THE ROLE OF LISTERIA IN INFECTIOUS PATHOLOGY OF ANIMALS AND HUMANS

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Abstract: A modern concept of the development of cells of infectious forms in animals and humans is presented. An analysis of the main factors determining the rapid increase in the incidence of listeriosis in recent years was carried out: infection and active reproduction of listeria in food products, increased sensitivity to listeria in the risk group against the background of the level of cellular immunity. The features of intracellular parasitism and the expression of Listeria pathogenicity factors are considered. Analysis of various methodological approaches to the diagnosis of listeriosis indicates the leading role of bacteriological methods for the isolation and identification of L.monocytogenes based on modern selective agents and the need for their development in modern medical laboratories and sanitary surveillance centers.

Key words: listeria, epizootology, epidemiology, zoonosis, sapronosis, pathogenicity factors, microbiological diagnostics, monocytosis, concomitant infection.

In 1926, E.G. Murray et al. Listeria was isolated during an epizootic of laboratory animals in a Cambridge nursery]1]. The name L.monocytogenes was given in 1940 in honor of the English surgeon D. Lister (1827-1912), who developed the asepsis method, and at the same time indicated the presence of monocytosis, characteristic of sick rabbits and guinea pigs. In 1929, Listeria was first isolated from a sick person, as well as from sheep, one of the main hosts of Listeria that humans come into contact with.

Three main stages can be distinguished in the relationship between Listeria and the human population. The first was before the 50s, when no more than 70 cases of listeriosis were identified in the world, usually in people who had direct contact with infected animals (slaughterhouse workers, livestock farmers, milkmaids).

The second is the 50-60s. The number of cases of listeriosis reaches several thousand. This infection is considered a very dangerous zoonosis with a high mortality rate, but most cases are still associated with agricultural regions and the consumption of raw milk, contact with sick animals, including rodents.

The third - 80s - to the present. Numerous epidemic outbreaks and sporadic cases of listeriosis in highly developed countries of the world (USA, UK, Switzerland, Canada, France) were associated with the consumption of finished products of the food industry (cheeses, especially soft cheeses, semi-finished meat products, salads, etc.), after which this disease became considered as one of the important foodborne infections in the world.

Listeriosis, as before, is not a widespread infection. In terms of the number of identified cases, it is significantly inferior to salmonellosis and campylobacter, but superior in mortality and severity of the clinical course. Thus, of the 2518 people with listeriosis identified in the United States in 1997, 20% had a fatal outcome, and hospitalization of patients was required in 92% of cases]5]. Diagnosis of listeriosis is associated either with the work of veterinarians or with the enthusiasm of individual researchers. The lack of an effective system of sanitary-epidemiological and epidemiological surveillance of listeriosis and the unsatisfactory quality of laboratory diagnostics have created a kind of vacuum between the real role of listeria in human infectious pathology and practical research in this area by clinical microbiologists.

Epizootological, epidemiological and clinical features of listeriosis. The place and role of Listeria in human infectious pathology can be most fully characterized from the following positions. Listeria as causative agents of saprozoonotic infection. Until the 1980s, listeriosis was considered a typical zoonosis with a fecal-oral transmission mechanism.]8,9]. The causative agent of listeriosis has been isolated from more than 90 species of wild and domestic animals, birds, fish, shellfish, insects and ticks. Listeria is a common component of the fecal microflora of many mammals [10]. The traditional source of infection for humans are farm animals and rodents.

Data from domestic and foreign researchers in recent years indicate exceptionally broad adaptive abilities of Listeria, allowing them to reproduce in a saprophytic environment in various natural substrates (plant, soil, water). Listeria is capable of reproducing in a wide range of temperatures (4-45°C), pH (4.8-9.0) and humidity, in the presence of NaCl (20%) and 15% CO_2. The high metabolic plasticity of Listeria makes it possible for them to transition from the saprophytic to the parasitic phase and vice versa. These circumstances, along with traditional ideas about the connection between listeria and warm-blooded animals, allow us to consider listeriosis as a typical saprozoonosis.

The role of Listeria in perinatal and neonatal pathology. Listeria infection poses the greatest danger to pregnant women and newborns. It causes miscarriages,

stillbirths, the development of fetal defects, as well as meningitis, sepsis and pneumonia in newborns. For Listeria, as for other facultative intracellular parasites (legionella, mycobacteria), cellular immunity plays a major role. A decrease in the level of cellular immunity during pregnancy, especially in later stages, causes an increase in susceptibility to listeria infection in this risk group. More than 20% of cases of perinatal listeriosis result in intrauterine fetal death. Biology and pathogenicity factors of Listeria. L.monocytogenes is a small gram-positive, non-spore-forming bacillus, facultative anaerobe, chemoorganotroph. Listeria ferments glucose, is catalase-positive, oxidase-negative. The optimal growth temperature is 30-37ºC, although Listeria, as psychrophilic microorganisms, can grow in a wide temperature range, starting from +4ºC. At a temperature of 20-25°C, Listeria is motile due to the formation of a few peritrichial flagella. At a temperature of 37°C, flagella, as a rule, are not formed, and Listeria are immobile [9].

The scientific aspect of interest in Listeria is due to the fact that these bacteria have become one of the most popular models for studying intracellular parasitism. All stages of interaction with a eukaryotic cell and intracellular replication of Listeria are quite well studied. These include:

-interaction of listeria with specific receptors of eukaryotic cells;

-active induction of phagocytosis, as a result of which the bacterium ends up in the primary phagosome, surrounded by a single-layer membrane.

-lysis of the primary vacuole

- division in the cytoplasm of a eukaryotic cell;

- polymerization of actin, necessary for the movement of bacteria through the cytoplasm with the formation of a characteristic “actin tail”;

-penetration into the neighboring cell by pushing through the membrane and forming a finger-like invagination into the neighboring cell.

-lysis of a secondary vacuole surrounded by a double membrane.

-a new division cycle in the neighboring cell.

Table 1. Pathogenicity factors of L.monocytogenes

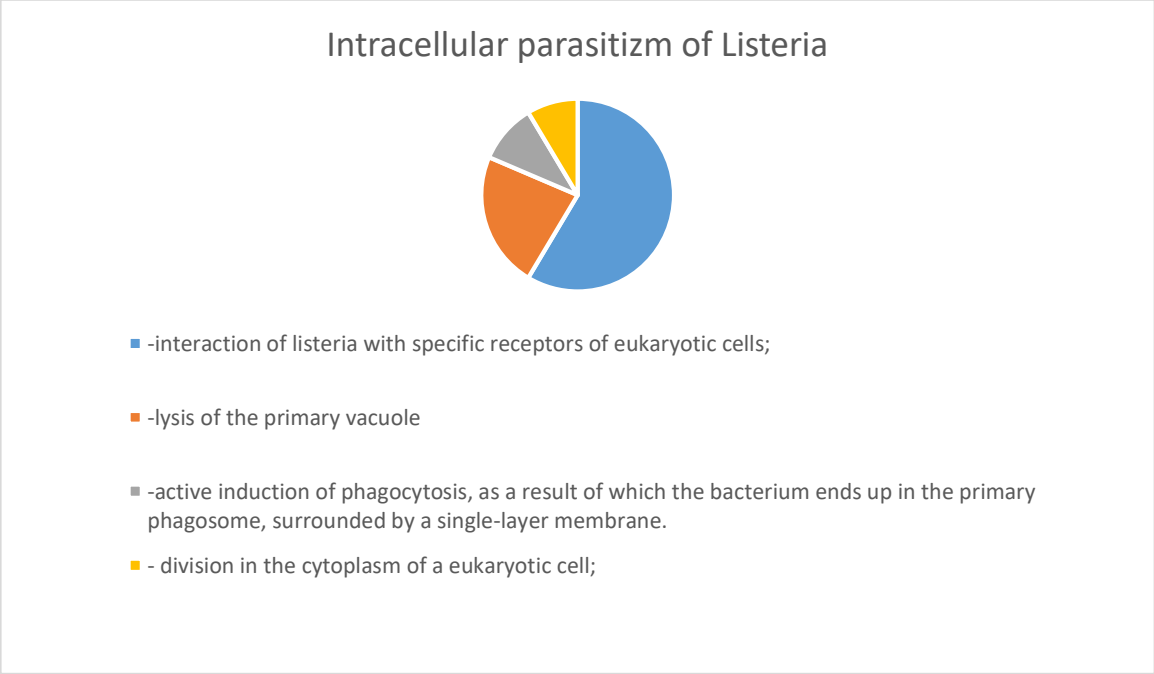
Protein	Function
PrfA	Regulation of virulence gene transcription
Listeriolysin	Lysis of primary and secondary phagosomes

PICA (phosphatidylinositol-specific phospholipase C	Phagosome lysis
Lecithinase	Lysis of the secondary phagosome
Metalloprotease	Post-translational modification of lecithinase
InternationalInIB	Induction of phagocytosis
ActA	Actin polymerization

Listeriolysin is the main pathogenicity factor of Listeria and has a pronounced toxic effect when infecting laboratory animals, causing their death. When interacting with a eukaryotic cell, listeriolysin O participates in the lysis of the vacuole (primary and secondary), ensuring the free division of listeria in the cytoplasm.

Phosphatidylinositol is a specific phospholipase C (PICA), a protein with a molecular weight of 36 kDa. Participates in the lysis of the membrane of the primary vacuole together with listeriosin O.

Phosphatidylcholine is a specific phospholipase C (PICA), a protein with a molecular weight of 33 kDa. The enzyme is species specific for L. monocytogenes and is involved in the lysis of the secondary vacuole. Internalin A (InIA), an 88-kDa protein, is involved in epithelial cell invasion. Internalin B, a 65 kDa cell wall protein, is required for invasion of hepatocyte cells, but not intestinal epithelium.



Conclusion

The data presented indicate the multifaceted role of listeria in human infectious pathology and the need to further improve sanitary-epidemiological and epizootological surveillance and laboratory diagnosis of listeriosis. This can be achieved mainly as a result of combining efforts in the organizational work of bacteriologists, epizootologists, epidemiologists and specialists in the field of food hygiene. Establishing the production of selective media for the isolation of Listeria and other reagents necessary in modern schemes for the isolation and identification of L.monocytogenes; implementation of nutritional recommendations excluding the consumption of foods in which listeria is most likely to multiply, monitoring listeria in obstetric hospitals to prevent nosocomial listeriosis.

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