What is an Atypical BSE?

Antonio C. Alessi1*

1 Unesp – São Paulo State University, Dept. of Veterinary Pathology., Unesp, Jaboticabal, SP, Brazil.

* Corresponding Author: Via de acesso Prof. Paulo Donato Castellane, s/n, Jaboticabal, SP 14884-900, Brasil. E-mail: antonio.alessi@gmail.com

Submitted September 17th 2013, Accepted October 25th 2012

Abstract

The number of cases of Bovine Spongiform Encephalopathy (BSE) in the United Kingdom (UK) and Europe has decreased during the last years. The disease is designated as Classical BSE (C-BSE) once the prion protein involved is very constant and has genetic identity. On the other hand, atypical cases have occurred in several countries, apparently without any relationship with contaminated feeding. Atypical cases, H or L-BSE can have involvement with the etiology of the known C-BSE, first diagnosed in the UK. With the control of C-BSE based on rigid control of feeding, the occurrence of atypical BSE may predominate in the future. In this hypothesis atypical BSE, probably a spontaneous encephalopathy of cattle, will be considered as Sporadic BSE in contrast with the C-BSE that could be nominated UK-BSE.

Key Words: Bovine Spongiform Encephalopathy, BSE, Atypical BSE, cattle, prion protein.

Introduction

The history of unconventional virally induced encephalopathies started to change dramatically when Wells et al., 1987 (37) communicated the diagnosis of a novel spongiform encephalopathy in cattle. This disease was associated with a novel neurological clinical syndrome characterized by relative constancy of signals, insidious onset and progressive course necessitating slaughter in one to six months. The cases started in April 1985 and were observed only in Friesian/Holstein cattle, aged between three and six years, from dairy herds in widely separated geographical locations of England. The authors suggested the provisional designation Bovine Spongiform Encephalopathy (BSE) for the disorder. The very elegant short communication was published in the Veterinary Record, showing histological aspects of the intriguing disease, very similar to the known spongiform encephalopathies of humans, sheep, goats, captive mule deer, rocky mountain elk and ranch reared mink. Vacuolation of grey matter neuropil and vacuoles in neuronal perikaryon were the most characteristic aspects observed on histological examination. This vacuolation varied in severity with anatomic location but the pattern of variation was similar in different animals. Necrotic neurons were also occasionally observed. Fibrils appeared in the ultra-structural analysis of fresh brain tissue from affected cows.

The epidemiological studies were developed in the following months and published by Wilesmith et al., 1988 (39). A wide collection of data was assessed. No chemical substances could be implicated as well vaccines or hormones, and no newly introduced animals were a common factor in the farms with clinical cases. Finally it was suggested that exposure of cattle to a scrapie-like agent, via cattle feedstuffs containing ruminant-derived protein, beginning in the 1981/82 years was involved. During the following years the number of cases increased (29) as an epidemical occurrence (Fig. 1). In 1992 the number of reported cases reached more than 35000 cases, decreasing in the next years. In 2010, 2011 and 2012 the number of cases respectively reported were 11, 7 and 3. The control of the disease started with a feed ban (ruminants protein forbidden to ruminants) in 1988 (38), reinforced in 1996 (animal protein forbidden to ruminants). This measure was necessary because very low doses of infective material can infect cattle by the oral pathway (36). In 1996 researcher groups had strong evidence that BSE was the cause of a new human disease named variant Creutzfeldt-Jakob Disease (vCJD) (40).
C-BSE cases occurred in many other countries in Europe (Fig. 2) (29) due to the import of animals and food from the UK. The number of cases in Ireland, Portugal and France was greater than one thousand that means much lower than in the UK where the total diagnosed cattle reached 184,621 by 2012. This represents 97% of all European cases. On the other hand the number of cases in Europe greatly decreased in the last years. During the period 2010-2012 the number of cases in Spain reached 25, comparable with the 21 cases diagnosed in the UK. The remaining countries had lower number of cases (Fig. 3). Autochthonous BSE cases were diagnosed also in countries outside Europe, including Canada (total of 20 cases), USA (total of 3 cases), Japan (total of 36 cases), Israel (one case) and Brazil (one case). Some of the cases were detected during the screening in the abattoir or in imported animals (29).

Origin of BSE

The theories about the origin of the BSE agent were concentrated in the scrapie agent at first, but evidences were not convincing (21, 12). For example, intracerebral inoculation of scrapie in transgenic mice induces an encephalopathy with clinical onset and neuropathological changes different from those caused by inoculation of BSE or vCJD (21). Another theory about the origin of BSE agent was based on the hypothesis that wild animals dead in the zoos could be introduced in the animal feeding in the UK. Dead animals of the zoos usually were sent to meat and bone processing plants. Because of this, wild Bovidae, Felidae or African antelope were pointed as possible sources of infection once they could be carrying an undiagnosed sporadic spongiform encephalopathy. The evidence for this theory has not been supported (21). The human origin for the BSE epidemic in the UK was presented by Colchester & Colchester, 2005 (12). Humans remains present in imported mammalian raw material introduced in the feeding of animals could have contaminated cattle. No further evidence of this theory was presented. Currently the intrinsic theory has gained strength, because of the description of atypical forms of BSE, not linked to contamination via food. The origin of BSE could have been intrinsic, arising spontaneously in individual cattle. This admits that a natural rare Transmissible Spongiform Encephalopathy (TSE) in cattle occurs, probably in many countries and it could have been introduced in the feeding of cattle in the UK (4).
Atypical BSE

Atypical BSE was first described in 2004 in Italy (11) as a novel molecular phenotype in cattle, the L type, in contrast with the C (classic) type of the typical BSE. During the same year a second atypical BSE variant, the H-type, was reported in France (5) and later in Canada, Denmark, Germany (10), Ireland, Italy, Japan, Netherlands, Poland, Sweden, Switzerland, UK (33, 34, 35) and Brazil (3, 8). Belgium analyzed most of the BSE cases and found no atypical case (15). Based on Western Blot (WB) analysis L-type demonstrates faster electrophoretic mobility of PrPSc unglycosylated moiety (5). This type is also called bovine amyloidotic spongiform encephalopathy (BASE) because of the presence of amyloidotic plaques. The H-type cases were characterized by a higher molecular weight of the unglycosylated fraction of PrPSc than C-type BSE. It is acceptable that both types of atypical cases are not originated from the BSE prion that caused the epidemic outbreak in the UK in the decades of 1980 and 1990. The occurrence of atypical cases is supposed to be sporadic (30). On the other hand the emergence of C-BSE strain properties during serial passages of H-BSE in wild-type mice was reported by Baron et al (4). The study sheds light on the origin of the British BSE epizootic disease. The importance of this study (4) refers to the origin of the British epidemic BSE. A conversion of an atypical form into a “classical” form could have occurred. In the near future, it is expected that the control of the disease now denominated C-BSE will reduce drastically the number of cases in all countries. This is evidenced by the data presented nowadays by OIE (29) in contrast with previous...
Alessi; *What is an Atypical BSE?* Braz J Vet Pathol, 2013, 6(2), 128 - 132

data (Figs. 1-3). On the other hand, the prevalence of “atypical” cases, or Sporadic BSE (S-BSE), is growing as the surveillance includes de immunohistochemical, ELISA, WB and genetic analyses in the diagnosis. The analysis of older cattle is also a condition that should reveal more sporadic cases. Thus, it can be expected that the number of cases of S-BSE will overcome the number of C-BSE.

**Figure 3.** BSE cases in European countries in the years 2010, 2011 and 2012. UK cases represent 22.5% of the total. Germany, Belgium and Italy had no cases in this period. Spain reports three atypical BSE cases. Switzerland reports one atypical imported BSE case. Source: OIE 2013.

**Conclusion**

With the control of C-BSE based on rigid control of feeding, the occurrence of atypical BSE may predominate in the future. In this hypothesis atypical BSE, probably a spontaneous encephalopathy of cattle, will be considered a sporadic BSE (S-BSE), type H or type L, in contrast with the C-BSE that could be renamed to UK-BSE.

**References**


20. KIRKWOOD JK., WELLS GAH., CUNNINGHAM AA., JACKSON SL., SCOTT AC., DAWSON M., WILESMITH JW. Scrapie-like encephalopathy in a greater kudu (Tragelaphus strepsiceros) which had not been fed ruminant-derived protein. Scandy 2001, 17, 179-184.


23. M’GOWAN JP. Investigation into the disease of sheep called "scrapie" (Traberkrankheit, La tremblante). With especial reference to its association with Sarcoспорidiosis. William Blackwood and Sons, Edinburgh, 1914.


27. M'GOWAN JP. Investigation into the disease of sheep called "scrapie" (Traberkrankheit, La tremblante). With especial reference to its association with Sarcoспорidiosis. William Blackwood and Sons, Edinburgh, 1914.


