



# Listeriosis: A Resurfacing Menace

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## ABSTRACT

Listeriosis is a rare but potentially deadly foodborne infection. *Listeria monocytogenes* is a common contaminant of food, and may cause severe disease in pregnant women, fetuses, neonates, the elderly, and those who are immunocompromised by medical conditions or treatments. Delay in treatment is an independent risk factor for neurologic sequela of *L monocytogenes* infection. A review of the literature, pathophysiology, epidemiology, clinical presentation, prevention, diagnosis, and treatment options is presented. The role of the primary care provider in prevention, patient education, and clinical management is reviewed.

**Keywords:** bacterial meningitis, fever, foodborne infection, *Listeria monocytogenes*, listeriosis

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## LISTERIOSIS: A RESURFACING MENACE

**L**isteria *monocytogenes* was identified as a foodborne pathogen in humans for the first time in the 1980s.<sup>1</sup> Listeriosis is relatively rare, but often lethal. Most cases are sporadic, but infrequent outbreaks occur and can be traced to contaminated foodstuffs. *L monocytogenes* is a ubiquitous bacterium with widespread distribution in the environment. It is a common contaminant of food and food preparation equipment and has been isolated in soil, farm environments, feces of asymptomatic people, food preparation environments and equipment, a variety of raw and processed foods, dairy products, and produce.<sup>2</sup>

Exposure to *L monocytogenes* is universal, but reported *Listeria*-associated illness rates are low. The ability of the organism to invade the tissue and avoid the body's immune defenses is dependent on the integrity of the host immune system and the virulence of the pathogen. Those most susceptible to severe listeriosis include pregnant women and their newborns, the elderly, and patients who are immunocompromised.<sup>3</sup> Disease presentations range from noninvasive, self-limited gastroenteritis to life-threatening, invasive disease primarily affecting the central nervous system (CNS). There is a high hospitalization rate with a 21% mortality rate for patients diagnosed with meningitis and septicemia.<sup>3</sup>

This CE learning activity is designed to augment the knowledge, skills, and attitudes of nurse practitioners and assist in their diagnosis and treatment of patients at risk for listeriosis:

- Identify patients at risk for listeriosis
- Formulate appropriate prevention and education plan for all patients, particularly those at high risk
- Provide appropriate diagnosis and treatment of listeriosis.

The authors, reviewers, editors, and nurse planners all report no financial relationships that would pose a conflict of interest.

The authors do not present any off-label or non-FDA-approved recommendations for treatment.

This activity has been awarded 1.0 Contact Hours of which .25 credits are in the area of Pharmacology. The activity is valid for CE credit until January 1, 2020.

In March 2017, there was a multistate outbreak of listeriosis related to raw milk cheeses made by the Vulto Creamery, in which 8 people were infected throughout 4 states, resulting in 2 deaths. In 2016, there were several outbreaks related to frozen vegetables, raw milk, and packaged salads.<sup>4</sup> During these multistate outbreaks, 30 people were infected and 5 people died. In 2015, the United States Centers for Disease Control and Prevention (CDC) documented invasive listeriosis in 10 patients across 4 states over a 5-year period. Five patients acquired invasive listeriosis while hospitalized for unrelated conditions in a hospital in Kansas. Three of those patients died. Genetic fingerprinting implicated single-serving ice cream from a Blue Bell ice cream plant in Oklahoma. Blue Bell recalled its products and the outbreak abated. Despite Blue Bell's timely response, the mortality rate in this outbreak was still 30%.<sup>5</sup>

Delay in treatment is an independent risk factor for neurologic sequela of *L monocytogenes* infection, and nurse practitioners in primary care are ideally situated to provide surveillance, rapid identification, and treatment of this disease. Knowledge of the pathophysiology, epidemiology, clinical presentation, diagnosis, and treatment are crucial for providers engaged in education, prevention, and treatment of this disease.

### PATHOPHYSIOLOGY

*L monocytogenes* is a beta-hemolytic, Gram-positive rod capable of causing severe disease in vulnerable patients when ingested in sufficient quantity.<sup>6,7</sup>

*L monocytogenes* is a hardy bacterium that can thrive in a wide range of conditions. It is capable of surviving in the environment on inanimate objects, but is adapted for survival in the body by invading the cell and spreading to adjacent cells without exposure to the extracellular environment. It can survive at refrigeration temperatures (1°–45°F) and a wide range of pH levels (4.0–9.5). It is also capable of growth in a high-sodium chloride environment. The organism is able to resist common industrial cleaning agents.<sup>2,8</sup>

Infection results from ingesting sufficient quantities of the organism. In the case of invasive disease, the organism invades the intestinal epithelial cells and spreads through the lymph and blood to distant sites.<sup>1</sup> It can evade the body's innate immune system

through resistance to stomach acidity and bile acids, attack by macrophages, and competition from normal gut flora for nutrients.<sup>1,8</sup> It is able to breach 2 other immune system barriers: the placental barrier and the blood-brain barrier. This characteristic gives the organism an ability to cause fetal infection, neonatal illness, and invasive central nervous system disease.<sup>1</sup>

### EPIDEMIOLOGY

The study of *L monocytogenes* disease is complicated by the pervasive presence of the pathogen in the environment, long and variable incubation periods for invasive disease, variable presentations of the disease, and the uncertain quantity of organism required to produce disease.<sup>9</sup> There is no clinical or epidemiologic evidence supporting person-to-person transmission except for vertical transmission from mother to fetus.<sup>6</sup>

Some foods are particularly prone to *L monocytogenes* contamination. Previous outbreaks have been traced to dairy products, particularly Mexican-style cheese, which is not exposed to heat during processing.<sup>8</sup> Other outbreaks have been traced to cantaloupes,<sup>10</sup> deli meat, fish,<sup>2</sup> ready-to-eat meats such as hot dogs, pasteurized and unpasteurized cheese, premade salads,<sup>11</sup> and precut celery.<sup>12</sup> The ability of the organism to multiply at refrigeration temperatures makes it a particular hazard in ready-to-eat foods that require refrigeration and are eaten without heating.<sup>7</sup> It is destroyed by high temperatures used in processing and cooking, but contamination postprocessing and in the retail setting is common.<sup>13</sup>

Although a rare occurrence relative to other foodborne infections in the US, listeriosis is the third leading cause of death from foodborne illness (19%), behind nontyphoidal salmonella (28%) and *Toxoplasma gondii* (24%).<sup>14,15</sup> The US Foodborne Diseases Active Surveillance Network (FoodNet) reported no change in the incidence of reported cases of listeriosis in the US from 2006 to 2014.<sup>3</sup> The US incidence is low with only 118 cases reported in 2014, but hospitalization rates were 92%, with 15.3% case fatality.<sup>16</sup>

Ninety percent (90%) of invasive listeriosis occurs in specific high-risk subgroups: pregnant women or their newborns; people > 65; or those individuals

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