BOVINE TB ZOONOSES; A REVIEW

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ABSTRACT: Bovine tuberculosis (TB) is a disease characterised by progressive development of specific granulomatous lesions or tubercles in lung tissue, lymph nodes or other organs. Bovine species, including bison and buffaloes, are susceptible to the disease, but nearly all warm blooded animals can be affected. Man is also susceptible to the disease, the highest risk groups being individuals with concomitant HIV/ AIDS infection. In Africa, human TB is widely known to be caused by M. tuberculosis; however, an unknown, proportion of cases are due to M. bovis. Consumption of unpasteurised milk and poorly heat- treated meat and close contact with infected animals represent the main sources of infection for humans. This review attempts to examine the impact of bovine TB on the health of animals and humans.

Keywords: *Mycobacterium bovis, Transmission, Conducive Factors, Vaccination.*

INTRODUCTION

Bovine tuberculosis results from infection by Mycobacterium bovis, a Gram positive, acid-fast bacterium in the Mycobacterium tuberculosis complex of the family Mycobacteriaceae (NAIHS, 2001)

Bovine tuberculosis is a chronic bacterial disease of cattle that occasionally affects other species of mammals. This disease is a significant zoonosis that can spread to humans, typically by the inhalation of aerosols or the ingestion of unpsteurized milk.

In developed countries, eradication programs have reduced or eliminated tuberculosis in cattle, and human disease is now rare; however, reservoirs in wildlife can make complete eradication difficult. Bovine tuberculosis is still common in less developed countries, and severe economic losses can occur from livestock deaths, chronic disease and trade restrictions. In some situations, this disease may also be a serious threat to endangered species (CFSPH, 2007).

TRANSMISSION

Inhalation of M. bovis is the most probable and principle route to bovine infection and is facilitated by close, prolonged contact between infected and healthy animals. Ingestion of M. bovis directly from infected animals or from contaminated pasture, water or utensils may also by very common. While congenital infections and vertical transmission have been recorded, these routes, like genital transmission, which occurs when reproductive organs are infected, are now rarely seen I regions that have intensive eradication programmes (Neil et al ., 1994).

Animal- to-animal transmission: Infectious animals may shed M. bovis in a number of ways: in faeces, milk, discharging lesions, saliva and urine (Neil et al ., 1991). Intensive livestock farming promotes close contact between animals, favouring the spread of M. bovis. Extensive livestock farming, however, especially transhumance with no housing system raises the question as to how bovine TB transmission can take place. Close contact between animals occurs for example at water points such as ponds, wells and streams. Vaccination and artificial insemination centers, dipping tanks, auction stations, market places and transportation are the commonest animal gathering places, and again are sites where transmission of infection could easily occur. Due to the high ambient temperature in tropical zones, animals tend to concentrate under trees or other shaded areas for parts of the day, preferring to graze early in the morning and late in the afternoon. Possibly the most dangerous sport for nose-to-nose or mouth-to-mouth contact between animals are salt supplementing points. Some of the above situations simulate the dangers of intensive farming in relation to disease transmission (Ayele et al., 2004; Menzies and Neil, 2000).

Animals- to-human transmission: Human TB due to M. bovis in developing countries today is analogous to conditions in the 1930s and 1940s in Europe, where more than 50% of cervical lymphadenitis cases in children were caused by M. bovis infection. This is exacerbated by the added burden of HIV/acquired immune-deficiency syndrome (AIDS). In industrialized countries, the incidence of TB due to M. bovis in human is almost at zero level as a result of pasteurisation of milk and milk products and eradication of bovine TB in cattle populations (Collins and Garange, 1983). However, in developing countries, bovine TB in animals can be widely distributed in regions where control measures are not applied or are conducted sporadically and pasteurisation is rarely practiced (Cosivi et al., 1998).

In industrialised countries, the direct correlation between M. bovis in cattle and TB due to M. bovis in humans has been well documented, whereas little information is available from developing countries (Collins and Garange, 1983). Pulmonary TB due to M. bovis is more common is rural dwellers, as a result of inhalation of dust particles or bacteria-containing aerosols shed by infected animals, while urban dwellers acquire the infection via the gastrointestinal route and develop extra-pulmonary TB (Daborn et al., 1996).

Current economic and social globalisation has created greater opportunities for the spread of zoonotic disease such as TB. When considering the revival of TB in countries preciously declared to be free of the disease, it is worth noting the statement by Grange:'we are now learning the hard way that none are safe until all are safe' (Granage, 1996; Fritsche et al., 2004).

Human- to-animal transmission: The role of humans in infecting cattle with bovine TB was reviewed by Torning (1965), Sjoren and Hillerdal (1978) cited several example of human-to-cattle transmission, and stressed the potential danger that patients with smear-positive pulmonary TB due to M bovis may pose to animals. However, reports of human infection of cattle are rare (O'reily and Daborn, 1995). The genitourinary tract in humans is as site of non-pulmonary TB due to M. bovis; genitourinary TB may appear to be of little importance to epidemiologists in studying human infection, but this route of infection from man to cattle is well documented. Grange and Yates (1994) reported that farm workers urinating in cowsheds may represent a source of infection for animals. An analogous situation is thought to occur in rural Africa, where patients with genitourinary TB may urinate on posture: animals craving salt preferentially graze on this grass and may succumb to infection.

Human-to-human transmission: Human TB caused by M. bovis as a result of human-to-human transmission was reported in the Netherlands in 1994 (Van et al ., 1994). Evidence oftransmission of M. Bovis between humans is considered rare and largely anecdotal, and the rate to transmission seems insignificant compared to animal-to-animal or animal-to-human infection. (O'Reilly and Daborn , 1995). Human-to-human transmission of M. bovis is considered less efficient than that of M. tuberculosis (Van, 2001). However transmission among HIV infected humans, where immunosuppression increase the susceptibility of the host organism to infection, may be different, M. bovis has been isolated from HIV-infected individuals in some industrialised countries, with an additional serious complication of high primary resistance to isoniazid, streptomycin and pyrazinamide (Guerrero et al ., 1997).

FACTORS CONDUCIVE TO THE PERSISTENCE OF TB

The neglect of TB control by many governments poorly managed control programmes, poverty, high population growth, population dislocation and the rise of HIV endemic areas predisposes to the persistence of TB.

Culture and customs: TB is stigmatized I many cultures and patient hiding their TB status due to discriminatory view about TB sufferers may further complicate TB control (Edington et al., 2002).

Responding to public health imperatives and minimizing stigma remain in a delicate balance. The profile of risk for bovine TB, however, is based o animal to-human, rather than human to-human transmission. Social discrimination based on TB status is thus more a matter of stigma than of appropriate public health precautions. Risk factor assessment and identification of this infectious agent in both humans and animals will be the first step towards adopting dependable preventive, therapeutic and control measures.

Illiteracy: Another, yet unsolved social problem in most rural communities is illiteracy. Inability to read and writer, and failure to utilize modern methods of communication, makes prevention and control programmes difficult and often impossible to apply.

Demography, eating habits, living and socio-economic status of families: For most urban dwellers, bovine TB considers milk the main vector for infection while farmers and abattoir workers are mostly exposed to aerosol infection, by close contact with infected animals. For most rural populations, consumption of raw milk and milk products and close association between animals and farmers are common, and encourage exposure to both alimentary and respiratory infection by M. bovis. The following factors contribute to the acquisition of infection in farmers and urban dwellers:

1) Family ownership of cattle; 2) previous livestock ownership; 3) history of working with animals; 4) living with a relative who owns cattle; and consumption of unpasteurised milk and raw or poorly cooked meat (anonymous, 1997; pavlik et al ., 2002).

Occupations related to acquisition of infection are: 1) abattoir workers, veterinarians and laboratory technicians; 2) animals caretakers in zoos; and 3) workers in animal reservations and national parks (Grange and Yates, 1994; Liss et al., 1994; Pavlik et al., 2002).

Infants are more vulnerable to food-borne M. Bovis infections, whereas in older individuals overt may occur as a result of endogenous reactivation. Poor sanitation, lack of access to clean water, crowding, poor housing and the absence of health care play an important role in the epidemiology of TB in developing countries (Triggel, 2003).

PUBLIC HEALTH SIGNIFICANCE

Some human infections are asymptomatic. In other cases, localized or disseminated disease can develop either soon after infection, or many years later when waning immunity allows the infection to reactivate. Localized disease can affect the lymph nodes, skin, bones, and joints, genitourinary system, meninges or respiratory system. Cervical lymphadenopathy (scrofula), which primarily affects the tonsillar and pre-auricular lymph nodes, was once a very common form of tuberculoses in children who drank infected milk (Pollock et al., 2006). In some cases, these lymph nodes rupture and drain to he skin; chronic skin disease (lupus vulgaris) may occasionally result. Human infected through the skin can develop localized skin disease ("butcher's wart"), a form usually thought to be benign and self-limiting. Pulmonary disease is more common in people with reactivated infections than initially; the symptoms may include fever, cough, chest pain, cavitation and hemptysis. Genitourinary disease can result in kidney failure. Bovine tuberculosis can be treated successfully with antimicrobial drugs, but untreated infections may be fatal (Grange, 2001; PAHC, 2007).

CONTROL AND PREVENTION

There are various reasons for attempting to eradicate bovine TB: 1) the risk of infection to the human population; 2) loss in productivity due to infected animals; and 3) animal market restrictions set by countries with advanced eradication programmes (Cousins, 2001). The priority they are given will vary depending on factors specific to the country in question. In industrialize countries; regular testing and removal of infected animals under mandatory national bovine TB programmes have successfully carried out control and eradication of bovine TB. Such programmes have been successful in many European Union member states and in seven central European countries between 1953 and 1980 (Pavlik et al ., 2002).

In developing countries, however, bovine TB remains a major animal health problem, mainly because these countries cannot shoulder the financial burden required to implement a control programme and compensate for slaughtered animals. Limited access to education, poor information networks and lack of disease surveillance are other factors that limit the implementation any such programme.

Vaccination: BCG, and attenuated strain produced by continuous subculture of a wild-type M. bovis isolate from cattle, has played a crucial role in controlling human TB, particularly in children. However, its use for bovine TB in less effective. Using BCG vaccination to control bovine TB is an option that has been considered in European countries, North America and some African countries (WHO, 1959).

It was found that and absence of protective immunity in BCG-vaccinated cattle, possibly inked to immune responses developed to environmental mycobacteria, although it might have been expected that exposure to the shared antigens of environmental mycobacteria would provide acquired protection from bovine TB (Buddle et al ., 1995).

In a study, it is examined the efficacy of vaccination with BCG alone and DNA prime-

BCG boost regimen in cattle challenged with virulent M. bovis. The prime- boost regimen significantly enhanced protection in six parameters compared to significant enhancement of protection in only two parameters for BCG alone (Skinner et al ., 2003).A vaccination strategy employing BCG would obviously necessitate developing differential diagnostic assays to distinguish vaccinates from non-vaccinates, as BCG vaccination causes sensitivity to tuberculin, the PPD routinely used in skin testing tuberculous cattle. Because of this and the varying efficacy of BCG in cattle, recent research capitalising on advances immunology and molecular biology has focused on alternatives to BCG, including novel attenuated M. bovis strains, sub-unit vaccines (Ginsberg, 2002). The recently available M. bovis genome sequence should have a significant impact on new generation vaccine candidates (Garnier et al., 2003). Eradication of bovine TB using compulsory test and slaughter strategies has proven difficult even in industrialised countries, where cattle movement can usually be controlled.

Development and production of an effective vaccine with appropriate methods and strategies for delivery could therefore contribute to bovine TB control.

CONCLUSION

Following remedial measures are suggested for bovine TB:

Pasteurisation of milk is essential to render milk free of M. bovis for human consumption, this option is not applicable in rural communities due to lack of infrastructures and traditional use of curdled milk; this custom should be eradicated by education the public to boil milk before consumption.

As inspection of abattoir meat is limited in urban areas for the same reasons as milk pasteurisaiton, thoroughly cooking meat would reduce human TB due to M. bovis and other food-borne infectious diseases.

Economic and technical assistance by industrialized countries is essential to promote control of TB in general and of bovine TB in particular. The decision makers of all African nations, particularly heads of government and departments of culture, health, education and agriculture, can play a role by creating the infrastructure necessary to achieve this goal.

In the context of global eradication of TB, elimination of bovine TB in domestic and wild animals could be considered as a long-term objective for developing countries.

The international community must respond rapidly to these problems to curb any additional contribution to the growing global TB pandemic, with its consequent disastrous effect on humans.

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