Diagnosis of swine abortion

Larry D. Holler, DVM, PhD

Reproductive failure occurs in most if not all swine operations at some rate; however, the effects are perceived as significant only after measured production rates decline below expected norms for the given operation. As expected, this level varies greatly among producers and production styles. Regardless of the management interventions, vaccination protocols, and diagnostic procedures implemented, there will always be some level of fetal wastage in swine herds. So both producers and practitioners often ask, "why bother with swine abortion / stillbirth diagnosis when the diagnostic lab never seems to give me any useful information?" The answer to this question is difficult to explain to producers who are experiencing financial losses associated with chronic abortion problems in their herds. It can be equally frustrating to explain to the practitioner who is diligently searching for solutions to abortion problems and relies on the diagnostic laboratory for timely answers and practical information. Abortion diagnosis rates for swine are traditionally very low, and a large percentage of reproductive wastage is probably not associated with an infectious etiology. However, it is still recommended that complete diagnostic workups be routinely performed in cases of swine abortion / stillbirth in order to confirm or rule out the common causes of infectious abortion and to remain vigilant for emerging swine diseases. In this article, I will outline the standard diagnostic protocol for swine abortion/stillbirth diagnostics at South Dakota State University while briefly reviewing the common causes of infectious abortion / stillbirth and examining the possible pitfalls involved in swine abortion diagnostics. Keep in mind that there will be some variation of procedures among laboratories, and this discussion is intended only as a general guideline. For a detailed discussion of specific aspects of reproductive failure in swine, the reader is encouraged to consult several of the excellent references that are available in this area.[1,2]

Sample submission

The quality of diagnostic service is usually directly related to the quality and appropriateness of samples submitted to the diagnostic laboratory. The correct specimens must be collected, preserved, and submitted to the laboratory in a timely fashion. Avoid leaky obstetric sleeves and samples that have spent the Fourth of July weekend in a UPS truck. If you are uncertain about available means of shipping samples to the lab or how to properly package your samples, please contact your diagnostic laboratory prior to submission. Fill out submission forms completely. Give a thorough history of the current problem including the age of the animals affected (gilts versus sows), how many animals are affected, vaccination status of the herd, recent additions, changes in feeding programs, environmental conditions, housing changes, and any previous or current disease problems that have been recently diagnosed in the herd. A complete history can often give the diagnostician valuable clues in finding a diagnosis. Unfortunately, the majority of submission forms are left nearly blank.

Animal Disease Research and Diagnostic Lab, South Dakota State University, Brookings, South Dakota 57007

Necropsy

With swine abortions, it is usually convenient to submit entire chilled (not frozen) fetuses and placenta to the laboratory for evaluation. We routinely limit our investigation to three representative fetuses and all mummified fetuses from an affected litter. We do not discourage submission of entire litters, as we often gain some information by evaluating gestation ages, litter size, numbers of mummified fetuses, and an estimate of postmortem condition. Necropsy procedures vary, but as in all necropsies, it is important for practitioners or diagnosticians to develop a consistent protocol that they feel comfortable with and that facilitates their ability to detect gross lesions and collect appropriate samples. Gross lesions are infrequently observed in porcine fetuses and when observed are often not specific for a particular etiology. Nonspecific congestion and hemorrhage of visceral and cutaneous tissues combined with variable amounts of blood-tinged fluid in the pleural, pericardial, and peritoneal cavity are common changes that very seldom correlate with a specific diagnosis. Without gross lesions to guide our diagnostic efforts, we routinely collect a specific set of fetal tissues and rely on a predetermined battery of laboratory tests to confirm or rule out specific etiologic agents. The battery of tests included in this workup should be constantly evaluated and updated as new technology develops and emerging disease agents are recognized. When the necropsy is performed at the diagnostic laboratory, the pathologist can collect appropriate samples for virologic, bacteriologic, and histopathologic examination. When the necropsy is performed in the field, sample selection and submission become more critical. Fresh tissues should include lung (bagged separately), liver, spleen, kidney, heart, tonsil, brain (bagged together), placenta (bagged separately), and any other tissue or organs that you think may be required, Submit these in a securely packaged and chilled container with ice packs. The same set of tissues can be fixed in 10% neutral buffered formalin. Fetal

thoracic fluid and stomach contents are also required for a complete diagnostic workup. Submit fluids in labeled glass or plastic tubes with secure lids. Syringes with attached needles leak in transit and represent an unnecessary health threat to the laboratory personnel handling the mail.

Histopathology

Histologic examination of fetal tissue is usually an unrewarding process in swine abortion diagnostics. We can, however, occasionally find evidence of focal inflammation or perhaps a fetal pneumonia that signals the likelihood of an infectious process. Absence of histologic lesions does not preclude finding an etiologic diagnosis. Significant lesions can be obscured by postmortem autolysis; therefore, the faster the samples are preserved, the greater the chance of observing microscopic changes. We routinely attempt histologic examination in all cases that submit suitable tissues for evaluation.

Bacteriology

Determine which tissues are suitable for bacterial isolation in swine abortion cases based on the previous successes of the diagnostic laboratory. Potential bacterial etiologies include *Actinobacillus rossii*, *Actinobacillus* spp; *Streptococcus* spp, *Erysipelothrix* spp, *Actinomyces pyogenes*, *Pasteurella* spp, *Salmonella* spp, *Bacillus* spp, *Escherichia coli*, and various other bacterial organisms.[3,4] Fetal stomach contents and lung are our tissues of choice for routine bacterial isolation. If we isolate a moderate to heavy growth of a particular bacterial organism in relatively pure culture from stomach contents and lung, and we find histologic evidence of inflammation (i.e., fetal pneumonia or placentitis), we become suspicious that this organism may be involved in the abortion case. If we are unable to establish any other likely cause of abortion in the case, we will make presumptive diagnosis of bacterial abortion based on this evidence. Implicating a common bacterial organism, even isolated in pure culture, is difficult without some other evidence of infectious disease (i.e., inflammation on histopathology, sick sows, etc.). The majority of bacterial abortions are sporadic. Occasional organisms such as *Streptococcus suis* and *Erysipelothrix* spp that cause systemic disease in affected herds can be associated with abortion outbreaks. As a general rule, a diagnosis of bacterial abortion is uncommon in swine.

Leptospirosis caused by various serovars of *Leptospira interrogans* has long been recognized as a potential swine pathogen in this country. Many herds will test serologically positive for this organism, probably reflecting widespread vaccine use. Occasional acute and chronic cases of leptospirosis are associated with late-term abortions, stillborn and weakborn pigs, and early embryonic death. Diagnosis of *Leptospira* infection is often difficult. Occasional affected pigs will have a mild fibrinous peritonitis and pleuritis with swollen and congested livers and kidneys. Evidence of inflammation in affected piglets is inconsistent. For diagnosis, we routinely rely on immunofluorescent staining of the organism in homogenates of kidney and lung. False positives associated with nonspecific fluorescence are occasionally a problem with this test. Equally disconcerting to the diagnostician is the possibility of false-negative tests associated with poor sample quality. Demonstrating organisms with typical morphology and movement is possible with dark-field microscopy; however, caution must be taken to distinguish actual organisms from look-alike artifacts. Isolating the organism is difficult, tedious, and unsuitable for routine diagnostic testing in most situations. Detecting elevated antibody titers ($\geq 1:1600$) in affected sows can provide evidence for infection; however, the vaccination status of the herd and the clinical picture should be considered before implicating *Leptospira* spp based solely on serology results.

Virology

Viral agents associated with swine abortions include those that cause systemic disease in the sow, indirectly affecting the fetus, and those that primarily directly affect the fetus. Examples of the first category include pseudorabies virus (PRV), transmissible gastroenteritis (TGE), swine influenza virus (SIV), and porcine reproductive and respiratory syndrome virus (PRRSV). Examples of the second group include porcine parvovirus (PPV) and enteroviruses (PEV) and potentially, encephalomyocarditis virus (EMCV). When you are suspicious of a particular viral etiology in swine abortions, it's important to keep this distinction in mind. For example, diagnosing PRRS from fetal tissues is routinely unrewarding. Producers and practitioners are often suspicious of PRRS in older pigs on a farm and are often frustrated when we are unable to isolate or identify the virus from an abortion case from the same premises. Unfortunately, the pathogenesis of this virus in reproductive disease is largely still unknown. Additional research may hopefully unravel this mystery and leave the diagnostician with a more sensitive set of tools to diagnose this problem. Currently, diagnosis of PRRSV is based primarily on serologic evidence of the virus in the sow and clinical and diagnostic evidence of respiratory disease in young pigs on the same premises.[2]

Porcine parvovirus (PPV) is our most common cause of diagnosed porcine abortion.[4] When we diagnose PPV, we usually are looking at a herd with minimal or no vaccination procedures for PPV or herds that occasionally have gilts abort that are immunologically naive to PPV. The stage of gestation when the virus infection occurs will determine the clinical presentation with parvovirus abortion (i.e., embryonic deaths, mummies, weakborn, or stillborn piglets). Fluorescent antibody (FA) techniques (primarily on lung tissue from mummified fetuses and virus isolation procedures from aborted or stillborn piglets) are generally reliable in diagnosing PPV. Pseudorabies is rapidly becoming a regional problem. For diagnosis, FA techniques and virus isolation are our standard techniques. For the remaining viral pathogens (PEV, EMCV, and potential new viral

pathogens) we rely on virus isolation procedures, recognizing that our overall success rate will be low.

Serology

Serology is often used as a diagnostic tool in diagnosing porcine abortion. The porcine fetus is generally considered at least partially immunocompetent by 70 days of gestation. Detecting elevated levels of immunoglobulin in fetal fluid of aborted fetuses past 70 days of age suggests an infectious abortion.[4] With PPV, an indirect FA procedure is frequently used to detect antibody in fetal fluids to this agent. Maternal serology is often beneficial for making a presumptive diagnosis of some causes of abortion if proper caution is used when interpreting the results. The majority of mature pigs have substantial antibody titers to PPV whether by vaccination or exposure. The vaccination status of the herd for agents such as leptospirosis, PRV, and PRRSV must also be considered when interpreting results. Contact your diagnostic laboratory and find out what tests are available and what criteria they use for interpretation.

Noninfectious causes of abortion

Noninfectious causes of reproductive wastage and abortion in swine account for the majority of economic losses in most typical swine production units. This type of wastage is often multifactorial, nearly always sporadic, and frequently difficult to diagnose. Carbon monoxide toxicosis associated with gestating sows in heated confinement buildings is a common cause of abortion in the upper midwest.[4] Clinical signs are usually not observed in affected sows. Tissues from aborted or stillborn piglets are bright red if postmortem autolysis is minimal. Levels of carboxyhemoglobin in sow blood is often elevated 15%–25%. Other environmental factors such as the effects of ambient temperature and length of daylight (such as in the fall abortion syndrome) are much more difficult to characterize. Likewise, factors that alter hormonal regulation of pregnancy maintenance and result in abortion are also poorly understood. The role of low levels of various mycotoxins in feedstuffs and imbalances in micronutrients in swine abortion is also poorly characterized.

Summary

Swine abortion diagnosis is a challenging yet often unrewarding process. Frequently, we as diagnosticians only succeed in telling the practitioner and producer what the problem isn't. Although this can be useful information, it often fails to define what an appropriate intervention strategy may be to minimize additional losses. In order to maximize this diagnostic process, it becomes important for the diagnostician, practitioner, and producer to work effectively together, sharing information and defining strategies to improve swine abortion diagnosis.

References

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