MAD COW DISEASE (BSE): DISEASE AND SURVEILLANCE

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Mad Cow Disease or Bovine Spongiform Encephalopathy (BSE) represents a group of symptoms that occur due to fatal neurodegneration with a long preclinical phase and affects several mammalian species incluiding humans characterized by spongiform degeneration of brain tissue and clinically by apprehension, hyperaesthesia, gait, ataxia and loss of general bodily condition. This is an afebrile, non-inflammatory disease of central nervous system, which has occurred as a result of the exposure of cattle to animal protein feeds containing the Scrapie agent. It is a zoonotic disease. It causes new variant Creutzfeldt-Jakob disease (nvCJD) in humans.

Synonyms:

Bovine Spongiform Encephalopathy (BSE) is popularly known as "Mad Cow Disease" or "Prion Disease".

Etiological Agent :

BSE is caused by a poorly understood type of infectious protein particle called 'Prion'. The 'Prion' particles lack nucleic acid hence is highly resistant to inactivation by physical as well as chemical agents. Prion is a modified from of a normal cellular protein known as PrPc.

Epidemiology :

Bovine Sopngiform Encephalopathy was first described in Great Britain in 1986 and subsequently developed to an epizootic with more than 1,70,000 cases occurring in Great Britain by 1998. But cases have occurred in imported British cattle in Oman, Canada, Germany, Denmark, Belgium and Italy. But geographic distribution of BSE has increased to 24 countries including USA.

Clinical Signs:

1. BSE has a long incubation period from 2-4 yrs.
2. The onset of clinical signs is insidious, but there is progression to death within 1-6 months duration.
3. There is no fever. Clinical signs progresses over time leading to alteration in behavior, temperament, posture, sensorium and movement.
4. Neurological signs include apprehensive behavior, hyperesthesia to touch and sound, ataxia and loss of bodily condition.
5. Behavioral changes like alteration in mental state and sensation also it includes changes like reluctant to pass through the milking shed, a change in milking order, reluctant to pass through passage ways. These changes are gradual in onset and increases over a period of time.
6. Posture and gait abnormalities like hind limb ataxia, tremors, falling and recumbency usually manifested.
7. Increased grooming of the trunk and legs is a frequent clinical sign and head rubbing by the affected animal is the most analogues sign to that of pruritis in sheep Scrapie.
8. Affected cattle may stare, presumably at imaginary objects, for long periods.
9. Avoidance of other cows in loose housing.

Diagnosis :

Currently, there is no test to detect the disease in live animal. BSE can be diagnosed histopathologically by microscopic examination of brain tissue.

Histopathology :

The characteristic changes comprise of discrete ovoid and spherical vacuoles in the neuropil called ‘spongiosis’ and is a feature of BSE. Usually gray matter is most affected but vacuolation of the white matter has been a prominent lesion. The prominent and characteristic feature is the lack of inflammatory response. The vacuolations are bilaterally distributed and usually symmetrical with a constant distribution pattern throughout the brain.

Samples Required:

Brain tissue must be collected from the cattles of age two years and above and which showed clinical signs of neurological disorders as altered behaviour and mental status, pelvic limb ataxia, hyperaesthesia to touch and sound abnormalities of postures and movements, generalized weakness leading to falling down and recumbency. The whole brain is removed as soon as possible and bisected longitudinally. One half is placed in an adequate volume of 10% formal saline and other half is kept fresh in ice or frozen. Fresh samples should be sent on ice or with frozen gel packs.

NEW VARIANT CREUTZFELDT- JAKOB DISEASE:

A newly recognized form of CJD, new variant Creutzfeldt-Jakob disease (nvCJD), was first reported in March 1996 in the UK. nvCJD has affected younger patients (average age 29 years, as opposed to 65 years), has a relatively longer duration of illness (median of 14 months as opposed to 4.5 months) and is strongly linked to exposure, probably through food, to BSE. Recent studies have confirmed that nvCJD is distinct from sporadic and acquired CJD. Similarities observed between the strain of the agent responsible for vCJD and those of BSE.

BSE Surveillance in India :

For surveillance of BSE it is important to study the prevalence, status of BSE and to minimize the possibilities of occurrence of disease throughout the country for export purpose. Presently, four Regional Disease Diagnostic Laboratories (RDDL) are actively involved in the BSE surveillance in India. As per the guidelines of the Govt. of India, brain samples are collected from major and small abattoirs of the different states under their jurisdiction and brain samples obtained during investigations carried out by the scientists of the RDDL's. In addition, field veterinarians also send the samples from animals which had neurological disorders.

Surveillance can be divided into two main categories, active and passive. Active surveillance is characterized examination of bovine brains from adult domestic animals with or without nervous disorders for neurological lesions with special reference to BSE. While Passive surveillance is based on conducting awareness programs, training and distribution of educational materials on BSE to the basic workers in abattoirs and feed industry.

IMPORTANCE OF BSE SURVEILLANCE IN INDIA :

India account for largest livestock population in the world comprising 219 million cattle, 94 million buffaloe,181 million sheep & goat and 16 million pigs. The country is witnessing a rapid growth in human population, decrease in land holdings, shrinking agricultural lands, importance is being given to commercial crops rather that food crops, all leading to scarcity of food.

Meat is an important live stock product, which is highly nutritious containing an average of 18-20% protein in addition to fat, carbohydrates, vitamins and minerals. The domestic demand for the meat is huge and the Indian domestic market is one of the biggest in the world. The animal protein consumption in the country is only 9.5gm/head/day. There is a very good potential and scope for further development of meat industry in India in order to export our meat and products in various countries. The demand for Indian meat is increasing and in turn more and more countries are now importing meat from India. The price structure of meat in the international market is favorable to our country.

The costliest meat in the international market is beef followed by mutton, pork and then chicken. The cheapest meat in India is the beef. However, beef is banned from export but buffaloe beef is permitted to be exported. Another advantage for our meat is the low fat and cholesterol content in our beef and buffaloe beef. The absence of BSE in our country is a favorable condition for promoting export of buffalo meat to other countries in the wake of reports of out breaks of the disease among European countries.

Table.1.
Points targets for different adult cattle population sizes in a country, zone or Compartment

Points targets for country, zone or compartment		
Adult cattle population size (24 months and older)	**Type A surveillance**	**Type B surveillance**
>1,000,000	300,000	150,000
800,000-1,000,000	240,000	120,000
600,000-800,000	180,000	90,000
400,000-600,000	120,000	60,000
200,000-400,000	60,000	30,000
100,000-200,000	30,000	15,000
50,000-100,000	15,000	7,500

The total points for samples collected may be accumulated over a period of a maximum of 7 consecutive years to achieve the target number of points determined in Table 1. Surveillance points remain valid for 7 years (the 95th percentile of the incubation period). To achieve this Endeavour, active contribution from field Veterinarians is a must.

INDIA is classified under List II 'B' meaning Provisionally BSE Free country, which needs surveillance.

Table.2.
Surveillance point values for samples collected from animals in the given subpopulation and age category

Surveillance subpopulation			
Routine slaughter	**Fallen stock**	**Casualty slaughter**	**Clinical suspect**
Age > 1 year and < 2years			
0.01	0.2	0.4	N/A
Age > 2 years and < 4 years (young adult)			
0.1	0.2	0.4	260
Age > 4 years and < 7 years (middle adult)			
0.2	0.9	1.6	750
Age > 7 years and < 9 years (older adult)			
0.1	0.4	0.7	220
Age > 9 years (aged)			
0.0	0.1	0.2	45