The Control of Brucellosis — A Veterinary Responsibility

P. Nicoletti


Brucellosis is an anthropozoonosis and each human case has a direct or indirect animal origin. The disease in humans is a reflection of more widespread disease in animals. Therefore, it follows that efforts to control human brucellosis will largely be unsuccessful unless veterinary workers fulfill their responsibilities. It is both logical and necessary that animals and human health officials cooperate to promote programmes to reduce animal brucellosis as much as possible by the most economical and practical methods. At the present time in most countries, the method which is most likely to produce results is widespread vaccination.

Although the causative agent of brucellosis was identified in 1887 by Bruce, it was not until 18 years later that a zoonotic relationship was established by Zammit.1 It was not until 21 years after the discovery of Bacillus abortus by Bang that Evans in 1918 reported the relationship of this organism isolated from cattle to Micrococcus melitensis. It was not until 1930 that Morales-Otero discovered B. abortus could affect man.1 Since these early studies, the relationship of animal and human brucellosis has been well established. Brucellosis is a true zoonosis. Four of the six species in the genus Brucella which are animal pathogens are also human pathogens and in a descending order of pathogenicity are: B. melitensis, B. suis, B. abortus and B. canis.

Brucellosis is a serious zoonosis and the most common species to affect man is B. melitensis. It is found where the disease is endemic in goats and sheep. This includes the Mediterranean littoral, Southeast Asia and parts of Latin America. Many epidemiologic factors affect the prevalence of brucellosis in humans. These include pathogenicity of the organism, close and frequent contacts between animals and humans, food habits, and standards of personal and environmental hygiene. Thus, incidence in humans increases during and following the parturition season in goats and sheep.

Current Situations and Special Problems
There have been reductions or elimination of brucellosis in many countries and increases in others.1 The prevalence in both animals and humans is often difficult to ascertain due to lack of adequate diagnostic tests and facilities, poor reporting, and lack of co-operation between veterinary and public health officials. There is general agreement that human cases are under-reported. Up to 20 or more cases may occur for each reported case.2

Epidemiologic factors which have contributed to increase in the incidence of animal brucellosis are...
larger herd sizes and density of animals, greater commerce and conmlingling of animal species. Outbreaks of *B. melitensis* in cattle have occurred with clinical disease in both animals and humans.\(^3\)\(^5\)

Technical limitations of diagnosis include long incubation periods, absence of antibodies in some clinical cases, and latency. Political turmoil, use of available funds for more acute diseases, and lack of resources are also important. Diseases such as brucellosis which may become chronic often fail to generate enthusiasm of livestock owners for control efforts. Many seropositive animals show no signs of disease. This leads to suspicion about the accuracy of diagnostic tests, reluctance to slaughter these animals, and lessened participation in a programme, if one exists.

The successful programmes to control and eradicate brucellosis have largely been with cattle. Caprine-ovine brucellosis in many countries has not been well controlled and successful efforts of countries for eradication are very few. Goats and sheep are adaptable to many areas which are not suitable for other types of agriculture. Close relationships of those who care for these animals including contacts and rapid consumption of unheated dairy products result in easy transmission by *B. melitensis*. Nomadism, poor hygiene, and lack of veterinary services are important factors. Special habits such as biting the navel cord of newborn animals contribute to human infections.\(^5\)

Camels are important in the agricultural economy of many countries as sources of food products, and means of transportation. Camels are in contact with infected goats and sheep and shed *B. melitensis* in the milk. Camel milk is usually consumed without heating and is a source of human brucellosis. No vaccine studies have apparently been conducted and pathogenicity of *Brucella* spp. in camels is poorly understood.

**Occupations**

Brucellosis has long been recognized as an occupational disease. Abattoir workers, farmers, and other animal caretakers, veterinary and laboratory personnel are at highest risk. Entry of the bacteria is by direct contact with the skin, conjunctiva, by aerosols and via the gastrointestinal tract.

Direct methods to prevent abattoir infections have not been very successful. This is due to lack of practical protective clothing and aerosol prevention and inadequate procedures of preslaughter identification of diseased animals. Therefore, as long as the disease exists in food-producing animals, these workers will continue to be at special risk.

Vaccination of humans has not played a major role in control of brucellosis. This is due to the lack of development of an effective vaccine without serious side-effects. Except for special situations, there is agreement that control of human brucellosis is through control of it in animals.

**Food Habits**

In countries with universal laws which require pasteurization of dairy products, human brucellosis is almost exclusively an occupational disease. However, compulsory pasteurization worldwide has been largely limited to milk from cattle and *B. abortus* is of much less pathogenicity for humans than *B. melitensis*.\(^3\)

Regulations which require the pasteurization of milk in the USA preceded the accelerated efforts to eradicate brucellosis from cattle and swine in the era after World War II. The reduction of human brucellosis accompanied these efforts (Fig. 1).

Food habits are difficult to change through educational programmes. Consumption of cheeses made from raw milk is a major source of human infections. Where brucellosis occurs from ingestion, individuals of both sexes and all ages are affected.

**Methods of Control**

The justifications for the control of brucellosis are public health and economics of food production. The latter includes losses due to reduced reproduction and milk yield and clinical effects such as epididymitis. Other losses may include restrictions in commerce, slaughter and replacement of seropositive animals and vaccination costs. It is difficult to measure economic losses due to the disease in humans such as medical costs and reduced productivity.

Three general methods of control of brucellosis in animals are often given. These are (1) test and slaughter, (2) hygienic, and (3) vaccination. These

![Figure 1. The reported incidence of human brucellosis in the USA. (Source: Centers for Disease Control, Atlanta, Georgia, USA.)(1)]
are most effective when they are combined, especially where the prevalence is high.

Test and slaughter of seropositive animals is usually a part of organized governmental programmes whose goal is eradication. These are preceded by surveys to determine prevalence in humans and various animal species which may be of public health or economic importance. These surveys assist in evaluations of the feasibility of subsequent efforts. Decisions should be based on realistic attainable goals or a backlash develops with loss of credibility of government officials and allied workers.

Eradication of diseases is a popular concept. However, few countries where brucellosis is currently endemic can afford the high costs. An administrative infrastructure of skilled workers, educational media, diagnostic facilities, and enforceable legislation is often absent. Replacement animals, compensation for forced slaughter of animals and other resources are necessary. Successful eradication programmes have been mostly limited to cattle brucellosis and in economically developed countries. Some other countries have attempted to emulate some or all of the aspects of these programmes and results have been negative. For example, it is not logical to restrict the use of vaccines to young animals when there are few or no controls of diseased animals.

The purpose of hygienic practices such as isolation of animals which have aborted is to reduce or prevent exposure of susceptibles. Premovement tests on local or international levels are parts of control programmes. However, these procedures are often difficult to administer and to gain acceptance. In many countries, those involved in livestock commerce may accept controls only for short periods and for more noticeable and emergency diseases. Isolation and other hygienic practices are often not practical or acceptable to those whose knowledge of the principles of disease transmission is poor. Acceptance of control measures is difficult among nomadic and small village societies where there are ancient and well established customs. These include commingling of animals, close human–animal contacts and traditional food habits.

There is much agreement that vaccination is the most effective and practical method of reducing the incidence of many diseases including brucellosis. Vaccination for brucellosis is acceptable since it is commonly practised for many other diseases. The live vaccines, *B. abortus* strain 19 and *B. melitensis* strain Rev 1, have proven to be the most effective agents in cattle and in goats and sheep, respectively. They are inexpensive to produce and are highly immunogenic. They may sometimes cause abortion but this may be practically eliminated by use of a lowered dose. They may cause infections in man if accidentally injected. It is necessary to keep them chilled until used and postvaccinal antibodies may interfere with interpretations of diagnostic tests. Although the immunity may not be complete in some animals, vaccination practically eliminates clinical brucellosis. On a population basis, the immunity is greater than 90%.

**Kuwait**

From 1982 to 1985, there was a large increase in reported cases of human brucellosis in Kuwait (Fig. 2). There was a corresponding increase in cattle brucellosis (culture-positive fetuses and seropositive cows) and, based upon reported abortions, also in goats and sheep. While health services and reporting of human cases were improved during this period, it was concluded that there was a true increase in incidence. There was also a substantial growth in the dairy cattle industry and in numbers of goats and sheep to provide food for a rapidly growing human population, including expatriates.

Following recommendations made during a consultancy in 1985, vaccinations of cattle (1985–1986) and goats and sheep (1987–1988) of sexual maturity were performed. Cows were vaccinated with a dose of $3 \times 10^6$ strain 19 and mature goats and sheep with a dose of $1 \times 10^7$ Rev 1. The strain 19 dose was selected through previous studies which found a greater than 90% reduction in brucellosis in large dairy cattle herds following vaccination. After vaccination of dairy herds in Kuwait, the percentage of abortions due to brucellosis was reduced by 94%. No previous widespread vaccination of Rev 1 using a reduced dose in mature goats and sheep has been reported. There was no increase in abortions for any reason immediately following vaccination.

![Figure 2: The reported incidence of human brucellosis in Kuwait. (Source: Epidemiology Unit, Ministry of Public Health, Kuwait.)](image-url)
The effectiveness of widespread vaccination of sheep and goats in reducing human brucellosis was also proven in the Mongolian People’s Republic.\textsuperscript{7} Over 33 million sheep and goats were vaccinated with Rev 1. The incidence rate of human brucellosis declined from 4.8 per 10,000 population to 0.23 per 100,000 in 7 years.

**Summary**

The aim of the control of animal brucellosis is to reduce the prevalence and incidence to the lowest level possible bearing in mind economic restraints. This compromise with total elimination (eradication) is the only logical philosophy and programme that is possible in many countries where brucellosis is endemic. It is especially true where brucellosis occurs among goats and sheep.

Of the methods available for control of brucellosis in animals, vaccination is superior. Use of live vaccines in reduced doses from that usually recommended and in entire populations is the most rapid, efficient and effective procedure. It is a veterinary responsibility to accept the challenge to control animal brucellosis which will control the disease in humans.

**References**