

Practical implementation of lung ultrasound in dairy calves

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Abstract

Routine thoracic ultrasonography is a developing service offered by veterinary practitioners that acts as an accurate, rapid, calf-side diagnostic tool to aid in calf health management. Bovine practitioners competent in the technique can provide this service to progressive producers by way of client education, demonstration and evidence of impact of bovine respiratory disease (BRD) in pre-weaned dairy calves. Routine, strategic scanning demonstrates trends in new infection rate, cure rates, and severity of lesions in those affected. Utilizing the data to establish benchmarks for individual calf programs allows practitioners and producers to make prudent, evidence-based decisions on treatment and management changes to aid in prevention. Routine thoracic ultrasound is a tremendous opportunity for new and recent veterinary graduates who are looking to expand clinic services and can be offered with little additional overhead. Consistent veterinary involvement brings the practitioner to the forefront in calf management and consultation.

Key words: ultrasound, dairy calves, lung, thoracic

Thoracic ultrasound technique

Utilization of ultrasonography for examination of the thorax of the pre-weaned calf is a rapid, non-invasive, calf-side diagnostic that allows the practitioner to gain insight on the respiratory disease status of calves with no outward clinical signs. With a reported sensitivity of 79 to 94% and specificity of 94 to 100%,^{1,2,3} this diagnostic technique offers an untapped potential to both the veterinary practitioner and producer to maximize detection of BRD in pre-weaned calves, reducing the negative-associated effects of BRD on replacement heifers during rearing and their productive lifetimes. Studies that include the entire lung field within the study design reported higher sensitivities (closer to the upper range noted above), indicating that thoracic ultrasound (TUS) is an excellent screening and diagnostic tool. For reference, on-farm calf-side clinical scoring systems, which have had a large impact on the detection of ill calves with respiratory disease, has reported screening sensitivities around 46%, and specificities of approximately 90%.⁴

Familiarity with the technique of TUS by bovine practitioners is an obvious essential step in offering this service to progressive dairy clients. Numerous opportunities have been available for practitioners to learn this technique at American Association of Bovine Practitioners preconference seminars and other university outreach meetings, and a growing number of new or recent veterinary graduates have good familiarity with the technique upon graduation.

Utilization of a 0 to 5 scoring technique described by Dr. Terri Ollivett⁵ simplifies the description of severity of lung consolidation on a numerical scale that is relatively easy to convey to producers:

Calves are ultrasound-scored using a 0 to 5-point scale:

- 0 and 1 = normal
- 2 = lesions > 1 cm, but < 1 lobe
- 3 = at least one lung lobe consolidated
- 4 = at least two lung lobes consolidated
- 5 = three or more lung lobes consolidated

Seventy percent isopropyl alcohol is applied to each side of the calf thorax as a contact medium, allowing the ultrasound to generate an image of the lung field as the probe is placed between each of the intercostal spaces 10th to 1st. Practitioners that develop competency and confidence in scanning calves should be able to perform this technique in under 30 seconds per calf.

Client education and marketing

Implementation of routine TUS on farms is primarily fueled by demonstration and/or word-of-mouth referral from producer to producer. That aside, educating producers on the long-term effects of BRD in pre-weaned calves and possible unknown prevalence is imperative to successful application of this service on-farm. Producer outreach and education meetings allow for dissemination of information to producers in a low-risk environment to market this service. Additionally, offering a trial of the service as a “loss leader” can show the producer the impact that ultrasonography has on detecting subclinical calves that would otherwise go undetected by the nature of the definition.

Strategic scanning

Practitioners that have demonstrated the importance and impact of subclinical BRD to producers are faced with the challenge of how to implement this diagnostic on farm as a cost-effective and impactful tool to use in a calf rearing program. Initial cursory scans should be done to determine the age of onset in each individual herd to customize a scanning plan to maximize detection on that specific farm. Scanning at approximately 3 weeks of age is a good starting point since maternal antibody is waning at the same time active immunity is being developed by the calf. Additionally, a scan at 5 weeks of age will straddle this timeframe in which the calf is most susceptible to respiratory disease called the window of susceptibility. Calves can additionally be evaluated at 7 weeks if they exhibited lesions at 5 weeks to monitor treatment success. A 2 or 3-scan system allows the producer and practitioner to monitor disease incidence and treatment success. Alternatively, practitioners may choose to scan to monitor post-treatment success (improvement or resolution of lesions within 7 to 10 days) or monitor prevalence of lesions at weaning or pre-grouping (“exit scanning”). Regardless of the approach, practitioners should be cognizant of how the data is going to be utilized.

Anecdotally, calves typically do not exhibit lung lesions under 2 weeks of age unless processing of the newborn calf is performed incorrectly or the possibility of disease pressure is high, such as instances of consistent failure of passive transfer, high prevalence of concurrent disease, ventilation inadequacies in barn-housed calves, subpar nutrition, etc. In these instances, treatment rates of clinical calves may be at an acceptable rate. Working with producers to identify and correct these problems can shift consultation toward the veterinarian, providing additional opportunities of business.

Pairing TUS results with additional diagnostics such as deep nasopharyngeal swabs for viral PCR (polymerase chain reaction) and bacterial culture can direct treatment efforts or practical vaccination needs and schedules. Knowing and understanding the current vaccination protocol can help direct scanning efforts toward logical timeframes to examine calves. It becomes obvious that detection is not prevention. That being stated, detecting calves with subclinical BRD can aid in correct treatment at the earliest onset of disease, allowing for better treatment success which subsequently follows with better post-transition performance until replacements enter the milking string. It is important to consider the option of metaphylactic treatment of all calves that fall into an at-risk age based on ultrasound guided determination of the highest risk age of onset. Factors that should be considered are veterinary cost, anti-infective cost, possibility of infection after anti-infective effectiveness ceases, and the factor of increasing scrutiny of “blanket dosing” antimicrobials. All these factors should be weighed by both the producer and veterinarian to determine the most economic solution, whilst being cognizant of responsible antimicrobial stewardship.

Data analysis and utilization

On a basic level, detection and treatment of subclinical BRD in calves is fairly straightforward – “this calf has subclinical BRD, so let’s treat her”. TUS scores should be entered into on-farm software to tie the calf’s respiratory health to her “permanent record”. Opportunities for practitioners with familiarity in on-farm records software or Microsoft Excel to analyze data are abundant, although reporting basic disease incidence and cure rate data may be all that is needed. For simplicity’s sake, assigning calves as either positive (score ≥ 2) or negative (score < 2) aids in generating new infection rate and cure rate data. Providing producers with a list of subclinical calves to treat and visit-to-visit key performance indicators offers producers a value-added service to track performance over time. The 3 most crucial indices to monitor are:

1. New infection rate (goal $< 25\%$)
2. New infection cure rate (i.e., excludes chronic calves (goal $> 80\%$))
3. Proportion of new infections with score ≥ 3 (goal $< 30\%$)

Monitoring these indices over time helps evaluate trends in calf respiratory health, treatment success and severity of lesions at first evaluation. For example, a recent decline in treatment success may lead to the discovery of under-dosing antibiotic, inappropriate antibiotic choice, or other factors that attribute to high disease pressure that may decrease treatment cure rate, elevate new infection rate, and the severity of those lesions. The overarching goal is to generate an idea of pre-weaned respiratory health of each calf going into weaning/grouping. Identification and treatment in the pre-weaned period prevent relapses during the most stressful time in the calf’s

life. Further records analysis can include trends over time in pre- and post-weaned treatment rates, survival rates, culls and ability to make it to first and subsequent lactations. Monitoring these trends at or around the beginning of TUS implementation can demonstrate the benefits to the producer of detection and intervention of subclinical BRD. Trends in completion rates of the pre-weaned phase may be noticed early (months), while trends in post-weaned and first lactation completion rates will take more time to observe (several months to years). Reporting these trends to producers is important to determine if a TUS program is providing benefit.

Opportunities for young practitioners

New and recent graduate practitioners generally strive to create a niche or aspect of veterinary medicine in which they thrive in. Practice owners should be cognizant of this and allow flexibility to their associates to develop new skills and services for their clientele. TUS is a developing and emerging skill that producers unknowingly crave and seek out. New hires generally are either 1) replacing an existing position within a practice, or 2) carving out a new position for themselves within the practice, attempting to accumulate clientele that they consider their own.

Regardless of either of these common scenarios, exploring new services to offer to producers falls, by nature, onto the younger generation of veterinarian. Since rectal ultrasonography for pregnancy diagnosis is commonly offered by many veterinary practices, there is little overhead in offering TUS other than isopropyl alcohol and time. Additionally, developing this service will naturally generate questions and concerns by producers that will be funneled to the practitioner.

Historically, young-stock rearing on dairies functions commonly in lieu of veterinary involvement other than maintaining a valid veterinary client-patient relationship and when occasional calf health issues arise. Producers, with increasing frequency, are looking to feed mill or pharmaceutical company representatives due to their availability and perceived free-of-charge consultation. Shifting the focus to the veterinarian as the forefront authority on calf health is imperative to not only the success of the calf program, but also for the industry to garner consumer trust. Routine TUS assists in more concrete veterinary involvement in a calf program, using advanced diagnostic capabilities to ensure calves are attaining their potential.

Conclusions

Routine TUS is an emerging service that can be offered by bovine veterinarians to aid in calf health management. Competency in the technique allows for rapid detection and diagnosis of subclinical BRD in pre-weaned calves. Scheduled herd visits with an intent to utilize the data collected allows for monitoring of management changes, as well as providing insight to each individual calf’s respiratory health prior to transition to a dry ration. Providing the producer with key performance indicators after each visit strengthens the value of this service, in which focus of implementation should be toward progressive producers. TUS allows for expansion of practice services, shifting the focus of calf consultation toward the veterinarian.

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