衞生防護中心
Centre for Health Protection

Scientific Committee on Enteric Infections and Foodborne Diseases

Updated situation of listeriosis in Hong Kong

Purpose

This paper provides an update of the epidemiology of listeriosis in Hong Kong and makes recommendations on the measures for prevention and control of the disease.

The pathogen and the disease

The bacteria

2. *Listeria monocytogenes* is a Gram-positive rod-shaped bacterium. There are thirteen recognised serotypes of *L. monocytogenes*, and about 95% of human infections were caused by serotypes 1/2 a, 1/2 b, 1/2 c, and 4b [1, 2].

3. The bacterium can grow over a wide range of temperatures from 0°C to 45°C, with an optimum around 37°C [3]. It can survive below freezing temperature (-7°C) [4] as well as in acidic conditions and high salt concentrations [3], thus favouring its transmission through food which are chilled, highly processed and have a long shelf life [5].

Reservoirs

4. *L. monocytogenes* is universally found in the environment, particularly in soil, vegetation, animal feed, and in human and animal faeces. The bacterium can contaminate a variety of foods such as meat, milk, fish and vegetables, and is frequently isolated from the environment of food processing plants [6, 7].

5. There have been epidemiological investigations showing that a large range of ready-to-eat (RTE) food such as deli meats, soft cheese, sandwich, sprouts, pork tongue in jelly, and hot dogs have been implicated in outbreaks of listeriosis worldwide [8-13]. Besides, unpasteurised milk and smoked seafood were also ranked highly for the relative risks of listeriosis [14].

Mode of transmission

6. Listeriosis is primarily foodborne. The disease can also be acquired from an infected mother transplacentally, or during passage through the birth canal. Some cases of nosocomial transmission in hospital have also been reported [15].

Clinical presentation [1, 16, 17]

7. A person with listeriosis usually presents with fever and muscle aches, sometimes preceded by gastrointestinal symptoms such as nausea or diarrhoea. Manifestations of listeriosis are host-dependent and in older adults or persons with immunocompromising conditions, septicaemia and meningitis are common.

8. Pregnant women who acquire listeriosis may experience fever and other non-specific symptoms such as fatigue and aches. Infection during pregnancy can cause spontaneous abortion, stillbirth or premature delivery, or infection in newborns. Infected neonates with early onset of listeriosis (<7 days) are most often infected in utero, and diagnosed soon after birth with septicaemia or manifest as granulomatosis infantisepticum [2, 18]. Those with late onset infection (≥7 days) may be apparently healthy at birth but subsequently have symptoms onset from eight to 30 days (a median of fourteen days). Meningitis is more common in late-onset neonates [19].

9. Maternal fatality is uncommon and the postpartum course of the mother is usually uneventful. The case fatality rate is 30% in newborns and approaches 50% when onset occurs in the first four days. The overall case fatality rate among non-pregnant patients is nearly 30%, with more deaths occurred among patients aged 50 or above (24%) than in other age groups (14%) [1]. For patients without adequate treatment, the case fatality may reach as high as 70% [20].

Susceptible groups

10. The elderly, pregnant women, neonates, and immunocompromised individuals are at greatest risk of severe listeriosis. There are studies showing that the risk of infection increases with age, with higher incidence among persons of older ages, especially those above the age of 65 [21-24]. As for pregnancy, it was reported in the United States that pregnant women are about thirteen times more likely than other healthy adults to become infected by *L. monocytogenes*, and approximately one in six (17%) cases occurred in pregnancy [25]. There has been a strong association between

decreased T-cell mediated immunity and invasive listeriosis [19, 26]. Listeriosis may occur at any time but usually in the third trimester when cell-mediated immunity is at its lowest [26]. The disease is also often superimposed on other debilitating illnesses or conditions such as malignancy, organ transplantation, diabetes, liver disease, renal disease, heart disease, HIV infection, and use of immunosuppressant [21].

Incubation period

11. The incubation period is variable and considerably long, ranges from three to 70 days, with a median of three weeks [1].

Laboratory diagnosis

12. Diagnosis is usually confirmed by isolation of *L. monocytogenes* from a normally sterile site, such as from blood cultures, or less commonly, joint, pleural or pericardial fluid. The characterisation of the isolates using serological and molecular subtyping is a useful tool for epidemiological investigation and for relating a suspicious food to a given pathogen. In Hong Kong, the Public Health Laboratory Services Branch (PHLSB) of the Centre for Health Protection (CHP) provides, in suspected outbreak settings, serotyping of *L monocytogenes* isolates from clinical, food, and environmental specimens and further molecular subtyping by pulsed-field gel electrophoresis (PFGE) as necessary to facilitate epidemiological investigation.

Clinical management

13. For invasive listeriosis, prompt application of effective antimicrobial therapy is the mainstay of treatment. Use of intravenous antibiotics (ampicillin or penicillin G, alone or in conjunction with aminoglycosides) remains the main treatment of choice. Early antibiotics given to pregnant women with listeriosis can prevent infection of the foetus or newborn.

Epidemiology of listeriosis

Global situation

14. Listeriosis occurs worldwide with most being sporadic. Incidence of listeriosis in Europe has been relatively stable over the past few years following some significant rises in countries such as the United Kingdom, France and Germany since 2000 [27, 28]. During 2006 – 2010, the incidences of listeriosis among the European Union (EU) countries were 0.30 - 0.37 per 100,000 population. In 2010, Finland reported the highest notification rate (1.33 per 100,000), followed by Denmark (1.12 per 100,000) and Sweden (0.67 per 100,000) [29]. In the United States, there was a downward trend during the late 90s, yet the decline began to stabilise since 2003 with rates fluctuating between 0.25 and 0.32 cases per 100,000 population during 2008 - 2012 [30]. In Canada, the national reported rate of listeriosis remained below

0.72 cases per 100,000 population [31]. Listeriosis in Australia was about 0.25 - 0.36 cases per 100,000 population annually [32], while Japan had an incidence of listeriosis of 0.065 cases per 100,000 population during 1996 - 2002 [33].

15. While most cases occur sporadically, several large foodborne outbreaks of listeriosis have been documented in recent years. In 2009, one multinational listeriosis outbreak was identified in the EU as a result of consumption of a semi-soft sour milk cheese. In total, 34 confirmed cases and eight deaths were recorded in Austria, Germany and the Czech Republic [34]. In the United States, a multistate outbreak of listeriosis associated with whole cantaloupes from Colorado resulting in 147 confirmed cases and 25 deaths in 28 states was recorded in 2011 [35]. In addition, there was another outbreak linked to imported cheese, with 22 confirmed cases and four deaths in thirteen states reported in September 2012 [36]. In late December 2012, a nationwide outbreak in Australia resulting in 26 confirmed cases and three deaths, due to consumption of soft cheese was also reported [37, 38].

16. In EU countries, listeriosis caused a significant disease burden with over 99% of patients being hospitalised. Majority of the listeriosis cases were over 65 years old. The overall case fatality rate was about 17%, and mortality was exclusively higher in the older age groups (45 or above) (19%) [28]. Listeriosis in the United States has also resulted in high rates of hospitalisations (95%) and accounted for almost one-third of foodborne disease related deaths. Similarly, incidence was most pronounced among adults aged 65 or above [39].

Local situation

17. From 2008 to 2012, CHP received a total of 76 cases of listeriosis, which included six cases being notified through voluntary reporting before the disease was made statutorily notifiable in July 2008. The annual number of cases ranged from six to 26 (Figure 1) and there was no seasonal pattern observed. The incidence rate of listeriosis from 2008 to 2012 in regard to local population ranged from 0.09 to 0.36 cases per 100,000 population, which was comparable to other western countries (Table 1). There has been an increasing trend of reported listeriosis in recent two years, of which cases in 2011 (13 cases) and 2012 (26 cases) have accounted for 51% of the total number of cases of the past five years.

Figure 1. Number of cases of listeriosis by year in Hong Kong, 2008 – 2012.

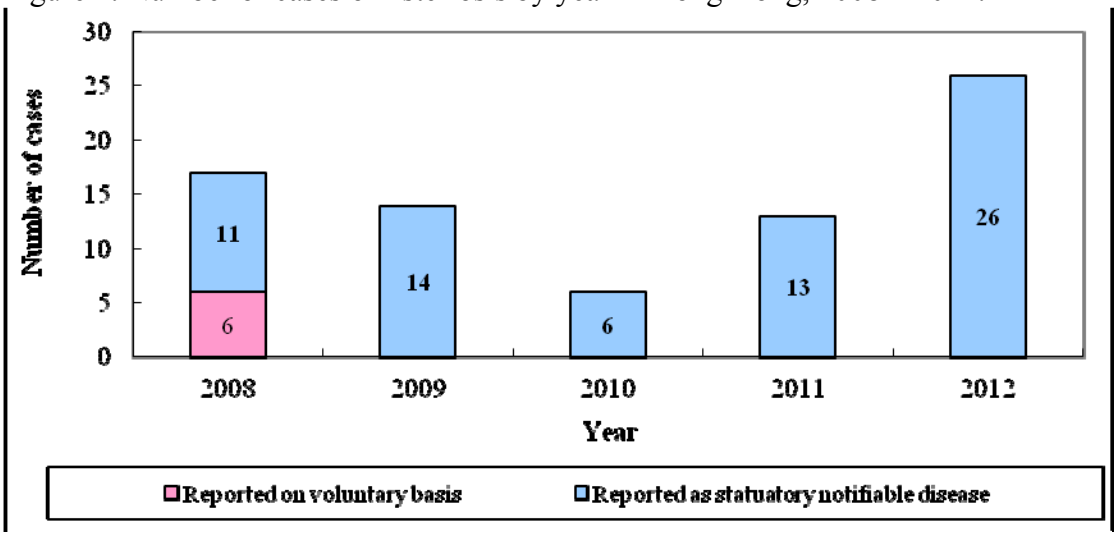

Table 1. Incidence rate (per 100,000 population) of listeriosis from 2008 to 2012 in Hong Kong and other countries.

Place	Year	Incidence rate (per 100,000 population)
Hong Kong	2008	0.24
	2009	0.20
	2010	0.09
	2011	0.18
	2012	0.36
EU[29]	2006 - 2010	0.30 - 0.37
US[30]	2008 - 2012	0.25 – 0.32
Canada[31]		0.72
Japan[33]	1996 - 2002	0.065
Australia[32]		0.26 – 0.36

18. Among the 76 listeriosis cases, most of them were sporadic except two pairs of pregnancy associated cases in which both the mothers and neonates were affected, and the epidemiologically linked cases among two family members who had consumed a ready-to-eat duck purchased in Mainland China.

19. The male to female ratio of listeriosis was 1:1.4 (32 males vs. 44 females). Age of the affected persons ranged from 1-day-old to 91 years (median = 58.5 years). The age-adjusted incidence rates of listeriosis from 2008 to 2012 are shown below in Table 2. Higher incidence is observed among the extremes of age (Table 3).

Table 2. Age-adjusted incidence rate (per 100,000 population) of listeriosis from 2008 to 2012

Year	Age-adjusted incidence rate (per 100,000 population)
2008	0.23
2009	0.17
2010	0.05
2011	0.15
2012	0.29

Note: Figures are compiled based on a new world standard population specified in GPE Discussion Paper series: No. 31, EIP/GPE/EBD, World Health Organization, 2001.

Table 3. Age-specific incidence rate (per 100,000 population) of listeriosis from 2008 to 2012

Age-group	2008	2009	2010	2011	2012
0-4	0.91	0.44	0.00	0.40	0.38
5-19	0.00	0.00	0.00	0.00	0.00
20-64	0.17	0.15	0.06	0.14	0.24
65 or above	0.79	0.67	0.33	0.53	1.33

20. Clinically, most patients presented with fever, malaise, chills and headache and were subsequently confirmed to be suffered from septicaemia, meningitis or meningoencephalitis. *L. monocytogenes* was isolated from blood in 55 cases (72%), cerebrospinal fluid (CSF) in six (8%), peritoneal fluid in three (4%), and the remaining twelve cases (16%) from other or multiple sterile sites such as placenta, bile, vitreous eye tissue, etc. All cases required hospitalisation with six of them died from listeriosis, which gave an overall case fatality rate of 8%. Sixteen other patients (21%) died from their pre-existing medical illnesses such as terminal malignancies.

Non-pregnancy associated cases

21. Excluding the pregnancy associated listeriosis cases (both mothers and neonates), there were 60 cases of listeriosis. Similar to the worldwide situation, majority of the cases (54/60 cases, 90%), had one or more underlying illnesses and/or with immunocompromising conditions including malignancies, renal failure, liver diseases, diabetes mellitus, HIV infection and on immunosuppressant medication.

22. Persons aged 65 or above constituted a significant proportion (34 cases, 45%) of the overall cases (76 cases). Except for two cases reported to have good past health, all the elderly patients with listeriosis were co-morbidly having underlying illness or immunocompromised. Totally four elderly patients

with listeriosis died of the disease which gave a case fatality rate among this group of 12%. For people aged under 65 years, the proportion of those suffered from one or more underlying illnesses and/or with immunocompromising conditions was 84 % (22/26 cases).

Pregnancy associated cases

23. Eleven listeriosis cases (14%) were pregnant women and almost all of them enjoyed good past health except two who had history of hypothyroidism and asthma, respectively. Six and five cases contracted the disease during the second and third trimesters, respectively. They commonly presented with fever (91%), followed by obstetric complications (64%) (e.g. vaginal bleeding, premature rupture of membrane, preterm labour), chills (27%) and gastrointestinal symptoms such as diarrhoea and vomiting (18%). All cases remained clinically stable and recovered after treatment, but for their babies, three pregnant cases resulted in spontaneous abortion and one had stillbirth. One mother had a preterm delivery and the neonate died one day after birth. This neonate was also found to have positive blood culture for *L. monocytogenes*. The remaining six mothers had their neonates delivered uneventfully. Overall, listeriosis in pregnant women had caused 45% of the mothers having abortion, stillbirth or neonatal death.

24. There were five cases (7%) involving neonates, of whom two of their mothers were also diagnosed to have listeriosis. All neonates with listeriosis required neonatal intensive care. Three of them had septicaemia and two suffered from meningitis. One died of listeriosis, making the case fatality rate of listeriosis among the neonatal group to 20%.

Risk factors

25. About 62% of the patients reported consumption of high risk food such as milk and dairy products (including ice-cream, cheese, yoghurt) during the incubation period (three days up to 70 days with a median of three weeks) but notably milk and milk products are indeed popular food group among the local population. According to the Hong Kong population-based food consumption survey (2005-2007), 37% of respondents had reported consumption of milk and milk products over a 24-hour period[40]. Other foods consumed included raw vegetables and salads (12%), deli meats (8%), and other RTE foods such as sushi and sandwiches (15%). However, the incriminated food items were not available for further laboratory confirmation due to the long incubation period. All food and environmental samples collected during the epidemiological and field investigations were tested negative for *L. monocytogenes* by available investigation means. Hence, the source of infections remained undetermined.

Prevention and control of listeriosis

26. Both CHP and the Centre for Food Safety (CFS) of the FEHD have been putting in place various measures for the prevention and control of listeriosis. There are strategies of effective disease surveillance programme and prompt investigation of reported listeriosis, health promotional initiatives to raise the awareness of the disease and the preventive measures, food safety training targeting to the food trade and food handlers, and enforcement of regulations designed to minimise *L. monocytogenes* in foods. The following reviews the existing prevention and control strategies and discusses potential areas for improvement.

Disease surveillance and investigation

27. Surveillance on listeriosis has been enhanced by including it as a statutory notifiable disease since July 2008. Upon receiving notification, CHP will initiate epidemiological investigation and carry out control actions accordingly. Among others, exposure history with regard to food consumption will be investigated to search for the source of infection. Food collaterals and household contacts, particularly the susceptible groups will be traced and put under medical surveillance. When suspected food involving food business is identified, CHP will collaborate with FEHD to conduct investigation and implement control actions at source level to prevent further spread of the disease.

28. At laboratory level, PHLSB will provide support for microbiological analysis of clinical specimens, food and environmental samples, and will perform typing of isolates as necessary to support epidemiological investigation of clusters.

29. Surveillance of listeriosis and prompt investigation allow early identification of potential source of the infection and early intervention to eliminate the risk to the public. Both CHP and CFS will continue the joint effort in this area and keep abreast of the latest evidence and international practices on effective strategies in surveillance of listeriosis and control actions for constant review and improvement.

Health promotion and food safety training

30. Currently, CHP and CFS have produced a wide variety of health education materials for the general public and food trade to heighten their awareness of listeriosis and the corresponding preventive measures. In the light of the rising trend of listeriosis in recent two years, CHP has enhanced the risk communication by reporting cases of listeriosis as news or review articles in its biweekly online bulletin Communicable Disease Watch (CDW) to alert the public of the features of listeriosis and the preventive measures. In 2011 and 2012, there were 22 news reports of listeriosis and two review articles published in the CDW.

31. CFS has also organised various publicity activities and food safety trainings for the food trade and food handlers. To target on the susceptible group, the CFS has been conducting regular outreaching talks in the elderly centres and the childcare centres.

32. As the epidemiological data shows that certain sub-population groups (e.g., persons who are immunocompromised, pregnant women and the elderly) are more susceptible to listeriosis, health promotional actions targeted to these susceptible groups should be strengthened. Collaborations with various health services sectors, namely obstetricians, oncologists, primary care physicians, Hong Kong Cancer Fund and Maternal and Child Health Centres, to provide the health advices on listeriosis and its prevention would be further strengthened. Likewise, more health promotional initiatives would be targeted to the susceptible groups as well as their caregivers to promote food safety and provide dietary guidance to avoid high-risk foods of listeriosis among them.

Food safety control

33. The CFS has various food safety programmes which cover the food safety actions designed to minimise *L. monocytogenes* in foods. They include setting *L. monocytogenes* criterion for RTE foods, conduction of food surveillance programme targeted at high risk food for *L. monocytogenes* and food incidents surveillance.

34. Setting microbiological limits forms the basis of allowing interpretation of microbiological analyses of RTE food and making recommendations on the appropriate follow-up action for food safety monitoring and control. It also facilitates the trade to draw up relevant food control plans and focus on the priority control measures based on the specified limits. In Hong Kong, CFS defines in the "Microbiological Guidelines for Ready-to-eat food", the limit as the absence of *L. monocytogenes* in 25g samples of refrigerated RTE food or food intended for infants [41], which is comparable to the standards adopted by the Codex Alimentarius Commission. The microbiological limits of *L. monocytogenes* in RTE food will be kept reviewed and updated regularly.

35. In Hong Kong, CFS has a structural food surveillance programme which covers diverse food commodities sampled at import, wholesale and retail levels to monitor food on sale to ensure its compliance with legal requirements and fitness for human consumption. *L. monocytogenes* in RTE food is one of the target food surveillance projects which focus on known high risk RTE food in the light of prevailing circumstances. The results have been released regularly to promote public awareness. In 2012, around 350 high risk RTE food samples, such as soft cheese, milk, dairy products and cold cut meat products, were taken for testing and only one sample was detected to contain *L. monocytogenes.* CFS has been taking appropriate risk management actions to limit and mitigate the impact of the affected products. Targeted food

surveillance on *L. monocytogenes* in RTE food and risk communication of the results should be continued. Regular review on the samples of high risk food to be collected can be considered taking into account of the latest evidence on relevant food science, suspected food identified in local listeriosis cases, and food incidents related to *L. monocytogenes* contaminated food.

36. Since over 90% of foods in Hong Kong are imported, CFS has an effective food incident surveillance system in place to monitor, assess and manage daily food incidents reported from the food authorities and media agencies worldwide. In 2012, CFS had identified about 100 food incidents associated with *L. monocytogenes* contaminated RTE food. Prompt risk management actions were implemented to minimise the food risk.

Summary and recommendations

37. Listeriosis is a serious and potentially fatal foodborne disease which mainly affects the persons who have underlying illness or are immunocompromised, the elderly and pregnant women. An increasing trend of reported listeriosis was observed in recent two years. In Hong Kong, there have been public health and food safety actions in place to prevent and control listeriosis. To further enhance the current actions in preventing listeriosis, it is recommended to:

(a) Strengthen the current health promotional actions by having more initiatives targeted to the susceptible group for raising their awareness on the disease and enable them to take appropriate preventive measures, and

(b) Keep abreast of the latest evidence and international practices on effective strategies in surveillance of listeriosis and the control actions; health promotion and food safety programmes in prevention and control of listeriosis for constant review and improvement.

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