Prevention and control of listeriosis

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Summary: Listeria monocytogenes, the most pathogenic species of the genus Listeria, is the cause of serious infections in man and animals. The author reviews the current state of knowledge and research concerning these diseases, their epidemiology and prevention and control measures.

KEYWORDS: Bacterial diseases - Disease control - Epidemiology - Food hygiene - Listeria - Zoonoses.

Despite growing concern among public health services and specialists in food hygiene, relatively little is known about listeriosis in man and animals. For this reason, the WHO organised a consultation in West Berlin, from 10 to 12 December 1986. The aim of this meeting was to set out the current state of knowledge about these diseases as well as useful directions for future research, and to recommend preventive measures. The present report, written by the OIE representative at the Berlin meeting, offers a brief outline of these questions.

LISTERIA MONOCYTOGENES

The genus Listeria contains two virulent species:

- Listeria monocytogenes (the species most pathogenic for man and animals),
- Listeria ivanovii (responsible for abortion in ewes, cows and goats, and possibly for disease in man).

Other species are: L. seeligeri (isolated on one occasion from a human being with meningitis), L. innocua, L. welshimeri, L. grayi and L. murrayi (all of which are non pathogenic).

These species are differentiated by the haemolysis test and by a small number of biochemical tests.

There are 16 serovars distinguishable by 14 somatic and 5 flagellar antigens. In most cases of human and animal listeriosis, however, only three serovars (1/2a, 1/2b and 4b) occur.

Phage-typing is important when epidemics occur. There are phage-typing centres in France, certain other European countries and North America.

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THE DISEASE

In man

Listeriosis takes the forms of meningitis, meningo-encephalitis and septicaemia; intra-uterine infection of the fetus during pregnancy leads to abortion, stillbirth, or infection in the neonate.

Immunosuppression renders human beings particularly susceptible to listeriosis, though infections can occur in apparently healthy subjects of all ages.

Strains of *L. monocytogenes* are sensitive to ampicillin, but antibiotic therapy may fail if the bacteria are located within cells. When the central nervous system is involved it is important to make a diagnosis promptly (by Gram staining of smears of cerebrospinal fluid, and bacteriological culture from this fluid and from blood). When febrile episodes occur in a pregnant woman it is important to set up a blood culture and to institute appropriate antibiotic therapy.

In animals

*L. monocytogenes* has been isolated from various species, and the infection is of economic importance in cattle, sheep and goats.

Among cattle it is manifested by abortion, and numerous strains of *L. monocytogenes* have been recovered from the stomach contents of aborted fetuses. Encephalitis may occur in non-pregnant animals, usually with a fatal outcome.

Among sheep, *Listeria* abortion has been recorded in most countries. Metritis and septicaemia occurring after a ewe has aborted may be fatal. Cerebral localisation of the disease in ewes and lambs can result in 60% mortality.

EPIDEMIOLOGY OF LISTERIOSIS IN MAN AND ANIMALS

Surveillance and data collection

In Europe the recording of data is incomplete in both man and animals, though in certain countries a central laboratory is responsible for collecting isolates of human and animal origin.

In those countries which operate a surveillance system, there has been an increase in human incidence during recent years. In the USA the annual incidence is 4-7 cases per million inhabitants. Twenty per cent of sporadic cases are fatal. Incidence is highest among infants less than one month old. The three epidemics in North America have been attributed, respectively, to the ingestion of raw cabbage salad, pasteurised milk and soft cheese.

Transmission of listeriosis

There has been little progress in the study of transmission of *Listeria* for three reasons:

- *L. monocytogenes* is widespread in the environment, and intestinal carriage occurs frequently without resulting in disease.
- No satisfactory typing system has been developed yet. Even today, only one method (phage-typing) has been validated for *L. monocytogenes*.
In general, listeriosis is a rare disease, and surveillance systems remain inadequate.

Investigations of various populations by differing techniques have shown that the proportion of healthy human carriers ranges from 0.5 to 91.6%. These results are difficult to interpret, however, because it is only recently that *L. monocytogenes* has been differentiated from other avirulent species. Future studies may provide more precise data on the frequency of the carrier state for *L. monocytogenes* (in the strict sense) among man and animals.

**Transmission by food**

Foodborne transmission has been under discussion for many years, and it is now recognised that the feeding of silage of poor quality and with a high pH to livestock may result in listeriosis among cattle, sheep and goats. In the Netherlands, improvements in silage preparation have led to fewer cases of listeriosis.

Evidence for foodborne transmission of human listeriosis has increased recently, although proof of its occurrence requires:

(a) a link between cases of disease and the consumption of a certain food;

(b) isolation of *L. monocytogenes* from the suspect food and from the patients (and shown to be identical by phage-typing);

(c) in sporadic cases the suspect strain of *Listeria* should have been isolated from a batch of food not manipulated by the patient.

These conditions are rarely met.

**Importance of listeriosis**

It is a severe disease with a high mortality rate, particularly among immuno-suppressed or immunodeficient persons. Increased use of immunosuppressive drugs in man increases the risk of listeriosis.

**PREVENTION AND CONTROL**

**General considerations**

There is a need for better knowledge of the epidemiology of listeriosis among man and animals. Eradication is impossible, for every food of animal or vegetable origin may be contaminated, either by handling or due to faecal carriage. The use of manure or litter from animal houses for soil fertilisation has increased the extent of environmental contamination in some countries.

There are two facets to prevention and control: animal production, and the processing of food products.

**Animal production**

Vaccination has not been considered in western Europe or the USA. Prevention is based on hygienic measures, including effective disinfection of surfaces contami-
nated by abortions or by animals with mastitis. Numerous animals are healthy carriers, and poultry are a reservoir of *Listeria*, even though the disease does not occur in them.

**Processing of food products**

It is necessary to take into account the frequent occurrence of *L. monocytogenes* in raw foods, and the intrinsic properties of foods which could enhance or diminish the multiplication of *Listeria* during processing.

(a) *Influence of intrinsic and extrinsic factors on the products*

Little is known of the effects of pH, redox potential and water activity. Cultures of *Listeria* grow at pH between 5 and 9.6, and at temperatures between 1 and 45°C. It is recognised that pasteurisation at 71.6°C or higher destroys *Listeria* after 15 seconds, but the resistance of intracellular bacteria is still under investigation.

The ability of *Listeria* to multiply at low temperature raises a major problem in the case of refrigerated meat.

(b) *Importance of Listeria in food — the risk factor*

The risk of contamination is considerable for raw products, for example, meat products eaten raw, cheese, fresh and refrigerated salads. Products consumed after cooking present less risk, although it is necessary to avoid recontamination after cooking.

(c) *Preventive measures*

Prevention and control are difficult at the farm level. The food industry has to cope with contaminated raw materials, resulting in the need to treat them as rapidly as possible by, for example, irradiation or lactic acid.

When the parameters of a food and its processing, in their relation to *Listeria* growth, are unknown, they should be investigated so that the “Hazard Analysis Critical Control Point” approach can be applied.

It is necessary to investigate the vectors of contamination for the products at risk, and then to apply the appropriate measures to avert contamination.

Factories should operate hygienic precautions to avoid recontamination of processed food, and training of factory personnel is required to improve hygiene during food processing.

**Information for consumers**

The public is still insufficiently aware of the risk associated with eating raw food. Immunosuppressed and immunodeficient persons are very sensitive to listeriosis, and health workers should call attention to this risk.

**Surveillance**

Problems are created by the ability of *Listeria* to multiply in food during storage, processing and distribution. We still lack reliable and rapid techniques to apply effective control. There are some promising new techniques, but further research is needed before they can be applied.