

Type C botulism in swine fed on restaurant waste¹

Djeison L. Raymundo^{2*}, Danilo C. Gomes³, Fabiana M. Boabaid³, Edson M. Colodel⁴, Milene Schmitz⁵, André M.R. Correa⁶, Iveraldo S. Dutra⁷ and David Driemeier³

ABSTRACT.- Raymundo D.L., Gomes D.C., Boabaid F.M., Colodel E.M., Schmitz M., Correa A.M.R., Dutra I.S. & Driemeier D. 2012. **Type C botulism in swine fed on restaurant waste.** *Pesquisa Veterinária Brasileira* 32(11):1145-1147. Setor de Patologia Veterinária, Departamento de Medicina Veterinária, Universidade Federal de Lavras, Cx. Postal 3037, Lavras, MG 37200-000, Brazil. E-mail: djeison.raymundo@dmv.ufla.br

The paper addresses the epidemiologic data of the death of pigs during the period of 2002 to 2009 following the ingestion of botulinum neurotoxin type C. This neurotoxin was present in food residues originating from restaurant and hotel kitchens, stored in barrels without shelter from the sun and administered in a collective trough without prior thermal treatment. Animals which died at different ages showed clinical signs of botulism characterized by flaccid paralysis, weight loss, anorexia, weakness, lack of coordination, locomotion difficulties with the evolution of lateral recumbency with involuntary urination and defecation. No alterations were observed at postmortem and histological examination. The bioassay with serum neutralization in mice was carried out on samples of intestinal contents from pigs affected and revealed the presence of large quantities of botulinum toxin type C.

INDEX TERMS: Botulism, *Clostridium botulinum*, botulinum toxin type C, food waste, swine.

RESUMO.- [Botulismo tipo C em suínos alimentados com restos de restaurante.] Descreve-se a epidemiologia da morte de suínos ocorrida entre 2002 e 2009 pela ingestão da neurotoxina botulínica do tipo C. A neurotoxina presente em resíduos de alimentos provenientes de cozinhas de restaurantes e hotéis, armazenados em tonéis sem abrigo do sol e administrado em cocho coletivo sem tratamento tér-

mico prévio. Animais de diferentes idades morreram com sinais clínicos de botulismo caracterizados por paralisia flácida, emagrecimento, anorexia, fraqueza, incoordenação, dificuldade de locomoção com evolução para decúbito lateral com micção e defecação involuntárias. Nenhuma alteração evidente foi observada na necropsia e no exame histológico. O teste de bioensaio com soroneutralização em camundongos foi realizado com amostras de conteúdo intestinal dos animais afetados e alimentos e revelou a presença de grandes quantidades de toxina botulínica do tipo C.

TERMOS DE INDEXAÇÃO: Botulismo, *Clostridium botulinum*, toxina botulínica tipo C, restos de alimento, suínos.

INTRODUCTION

Botulism is caused by the ingestion of toxins produced by *Clostridium botulinum*, a Gram-positive bacillus found in soil, water and the digestive tract of animals. Under anaerobic conditions, the spores of *C. botulinum* proliferate and produce neurotoxins which are classified as seven different serotypes (A, B, C, D, E, F and G) (Fernandes & Riet-Correa 2007). Outbreaks of botulism described in cattle, horses, sheep and goats are generally related to the ingestion of toxins C and D, and these animals appear to be the most sensitive ones to the toxins. In domestic and wild birds outbreaks are related to the ingestion of toxin C (Langeneg-

¹ Received on March 5, 2012.

Accepted for publication on August 16, 2012.

² Departamento de Medicina Veterinária, Universidade Federal de Lavras (UFLA), Caixa Postal 3037, Lavras, MG 37200-000, Brazil. *Corresponding author: djeison.raymundo@dmv.ufla.br

³ Departamento de Patologia Clínica Veterinária, Faculdade de Veterinária, Universidade Federal do Rio Grande do Sul (UFRGS), Av. Bento Gonçalves 9090, Porto Alegre, RS 95320-000, Brazil.

⁴ Departamento de Clínica Médica Veterinária, Faculdade de Agronomia e Medicina Veterinária, Universidade Federal de Mato Grosso (UFMT), Av. Fernando Corrêa s/n, Coxipó, Cuiabá, MT 78060-900, Brazil.

⁵ Médica Veterinária, Rua Dr Timóteo 143, Floresta, Porto Alegre, RS 90570-000.

⁶ Médico Veterinário, Departamento de Produção Animal, Secretaria da Agricultura, Pecuária, Pesca e Agronegócio, Av. Praia de Belas 1768, 5º andar, Praia de Belas, Porto Alegre, RS 90110-000.

⁷ Departamento de Apoio Produção e Saúde Animal, Universidade Estadual Paulista Júlio de Mesquita Filho, Faculdade de Odontologia de Aracatuba, Rua Clóvis Pestana 793, Jardim Dona Amélia, Cx. Postal 533, Aracatuba, SP 16050-680, Brazil.

ger et al. 1983). Pigs are very resistant to botulinum toxins (Beiers & Simmons 1967, Smith et al. 1971), and only few cases of botulism have been reported. In swine only two cases of botulism from the ingestion of type C toxin have been reported (Beiers & Simmons 1967, Doutre 1967). The clinical signs presented by pigs are muscular weakness and generalized flaccidness, followed by recumbency and incapacity to move (Beiers & Simmons 1967, Doutre 1967). The aim of this paper is to report the occurrence of botulism caused by the type C toxin in swine fed on restaurant waste in Rio Grande do Sul, southern Brazil.

MATERIALS AND METHODS

Twelve pigs originating from five different farms were subject to necropsy at the Setor de Patologia Veterinária of the Universidade Federal do Rio Grande do Sul (SPV-UFRGS). Data related to the evolution of the disease, the history, epidemiological data and the clinical signs were obtained from the animal owners. During the necropsy tissue samples were collected, fixed in buffered formalin solution (10%), processed with routine techniques for histological analysis and stained using the hematoxylin and eosin (HE) method. Samples of the intestinal contents, liver and blood serum of the pigs were collected together with samples of food fed to the animals. These samples were maintained under refrigeration and sent for biological verification in mice and the seroneutralization test to the Departamento de Apoio Produção e Saúde Animal, Unesp, Campus Araçatuba, in São Paulo State, southeastern Brazil.

RESULTS

In the period of 2002-2009, five outbreaks of botulism in pigs were observed on different farms, and 12 animals were subjected to necropsy. All outbreaks occurred on farms rearing and slaughtering pigs. These farms had poor sanitary and hygiene conditions and were all located in the metropolitan area of Porto Alegre. In all the farms the pigs were fed with food waste from restaurant and hotel kitchens (Fig.1), which in outbreaks 1, 2 and 5 was the only food available for the pigs, while in outbreaks 3 and 4 the diet was supplemented with commercial feed for swine. This food was stored in metal or plastic barrels, without shelter from the sun (Fig.2), and the pigs were fed once a day in a collective trough without prior thermal treatment. In all five farms both sexes were affected, and the pigs were 60 to 150 days old. The morbidity ranged from 13.3 to 28%, the mortality from 13.3 to 24%, and lethality from 68.4 to 100%. All the five outbreaks occurred together in the warmer seasons of the year; three outbreaks were followed up during the summer and two outbreaks were observed in late spring. Epidemiologic data of the five outbreaks are shown in Table 1. The main clinical sign shown by the affected

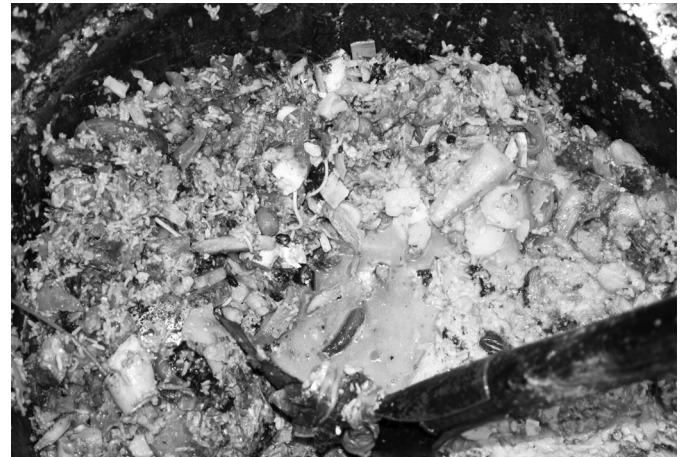


Fig.1. Botulism in swine associated with the type C toxin. Feeding pigs composed of food waste originating from restaurant and hotel kitchens.

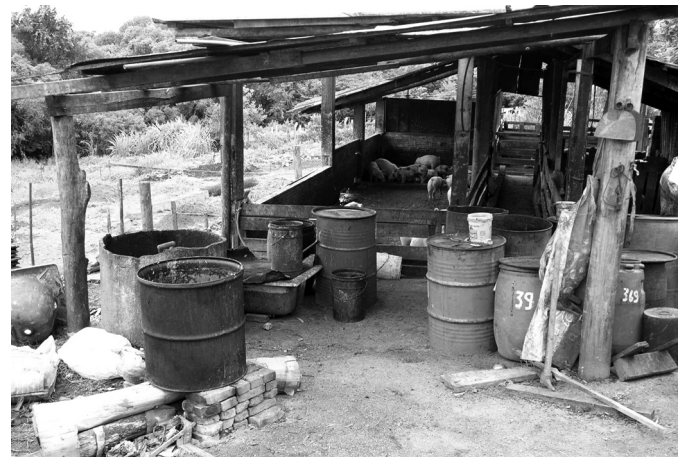


Fig.2. Botulism in swine associated with the type C toxin. Storage of food waste in metal or plastic barrels without shelter from the sun and under poor sanitary and hygiene conditions at pig rearing and slaughter farm.

ted pigs was flaccid paralysis (Fig.3). Anorexia, weakness, lack of coordination, locomotion difficulties with the evolution of lateral decubitus, and involuntary urination and defecation was also observed. It was noted that every time the pigs were stimulated to get up, they made an intense noise. A reduction in the consumption of water and food was observed and finally death. In the necropsy no significant alterations were found. Occasionally there was discrete ascites, the liver had multifocal white spots (parasite migration), and the inguinal lymph nodes were slightly enlarged. There were no significant alterations observed during histologi-

Table 1. Epidemiology of botulism outbreaks at five rearing farms where pigs are fed with restaurant waste

Outbreak	Age (days)	Animals at risk	Morbidity	Mortality	Lethality	Animals subject to necropsy	Characterization of botulinum toxin
1	60-150	75	19 (25.3%)	13 (17.3%)	68.4%	4	Type C
2	75-120	-	2	2	100%	2	Not detected
3	75-120	70	18 (25.7%)	15 (21.4%)	83.3%	4	Type C
4	60-120	30	4 (13.3%)	4 (13.3%)	100%	1	Type C
5	60-150	25	7 (28%)	6 (24%)	85.7	1	Type C



Fig.3. Botulism in swine associated with the type C toxin. Pigs with clinical signs of flaccid paralysis.

cal examination. The intraperitoneal inoculation of the intestinal contents and samples of food into mice produced clinical signs characteristic of botulism. This material was then characterized with use of homologous antitoxins in mice of CDC (Center for Disease Control and Prevention), indicating that botulinum toxin type C was responsible for four of the five outbreaks monitored.

DISCUSSION

The diagnosis of botulism in swine at these rearing farms was based on the epidemiology related to the use of food waste subjected to inadequate preservation at the farms, to clinical signs characterized mainly by flaccid paralysis and the absence of significant alterations in the necropsy and histological examination. The bioassay and the seroneutralization test in mice characterized botulinum toxin type C as the cause of pig death in four of the five outbreaks monitored. The occurrence of cases of botulism in pigs is rare, since they are more resistant than other animals to the effects of botulinum toxin (Kriek & Odendaal 2004, Radostits et al. 2007), and they are considered resistant to the poisoning (Smith et al. 1971, Barcellos & Oliveira 2007). Only reports of two other cases of the poisoning in pigs could be found in the literature, as described in the cases where botulinum toxin type C was responsible for the outbreaks (Beiers & Simmons 1967, Doutre 1967). In both cases the botulinum poisoning was associated with contaminated material in putrefaction ingested by the animals (Beiers & Simmons 1967, Doutre 1967). In all outbreaks monitored by SPV-UFRGS the main feed material of the pigs comprised food waste originating from restaurant and hotel kitchens stored in barrels under poor conditions and without prior thermal treatment before being given to the animals. All outbreaks occurred during the hottest time of the year, during summer or the end of spring. These factors may have led to proliferation of *Clostridium botulinum* and the production of type C toxin in the feed.

A differential diagnosis should be carried out for diseases which proceed with clinical signs of paralysis and recumbency on pig farms. The most important examples observed in Brazil is poisoning by ionophorus antibiotics

(Plumlee et al. 1995, Nogueira et al. 2009), poisoning by *Senna occidentalis* (Martins et al. 1985, Flory et al. 1992), the stress syndrome in pigs (Nogueira et al. 2009), poisoning by *Aeschynomene indica* (Riet-Correa et al. 2003), and traumatic lesions on the spinal cord (Barcellos & Oliveira 2007) which in several cases proceeds with signs of muscular weakness, paralysis of the limbs and prolonged and permanent recumbency. Selenium poisoning leads to paralysis of the hindlimbs and respiratory difficulties (Mihajlovic 1992, Oliveira et al. 2007). In cases of salt poisoning or water deprivation, the pigs show lack of coordination and acute depression (Fountaine et al. 1975). Viral and bacterial infections, such as Aujeszky's disease, rabies, streptococcal meningitis and Oedema disease, lead to lack of coordination, decubitus and respiratory difficulties (Barcellos & Oliveira 2007, Kriek & Odendaal 2004, Radostits et al. 2007).

Acknowledgement. - The authors are grateful to the Brazilian government funding agencies CNPq and CAPES for grants awarded to master and doctorate students at the Setor de Patologia Veterinária.

REFERENCES

- Beiers P.R. & Simmons G.C. 1967. Botulism in pigs. *Aust. Vet. J.* 43:270-271.
- Barcellos D. & Oliveira S.J. 2007. Doenças Causadas por clostrídios. In: Sobestiansky J. & Barcellos D. (Eds), *Doenças de Suínos*. Canone Editorial, Goiânia.
- Doutre M.P. 1967. Première observation de botulisme C beta chez le porc au Sénégal. *Rev. Elév. Méd. Vét. Pays Trop.* 20(2):351-535.
- Fernandes C.G. & Riet-Correa F. 2007. Botulismo, p.215-224. In: Riet-Correa F, Schild A.N., Lemos R.A.A. & Borges J.R.J. (Eds), *Doenças de Ruminantes e Equídeos*. Vol.2. 3ª ed. Pallotti, Santa Maria.
- Flory W., Spainhour Jr C.B., Colvin B. & Herbert C.D. 1992. The toxicologic investigation of a feed grain contaminated with seeds of the plant species *Cassia*. *J. Vet. Diagn. Invest.* 4:65-69.
- Fountaine J.H., Gasche Jr D.G. & Oehme F.W. 1975. Experimental salt poisoning (water deprivation syndrome) in swine. *Vet.Toxicol.* 17(1):5-8.
- Kriek N.P.J. & Odendaal M.W. 2004. Botulism, p.1885-1899. In: Coetzer J.A.W. & Tustin R.C. (Eds), *Infectious Disease of Livestock*. Vol.3. 2nd ed. Oxford University Press, Cape Town.
- Langenegger J., Döbereiner J. & Tokarnia C.H. 1983. Botulismo epizootico em bovinos no Brasil [Epizootic botulism in cattle in Brazil]. *Agroquímica* 20:22-26.
- Martins E., Martins V.M.V., Riet-Corrêa F., Soncini R.A. & Paraboni S. 1985. Intoxicação em suínos pela ingestão de sementes de fedegoso (*Cassia occidentalis* L.). *Comun. Téc.* 92, Embrapa-CNPQA, p.1-2.
- Mihajlović M. 1992. Selenium toxicity in domestic animals. *Glas. Srpska Akademija Nauka i Umetnosti. Odeljenje Medicinskih Nauka* 42:131-144.
- Nogueira V.A., França T.N. & Peixoto P.V. 2009. Intoxicação por antibióticos ionóforos em animais. *Pesq. Vet. Bras.* 29(3):191-197.
- Oliveira K.D., França T.N., Nogueira V.A. & Peixoto P.V. 2007. Enfermidades associadas à intoxicação por selênio em animais. *Pesq. Vet. Bras.* 27(4):125-136.
- Plumlee K.H., Johnson B. & Galey F.D. 1995. Acute salinomycin toxicosis of pigs. *J. Vet. Diagn. Invest.* 7:419-420.
- Radostits O.M., Gay C.C., Blood D.C. & Hinchcliff K.W. 2007. *Veterinary Medicine: A textbook of the diseases of cattle, horses, sheep, pigs and goats*. 10th ed. Elsevier, Philadelphia.
- Riet-Correa F., Timm C.D., Barros S.S. & Summers B.A. 2003. Symmetric focal degeneration in the cerebellar and vestibular nuclei in swine caused by ingestion of *Aeschynomene indica* seeds. *Vet. Pathol.* 40:311-316.
- Smith L.D.S., Davis J.W. & Libke K.G. 1971. Experimentally induced botulism in weanling pigs. *Am. J. Vet. Res.* 32(9):1327-1330.