Unique/Noteworthy Examples: Case-based Review of Diagnostic Medicine

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Introduction

Large animal veterinarians make animal management decisions daily. The decision to treat, cull, or spend resources to further investigate or work-up a case is based on the cumulative data provided by signalment, herd history, management practices, individual animal history, clinical examination (or necropsy), and ancillary/diagnostic tests. Access to specific information provided by properly selected and interpreted diagnostic tests has increased drastically in the last decade. Efficient application of diagnostics to provide the additional information needed to manage clinical cases depends on the diagnostic question and the samples available for testing.

Bovine Respiratory Disease

Diagnostic investigation of infectious respiratory disease in cattle can be done at several levels. The approach to individual testing and result interpretation differs from herd surveillance or investigation depending on the diagnostic question. Serologic testing is available for many viruses via virus neutralization and bacteria via ELISA or agglutination tests. These tests are antibody based and will answer diagnostic questions of antigen exposure and immunological response. High antibody titers can be from subclinical exposure, clinical exposure, or vaccination. Interpretation of serologic testing results require a good awareness of vaccine history and risk of exposure to the pathogen of interest. Paired acute and convalescent titers in the same animal run at the same time in the laboratory are best for titer interpretation. This is not always possible but results must be interpreted with caution with only a single titer result. BVD antigen capture ELISA can be run on serum to help with high VN titer interpretation or at the beginning of the diagnostic investigation if desired. This test targets viral antigen rather than antibody and is very good at identifying persistently infected BVD animals.

There are many test options for antemortem or postmortem samples that will investigate the presence of pathogens of interest via isolation/recovery or genetic material detection. Nasal samples can be submitted for bacterial culture, mycoplasma culture, PCR investigation of viruses or bacteria, or virus isolation (VI) to look for the presence of pathogens of interest. Knowledge of normal nasal flora and pathogen tropism is important in the interpretation of test results. PCR detection of virus genetic material will have a quicker result turnaround time than VI and does not depend on viable virus for detection. PCR is the methodology of choice for investigation of BRSV presence in the sample submitted. If antibiotics have been utilized recently, PCR methodologies will be more sensitive for the isolation for bacterial pathogens, especially *Mycoplasma*. If the animals have been vaccinated recently with modified live virus, detection of virus vis PCR or VI can be due to vaccine strain of virus.

Lung and/or trachea samples can be submitted for the same pathogen detection testing as well as for histopathological investigation of the disease process. Results from bovine upper respiratory samples are interpreted differently than those from the lower respiratory tract. Results from antemortem samples are interpreted differently from those from postmortem samples. Swabs are test methodology specific. Swabs that are designed for routine culture are not good for mycoplasma culture or PCR investigation and vice versa. Fresh lung tissue can be utilized for numerous testing methodologies but sample handling must be managed and the trade off in test sensitivity considered when interpreting results.

Abortion

Diagnostic investigation of bovine abortion is challenging due to the timing of investigation in relation to the insult that caused pregnancy loss as well as the lack of samples or samples of adequate quality. Diagnostic laboratories specialize in investigation of infectious causes of pregnancy loss or abortion. Diagnostic laboratories can assist with the investigation of other causes of abortion (nutritional, genetic, etc.) but consultation with other specialists and referral of samples to other laboratories will be required. The best samples for the investigation of infectious abortion are the entire fetus and placenta. Submission of dam serum samples are also highly recommended, especially if the dam has any signs of clinical illness (retained placenta, fever, metritis, etc.). Serologic investigation of dam serum will answer questions of antigen exposure. Gestational age, biosecurity practices, and vaccination history are needed for interpretation of most abortion dam serologic results. Diagnosis of some abortion pathogens as the cause of abortion will require serologic investigation of the brood herd

or pathogen identification in uterine, placental, or fetal samples. The approach to pathogens that cause early embryonic loss differs from pathogens that cause pregnancy loss after mid-gestation. Collection of samples from the bull may be needed during investigation of early term pregnancy loss. The most definitive diagnostic results come from fetal and placental tissues. Culture of abomasal content and PCR investigation of tissues appropriate to pathogen tropism will provide the most sensitive approach to ruling out infectious causes of abortion. Histopathology is a great tool for identifying signs of infection in the fetus if the sample has limited autolysis. If the sample is autolyzed, the absence of signs of infection does not rule out an infectious etiology. Analysis of fetal liver for trace minerals and vitamin A will also provide information about the fetal environment before pregnancy failure. Negative abortion diagnostics from appropriate samples provides valuable information to add to history and signalment during an abortion outbreak.

Calf Diarrhea

The investigation of calf diarrhea depends on the purpose of diagnostic testing. Individual animal management may be better served by monitoring clinical pathological abnormalities rather than identifying the causative agent. Population investigation in an acute outbreak is usually better managed if the causative agent or agents is known so that environmental, monitoring, treatment, and prevention protocols can be evaluated and adjusted as needed. In populations at high risk of calf diarrhea with calf diarrhea control protocols in place, diagnostics can be used to monitor the efficacy of the prevention, treatment, and control programs in place. Feces can be submitted for routine culture, *salmonella* culture and qPCR to detect rotavirus group A, coronavirus, *cryptosporidium* species and *Salmonella.* If routine culture isolates *Escherichia coli, Clostridium perfringens,* or *Salmonella* spp. additional diagnostics to identify virulence genes, toxin type, or serovar will help interpret results and apply the information to the management strategy. E. coli PCR will identify virulence genes that will allow clinicians to diagnose ETEC vs. EHEC, invasive *E. coli* species, and cases where vaccines targeting K99 will add value to prevention programs. *Clostridium perfringens* toxin typing via PCR can help identify type of *Clostridium perfringens* and correlate pathogen recovery with clinical findings. *Salmonella* spp. isolates are referred to NVSL for serotyping.

Conclusion

TVMDL has serologic and tissue-based panels for several bovine syndromes in addition to the syndromes reviewed above. The panels are designed to aid with the investigation of common causes of each syndrome. Additional testing may be needed to complete the diagnostic investigation either based on the results of the initial testing or based on the risk of disease in an individual population. Details on the panels and samples required can be found at tvmdl.tamu.edu. Veterinary diagnosticians are available to help design custom diagnostic testing plans based on individual cases and to help interpret test results.