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You suspect a foreign animal disease in a client's animal – now what do you do?

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Introduction

The introduction of foreign (exotic) and emerging animal diseases to livestock in the United States could have a substantial impact on public and animal health, agriculture and the economy. Livestock in the United States are naïve to many of these diseases, which makes them highly vulnerable to accidental or intentional introduction of exotic diseases. In the case of agroterrorism, veterinarians will be needed to take an active role in responding to and identifying exotic diseases.

The presence of a foreign animal disease (FAD) in the United States would result in animal losses as well as export bans on animals and animal products. There is also the cost of government programs to control or eradicate the disease. If the disease spreads into the local wildlife, as has been the case with brucellosis and bovine tuberculosis, eradication can be complicated.

In the case of mucosal diseases (those diseases affecting primarily the gastrointestinal tract with erosions of the mucosal surfaces), there is potential for a FAD to be mistaken for an endemic disease. This could cause a delay in the response time and increased spread of the disease. Simulations indicate that 40 states could be infected with Foot-and-Mouth Disease (FMD), 30 days after a terrorist attack at 5 locations in the United States. The differential diagnoses for FMD include: bovine viral diarrhea virus, malignant catarrhal fever, vesicular stomatitis, bovine papular stomatitis, infectious bovine rhinotracheitis, rinderpest and bluetongue.

The goal of this paper is to provide a brief overview of some of the differentials for mucosal diseases and the role of state and federal agencies in the control of these diseases.

Foot-and-Mouth Disease

Foot-and-Mouth Disease (FMD) is one of the most contagious diseases of cloven-hoofed animals. Only 10 virus particles are needed to cause an infection by injection or inhalation (10,000 virus particles if ingested). The last outbreak to occur in the United States was in 1929. FMD is caused by an *Aphthovirus* that is present in the breath, saliva, feces, urine, milk and semen and is transmitted by aerosols, direct or indirect contact with infected animals.

The clinical signs are fever, lameness and vesicles, which progress to erosions in the mouth nares, muzzle feet or teats. The virus replicates in stratum spinosum of the epithelium and lesions occur in areas of trauma, such as the feet or where the teeth impact on the mucosa. Pigs are considered the amplifying hosts, cows the indicator hosts and sheep the maintenance hosts for the disease. Sheep can maintain the virus for a maximum of 9 months and the virus can be stable in a fecal slurry in the winter for 6 months.

The morbidity can be 100% in a susceptible population, but mortality is usually less than 1%. However, in young animals mortality can be up to 40% due to severe myocardial necrosis.

The diagnosis can be made with ELISA and Virus Neutralization tests; however, before collecting or sending any samples from a vesicular disease suspect, the federal and state veterinarians need to be contacted. The samples need to be transported under secure conditions to authorized laboratories to prevent the spread of the diseases. If you are highly suspicious of FMD, do not send samples to State Veterinary Diagnostic Laboratories. Instead, foreign animal disease diagnosticians will come to you.

Rinderpest

Rinderpest is an acute, contagious disease of cloven-hoofed animals that has not been found in the United States and is currently being eradicated world-wide (goal: 2010). Rinderpest is caused by a paramyxovirus (genus: *Morbillivirus*) that is transmitted through direct or close indirect contact with infected animals.

The clinical signs are high fever (104-107°F), lachrymal discharge, profuse diarrhea and mucosal erosions of the mouth and digestive tract. The postmortem lesions range from necrotic foci to red erosions found in the gums, lips, hard and soft palates, cheeks, and base of the tongue. These lesions can extend into the gastrointestinal tract and upper respiratory tracts. Rinderpest does not cause vesicular lesions and does not cause lesions on the feet.

The morbidity and mortality can be high with more virulent strains. Rinderpest has almost been eradicated, but should be considered a differential diagnosis when cattle are acutely febrile with oral erosions and/or gastrointestinal signs.

The diagnosis is made by virus isolation; however, before collecting or sending any samples from a vesicular disease suspect, the federal and state veterinarians need to be contacted. The samples need to be collected by foreign animal disease diagnosticians and transported under secure conditions to authorized laboratories to prevent the spread of the diseases.

Malignant Catarrhal Fever

Malignant Catarrhal Fever (MCF) is highly fatal disease of cattle (deer and bison) that occurs sporadically in the United States. The wildebeest-associated (WA-MCF) form is primarily in Africa, however, the sheep-associated (SA-MCF) form has a worldwide distribution. SA-MCF is caused by ovine herpesvirus-2 (OvHV-2) and is transmitted by sheep primarily during lambing. The peak shedding of OvHV-2 occurs in the nasal secretions of lambs 5-7 months-old. Cattle are considered “dead-end” hosts of the disease.

The clinical signs in cattle with SA-MCF include: profuse mucopurulent nasal and ocular discharge, keratoconjunctivitis with corneal opacity and enlargement of the peripheral lymph nodes. The corneal opacity is referred to as “blue eye” and is caused by corneal edema, secondary to vasculitis. The specific gross lesions include: buccal papillary necrosis, erosions

and ulcerations of mucous membranes (nasal septum, turbinates, larynx pharynx, esophagus, trachea, and bronchi) and renal infarcts.

The morbidity for SA-MCF is usually low, but mortality is 90-100% among symptomatic animals.

SA-MCF should be suspected if the cattle have contact with sheep or goats. The diagnosis is made based on histopathologic lesions and PCR test. The virus becomes inactivated in dead animals quickly, so samples should be taken as soon as possible and shipped on ice (not frozen). SA-MCF is a reportable disease in many states and the state authorities should be contacted.

Infectious Bovine Rhinotracheitis

Infectious Bovine Rhinotracheitis (IBR) has been recognized in the United States since the early 1950s as a complex of disease syndromes leading to respiratory tract infections, eye infections, abortions, genital infections, brain infections and generalized infections of newborn calves. The virus can persist in recovered animals for years and be reactivated at times of stress and it is transmitted through the secretions of the eye, nose, and reproductive organs.

In the majority of cases, the respiratory form predominates with clinical signs of high fever (104-108°F), depression, decreased appetite and respiratory distress. As the nose becomes encrusted with nasal discharge, the crusts can be rubbed off causing the nose to be inflamed (“red nose”).

The morbidity can be high, but the mortality from IBR in the respiratory form is low without secondary infections. IBR abortions can occur from natural infection or result from some modified-live vaccines given to pregnant animals or animals in contact with unvaccinated pregnant animals. The fetus dies at about 5-6 months and partially decomposes before being aborted.

Bovine Viral Diarrhea Virus

Bovine Viral Diarrhea virus (BVDv) has a world-wide distribution and is seen in cattle, sheep and less commonly pigs. BVDv is a Flavivirus of the genus *Pestivirus* and is transmitted by direct contact with nasal mucous, saliva or fomites and intrauterine infection. There are two genotypes and cytopathic and non-cytopathic biotypes. Only the non-cytopathic biotype crosses the placenta to invade the fetus during the first 120 days of gestation, resulting in persistently infected (PI) calves.

Acute BVD in adult cattle, can result in oral lesions similar to those seen with Rinderpest. The mucosal disease is a fatal disease of PI calves, 6-months to 2-years-old. The lesions of mucosal disease include erosions and ulcerations of the gums, tongue, hard palate, coronary band and interdigital. The morbidity of mucosal disease is low, but the mortality is high.

Bluetongue

Bluetongue is an insect-borne viral disease of ruminants that is transmitted primarily by *Culicoides variipennis* var *sonorensis* in the United States. It is not a contagious disease, but it

can also be transmitted on surgical equipment and needles. In the United States, the vector and disease are limited to the Southern and Western states. Bluetongue is caused by an orbivirus (5 serotypes in the U.S.).

The clinical signs are predominantly seen in sheep and cattle can be asymptomatic. However, recent bovine cases in the United Kingdom and Kentucky had lesions similar to those seen with FMD. The common clinical lesions in sheep include: oral erosions and ulcerations, petechiations in mucous membranes, inflammation and necrosis along the coronary band, facial edema, and nasal discharge.

In cattle, morbidity can be up to 5% and death is rare, but in sheep morbidity can be up to 100% and mortality can vary from 0-50% (depending on the strain).

The diagnosis can be made using virus isolation, PCR and serology. Bluetongue is a reportable disease in many states and the state authorities should be contacted.

Foreign Animal Disease Investigation

The prevention of a FAD from becoming endemic requires vigilance and cooperation from multiple government agencies. The National Response Plan (NRP) was developed after September 11, 2001 and is coordinated by the USDA. The USDA-APHIS Veterinary Services unit has developed training and eradication guidelines for FADs and manages testing and quarantine for imported animals and animal products. Only the USDA-APHIS National Veterinary Services Laboratories (NVSL) can confirm the outbreak of an exotic disease and proper procedures must be followed when collecting and submitting samples to the NVSL to prevent further spread of a disease.

Private practitioners and producers are the first people to see the disease. Practitioners should immediately contact the State Veterinarian and the APHIS Area-Veterinarian-in-Charge (AVIC) and should never attempt to diagnose a FAD on their own. The AVIC or a Foreign Animal Disease Diagnostician (FADD) will perform the herd exam and necropsies on site and then submit samples to the NVSL. The APHIS VS – Emergency Management team will coordinate the response with the AVIC, FADD, State Veterinarian and other emergency personnel. If the outbreak is not an exotic disease, then the case is closed. But if an exotic disease is found, then the coordinated response goes into effect.

An effective response requires immediate action and communication with state and federal agencies. Veterinarians in the field are the first line of defense and play a critical role in control and eradication of exotic and emerging disease threats.

Do's and Don'ts for suspected Foreign Animal Diseases:

- DO report your suspicions to the state or federal veterinarians if you suspect a FAD.
- DO consider exotic and emerging diseases in your differentials.
- DO routine cleaning and disinfection of your equipment and clothing.

DO NOT spread diseases by neglecting simple biosecurity practices.

DO NOT try to collect and submit the samples yourself if you suspect a FAD.

DO NOT send samples in the mail – sampling should be done by specially trained individuals and samples should be shipped under secure conditions.

References

1. August, K, et. al. Emerging and exotic diseases of animals, 3rd edition; edited by Anna Rovid Spickler and James A. Roth. Ames, Iowa: Institute for International Cooperation in Animal Biologics, 2006.
2. Bexiga R, et. al. Clinical differentiation of malignant catarrhal fever, mucosal disease and bluetongue. *Vet Rec* (2007) 161: 858-859.
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5. Rinderpest and Peste des Petits Ruminants; edited by T barret, PP Pařtoret and WP Taylor. Amsterdam: Boston: Elsevier, c2006.

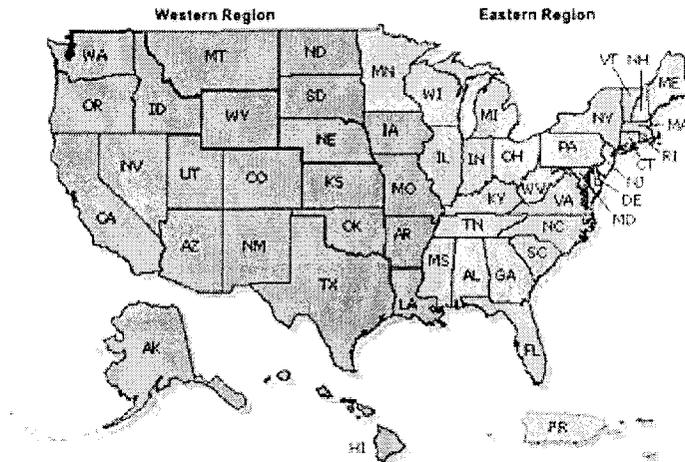
Pictures and lecture materials from the Veterinary Laboratory Diagnostic Course: Plum Island Animal Disease Center, Foreign Animal Disease Diagnostic Laboratory; Plum Island, New York. November 4 – November 9, 2007.

Internet Resources

1. Food and Agriculture Organization of the United Nations: www.fao.org
2. Malignant catarrhal fever web site at Washington State University: www.vetmed.wsu.edu/mcf
3. United States Department of Agriculture – Animal and Plant Health Inspection Service: www.aphis.usda.gov/animal_health/
4. USAHA Foreign Animal Diseases Book: http://www.vet.uga.edu/vpp/gray_book02/
5. World Organization for Animal Health (OIE): www.oie.org

Appendix A

Federal Area Veterinarians in Charge (AVICs):
http://www.aphis.usda.gov/vs/area_offices.htm



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Appendix B

CURRENT CATTLE DISEASES ON THE OIE LIST AND THEIR STATUS IN THE UNITED STATES		
Disease	Status	Date of Last Occurrence / Notes
Bovine anaplasmosis	Present	
Bovine babesiosis	Present	Limited distribution (endemic in the territories of Puerto Rico and the U.S. Virgin Islands; last occurrence on the U.S. mainland was in 1943)
Bovine brucellosis (<i>B. abortus</i>)	?	No domestic herd detection in 2006 / limited distribution / national eradication program
Bovine genital campylobacteriosis	Present	Sporadic / limited distribution
Bovine spongiform encephalopathy	One case	2006 (Alabama)
Bovine tuberculosis	Present	Sporadic / limited distribution / national eradication program
Bovine viral diarrhea	Present	
Contagious bovine pleuropneumonia	Free	1892
Lumpy skin disease	Free	Never occurred
Enzootic bovine leucosis	Present	
Hemorrhagic septicemia	?	Sporadic / limited distribution (bison)
Infectious bovine rhinotracheitis / infectious pustular vulvovaginitis	Present	
Theileriosis	Free	Never occurred
Trichomonosis	Present	
Trypanosomosis (tsetse - transmitted)	Free	Never occurred
Malignant catarrhal fever (Wildebeest-associated)	Free (?)	April 2008 (Texas and Louisiana)
Rinderpest	Free	Never occurred

http://www.aphis.usda.gov/vs/nahss/disease_status.htm#cattle (accessed 04/09/2008)

Appendix C

Disease	Susceptible Species	Geographic distribution	Transmission	Post Mortem Lesions	Morbidity and Mortality	Actions
Bluetongue	Ovine and Bovine.	Southern and Western U.S.	Virus primarily transmitted by <i>Culicoides varipennis</i> var <i>sonorensis</i> in U.S. (Sx equip and needles)	Facial edema Nasal discharge Petechiae, ulcers and erosions in the oral cavity.	Cattle: mostly asymptomatic, morbidity up to 5%, death is rare. Sheep: Morbidity up to 100%, mortality 0-50%.	Reportable disease: Federal and State Vets should be contacted.
Bovine Viral Diarrhea	Bovine, Ovine and less often Porcine.	Worldwide	Direct contact.	Erosions and ulcerations of the gums, tongue, hard palate, coronary band and between digits.	Morbidity of mucosal form is low but mortality is high	OIE listed, present in the U.S.
Foot-and-Mouth	Cloven-hoofed animals.	Endemic in parts of So. America, Africa, Asia and the Middle East.	Aerosols and direct or indirect contact.	Vesicles and erosions of the mouth, nares, muzzle, feet or teats.	Morbidity can be up to 100%, but mortality is usually less than 1%.	Reportable disease: Federal and State Vets should be contacted.
Infectious Bovine Rhinotracheitis	Bovine.	Europe, America, Asia and Australia.	Direct contact.	“red nose” and abortions	Morbidity can be high, but mortality is low without secondary infections.	OIE listed, present in the U.S.
Malignant Catarrhal Fever	Bovine and wild ruminants (buffalo and cervids). Less often Porcine.	Worldwide (SA), Africa (WA).	Direct and close indirect contact with sheep.	Buccal papillary necrosis, erosions and ulcerations of mucous membranes.	Morbidity is usually low for SA-MCF, but mortality is 90-100%.	Reportable disease (most states): State Vet should be contacted.
Rinderpest	Cloven-hoofed animals. (<i>Bos Taurus</i> > <i>Bos indicus</i>)	Confined to Somalia and Kenya.	Direct and close indirect contact.	Necrotic foci and erosions of mucosal membranes, but NOT feet.	Morbidity and mortality can be high.	Reportable disease: Federal and State Vets should be contacted.
Vesicular Stomatitis	Bovine, Ovine, Caprine, Porcine, Equine, Camelids and humans	Endemic in Central and South America and parts of North America.	Direct and indirect contact.	Vesicles and erosions of the mouth, nares, muzzle, feet or teats. (clinically indistinguishable from FMD)	Morbidity varies from 5-90% and mortality is low among horses and cattle.	Reportable disease: Federal and State Vets should be contacted.