Review

La Tuberculosis Bovina: un problema aún sin resolver.

Bovine Tuberculosis: a yet unresolved issue

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Introduction

The National Institute of Forestry, Agricultural and Livestock Research (INIFAP), is an institution whose mission is to "contribute to the productive, competitive, equitable and sustainable development of agriculture and forestry chains, through the generation and adaptation of scientific knowledge and technological innovations and the training of human resources to meet the demands and needs for the benefit of the sector and the society in a framework for institutional cooperation with public and private organizations". On the other hand, is defined as an institution that "provides scientific and technological excellence with leadership and national and international recognition for its ability to answer to the demands of knowledge and technological innovations in agricultural, livestock benefit and society in general".

Bovine Tuberculosis (TB) in Mexico: the foundations

The strong impact of bovine TB exerts on the animal and public health requires constant updating in the forms of behavior, control and diagnosis of the disease.

Bovine tuberculosis is considered the oldest disease, the most studied and which continues to cause the death of many humans and animals; It also generates severe casualties in animal production -which may even be 15%- and consequently, considerable economic losses. On the other hand, the World Health Organization (who) defines it as an endemic disease and zoonotic risk and great impact on public health.

This work includes aspects such as the current situation of tuberculosis in the country and the world, the increase in new cases and the mortality rate. With respect to their incidence and prevalence, these have been a marked decrease, although new cases total amounts to approximately 18,000 and 2,000 deaths. The proportion of cases of tuberculosis, according to its form of presentation, is as follows: 81.6% for pulmonary TB, 1.6% for TB meningeal and 16.6% for other forms of TB. Reported that the mortality rate per 100,000 inhabitants, according to sources such as INEGI, DGIS, SINAIS and health, from 1990 to 2009, has declined considerably. Another outstanding aspect is that most of the municipalities in all Mexico more than 101 cases of human TB.

In Mexico and Latin America, the epidemiology of TB affects a number of wild animals that contribute to this disease in the environment, as well as to increase the possibility of cases of human TB, whose causal agent is in the Bacillus which affects cattle at a rate of between 3% and 10%. The countries of Europe, North America and Australia are free of the disease or about to eradicate it, however, the presence of wildlife acting as reservoirs of Mycobacterium bovis has prevented countries such as Ireland, New Zealand, UK, Ireland North and United States reach this condition.

The eradication of TB has been unable according to the type of wildlife present in every country, for example, in the United States whitetail deer, bison and elk have been responsible for regional outbreaks, while in New Zealand, badger "brush tail" (Trchosus Vulpecula), and in the UK and the Republic of Ireland, badger (Meles meles) act the same

way. Moreover, in New Zealand and Australia they are important red deer and wild pig, the latter reported in Argentina, Brazil and Spain as a potential reservoir of bovine TB.

The prevalence in regions of Latin America is about 1%, where 70% of the animals is. There are strategies based on "trial and sacrifice" that involve the detection and elimination of positive cases of TB programs. They claim that all countries have programs to control TB. They are divided according to their percentage, which ranges from less than 0.1% up to more than 1%; and even values are unknown. For example, in Argentina the prevalence varies from 4% or more; Brazil does not have updated information, however, after the implementation of the National Program for the Control and Eradication of Brucellosis and Tuberculosis (PNCEBT), the prevalence varies from 0.7% to 3.3%; Chile presents different areas of prevalence depending on the region, with percentages ranging from 0.01% to 23.6%. Meanwhile, in Mexico 83.12% of the country shows lower prevalences of 0.5% and several regions are considered low prevalence.

Moreover, the etiologic agent of bovine TB described from the perspective of the various constituents of the cell wall, the differences between M. tuberculosis and M. bovis, considering the growing conditions, biochemical tests, genome features as well as their resistance and susceptibility to various drugs used in the treatment of this disease.

The epidemiology of bovine TB is tackled considering that M. bovis is the causative agent in both cattle and humans, without neglecting the importance of wildlife acting as reservoirs of this bacterium. The presence of lesions or the affected system indicates the route of entry of M. bovis; well, the first route of infection is respiratory, followed by digestive system. Other routes (congenital) and vertical transmission are often important in areas where prevalence is high.

There are several predisposing factors such as age, sex, herd size, genetics, nutrition, comorbidities, physiological state, behavior, environment, management practices, among others. There are also other risk factors, such as intensity of the production system, soil acidity, poor diet, stress, breastfeeding, childbirth and immunosuppression caused by infectious agents (virus, bovine viral diarrhea). In the case of humans, the major risk factors are: Immune and socioeconomic status, exposure, and coinfection with HIV.

Human TB has been studied from different angles, among which are the transmission paths, the source of M. bovis and its relation to the causative agent of human TB (M. tuberculosis), as well as control agent developed countries with, for example, pasteurization. It has been stated that consuming milk products contaminated with M. bovis is one of its main causes and ruled that the consumption of meat animals can transmit tuberculosis agent, since when flesh injuries occur in this channel is seized and it fails to smolder. Moreover, studies where human TB cases are caused by M. bovis, whose shares have been rising.

Also present situations such as the slight difference between the cases of human TB caused by M. tuberculosis and M. bovis in clinical, radiological and pathological aspects are. In developed countries, cases are rare because eradication programs have been effective; However, in developing countries M. bovis remains responsible for human cases due to consumption of raw milk and fresh cheeses; They have been determined sub reports of human cases due to the ways of diagnosing the disease and the causative agent; the high prevalence in dairy cattle Airborne favors or digestive exposure to the bacillus, which increases the risk to public health. For the situation in Mexico, recommend the installation of a reference laboratory, develop a national database with the characteristics of the agent both livestock and humans; implement research projects to determine more precisely the role of M. bovis in cattle and humans; determine the role of milk products and transmission mechanisms of cattle to human, holding awareness campaigns about the risks of drinking raw milk, and so on.

It is essential to know the functioning of the immune system against the disease to determine the behavior of various pathogens in the animal organism. It should be noted that there have been significant advances in the understanding of the immune response and the various components thereof. It is known that the immune system is made up of organs, cells and molecules that act orderly and dynamically in order to protect the body from a wide variety of pathogens. There are two forms of protection, known as nonspecific (skin and certain cell populations: macrophages, for example) and the other specific (antibody or humoral response). It describes in detail what happens when the body faces the M. bovis, since the cells involved in the immune response are most affected (macrophages) and to

determine the elimination of positive cattle, with consequent economic losses. It is also important to understand the mechanisms related to the establishment or elimination of the disease producing agent. Clearly different types of cells involved in innate immune responses and their characteristics against mycobacterial infections explained. Also important pathways for the M. bovis to eliminate transmission, how infection or disease established in cattle.

Macrophages, dendritic cells, mast cells, basophils, eosinophils, natural killer (NK) cells and neutrophils are characterized, and their participation in the innate immune response. As for the adaptive immune response, notes the importance of lymphocyte populations whose participation is important against various infections and diseases. reference to TB is a complex and dynamic process which involved cellular and molecular events in an orderly manner is made, such as recognition of the bacillus, phagocytosis, immune response and avoidance mechanisms, which are explained in detail on the way income (inhalation or ingestion, phagocytosis of the bacilli start the inflammatory process, response of the organism, advancement and progress of the disease, and later spread to other organs).

It is not only necessary to know the characteristics of the pathogen but also learn the ways of diagnosing the disease. This document describes the main diagnostic tools used today and which have been developed or are under development and seeking a reliable way to identify the presence of M. bovis in advance and with high precision. For this, detailed ante-mortem tests, such as test anocaudal fold, bend test and simple comparative cervical test, in which the tuberculin is used, corresponding to pure protein derivatives of M. bovis (bovine PPD) and M . avium (avian PPD), the application is intradermal. To improve the specificity and sensitivity of diagnostic tests for the problems in the above tests, the test sample of blood in which the presence of interferon gamma (IFN-α) is determined, which is an interleukin produced is performed T lymphocytes and NK cells.

As for post mortem tests, detection of lesions at slaughter mentioned, however, the sensitivity is low but can reach 95% to conduct a careful examination lymph nodes and lungs, although the authors cited inspection to determine sacrifice It detects only 55%, compared to the recovery of mycobacteria through bacterial culture. Although the detection of positive animals at slaughter is low, both on trail inspection, sending samples to

laboratories lesions suggestive of TB, identification and traceability of cattle, they are crucial for the control and eradication of TB role.

There are direct diagnostic methods such as smear, culture, histopathology and molecular tests that can be performed before or post mortem, which have various advantages and disadvantages from the point of view of sensitivity, specificity and utility. However, it is necessary to determine whether it is practical and cost to perform any of them. As for molecular testing, it mentioned the PCR (polymerase chain reaction), which is characterized by being particularly useful for the rapid detection of infection in an animal suspected.

Another aspect are diagnostic tests based on the humoral response, including ELISA, immunoblotting (MAPIA), capture of specific antibodies, agglutination with latex beads (LBAA), fluorescence polarization, and cross-reactions.

Conclusion.

In conclusion, recommend the use of various diagnostic tests mentioned above since each of them has different degrees of sensitivity and specificity to detect jointly the humoral and cellular response in cattle. It then searches that are simple tests, ease of deployment, low cost and have great impact on control strategies of the disease.

An aspect or relatively new concept refers to the molecular epidemiology, which is complemented with the traditional epidemiology, as it can establish the relationship between different strains of microorganisms if they have identical genomic fingerprints. The application of this term has several examples, such as determining the transmission of the bacillus from animals to man and / or between humans. Among the molecular genotyping techniques is, espoligotipificación, repeated sequences serial number variable (VNTR) and Mycobacterium interspersed repeated units (MIRU). All of these techniques contribute to the quality control of bacteriological diagnosis, thereby reporting false positives are avoided.

To control the disease is being implemented on an experimental basis and in some countries have made good progress with the help of vaccination. Although producers have mentioned

his interest in this form of disease control, we have encountered obstacles with the field tests. Some point to use vaccination in developed countries would not be useful because of the low prevalence, but it would be in countries or areas of high prevalence. The only vaccine used in human and in some cases in animals is the BCG strain, which does not comply with all the characteristics of an ideal vaccine, however, it is used to compare with any other potential vaccine. In the last decade they have been used many vaccines, namely DNA vaccines, subunit vaccines (proteins), live vectors (attenuated recombinant virus) and attenuated strains of M. bovis and related mycobacteria TB. It notes that the success of vaccination depends on the type of protocol used, as well as the prevalence of the same as the area or region to apply.

Finally, the importance of TB in international trade, which has imposed a tariff barrier mentioned important because the United States increased control measures on cattle imports from Mexico for the purpose of eradicating TB from their territory.

The main objective of this work is to support all those professionals dedicated to animal health, mainly cattle, and participate in the process control and eradication of bovine TB.

It is important to be updated about the disease, its transmission and ways of diagnosis, generating huge economic losses and affects public health.