

## Toxoplasmosis in Captive Eastern Grey Kangaroos (*Macropus giganteus*)

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**Abstract:** Two, 2 years old males, Eastern grey kangaroos (*Macropus giganteus*) which were captive in a zoo presented anorexia, weakness, blindness, convulsions and sudden death. Gross and microscopic lesions were consisted with severe pulmonary edema, multifocal myocarditis and moderate distensive cardiopathy, severe catarrhal and ulcerative gastroenteritis and non-suppurative encephalitis. At light microscopy examination of tissues stained with haematoxylin and eosin, *Toxoplasma gondii* tachyzoites were identified in lungs, myocardium, stomach glandular tissue, spleen, kidney and brain and both cases were positive to *T. gondii* using immunohistochemistry technique however, the source of infection could not be determined. In addition to the best of the knowledge this is the first confirmed report of toxoplasmosis captive Eastern grey kangaroo in Mexico.

**Key words:** *Toxoplasma gondii*, captive grey kangaroo, *Macropus giganteus*, stomach, tissue, Mexico

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### INTRODUCTION

The Eastern grey kangaroo, *Macropus giganteus* is endemic to Eastern Australia and the island of Tasmania where the free-ranging population is increasing in recent years as consequence of livestock production activities (Munny *et al.*, 2008). In addition, this species has been preserved in zoos around the world where is affected by several diseases (Stern, 2010). Concerning parasitic diseases, these have been proposed as one of the main risks that affects the health of macropods (kangaroos, wallabies and wallaroos) populations.

*Toxoplasma gondii*, the etiological agent of toxoplasmosis, affects a broad range of warm-blooded animals (More *et al.*, 2010; Shaapan and Ghazy, 2007; Bonyadian *et al.*, 2007; Sabry and Reda, 2008; Kanga-Waladjo *et al.*, 2009; Shaapan *et al.*, 2012) with particular interest in zoo animals (De Camps *et al.*, 2008). This disease is cause of significant morbidity and mortality rates in macropods with several acute and chronic manifestations, i.e., diarrhea, respiratory distress, weight loss, blindness, neurological deficits and sudden death (Basso *et al.*, 2007; Dubey and Crutchley, 2008; Parameswaran *et al.*, 2009; Hermosilla *et al.*, 2010; More *et al.*, 2010; Portas, 2010; Stern, 2010). Furthermore, toxoplasmosis in macropods also is considered as a public

health problem due to the mobilization of live animals and consumption of infected meat (De Camps *et al.*, 2008; Bermudez *et al.*, 2009; Parameswaran *et al.*, 2009). Several researchers have reported the presence of toxoplasmosis in captive macropods and this information is important for their management in zoological gardens (Parameswaran *et al.*, 2009). Consequently, the purpose of this report is to describe the clinical and pathological findings of two cases of toxoplasmosis in Eastern grey kangaroos located in the Ciudad Victoria Zoo in the Mexican state of Tamaulipas.

### MATERIALS AND METHODS

In June 2006, two male Eastern grey kangaroos, 2 years old in average and previous clinical history of anorexia, weakness, blindness, convulsions and sudden death were submitted to the Pathology Teaching Laboratory of the College of Veterinary Medicine at the Autonomous University of Tamaulipas for conducting a pathological diagnosis. At necropsy, the most consistent gross lesions in both cases were pulmonary congestion, tracheal edema with abundant foamy secretion and right ventricular distention. In abdominal cavity there were yellowish secretion and petechial hemorrhages, gastric and enteric distention, moderate congestion of gastric

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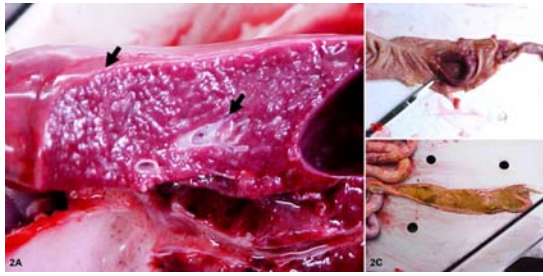


Fig. 1: Gross lesions of male Eastern grey kangaroos (*Macropus giganteus*) affected by *Toxoplasma gondii*; 2A) Transversal cut of lung with presence of pulmonary edema and congestion, tracheal foamy secretion and pleural thickness; 2B) Button gastric ulcers in gastric mucosa and 2C) Catarrhal enteritis

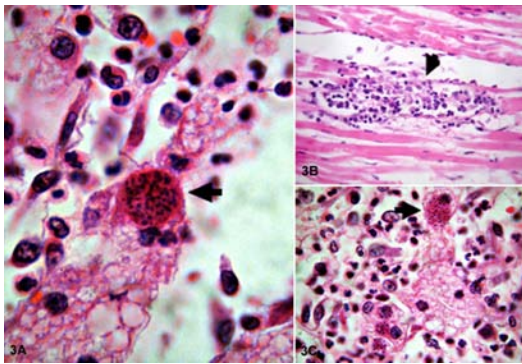


Fig. 2: Identification of tachyzoites with moderate infiltration of inflammatory cells and moderate and focal hemorrhages (haematoxylin and eosin); 3A) Lung (100x); 3B) Myocardium (40x) and 3C) Stomach glandular tissue (40x)

mucosa with focal button gastric ulcers of 0.5 cm in diameter in one of the cases and ulcers in the gastric fundus measuring 3 cm in diameter in both cases and catarrhal enteritis (Fig. 1). Despite the fact that gross lesions were not identified in organs other than the aforementioned, tissue samples were fixed in 10% phosphate-buffered formalin, embedded in paraffin, cut at 5  $\mu$ m sections and stained with haematoxylin and eosin for histopathological examination, strikingly identifying the presence of numerous toxoplasmal developmental stages (tachyzoites) in lungs, myocardium and stomach glandular tissue of both cases (Fig. 2); toxoplasmic structures also were identified in spleen, kidney and brain. Other microscopic findings were consistent with infiltration of inflammatory cells, hemorrhages and focal necrosis in lungs, heart, stomach, intestine, liver and brain. In

addition, brain sections were subjected to Immunohistochemistry (IHC) using antibodies against *T. gondii* according with the manufacturer's instructions (Meridian Life Science, Saco, ME, USA) and both cases were positive. In agreement with the identified gross and microscopic lesions and the IHC results, both cases were morphologically diagnosed as severe pulmonary edema, multifocal myocarditis and moderate distensive cardiopathy, severe catarrhal and ulcerative gastroenteritis and non-suppurative encephalitis caused by disseminated *T. gondii* infection however, the source of infection in both cases could not be determined.

## RESULTS AND DISCUSSION

Macropods are highly susceptible to toxoplasmosis (Basso *et al.*, 2007; Dubey and Crutchley, 2008; Hermosilla *et al.*, 2010; More *et al.*, 2010). However, reports of natural acquired disease and epidemiological information are limited (Stern, 2010) despite the fact this disease has been associated with severe pathology and sudden death (Parameswaran *et al.*, 2009; More *et al.*, 2010; Portas, 2010) and is one of the most commonly diagnosed in captive kangaroos (Hermosilla *et al.*, 2010; Stern, 2010). In addition, the diagnosis is frequently obtained when necropsies are carried out (Adkesson *et al.*, 2007).

Few reports have described the infection by *T. gondii* in captive Eastern grey kangaroo around the world, i.e., in the United States of America, Patton *et al.* (1986) reported three cases and Miller *et al.* (2003) also reported three cases of juvenile Eastern grey kangaroo but De Camps *et al.* (2008) reported only one case of toxoplasmosis in Eastern grey kangaroo in the same country, in the same manner that in Argentina one case of toxoplasmosis was reported by More *et al.* (2010).

In addition, other captive macropods have been reported with toxoplasmosis in different geographical locations, i.e., Western grey kangaroo (*M. fuliginosus*), black-faced kangaroo (*M. fuliginosus melanops*), red kangaroo (*M. rufus*), Bennett's wallabies (*M. rufogriseus rufogriseus*), Dama wallaby (*M. eugenii*) and wallaroo (*M. robustus*) in the United States of America (Boorman *et al.*, 1977; Patton *et al.*, 1986; Dubey *et al.*, 1988; De Camps *et al.*, 2008) in Argentina, red kangaroo and Bennett's wallabies (Basso *et al.*, 2007; More *et al.*, 2010), Bennett's wallaby in Spain (Bermudez *et al.*, 2009) and red-necked wallaby (*M. rufogriseus banksianus*) in Germany (Hermosilla *et al.*, 2010) have been diagnosed with this disease. ongenital transmission of *T. gondii* is a rare condition (Basso *et al.*, 2007; Parameswaran *et al.*, 2009) and as macropods are herbivores, the horizontal is

the main route of transmission through ingestion of sporulated oocysts shed from domestic or feral cats or other captive wild felids which are the definitive hosts of *T. gondii* (Patton *et al.*, 1986; Basso *et al.*, 2007; Bermudez *et al.*, 2009; Parameswaran *et al.*, 2009; De Camps *et al.*, 2008; Hermosilla *et al.*, 2010; Stern, 2010).

In addition, clinical toxoplasmosis is associated with immunosuppressed animals under stress conditions and captivity is considered as a stressor factor (Parameswaran *et al.*, 2009; Hermosilla *et al.*, 2010; More *et al.*, 2010; Portas, 2010). Based on the aforementioned information and the fact that the two Eastern grey kangaroos here reported were captive in a city zoo, the most probably source of infection was the presence and close contact with infected feral cats because these animals have been observed in for many years at the Ciudad Victoria Zoo. Despite the fact that we do not generated information regarding infected cats or wild felids in this zoo, the presence of antibodies against *T. gondii* has been reported native wild and feral mammals including wild felids, in other regions of Mexico (Kikuchi *et al.*, 2004; Suzan and Ceballos, 2005; Dubey *et al.*, 2009).

### CONCLUSION

Despite the fact that the diagnosis of toxoplasmosis was based on the identification of *T. gondii* like tachyzoites by means of light microscopy and the presence of antibodies by the IHC and the use of molecular techniques was not attempted, this is to the best of the knowledge, the first confirmed report of toxoplasmosis captive Eastern grey kangaroo in Mexico in agreement with a literature search performed in the United States National Library of Medicine (MEDLINE/PubMed) and the Web of Science (Thomson Scientific) databases. Consequently, this report emphasize the need and importance of monitoring activities concerning toxoplasmosis of kangaroos and other captive animals and also populations of feral cats in order to improve the health status of the former species and preserve health of veterinarians, caregivers and zoo visitors.

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