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Sesión plenaria: Symposio sobre bioterrorismo, grandes amenazas epidémicas y bioseguridad: sesión IV (bioseguridad)

Aula 13F, Facultad de Farmacia
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184.- Parasites and biosecurity: an overview

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Biosecurity issues as they impact on agriculture, health and the environment are becoming more important as a consequence of globalization, migration, climate change, and political instability. This applies to the causative agents of all infectious diseases including those caused by parasites, for which emerging threats are increasingly being recognized. This is particularly so for vector-borne diseases and those utilizing wildlife as reservoirs. Surveillance is critical in maintaining biosecurity. This not only requires the availability of the most appropriate "tools" for detection, but also the awareness and willingness of government authorities to apply comprehensive surveillance and response programmes. In this presentation, these issues will be illustrated using Australia and its near neighbours in the Asia Pacific region, as examples.

In view of factors that are enhancing the global spread of emerging and re-emerging diseases, and despite Australia having quarantine policies and surveillance activities considered to be among the best in the world in preventing the entry of exotic pests and diseases, there is still a need to re-evaluate Australia's biosecurity. This is particularly so given the problems Australia has faced with exotic diseases in the past, such as babesiosis, echinococcosis and toxoplasmosis that were all introduced many years ago but which continue to threaten livestock industries and wildlife. The important current parasite disease threats to Australian agriculture, public health and wildlife are similar to those in other parts of the world and include surra, screwworm, trichinellosis, malaria, and leishmaniasis. Migration and increasing tourist travel have resulted in a rise in the number of cases of exotic parasitic diseases diagnosed in Australia. Although the life cycles of some of these diseases are unlikely to become established in Australia, there are many "silent" exotic zoonotic diseases that may not manifest themselves as clinical problems for varying periods following entry into the country and may not subsequently be accurately diagnosed. The awareness of medical and veterinary personnel thus need to be heightened in the differential diagnosis of such diseases, not only in humans but also in companion animals.

Recent outbreaks of malaria and leishmaniasis have served to emphasise the need for urgent action. Not only that attention has to be given to how future surveillance activities should be undertaken, but also the limitations of what is known about the potential for transmission of introduced diseases. In this context, more data is needed on vectorial capacity and the potential role of native and feral reservoir hosts.

Early detection of infectious disease agents is essential. Resources for conventional surveillance activities are time-consuming and expensive and the data provided are often limited, particularly in detecting "novel" agents and determining vector distribution. Future surveillance activities must be on a regional basis and involve both border and pre-border surveillance activities if they are to be effective, and lead to the protection of both trade and peoples health. This will require international cooperation, technology transfer and training. Surveillance activities must also be supported by rapid, and "field-friendly" diagnostic tests, more comprehensive epidemiological data and modeling, all of which can be complemented increasingly by technologies that provide information on environmental factors. Thus, genomic and remote sensing technologies, coupled with GIS systems are likely to be the mainstay for quarantine surveillance activities in the future.

Thompson, R.C.A., Owen, I.L., Puana, I., Banks, D., Davis, T.M.E., Reid, S.A., 2003. Parasites and biosecurity - the example of Australia. Trends in Parasitology, 19, 410-416.

185.- Biosecurity for emerging zoonotic parasites: *Leishmania*, *Trichinella*, *Angiostrongylus* and *Echinococcus*

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The close contact between humans and animals continues to favor the occurrence of zoonotic infections, especially when sanitary conditions are inadequate and in areas where political or social instability has disrupted disease-control programmes and medical and veterinary services. Many of the newly emerging and re-emerging infections that have caused concern, and for which global surveillance systems are being developed, are zoonoses, and the recent SARS epidemic is a clear example of what can happen when an animal pathogen infects humans. With specific regard to zoonotic parasites, the various means of transmission must be considered when developing biosecurity strategies to address the risk of infection. In the present review, I examine the risks of infection and the means of controlling and preventing infection for parasite groups characterized by four different modes of transmission: (i) *Leishmania* (vector-borne); (ii) *Trichinella* (meat-borne); (iii) *Angiostrongylus* (mollusc-borne); and (iv) *Echinococcus* (transmitted through contaminated faeces). In addition to the mode of transmission, these parasites also have different incubation periods: a few days for *Trichinella* and *Angiostrongylus*, a number of months for Leishmania, and a number of years for *Echinococcus*. Humans are known to have a natural resistance to *Leishmania infantum* and *Echinococcus multilocularis* and often do not develop clinical disease. In the Mediterranean Basin, visceral leishmaniasis (*Leishmania infantum*) is considered as a re-emerging disease, whose reappearance is probably related to increases in the dog population (the reservoir) and in the population of immunodepressed persons and to both increases in, and the expansion of, populations of the Phlebotomine vectors. Moreover, in the past 20 years, veterinarians have been treating dogs with therapy that is ineffective and only results in a somewhat increased survival, which, however, has increased the contact between infected animals and vectors. Several control and prevention measures can be used to reduce the risk of transmission of *Leishmania* to dogs and to humans in endemic areas during the transmission season: the use of insecticide-impregnated collars for dogs, insecticides for rooms, very fine window screens, insect repellent applied to the skin, and the reduction of the time spent outdoors at night. In many countries, *Trichinella* infection has re-emerged in domestic animals and humans as a result of war, the failure of veterinary services, economic problems, the development of a black market for meat, the improper farming of pigs and horses, the illegal slaughtering of pigs, and the practice of leaving game-animal carcasses in the field after skinning. Furthermore, the host range of *Trichinella* has been found to be wider than previously believed, encompassing mammals, birds, and reptiles. Several control and prevention measures can be used to increase the biosecurity of the meat market: the use of the digestion method to control for *Trichinella* larvae in all domestic pigs, horses and game animals, at slaughtering or after hunting and especially on small farms; promoting the proper disposal of pork scraps after slaughtering and the carcasses of game animals after skinning; and teaching consumers to eat only well-cooked meat and meat products. *Angiostrongylus cantonensis*, which induces eosinophilic meningitis, and *Angiostrongylus costaricensis*, which induces granuloma and necrosis in the abdominal cavity, are transmitted to humans through the ingestion of raw infected snails and slugs or the mucus excreted by these mollusks (which can be found on vegetables). The main reservoirs are rats. To prevent infection, the following measures can be adopted: i) adequate cooking (70 °C) or freezing (-15 °C for 12-24 h); ii) thorough washing of vegetables that are eaten raw to eliminate snails, slugs, and their mucus; iii) teaching children not to touch snails; iv) adequate cooking of paratenic hosts of third-stage larvae, such as prawns, shrimp, and crabs, as well as the juices from these animals; and v) the elimination or, at least, the control and reduction of rat and mollusc populations. Both cyst-echinococcosis (*Echinococcus granulosus*) and alveolar-echinococcosis (*Echinococcus multilocularis*) are transmitted through the ingestion of eggs excreted with the faeces of dogs or foxes. However, the means of preventing and controlling these infections somewhat differ: to prevent cyst-echinococcosis, shepherds must be educated not to feed their dogs with the internal organs of slaughtered sheep, whereas to prevent alveolar-echinococcosis, which is related to sylvatic or synanthropic (urban-echinococcosis) cycles, the vulpine population must be reduced, although this is quite difficult to put into practice. In any case, the following measures are recommended for preventing both infections: i) vegetables should be thoroughly washed or boiled; ii) after agricultural work or gardening, hands should be thoroughly washed; and iii) persons at risk (e.g., shepherds, gardeners, and butchers) should be periodically monitored by serology. These four zoonoses can be considered as representing a permanent public-health risk, not only because of the appearance of new risk factors but also because of a sudden and significant increase in previously identified factors. Continuous health education and strict surveillance are crucial for biosecurity.

186.- Emergence and spread of vector-borne parasites

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In recent years, vector-borne parasitic diseases have emerged and re-emerged in new and previously reported geographical regions, becoming global health and economic problems for humans and animals, both livestock and pets. Malaria is the most important vector-borne disease causing 300 million acute illnesses annually, in Tropical and Sub-Tropical regions. Reemergence of malaria is frequently reported in regions where the parasite was eradicated or a significant decrease in incidence of the disease was already reported. Moreover malaria cases are globally exported from endemic regions, and autochthonous cases are being reported in different parts of the world. Other parasites of biosecurity importance include *Leishmania, Trypanosoma, Dirofilaria* and *Babesia spp.* (this list does not include important vector-borne bacteria and viruses). The development of new diagnostic molecular techniques allows researchers to diagnose and trace infecting agents, their origin and their spread routes.

The ecology and epidemiology of vector-borne diseases are affected by three major factors: the pathogen, the host (human, animal or vector) and the environment, and is influenced by the sensitivity and rate of exposure of the host. In the last few decades, the world has been undergoing major changes which affect the emergence, resurgence and spread of vector-borne diseases. Drivers of global change are complex and include physical, biological and socioeconomic factors. For example, atmospheric composition is being changed constantly as a result of human activities, particularly burning of fossil fuels. This latter action results in the significant increase of atmospheric CO_2 concentration. Increased atmospheric CO_2 concentrations reduce plants' water loss through transpiration and act as fertilizer. Therefore, plants produce more foliage with the same amount of water, increasing the density of plant foliage for extended periods in the year and providing more favorable microclimates for insect vectors. Other important drivers for the emergence and spread of vector-borne parasites include human-induced global warming, urbanization, industrial and agricultural chemical pollution, extensive land use, alterations in water storage and irrigation habits, development of insecticide and drug resistance, changes in public health policy, emphasis on emergency response rather than prevention, shortage of specialists trained to respond effectively to emerging and reemerging infections, genetic changes in pathogens, and revolution in trade and travel habits.

Trade is a major factor for the emergence and spread of vector-borne diseases especially in recent years, where borders have been opened between countries and some inspection measures such as quarantine have been withdrawn in some countries. Large quantities of goods are transported daily around the world allowing invasion of vectors through airplanes, ships, containers, luggage and other means (for example transport of *Anopheles* mosquitoes via tires). Livestock, pet and exotic animal international transportation are also important factors in the spread of infectious agents and vectors. Tourism and international travel are additional important drivers. The number of international travels is increasing each year: About one million people travel internationally each day, and about fifty million travelers travel annually from developed to developing countries and vice versa. To emphasize this point, about 20 million people visit malarious areas, and about 10,000 malaria cases are imported annually to the European community alone. Some travelers are accompanied by their pets, and these may serve as transport host for vectors and hosts for a variety of infectious agents. In addition, there are more than 14 million refugees globally, as a result of wars and poverty over different parts of the world mainly in Africa, South and Central Asia and the Pacific, and the Americas. The increase in travel, refugee movements, and displacement of people from rural areas to cities increase the spread of pathogens and their vectors. Global spread of infections and vectors are being driven not only by human activities and movement, but also by natural factors such as movement of vectors by wind, carriage on transport hosts like migrating birds, and by other means of movement (flying, walking, etc…).

Better epidemiological knowledge, improved identification of parasites and vectors (GIS, remote sensing and climate models) may provide tools for epidemic prediction and preventive public health and intervention programs. Health care workers, physicians, veterinarians and biosecurity officers (governmental and farm officers) should play a key role in the prevention of diseases. Taking into account the globalization effects and the current risks of bioterrorism, a global approach should be implemented by international organizations and governments in collaboration with scientists (new vaccines and drugs development) in prevention of the emergence, reemergence and spread of these vector-borne diseases.

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