# Herd health considerations for maximizing reproductive outcomes

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## Introduction

Reproductive efficiency on a cow-calf enterprise is one of the most important parameters that affects profitability for the farmer/rancher. There are many reasons for suboptimal or poor performances in reproductive success whether it be poor conception or pregnancy rates, early embryonic death (EED), mid-late term abortions, or weak/poor neonatal calf health aka “weak calf syndrome”. There are some of these aspects that can be controlled by the cattlemen and some factors that are beyond their control. However, the bottom line for most producers and veterinarians is to provide an optimal plan for a successful outcome by getting as many live and healthy calves on the ground as possible. Even though there are factors beyond the control of the cattleman, many factors can be minimized by proper management techniques to control or reduce the risk of reproductive losses in the breeding cattle herd.

## Abortions

Abortions are traditionally frustrating for all members involved including the producer and the veterinarian. In addition, abortions can be devastating from a financial perspective with some abortion storms occurring that could amount to 60% loss of future calf crop. The ultimate goal is to have limited or no abortion events, however reality usually defeats our optimistic perception due to normal abortion losses. The true objective after abortions occur is to figure out a definitive cause and devise a plan to eliminate and prevent future occurrences, whether it be in the current calving season, if possible, or in future calving seasons. However, the success rate of accurate/definitive etiologic diagnosis is <50% (Anderson, 2007) due to limitations, which include proper timing, diagnostic capabilities, adequate tissue submission, and lack of pathologic findings. Diagnostic tools are continually be developed however, most abortion cases are diagnosed as “idiopathic” or “of unknown in origin”.

Most abortions are a result of a single/isolated incident which can prevent adequate information with limited numbers to incite a problem. Many investigators use a benchmark of 2-5% abortion rates as an indicator for a potential problem, however, the first abortion can be the most important one by potentially offering information to change management decisions to prevent further losses in the herd. Sporadic abortions are notoriously the most frustrating cases due to the lack of consistency with timely abortions for a case workup. Mycotic (fungal) abortions are a typical example of this situation where abortions occur throughout gestation due to moldy feedstuffs being digested inconsistently throughout the herd.

Infectious agents can cause abortions, however many of the infectious agents are not contagious and are natural inhabitants or ubiquitous of the soil and the surrounding environment (examples: *E. coli*, *Bacillus* sp., and *Trueperella pyogenes*, and fungal organisms). These agents usually are eliminated by the cow/heifer through their immune system, however with excessive stressors the animal can be compromised enough to allow the opportunistic agents to invade the bloodstream and cause damage to the placenta and growing fetus at any particular part of gestation causing fetal loss (Engelken and Dohlman, 2015).

Contagious abortion pathogens include viral (IBR and BVD) and protozoal (Neospora) agents. These contagious agents can cause abortion storms. Not all abortions are infectious or contagious, even though they are targeted through diagnostics, and it is important to understand that other factors could cause abortions at any given time during gestation. Some factors may or may not be detectable including: metabolic/hormonal abnormalities, nutritional imbalances, toxins, overt stress, and genetic abnormalities.

Table 1 highlights diagnostic laboratory data from Iowa State University Veterinary Diagnostic Laboratory (ISU VDL) with the distribution of causes of abortion in beef cattle over the past 5 years. During this 5 year overview, 72% of abortion work-ups consisted of an idiopathic or unknown cause for the abortion. Generalized abortions were given to 170 cases (27.8% of total) including unidentified and identified bacterial abortions (107 cases, or 17.5% of total), unidentified and identified fungal abortions (24, 3.9%), identified viral abortions (24, 3.9%), unidentified and identified protozoal abortions (10, 1.6%) and toxin induced abortions (5, <1%).

Specific bacterial diagnoses were found in 72 cases, with *Bacillus* sp. (25, 23.4%), *Arcanobacterium pyogenes* (11, 10.3%), *Listeria monocytogenes* (8, 7.5%), *Ureaplasm* sp. (6, 5.6%), and *Campylobacter* sp. 6, 5.6%) being the most common bacteria isolated from aborted tissues. Specific viral diagnosis were found in 24 cases, with Infectious Bovine Rhinotracheitis (IBR) virus (18, 75.0%) and Bovine Diarrhea Virus (BVD) (6, 30.0%) being the isolated virus from infected tissue (Table 2).

**Table 1.** Beef cattle abortions at ISU VDL (613 Cases: 2011-Current)

| Diagnosis | Number (n) | % of Total |
|---|---|---|
| Idiopathic/Unknown | 443 | 72.3% |
| Bacterial | 107 | 17.5% |
| Fungal | 24 | 3.9% |
| Viral | 24 | 3.9% |
| Protozoal | 10 | 1.6% |
| Toxin | 5 | 0.8% |

**Table 2.** Abortion agents based on category at ISU VDL (170 Cases: 2011-Current)

| Agent Category | Number(n) | % of Total Category |
|---|---|---|
| **Bacterial** | | |
| Unidentified | 33 | 30.8% |
| *Bacillus* sp. | 25 | 23.4% |
| *Trueperella pyogenes* | 11 | 10.3% |
| *Listeria monocytogenes* | 8 | 7.5% |
| *Ureaplasm* sp. | 6 | 5.6% |
| *Campylobacter* sp. | 6 | 5.6% |
| *E coli* | 4 | 3.7% |
| *Leptospira* sp. | 4 | 3.7% |
| *Salmonella* sp. | 2 | 1.9% |
| *Staphylococcus* sp. | 3 | 2.8% |
| *Bibersteinia trehalosi* | 1 | 0.9% |
| *Mycoplasm* sp. | 1 | 0.9% |
| *Pasteurella multocida* | 1 | 0.9% |
| **Viral** | | |
| Infectious bovine rhinotrachetis (IBR) | 18 | 75.0% |
| Bovine viral diarrhea (BVD) | 6 | 25.0% |
| **Fungal** | | |
| Unidentified | 21 | 87.5% |
| *Aspergillus* sp. | 3 | 12.5% |
| **Protozoal** | | |
| Unidentified | 3 | 30.0% |
| *Neospora* sp. | 7 | 70.0% |
| **Toxin** | | |
| Nitrates | 5 | 100.0% |

This data is very similar to the previously reported data from the Iowa State Veterinary Diagnostic Laboratory (Magstadt, 2014). During that 11+ year time period there were 2,032 bovine (including dairy) abortion cases submitted and 1,358 – approximately 2 out of every 3 cases – were diagnosed as idiopathic abortion (Table 3). Slight differences included more diagnosed cases of *Arcanobacterium pyogenes* (64 cases, 3.2% of total abortions) and *Neospora* sp. (53, 2.6%), however these differences may be due to inclusion of dairy cattle. In addition, that report suggested that there was not a relative increase of IBR abortions within the 11+ year time frame.

**Table 3.** Bovine abortion case distribution ISU VDL (2003-2014)

| Diagnosis | Number (n) | % of Total |
|---|---|---|
| Idiopathic/Unknown | 1358 | 66.8% |
| Bacterial | 300 | 14.8% |
| Fungal | 45 | 2.2% |
| Viral | 88 | 4.3% |
| Protozoal | 53 | 2.6% |

In addition, this currently reviewed data is very similar to the previously examined diagnostic data across 3 different veterinary diagnostic laboratories in South Dakota, Nebraska, and Wyoming throughout a 10-year period (Yaeger 1993). Interestingly, that data revealed higher diagnosed viral abortions than currently reported, probably do to more efficacious vaccines being produced and with producer willingness to vaccinate to protect their herds, even though data shows that vaccinations are used less than 40% of the time on cow/calf operations for reproductive pathogens (NAHMS, 2007).

## Management

There are many management considerations to eliminate or lower abortion causes. Prevention is the key and it entails good husbandry and proper immune function to combat opportunistic pathogens and possible infectious (contagious or noncontagious) pathogens. Proper nutrition and eliminating stressors are fundamental management objectives. Eliminating possible exposure routes and minimizing immune system workload is crucial for successful elimination or lowering of opportunistic pathogens causing reproductive losses.

Vaccinations are an important tool to protect beef cow-calf herds, but the vaccination protocols need to be effective and selection is critical for cost effectiveness. Complete protection from every pathogen is impossible therefore understanding what disease risks are currently in the herd and what potential risk maybe brought into the herd (Spire, 1988). Vaccination protocols and programs need to be made a herd-to-herd basis, as risks are different from farm to farm. Quoting a professor I had: “vaccines in general get too much claim and to much blame”, and I still believe that today. There is no vaccine that can prevent a disease if the exposure is too great. Additionally, even though vaccines are given there is still is an inherent risk depending on management decisions. Making a decision to have an “open” or “modified open” herd would automatically increase the likelihood of a disease manifestation in the resident herd and vaccination selection and timing are important criteria to understand (Spire, 1988). Vaccine development and technology has advanced in the past decade, where products have claims to have “fetal protection”, which essentially would help eliminate possible transfer in utero through the placenta and to the fetus pending manufacturing dosing and timing (Ficken et al. 2006)(Fairbanks et al.,2004). Additionally, the decision to use killed or modified live vaccines (MLV) should be evaluated by the overseeing veterinarian. For an example: IBR abortions usually occur within 50 days from exposure hence pre-breeding vaccines would be useful if the risk is present and the use of MLV or killed products would be based on timing of vaccines and if the cows/heifers had seen a MLV prior. If pregnancy is already established MLV need to be used with caution since MLV vaccine can result in undue abortion if animal(s) have not seen the vaccine prior.

## Diagnostic workup

Not all abortions can be prevented but it is essential to understand what to do when the event happens in order to establish management changes for the current calving season and to prevent causes in future calving seasons.

First, it is very important to determine gestational period of abortion or reproductive loss due to some pathogens having classical tendencies to be more prevalent at differing stages of pregnancy, for examples: Tritrichomonas fetus and Neospora (Kirkbride, 1992).This allows veterinarians and diagnosticians to develop a differential list from the exhaustive array of possible bacteria, viruses, fungi, protozoan, and toxins that may have caused the pregnancy loss. Additionally, this allows thorough planning for utilization possible diagnostic testing tools to maximize a potential diagnosis. History, by far, is the most critical piece of an abortion workup. Without it, the possibilities are endless. However, if known exposures, changes to management, vaccination history, nutritional changes, etc. could be helpful in pinpointing potential causes.

In any abortion event, it is critical to have adequate samples for diagnostic testing. However, reality will claim that some of these tissues or specimens are impossible to obtain. Table 4 is a preferable list of tissues and specimens that would be ideal to have for diagnostic testing (always confirm with diagnostician if they need additional samples):

## Steps after abortion occurs:

1. Identify individual animal with appropriate id and isolate from the herd
2. Collect/Recover aborted tissue including fetus and placenta
   – *always wear gloves due to potential zoonotic risks*
3. Call veterinarian as soon as possible to get them involved to submit adequate tissues to increase chances of getting a definitive diagnosis
4. Talk to diagnostician of laboratory of choice to make sure there is adequate information and samples
5. Package and chill samples and get samples to diagnostic lab ASAP
   – *never freeze samples as that could prevent adequate diagnosing*

**Table 4.** Preferred Tissue/Specimen Submissions for Beef Cattle Abortion

| Formalin-fixed | Fresh |
|---|---|
| Placenta | Placenta |
| Skeletal muscle (tongue/diaphragm) | Thymus |
| Ear notch | Lung |
| Thymus | Heart |
| Lung | Liver |
| Heart | Kidney |
| Liver | Spleen |
| Kidney | Lymph node |
| Spleen | Brain (1/2) |
| Lymph node | Stomach contents |
| Adrenal gland | Thoracic fluid |
| Brain (1/2) | |

Many times serology is submitted as it is sometimes the only option, pending the situation. Traditionally, a single serum sample has little value due to misinterpretation between titers. However, a lack of titer may rule-out potential causes. Paired serum samples are another option but many times there is a lag period between infection, abortion, and seroconversion of titers. One option for serologic sampling would be "serologic profiling" (Holler, 2012). This method maybe useful in chronic abortion cases for certain herds. Serologic profiling would enhance the opportunity to use serum as a diagnostic tool with increased confidence.

## References

Anderson, M. 2007. Infectious causes of abortion during mid- to late-gestation. Theriogenology 2007; 68:474-486

Engelken T., Dohlman T. 2015. Beef Herd Health for Optimum Reproduction. Bovine Reproduction. 1st Edition. Edited by Richard Hopper Hopper. P347-352

Fairbanks, K. Reinhart, C., Ohnesorge, W., Loughlin, M., Chase, C. 2004. Evaluation of fetal protection against experimental infection with type 1 and bovine viral diarrhea virus after vaccination of the dam with bivalent modified-live virus vaccine. JAVMA 2004; 225:1898-1904

Ficken, M., Ellsworth, M., Tucker, C. 2006. Duration of the efficacy of a modified-live combination vaccine against abortion caused by virulent bovine herpesvirus 1 in one-year duration of immunity study. Vet Therapeutics 2006; 7:275-282

Holler, L. 2012. Ruminant abortion diagnostic. Vet Clin North Am Food Anim Pract. 2012; 28:407-418

Kirkbride, C. 1992. Etiologic agents detected in a 10-year study of bovine abortions and stillbirths. Journal Vet Diagnostic Investigation. 1992; 4:175-180

Magstadt, D. 2014. ISU Veterinary Diagnostic Laboratory: Abortion Diagnosis. IVMA Newsletter. April, 2014

NAHMS. 2009. Beef 2007-08, Part IV. Reference of Beef Cow-Calf Management Practices in the United States. USDA

Yaeger, M. 1993. Cattle Abortions – Causes and Prevention. Proceedings: The Range Beef Cow Symposium XIII. Accessed August 1, 2016. http://digitalcommons.unl.edu/rangebeefcowsymp/219/