MYCOBACTERIUM BOVIS

THE ORGANISM/TOXIN

This is one of two species of the "tubercle bacilli" (the other is *M. tuberculosis*) that are able to cause tuberculosis. Unlike *M. tuberculosis*, *M. bovis* infects cattle and other animals, and so the disease can be spread to humans via contaminated milk and meat.

GROWTH AND ITS CONTROL

Growth: It is a characteristic of the organism that it is very slow growing, and so given the shelf life of foods that it has been associated with, e.g. unpasteurised milk and raw meat, growth in foods is unlikely to be significant. The organism is a microaerophile.

Survival:

Temperature: Survival is better under cool conditions, e.g. survived in cow faeces for 5 months in winter and 2 months in summer.

Water Activity Survives dry conditions well.

Inactivation (CCPs and Hurdles):

Temperature: Inactivated by normal pasteurisation. An inoculum of 10^5 / ml cells became undetectable after 30 minutes at 63.5^{o}C in whole milk (low temperature, long-time pasteurisation).

In meat products the D time at 61^{o}C was 1 min, while at 55^{o}C it was approximately 10 min. Treatment at 65^{o}C for 5 min gave a 5 D kill.

Sanitisers/Disinfectants: (These products must be used as advised by the manufacturer).

Much of the information presented here is derived from papers describing medical rather than food industry applications of these sanitisers.

An enzyme based-iodine disinfectant inactivated the organism more rapidly than 2% glutaraldehyde.

Ortho-phthalaldehyde applied at the minimum effective concentration resulted in a 6 log reduction in numbers in 5 minutes.

A study of 14 hospital disinfectants found chlorine dioxide, 0.8% hydrogen peroxide plus 0.06% peroxyacetic acid, glutaraldehydes (2% alkaline and 2% acidic, a phenolic and chlorine (approx. 1,000 ppm) and an iodophor were effective, some quaternary ammonium compounds and 0.13% glutaraldehyde plus 0.44% phenol plus 0.08% phenate were ineffective.

On their own chlorhexidine diacetate and cetylpyridinium chloride are relatively ineffective, but their action may be improved in the presence of ethambutol.

Treatment with 0.3% benzalkonium chloride is not effective.

(N.B. The absence of a sanitiser/disinfectant from this section does not necessarily imply that it is ineffective).

Radiation: Inactivated by sunlight.

THE ILLNESS

Incubation: In airborne infections and in immunocompetent people the incubation period can be years, while in immunosupressed people it may be months. Cases of the gastrointestinal form can occur after reactivation of infections that must have occurred many years earlier.

Symptoms: Fever, chills, weight loss, abdominal pain, diarrhoea or constipation. Other symptoms depend on the organs infected.

Symptoms may last for months or years.

The organism enters the body via the intestinal tract in foodborne infections, and primary infection is set up in the associated lymph nodes to form "tubercles". The infection is often contained at that point, but it can also spread to other parts of the body to cause illness.

The reverse can be true in that pulmonary disease can spread to the intestinal region.

The case fatality rate for tuberculosis in New Zealand was 3.1% in 1999.

Condition: Intestinal tuberculosis or tuberculous enteritis.

Toxins: Does not produce toxins.

At Risk Groups: Immunosupressed people are especially at risk of either acute infection or reactivation of an infection acquired in the past. In countries where infection is uncontrolled children are at greater risk of infection.

Long Term Effects: The course of the disease is long term and may result in death.

Dose: The infectious dose for organisms ingested (as opposed to inhaled) is probably very high (millions of organisms).

NZ Incidence: 357 cases of tuberculosis were notified in 2000.

In 1999 450 cases of tuberculosis were notified, and of these species identification was performed on 310 isolates. Only 1.9% (six cases) of these isolates were caused by *M. bovis*, which indicates 8-9 cases out of the 450 reported.

In 1998 3.1% of isolates from New Zealand resident Pacific Islanders were *M. bovis*.

In 1997 3.0% of cases were caused by *M. bovis*.

In 1996 4.5% of imported tuberculosis cases were caused by *M. bovis*.

One case in recent years has been attributed to the consumption of unpasteurised milk.

Treatment: Multiple antibiotic treatment is required to be administered over protracted periods. This is because the organism may have antibiotic resistance and this will not be apparent for long periods because of the slow growth of the organism. The antibiotics currently used are rifampicin, isoniazid and ethambutol.

Infected lymph nodes can be removed.

Multiply drug resistant forms have caused outbreaks among AIDS patients that resulted in deaths of all those infected.

SOURCES

Human: Humans are a reservoir of the organism, but human to human infection occurs only rarely.

Animal: Cattle and other animals are reservoirs of the organism. The possum is a reservoir in New Zealand, making eradication from livestock difficult.

Food: Meat and milk derived from infected animals may contain the organism. Tubercles are detectable post-mortem in food animals, and infection can also be detected using an immunological test.

Environment: Can persist and remain infective in the environment for long periods.

Transmission Routes: Can be by respiratory aerosols between humans and animals. To a lesser extent also transmitted by milk and meat derived from infected animals. Apparently not transmitted by the waterborne route.

OUTBREAKS AND INCIDENTS

Outbreaks: No recent reports of foodborne outbreaks of *M. bovis* infection could be located. The last outbreak attributed to contaminated milk occurred in the UK in 1959.

Epidemiological Data: A study in Ireland on disease caused by *M. bovis* between 1983 and 1992 found that most cases could be attributed to the prior consumption of milk in the pre-pasteurisation era.

Information from Australia indicated that most non-imported cases had worked in the livestock industry, indicating an occupational exposure.

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