TÜBİTAK

Turkish Journal of Veterinary and Animal Sciences

http://journals.tubitak.gov.tr/veterinary/

Short Communication

Turk J Vet Anim Sci
(2015) 39: 241-244
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doi:10.3906/vet-1404-98

Report of rabies in feedlot cattle introduced to Baja California from the state of Guerrero, Mexico

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Received: 23.04.2014 • **Accepted:** 09.12.2014 • **Published Online:** 01.04.2015 • **Printed:** 30.04.2015

Abstract: Rabies is a fatal infection of the central nervous system produced by a *Lyssavirus* of the family *Rhabdoviridae*. The virus is distributed worldwide and is primarily transmitted by rabid animal bites, with multiple reservoirs depending on the region. The vampire bat *Desmodus rotundus* is distributed in several states of Mexico and is considered the main vector of rabies in cattle. In the state of Baja California, no cases of paralytic rabies have been reported. In this work, we report the first three cases of rabies in feedlot cattle showing nervous signs, which were later confirmed in a reference laboratory by immunofluorescent analysis. Considering that the majority of feedlot cattle are introduced to Baja California from other states of Mexico where rabies is considered endemic, it is necessary to strengthen current programs of vaccination to reduce the rate of infected animals in their places of origin to avoid the spread of rabies to other geographic areas of the country.

Key words: Rabies virus, *Desmodus rotundus*, feedlot cattle, histopathology, direct immunofluorescence

Rabies is a zoonotic disease that remains an important public health problem worldwide and causes more than 60,000 human deaths each year. The causative agent of rabies is an RNA virus of the genus *Lyssavirus* in the family *Rhabdoviridae* (1). Rabies viruses (RVs) are divided in seven genotypes based on their genetic similarities. The infectious cycle of RV is perpetuated by vampire bat bites and deposition of the virus through saliva in subcutaneous tissue and muscles (2,3). After peripheral infection, RV invades the central nervous system, resulting in progressive fatal encephalomyelitis in almost all cases (4). RV is distributed worldwide and has a broad range of reservoir host species within the mammalian orders *Carnivora* and *Chiroptera* (5). The most important of these reservoirs as a source of human disease is the domestic dog (*Canis familiaris*). In the Americas, a number of bat species are also responsible for the transmission of rabies to humans, particularly the common vampire bat *Desmodus rotundus* in Latin America and a number of insectivorous bat species in North America (6). This has emerged as a public health risk, as bites can occur without the victim realizing that an exposure has taken place, and many cases of bat-transmitted rabies have no recorded exposure to a bat prior to the development of infection (7). *Desmodus rotundus* is considered the main reservoir for rabies in cattle for Latin America (8) and the main cause of rabies in cattle in Mexico with annual economic losses of about $35 million due to reduced production of meat and milk and the inevitable death of cattle (9).

According to epidemiological records from the Office of Animal Health Campaigns in Mexico, from 2001 to 2010, the prevalence of rabies in cattle increased from 3.80% to 5.63% (9). This implies that from an inventory of 35.5 million head of cattle in 2010, about 649,596 animals are at risk of contracting rabies and dying from this infection (9). Regarding human cases of rabies, the Secretary of Health in Mexico reported 23 cases of human rabies transmitted from wild animals between 2000 and 2006, of which 14 cases (60%) were transmitted from a vampire bat attack in rural zones close to the natural habitat of *Desmodus rotundus* (9).

The state of Guerrero is located on the Pacific coast and is home to different species of vampire bats, including *Desmodus rotundus* (10,11). In 2012, animal health authorities reported 634 notifications of suspected bovine rabies, of which 627 farms were identified with vampire

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bat aggression. From those, 192 cases of bovine rabies were confirmed in 25 states considered endemic for the disease with appropriate ecological conditions for the survival of the vampire bat *Desmodus rotundus*. The same animal health authority considered Mexico City and the states of Nuevo León, Coahuila, Baja California, Baja California Sur, Aguascalientes, and Tlaxcala to be free of bovine rabies (12).

The aim of this report was to describe three cases of rabies in feedlot cattle introduced to the municipality of Mexicali, Baja California, in northwest Mexico, that showed nervous signs and postmortem lesions suggestive of rabies. This finding represents the first report of rabies in cattle in the state of Baja California. Samples collected from affected tissues were fixed in 10% buffered formaldehyde and processed for histopathology at the Laboratory of Pathology, at the Institute for Research in Veterinary Sciences (IICV) at the Autonomous University of Baja California (UABC). To confirm the diagnosis, a portion of the brain was sent to the reference laboratory of the Mexico-U.S. Commission for the Prevention of Foot-and-Mouth Disease and Other Exotic Animal Diseases (CPA), in Mexico City, where immunofluorescent testing was performed to confirm the diagnosis of rabies.

Case 1: An 8-month-old male cross-breed zebu was introduced to Baja California on 20 January 2013. Upon arrival, the animal was noted for its poor body condition. On 9 March, the animal showed nervous symptoms including moderate salivation, bruxism, torticollis, and progressive paralysis. The animal died on 11 March. Necropsy was performed and the brain was collected for histopathology and direct immunofluorescence testing. Histological findings showed nonsuppurative encephalitis, severe perivascular lymphocytosis, multifocal gliosis, and neuronal degeneration affecting the thalamus, brain stem, and cerebellum (as shown in Figures 1 and 2). Although the histological findings were suggestive of rabies, the typical Negri bodies in neurons were not observed. The immunofluorescence antibody test (IFA) was performed by the national laboratory of reference (CPA) using a monoclonal antibody to confirm the diagnosis of rabies (inset, Figure 2).

Case 2: An approximately 12-month-old male cross-breed zebu was introduced to Baja California on 18 April. The animal was prostrate and presented dilatation of pupils, a flaccid anal sphincter, paralysis of the muscles of the limbs and jaw, bruxism, and opisthotonos. The animal died within a few hours of the signs and symptoms being recorded. Necropsy was performed and histopathology showed results similar to those of Case 1. Because the clinical signs and lesions were suggestive of rabies, the brain was also sent to CPA facilities in Mexico City, where immunofluorescent analysis was performed. The IFA test performed at the CPA laboratory was positive and a diagnosis of rabies was confirmed.

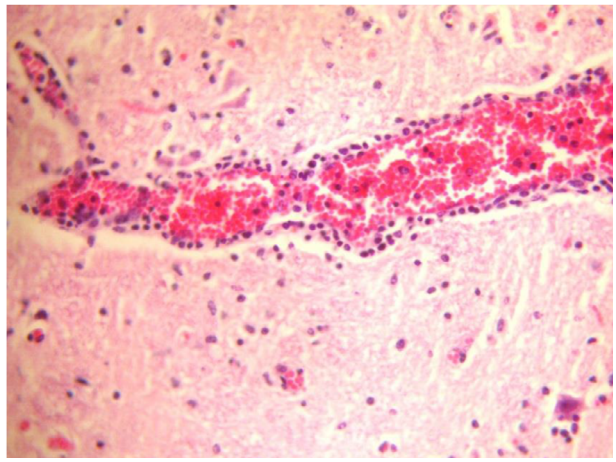

Figure 1. Perivascular mononuclear infiltrate in the brain stem (H&E 400×).

Case 3: An 8–9-month-old male cross-breed zebu was introduced to Baja California on 5 August 2013. On 3 September, the animal showed nervous symptoms, progressive paralysis, torticollis, and excessive salivation and died a few hours later. Similar to cases 1 and 2, the histopathology showed lesions suggestive of rabies; however, Negri bodies were not observed in neurons. Again, immunofluorescent analysis performed at the CPA laboratory confirmed the diagnosis of rabies.

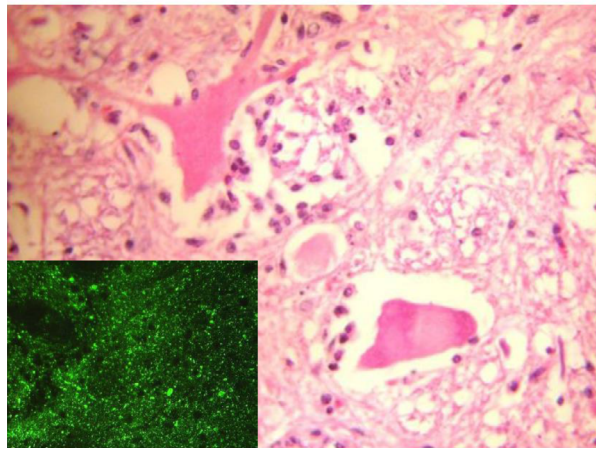

Figure 2. Chromatolysis and loss of Nissl bodies is observed. Degenerating neurons are surrounded by oligodendroglial proliferation (satellitosis) and macrophages (microglia or blood monocytes). Signs of phagocytosis by macrophages are observed (neuronophagia) (H&E 400×). Inset: Positive direct immunofluorescence on brain section using monoclonal antibody.

In Mexicali, there have been no reported cases of urban rabies since 1982 (13). Regarding rabies transmitted by wildlife, several studies have reported that the potential for suitable habitat and distribution of *Desmodus rotundus* in Baja California is negligible, due to lack of favorable environmental conditions (14,15).

Each year, the Mexicali Valley introduces an average of 315,000 head of cattle from at least 23 different Mexican states (16) and, besides official testing for tuberculosis, brucellosis, and ticks, the cattle receive no additional testing or treatment for any other pathological condition before shipment to different geographical areas of the country, mainly for feedlot purposes. This implies a significant risk for the introduction of several diseases like rabies to previously disease-free areas; rabies was unknown in Baja California until 2013.

Prevention and control of rabies requires the cooperation of veterinarians, laboratory personnel and public health authorities. An example of cooperation and coordination of this type was achieved in Europe, where several regions of the continent have been declared free of rabies, mainly as a result of the implementation of actions such as continuous surveillance, establishment of sanitary stations at the borders of endemic regions, the implementation of vaccination programs, and the development of effective oral vaccines for wildlife (17). Considering that the majority of feedlot cattle are introduced to Baja California from other states of Mexico where rabies is endemic, it is necessary to strengthen current programs of vaccination to reduce the rate of infected animals in their places of origin and to avoid the spread of the rabies virus to other geographic areas of the country.

Acknowledgments

This work is part of the requisites to obtain the grade of Doctor en Ciencias Agropecuarias of the first author (Autonomous University of Baja California). We thank Carolina Trillo for her excellent technical assistance.

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