so this antibiotic should be the drug of choice in patients' treatment [24,25].

According to the literature, attention is also focused on the clinical course features of neurolisteriosis. *Listeriosis meningitis* has a slower onset of symptoms compared to bacterial meningitis of other etiologies. The average time to symptom onset in patients with neurolisteriosis is 2 days before hospitalization. Fever is characteristic, occurring in more than 90 % of patients, but the classic triad of bacterial meningitis is recorded in up to 70 % of cases. One in five patients may have impaired consciousness, and one in ten patients has seizures. CSF changes are characteristic of purulent meningitis, but the degree of leukocyte elevation is less pronounced than in meningitis

caused by other bacteria. Focal cerebral lesions detected by CT or MRI are recorded in 25 % of cases [3,4,26].

A 10-year retrospective multicenter study analyzed 110 patients with bacteriologically confirmed listeriosis treated in ICU of 23 hospitals in France [6]. It was found that the average age of patients was 68 years, 71 % of patients had weakened immunity. In most cases, neurosteriosis occurred, 58 % of patients were on MV, 44 % of patients required vasopressor support, and the mortality rate was 32 %. Researchers have identified certain prognostic features for adverse outcomes in neurosteriosis. Each 1-point decrease in Glasgow coma score at admission was associated with increased mortality, as was higher CSF protein levels [6].

Clinical observation 2 demonstrates a rather rich epidemiological history of the pregnant woman regarding the high probability of being infected with *Listeria monocytogenes*, since she regularly ate semi-finished meat products, sausage, ham, salted red fish, vegetables, fruits, and herbs. During pregnancy, she travelled around the country and ate in various cafes, buying a lot of ready-made food products. In the anamnesis, it was noted that during pregnancy the woman had two short-term manifestations of enteritis without fever, was not treated and did not seek medical help, which can be associated with a probable *Listeria* infection. In a study [27], based on the results of observation and questionnaires of 589 pregnant women regarding their knowledge regarding the possibility of listeriosis infection, it was proven that pregnant women demonstrate a low level of awareness about listeriosis and more often resort to high-risk behavior.

Listeriosis is currently considered a predominantly foodborne infection. Infection most often occurs through the consumption of contaminated foods, such as ready-to-eat vegetable salads, processed meats, dairy products, pre-packaged sandwiches, cold-smoked fish, etc. The pathogen readily forms biofilms, making the pathogen cells difficult to remove using standard sanitation protocols. *Listeria monocytogenes* can be found hiding in tools and equipment that are difficult to clean (slicers, food transport equipment and refrigeration equipment, etc.) [8,13].

Current literature data indicate that pregnant women have a 100-fold increased risk of developing listeriosis when infected with the pathogen, compared to non-pregnant women of reproductive age [4]. At the same time, it is extremely difficult to clearly determine the most likely food product, the consumption of which led to infection with *Listeria*. In neonatal listeriosis, the incubation period is longer and ranges from 17 to 90 days with a median of 27–28 days. The incidence of neonatal listeriosis in the world is from 1.3 to 25 cases per 100,000 live births [4].

Today, there are certain explanations regarding the pathogenetic mechanisms of neonatal listeriosis. Listeriosis develops in pregnant women even in the absence of comorbid immunosuppressive pathology, since the physiological immunosuppression that occurs during pregnancy is sufficient for disease development. It is believed that *Listeria monocytogenes* can colonize the placenta by intercellular spread from infected phagocytes to cytotrophoblasts or by direct invasion of the trophoblast by internalins A and B. Internalin P, which is specific to *Listeria*, additionally promotes penetration into the pla-

centa. After *Listeria monocytogenes* enters the placenta, it actively multiplies, leading to fetal colonization with cell-to-cell spread. *Listeria* from the placental reservoir entering the bloodstream can re-infect the mother's liver and spleen, contributing to the maintenance and infection exacerbation. Transplacental spread of *Listeria* to the fetus leads to abortion, stillbirth, or neonatal sepsis. Congenital neonatal listeriosis may also occur, with meningitis as the main manifestation [4,28].

In clinical observation 2, the pregnant woman had only short-term diarrhea, which was probably a manifestation of listeriosis enteritis. However, this caused *Listeria* to overcome the hematoplacental barrier and develop fetal / neonatal listeriosis with bacteremia (identified at birth) and consequently caused premature birth and death for the newborn.

An analysis of the literature on this issue proves that maternal listeriosis can have a subclinical course up to the manifestation of obstetric signs, the only manifestation of which is premature birth, often accompanied by severe fetal distress. In every third pregnant woman, listeriosis has clinical manifestations at the onset of the disease, such as general malaise, abdominal pain, dry cough, fever, nausea, vomiting, headache. In most cases, pregnant women recover from listeriosis without even antibiotic treatment. However, neonatal listeriosis, caused by mother-to-infant transmission, has severe clinical manifestations. Newborns with listeriosis develop bacteremia (72 %), pneumonia (13 %), and meningitis (19 %). Mortality from neonatal listeriosis is up to 50 %, and surviving newborns have neurological sequelae [4,29].

Since human listeriosis is a foodborne infection caused by an environmental bacterium, the main focus of prevention of this infection is to control *Listeria monocytogenes* food chain contamination. Therefore, environmental monitoring of food establishments for *Listeria* and enhanced sanitation efforts are of particular importance. Food control measures are critically important, but there is currently no international consensus on acceptable levels of *Listeria monocytogenes* contamination. The Food and Drug Administration (FDA) has a zero-tolerance policy because even low levels of *Listeria monocytogenes* food products contamination are associated with a risk of illness in immunocompromised individuals. The Centers for Disease Control and Prevention (CDC) considers it necessary to report every case of listeriosis nationally [4,30,31].

Regarding general measures to prevent listeriosis, it is important to note the importance of health education for people at risk. For example, people at risk should only eat properly cooked food and avoid semi-finished products, unpasteurized dairy products, vacuum-packed soft cheeses, dried or smoked fish products, etc. Since *Listeria* can multiply in the temperature conditions of a refrigerator, products shelf life cannot be ignored [31,32].

Conclusions

1. The presented clinical observations demonstrate the development of severe invasive forms of listeriosis in patients at risk. In the first observation, infection with *Listeria* in a patient with chronic hepatitis of mixed gen-

esis led to the formation of neurolisteriosis in the form of purulent meningitis, complicated by edema-swelling of the brain. The second clinical observation demonstrates the formation of fetal / neonatal listeriosis with the development of bacteremia, which caused premature birth and an unfavorable outcome of the disease in the newborn.

2. Clinical analysis of listeriosis cases will increase the awareness of practicing physicians in the modern spectrum of infectious diseases and will contribute to increasing the efficiency of listeriosis diagnostics and, accordingly, further effective treatment.

AI statement

The authors did not use artificial intelligence tools in the preparation of the manuscript.

Ethical approval

The study was approved by the Bioethics Committee of the Zaporizhzhia State Medical and Pharmaceutical University reviewed the materials provided in the article and found no violations of the ethical standards set forth in applicable regulatory documents, including the Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine, and other legal acts (Protocol No. 06 of 16.04.2026).

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