Epidemiology of Listeriosis

Monika Naus, MD, MHSc, FRCPC, FACPM
Associate Director, Epidemiology Services
BC Centre for Disease Control

November 20, 2001
Foodborne illness

- More than 200 known diseases are transmitted through food:
  - viruses, bacteria, parasites
  - toxins, metals
  - prions

- US estimates 1999:
  - 38.6 million illnesses each year

Food-borne pathogen illnesses - US estimates

Total Illness: 38.6 million

- Bacteria: 25% of total
- Parasites: 5% of total
- Viruses: 70% of total

Food-borne: 13.8 million

- Bacteria: 90% of food-borne
- Parasites: 5% of food-borne
- Viruses: 5% of food-borne

Listeriosis: 2,500 total cases per year
- 99% food-borne
- 92% hospitalized
- 20% fatal
Listeria - burden of illness

- Of the 13.8 million US annual cases of food-borne illness, accounts for:
  - 0.02% of cases (~2,500)
  - 3.8% of hospitalization due to food-borne illness (~2,300)
  - 27.6% of deaths from food-borne illness (~500)
    - mortality 11% under 40 years old, 63% in >60 year olds
Listeria monocytogenes

- Methods of transmission
  - mother to foetus in utero or at childbirth
  - infant to infant (newborn nursery)
  - animal to human
  - food - most important

- Incubation period 3-70 days
  - median = 3 weeks
Propensity for immunocompromised persons

- Overall incidence is 0.7 per 100,000
- In persons > 70 years: 3 x higher
- In pregnant women: 12 x higher
- In persons with AIDS: 100-300 x higher
- Other immunocompromised:
  - corticosteroid treatment
  - cancer
  - diabetes mellitus
  - renal failure
Listeriosis - clinical syndrome

- Flu-like illness, fever, malaise, headache, GI symptoms, back pain
- Meningitis, septicemia
- Infection in pregnancy: spontaneous abortion, stillbirth or prematurity, infection in the newborn (pneumonia, septicemia)
Listeriosis - diagnosis

- Culture of blood or cerebrospinal fluid
- Rarely other normally sterile sites
- Bacterium - Gram positive rod
  - serovars 1/2a, 1/2b, 4b cause most human illness
**Listeria - treatment**

- Initial therapy with IV ampicillin and an aminoglycoside (gentamicin)
- Alternative is trimethoprim-sulfamethoxazole
- Rx duration 10-14 days; for meningitis 14-21 days
- Cephalosporins are not active against *L. monocytogenes*
Descriptive epidemiology - Canada

- Person
- Place
- Time
Listeriosis incidence in Canada by age and sex, 1998

Number of reported cases

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>1 to 9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10 to 19</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20 to 29</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>30 to 39</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>40 to 59</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>60+</td>
<td>18</td>
<td>28</td>
</tr>
</tbody>
</table>
Salmonellosis, BC, 2000 by age and sex

![Bar chart showing the rate per 100,000 population for Salmonellosis Reports by age group and sex in BC, 2000. The chart includes data for both females and males, with separate bars for reports and rates.](chart.png)
VTEC, BC, 2000 by age and sex
Reported rates of listeriosis in Canada, 1998, per 100,000

red: 0.4-0.8; orange: 0.2<0.4; yellow: 0.02<0.2; green: 0<0.1
Listeriosis incidence in Canada by jurisdiction, 1998

Number of reported cases

<table>
<thead>
<tr>
<th>Province</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nfld.</td>
<td>1</td>
</tr>
<tr>
<td>PEI</td>
<td>0</td>
</tr>
<tr>
<td>NB</td>
<td>2</td>
</tr>
<tr>
<td>Que</td>
<td>51</td>
</tr>
<tr>
<td>ON</td>
<td>8</td>
</tr>
<tr>
<td>Sask</td>
<td>12</td>
</tr>
<tr>
<td>AB</td>
<td>2</td>
</tr>
<tr>
<td>BC</td>
<td>2</td>
</tr>
<tr>
<td>NWT</td>
<td>0</td>
</tr>
</tbody>
</table>

“Estimated annual cost of listeriosis in Canada: $11.1 to 12.6M”

Listeriosis incidence in Canada 1990-1998

Number of reported cases

Source: Health Canada
Notifiable Diseases On-Line
Listeriosis incidence in BC 1991-2000

Number of reported cases

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>2</td>
</tr>
<tr>
<td>1992</td>
<td>3</td>
</tr>
<tr>
<td>1993</td>
<td>2</td>
</tr>
<tr>
<td>1994</td>
<td>10</td>
</tr>
<tr>
<td>1995</td>
<td>3</td>
</tr>
<tr>
<td>1997</td>
<td>3</td>
</tr>
<tr>
<td>1998</td>
<td>2</td>
</tr>
<tr>
<td>1999</td>
<td>3</td>
</tr>
<tr>
<td>2000</td>
<td>7</td>
</tr>
<tr>
<td>2001</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: BC Centre for Disease Control
2001 data to November 20, 2001
### Listeriosis & other enteric disease incidence, BC, 2000

**Number of reported cases (logarithmic scale)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Campy</th>
<th>Yers</th>
<th>Salm</th>
<th>VTEC</th>
<th>Vibrio para.</th>
<th>Typh</th>
<th>List</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2553</td>
<td>1018</td>
<td>684</td>
<td>163</td>
<td>14</td>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>

(Data in thousands)
Listeriosis - occurrence

- Sporadic and outbreak associated
  - sporadic far exceed outbreak; source rarely determined
- Foods associated with infection:
  - nearly all types, esp. manufactured ready-to-eat foods stored refrigerated for long periods
Outbreaks of listeriosis in North America and Europe - newly implicated foods

- 1982 Maritimes: packaged coleslaw mix made from cabbages contaminated with sheep manure
- 1988, 1995: soft cheeses made from both raw and pasteurized milk
- 1989: case report related to turkey franks
- 1991: liver pâté
- 1995: jellied pork tongue
- 1997, 1999: rainbow trout
- 1998: smoked mussels
- 1999: frankfurters
- 2000: processed turkey and chicken deli meat; imitation crab meat
Outbreak investigation

- Case risk factor and food exposure history
- Case-control study
- Implicated food distribution traceback
- Food/ environmental testing at case home, retail and plant
Methodological challenges

- food history for 2 months prior to onset of illness
- wide array of potential food items
- “deli” foods with cross-contamination
- fatal outcomes without proxy historian
- some success with case-case comparison
Public health activities

- Listeriosis is a reportable disease in Canada since 1987
  - reporting rates estimated to be high
- Baseline rates are low and increases are apparent
- Isolates routinely serotyped; fingerprinting used to identify potential outbreaks
- Outbreak investigation
  - local/provincial/federal public health
  - laboratory
  - food agencies
- Public advisories during outbreak recalls
- Public education
Dietary recommendations for persons at high risk of listeriosis *

- Avoid soft cheeses (e.g., feta, brie, Camembert, Mexican-style, and blue-veined cheese). There is no need to avoid hard cheeses, cream cheese, cottage cheese, or yogurt.
- Leftover foods or ready-to-eat foods (e.g., hot dogs) should be reheated until steaming hot before eating.
- Although the risk for listeriosis with foods from delicatessen counters is relatively low, persons at high risk may choose to avoid these foods or to thoroughly reheat cold cuts before eating.

*High risk persons are those who are immunocompromised by illness, medication or other therapy and pregnant women.
General guidelines for preventing listeriosis through home-food handling and preparation

- Thoroughly cook raw food from animal sources
- Wash raw vegetables
- Keep uncooked meats separate from vegetables
- Avoid unpasteurized dairy products
- Wash hands, knives and cutting boards after exposure to uncooked foods
SUMMARY

Features of listeriosis compared to other food-borne bacterial illnesses

Listeriosis

- Low incidence
- Systemic symptoms
- Host: poor T cell immunity - newborn, pregnancy, elderly, immunocompromised
- Source = food; potential for outbreaks
- High rate of hospitalization and mortality

Most other pathogens

- High incidence
- Gastrointestinal illness
- Host: healthy people
- Source (non-toxin mediated) food 30-95%; water, p-t-p, potential for outbreaks
- Low hospitalization and mortality
Listeriosis as an emerging pathogen

- Demographic changes influencing future epidemiology
  - aging of the population
  - increased numbers of immunocompromised persons

- Unknowns which lead to caution about listeria ("listeria hysteria"): 
  - minimum dose required to cause infection
  - variation in virulence (ability to cause severe disease)