BOVINE SPONGIFORM ENCEPHALOPATHY

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INTRODUCTION

The first observation of bovine spongiform encephalopathy (BSE) is estimated to have occurred in Great Britain in April of 1985. A specific diagnosis was arrived at in 1986. By June of 1990 there were 14,324 confirmed cases out of an estimated population of 10 million cattle in Great Britain (2, 22, 23, 104). Other cases have been reported in Ireland and Oman in 1989 and 1990, respectively (22, 23, 62, 52).

BSE is an afebrile neurological disease that primarily affects mature cattle. Clinical signs include abnormally stilted gaits, high stepping, heightened sensory perception, itching, anorexia, excessive licking, and death. Abnormal motor nerve control coupled with aggressiveness have earned the disease the common name of Mad or Raging Cow Disease. Although all types of cattle are susceptible, most cases have been reported in the Holstein-Fresian breed. The first clinical signs of the disease (onset) has been observed in cattle at an age of 1 year 10 months to 15 years. From onset, the disease course varies from less than 2 weeks to 14 months usually resulting in death or humane destruction within 4 months (2, 9, 20, 22, 23, 31, 37, 69).

The causative agent of BSE is not known, however, histopathological studies and clinical signs indicate a strong resemblance to that of scrapie. Brain extracts of suspect cattle have produced disease specific structures known as scrapie-associated fibrils (SAF). SAF are attributed to infectious type agents called prions. Prions are associated with a unique protein found in brain tissue called prion protein (PrP). Because scrapie has been transmissible via filtrates, the disease agent has been thought to be a virus. However, other characteristics of the disease do not readily fit traditional virus concepts (2, 6, 8, 9, 19, 31, 49, 54).

In 1979 studies were conducted by the United States Department of Agriculture (USDA) to attempt experimental transmission of scrapie to cattle. Approximately 30% of the inoculated cattle developed progressive neurological signs of the disease. Upon initial histological examination scrapie could not be confirmed. However, a more recent examination of the same tissues, coupled with new information, have shown PrP structures to be present (2, 79).

The incubation period for the disease has also been studied. Mice inoculated with BSE brain homogenates develop neurological signs of the disease 300 to 450 days later, therefore, indicating a prolonged incubation period before onset. In cattle the incubation period has been estimated to be from 2 to 8 years. Although the onset of BSE is observed in mature cattle the prolonged incubation period indicates that exposure can and does occur in calfhood. Calves have an estimated 30 times risk of exposure than adults (2, 31, 82).

To date there is no evidence of animal to animal transmission of BSE. BSE is considered a "common source" epidemic, meaning that animals contract the disease from a common element in their environment. Evidence has ruled out sources of the disease such as semen, chemicals, autosomal inheritance, biologics and pharmaceuticals. The primary suspect disease source are diets fed to cattle containing ruminant based meat and bone protein. Scrapie or BSE contaminated carcasses which are rendered for ruminant diets may account for the presence of SAF in the brain homogenates of affected cattle. The feeding of animal protein specifically derived from
ruminants was ceased in the United Kingdom as of July, 1988. Results of this control effort by the United Kingdom will not be assessable before 1992 (2, 9, 20, 23, 31, 91, 97).

There have been no reported cases of BSE in the United States. As a preventative measure a prohibition of importation of ruminants from the United Kingdom was implemented in July of 1989. Scrapie and other forms of spongiform encephalopathy are present in the United States, hence, the intense interest in BSE. A transmissible form of spongiform encephalopathy found in ranched mink, transmissible mink encephalopathy (TME), in the United States has been primarily attributed to the feeding of scrapie infected sheep and goat carcasses. However, cattle carcasses (also part of the ranched mink diet) are now a suspect source of TME (2, 3, 4, 83).

The USDA's Animal and Plant Health Inspection Service (APHIS) Veterinary Services program produces a Programs Alert on BSE (released in 1989) and a quarterly Foreign Animal Disease Report providing up-to-date information on diseases foreign to the United States including BSE. Copies of the Programs Alert and the Foreign Animal Disease Report may be requested from: USDA-APHIS, VS, 6505 Belcrest Drive, Room 741, Hyattsville, MD 20782.

Information contained within this Special Reference brief was derived from the above publications, AGRICOLA and from a variety of other resources. All citations that are present in the collections of the National Agricultural Library (NAL) will have the appropriate NAL call number included. Citations have been organized into categories reflecting the nature of the articles represented in this brief. Categories are: general and review articles; epidemiology and diagnosis; transmission; safety and control; wildlife and ; genetics.

The author wishes to extend her gratitude to Dr. Patrick McCaskey of the USDA Food Safety and Inspection Service and Dr. Edwin Pilchard and Vira Milbank of USDA-APHIS Veterinary Services division for their thoughtful review and additions to this document.

GENERAL AND REVIEW ARTICLES


NAL call number: 41.8 AM3
DESCRIPTORS: scrapie agent, research projects.

NAL call number: 41.8 AM3
DESCRIPTORS: scrapie agent, sheep, epidemiology.

NAL call number: 470 SC12
DESCRIPTORS: bovine spongiform encephalopathy (BSE), scrapie agent.

DESCRIPTORS: electroencephalography, human.

"Is BSE simply scrapie in cattle?" (Correspondence) R.M. Barlow, D.J. Middleton. Veterinary Record 126(12):295 (1990).
NAL call number: 41.8 V641
DESCRIPTORS: scrapie agent, nervous system diseases, disease transmission, bovine spongiform encephalopathy.

DESCRIPTORS: review, research assessment, future action.

NAL call number: 472 N21
DESCRIPTORS: scrapie, nervous system.

NAL call number: 448.8 L22
012
NAL call number: 448.9 R814
DESCRIPTIONS: nervous system diseases, scrapie, cattle diseases, sheep diseases, man, bovine spongiform encephalopathy (BSE).

013
NAL call number: 448.8 L22
DESCRIPTIONS: BSE, heat, international trade, meat.

014
NAL call number: 41.8 V641
DESCRIPTIONS: sheep diseases, cattle diseases, muscles, scrapie agent, bovine spongiform encephalopathy (BSE).

015
DESCRIPTIONS: neuro-disease, lentivirinae.

016
DESCRIPTIONS: neuro-disease, review.

017
NAL call number: 41.8 D484
DESCRIPTIONS: cattle, neuro-disease, review.

018
"Link between scrapie and BSE." (Correspondence) D. Westaway and S.B. Prusiner Nature 346(6280):113(1990).
NAL call number: 472 N21
DESCRIPTIONS: bovine spongiform encephalopathy, cattle, sheep, scrapie, epidemiology.
NAL call number: 448.8 L22
DESCRIPTORS: creuzfeldt-jacob disease, bovine spongiform encephalopathy, disease surveillance.

NAL call number: 41.8 V641
DESCRIPTORS: neuro-disease, public health, disease prevention.

NAL call number: 448.8 L22
DESCRIPTORS: bovine spongiform encephalopathy, cattle diseases, nervous system diseases, public health, cat diseases, meat.

DESCRIPTORS: cattle, swine, sheep, poultry, disease, research, government funding, scientific survey, United Kingdom.

"Minister outlines extent of BSE." (News and Reports) Veterinary Record 125(24):589(December 1989).
NAL call number: 41.8 V641
DESCRIPTORS: bovine spongiform encephalopathy, cattle, prevalence, United Kingdom.

NAL call number: QR1 J62
DESCRIPTORS: BSE, scrapie agent, central nervous system.

DESCRIPTORS: BSE, sheep, disease incidence, United Kingdom.

NAL call number: 41.9 J275
027
"Bovine spongiform encephalopathy. Bovine spongiform encephalopati(BSE)." S.B. Rasmussen.
DESCRIPTORS: BSE, review.

028
"Report of the working party on bovine spongiform encephalopathy." Sir R. Southwood. Leaflets Unit, PO Box 21, Stanmore, Middlesex HA7 2AY, UK; Department of Health ii:35 pp(1989).
DESCRIPTORS: BSE, scrapie agent, disease history, epidemiology, transmission, research, United Kingdom.

029
NAL call number: 41.8 V84
DESCRIPTORS: BSE, transmission, control.

030
NAL call number: 41.8 AN78
DESCRIPTORS: BSE, scrapie agent, feeds, meat meal, bone meal, international trade.

031
NAL call number: 41.8 V6456
DESCRIPTORS: BSE, review, scrapie agent, central nervous system.

032
NAL call number: 41.8 V641
DESCRIPTORS: bovine spongiform encephalopathy, central nervous system.

033
DESCRIPTORS: cattle disease, sheep disease, bovine spongiform encephalopathy (BSE), Johne's disease, pulmonary adenomatosis, bovine tuberculosis, Brucellosis, vaccines, import control, disease occurrence.

034
DESCRIPTORS: cattle disease, research, government funding, scientific survey, United Kingdom.

035
"Bovine spongiform encephalopathy (B.S.E.): A new disease?"
NAL call number: SF779.5.A1B6.
DESCRIPTORS: pathology, central nervous system.

036
NAL call number: 41.8 V641
DESCRIPTORS: BSE, disease prevalence.

037
NAL call number: 41.8 V641
DESCRIPTORS: BSE, review.

038
NAL call number: 41.8 V641
DESCRIPTORS: BSE, etiology, sheep, goats, deer, feeds, offal.

039
NAL call number: aSF601.U5
DESCRIPTORS: BSE, livestock, disease, statistics.

040
NAL call number: 41.8 V641
DESCRIPTORS: BSE, clinical signs, behavior.
DESCRIPTORS: bovine spongiform encephalopathy (BSE), neuro-disease.

"Bovine spongiform encephalopathy (BSE), a brief review." 
DESCRIPTORS: research review.

NAL call number:472 N42
DESCRIPTORS: BSE, etiology, epidemiology, scrapie, cattle, neuro-disease.

NAL call number: SF 602 P6
DESCRIPTORS: BSE, neuro-disease, etiology.

NAL call number: 41.8 V641
DESCRIPTORS: BSE, commentary.

NAL call number: HD9433 G7B4
DESCRIPTORS: bovine spongiform encephalopathy (BSE), bovine oncovirois, IBR, IPV, virus, leukosis, leptospirosis, United Kingdom.

EPIDEMIOLOGY AND DIAGNOSES

048
NAL call number: 41.8 AM3
DESCRIPTORS: BSE, scrapie agent, diagnosis.

049
NAL call number: 41.8 AM3
DESCRIPTORS: BSE, scrapie agent, histopathology.

050
NAL call number: 41.8 AM3
DESCRIPTORS: BSE, scrapie agent, epidemiology.

051
NAL call number: 41.8 V643
DESCRIPTORS: BSE, immunological response, diagnosis.

052
NAL call number: 41.8 V641
DESCRIPTORS: bovine spongiform encephalopathy, cattle, case study.

053
NAL call number: 41.8 V641
DESCRIPTORS: bovine spongiform encephalopathy (BSE), scrapie, cattle, sheep.

054
NAL call number: SF601 V44
DESCRIPTORS: BSE, scrapie agent, pathology.
"Incidence of BSE." (Correspondence) K.C. Taylor  
Veterinary Record 126(20):513(1990)  
NAL call number: 41.8 V641  
DESCRIPTORS: bovine spongiform encephalopathy, cattle, prevalence.

"Bovine spongiform encephalopathy in a cow in the United Kingdom." P.R. Scott, B.M. Aldridge, M. Clarke and R. Will.  
NAL call number: 41.8 AM3  
DESCRIPTORS: BSE, case study, pathology.

"Bovine spongiform encephalopathy: Diagnostic significance of vacuolar changes in selected nuclei of the medulla oblongata."  
NAL call number: 41.8 V641  
DESCRIPTORS: BSE, pathology, histopathological diagnosis.

NAL call number: QR355.J6  
DESCRIPTORS: BSE, antisera, testing, infection.

DESCRIPTORS: scrapie agent, pathology.

"Immunoblotting and lectin binding studies of fibril protein from natural scrapie and BSE." (Abstract) H. White and M. Dawson. First Congress, European Society for Veterinary Virology, Liege, Belgium, 6-7 April, 1989.  
DESCRIPTORS: bovine spongiform encephalopathy, scrapie.

NAL call number: 41.8 V643
DESCRIPTORS: BSE, diagnosis, histology, etiology.

062
NAL call number: 41.8 V641
DESCRIPTORS: Bovine spongiform encephalopathy, case report, histology, diagnosis.

063
DESCRIPTORS: BSE, pathology, histology, liver disease.

064
NAL call number: 41.9 D23
DESCRIPTORS: clinical signs, epidemiology, diagnosis, disease control, zoonoses.

065
NAL call number: 41.8 V641
DESCRIPTORS: BSE, diagnosis, histology, brain.

066
DESCRIPTORS: scrapie agent, histopathology, nervous system.

067
NAL call number: 41.8 V641
DESCRIPTORS: BSE, history, diagnosis, genetics, etiology, scrapie agent.

068
069
NAL call number: 41.8 V641
DESCRIPTORS: BSE, case report, pathology, central nervous system, clinical signs.

070
NAL call number: 41.8 V641
DESCRIPTORS: BSE, case report, blood glucose, encephalitis.

071
NAL call number: 41.8 V641
DESCRIPTORS: BSE, case report, encephalitis.

072
NAL call number: 41.8 V641
DESCRIPTORS: Bovine spongiform encephalopathy, cattle, lentivirinae.

073
NAL call number: 41.8 V641
DESCRIPTORS: BSE, hematological analysis.

074
"Bovine spongiform encephalopathy." (Correspondence.) P.N. Pulford. Veterinary Record 122(8):190(1988).
NAL call number: 41.8 V641
DESCRIPTORS: BSE, artificial insemination.

075
TRANSMISSION

076
NAL call number: 41.8 V641
DESCRIPTORS: BSE, case report, clinical signs, histopathology, scrapie.

077
NAL call number: 41.8 V641
DESCRIPTORS: BSE, central nervous system, histology.

078
NAL call number: 472 N21
DESCRIPTORS: bovine spongiform encephalopathy, neuro-disease, transmission.

079
NAL call number: 448.8 L22
DESCRIPTORS: bovine spongiform encephalopathy (BSE), neuro-disease, brain, proteins, scrapie agent, experimental infection.

080
NAL call number: 41.8 V641
DESCRIPTORS: bovine spongiform encephalopathy (BSE), cattle, scrapie, epidemiology.

081
DESCRIPTORS: BSE, experimental transmission, neuropathology, central nervous system, inbred mice.
NAL call number: 41.8 V641
DESCRIPTORS: BSE, mouse scrapie, neuropathology.

SAFETY AND CONTROL

"Recommendations concerning the risk of bovine spongiform encephalopathy in the United States." D.M. Asher
NAL call number: 41.8 AM3
DESCRIPTORS: human health, cattle feed, bone meal, future research.

NAL call number: 41.8 V641
DESCRIPTORS: bovine spongiform encephalopathy, birth.

NAL call number: 41.8 R3224
DESCRIPTORS: BSE, disease control.

DESCRIPTORS: man, prions, zoonoses, bovine spongiform encephalopathy (BSE), nervous system diseases.

NAL call number: 41.8 R3224
DESCRIPTORS: BSE, scrapie agent, feeding, disease control.

NAL call number: 448.8 B77
DESCRIPTORS: BSE, neuro-disease, creutzfeldt-jakob disease, meat.
NAL call number: SF602 A25
DESCRIPTORS: milk hygiene, salmonella, bovine spongiform encephalopathy (BSE), listeria, zoonoses.

DESCRIPTORS: BSE, epidemiology, pathology, transmission, zoonoses.

NAL call number: 41.8 V641.
DESCRIPTORS: BSE, disease control, feed contamination, rendering.

DESCRIPTORS: bovine spongiform encephalopathy (BSE), salmonellosis, listeria, scrapie, somatotropin, legislation, human health, zoonoses.

DESCRIPTORS: bovine spongiform encephalopathy (BSE), cattle, sheep, scrapie, control, review.

NAL call number: 41.8 V641
DESCRIPTORS: bovine spongiform encephalopathy, birth, central nervous system.

NAL call number: 41.8 V641
DESCRIPTORS: bovine spongiform encephalopathy, birth, central nervous system.

"Options for the control of scrapie in sheep and its counterpart
World Congress on Sheep and Beef Cattle Breeding, 19-23 June
NAL call number: SF 371.2 W67 1988
DESCRIPTORS: bovine spongiform encephalopathy (BSE), disease
resistance, genetics.

097
"Bovine spongiform encephalopathy." (Meat inspection)
(Correspondence.) J.F. Gracey. Veterinary Record
NAL call number: 41.8 V641
DESCRIPTORS: BSE, meat products, rendering, cattle, zoonoses.

TOXICITY

098
"Bovine spongiform encephalopathy: Possible toxicity link?"
(Human hexachlorophene poisoning. Correspondence). C.B.
NAL call number: 41.8 V641
DESCRIPTORS: BSE, etiology, hexachlorophene.

099
"Bovine spongiform encephalopathy." (Hexachlorophane toxicity.
NAL call number: 41.8 V641
DESCRIPTORS: BSE, encephalitis, etiology.

100
"Bovine spongiform encephalopathy." (Hexachlorophane toxicity.
Correspondence.) G.A.H. Wells and J.W. Wilesmith. Veterinary
NAL call number: 41.8 V641
DESCRIPTORS: BSE, etiology.

WILDLIFE

101
"Antelopes die of "mad cow" disease". P. Aldhous. Nature
NAL call number: 472 N21
DESCRIPTORS: neuro-diseases, zoo animals, bovine spongiform
encephalopathy (BSE).

102
"Spongiform encephalopathy in an eland." (Correspondence) A.J.
Fleetwood and C.W. Furley. Veterinary Record
NAL call number: 41.8 V641
DESCRIPTORS: scrapie agent, zoo animals, case reports,
genetic, tragelaphus oryx, spongiform encephalopathy, antelopes, bovine spongiform encephalopathy (BSE), United Kingdom.

GENETICS

103
NAL call number: 41.8 V641
DESCRIPTORS: BSE, heritability, scrapie agent, resistance.

ADDENDUM

104
DESCRIPTORS: Bovine Spongiform Encephalopathy (BSE), update.

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