Practical guide to the bovine necropsy

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Abstract

Food animal veterinarians often have the opportunity to determine the cause of death of bovine patients based on grossly visible pathological changes alone, without the need for additional diagnostic testing. In some production systems (e.g., feedlot, stocker, and some cow-calf operations), a field necropsy is performed for almost every mortality; however, for one reason or another, some veterinarians and producers are reluctant to consistently take advantage of performing this procedure. The information collected from postmortem necropsies facilitates ongoing monitoring of disease rates in populations, feeds back into various animal health protocols, and guides decisions pertaining to disease outbreaks. Developing a standardized procedure and employing the appropriate equipment can usually produce a diagnosis very quickly. Furthermore, with the implementation of commonly used technologies, the same principles can be utilized to assist with expanding the geographic area in which diagnoses are made.

Introduction

Performing bovine necropsies is an essential part of understanding the progression of pending and ongoing disease outbreaks in feedlot, stocker, cow-calf and dairy operations. The information gleaned from this procedure not only assists with decisions required to attenuate disease outbreaks, but is also instrumental in designing rational preventive and therapeutic animal health strategies. Given the value of the information that this procedure can provide, it behooves practitioners to be equipped with the proper equipment and procedures to effectively and efficiently determine the cause of death in bovines. Additionally, the use of digital imagery and remote diagnostics can facilitate timely completion of the prosection and enhance scalability for practitioners; expanding their practice area and expertise associated with gross pathological changes.

Equipment

Considering the objective of making a postmortem diagnosis based solely on grossly visible pathological changes, the equipment required to complete a bovine necropsy in the field is limited and simple. Latex gloves, boots, appropriate outerwear (coveralls, etc.), and eye protection are all recommended, but at a minimum, a knife and an instrument to cut through the ribs are the only equipment that is absolutely necessary. A device for recording digital images (of lesions, ear tags, etc.), though not required, is highly recommended.

Many types of knives are available on the marketplace (e.g., sticking, skinning, trimming, carving, butcher, etc.). The specific type of knife selected is largely dependent on the preference of the prosector and the job required. However, in our collective experiences, the most versatile knives are those that are straight-backed, made of stainless steel, and have a blade that is a minimum of 6 inches in length.

Maintaining a sharp edge is paramount to safe operation of a necropsy knife. Practitioners should learn and be proficient at both sharpening and steeling the knife. A stationary commercial knife sharpening tool is an essential piece of equipment for any clinic that performs a modest number of necropsies, and a sharpening steel or mobile sharpening device should be available in every mobile unit. Practitioners or clinics that only perform a limited number of necropsies each year may not care to invest in a stationary sharpening device; in these cases, we recommend stocking several knives in the vet truck (3 to 4) so that if a blade is damaged or dulled during the prosection it can be substituted for a new, sharp knife so that the procedure can be completed safely. If there is no sharpener at the clinic, knives should be sharpened periodically by a professional tradesperson. Additionally, an inexpensive utility knife with disposable "gut hook" blades can be purchased from any local hardware store; these are an effective method of opening the hide and can spare the blade on your necropsy knife.

Ribs are most effectively cut with one of the following instruments: reciprocating saw, pruning shears, axe or knife (juveniles). A reciprocating saw is fast and easy to operate, but a power source must always be present, or battery-operated units must be kept sufficiently charged. In addition, the many moving parts require regular cleaning and maintenance in order to extend the longevity of the unit and maintain a professional image with clients. Pruning shears are the slowest of the 4 methods, and have limited effectiveness in animals with a moderate degree of ossification. An axe is very versatile but its effectiveness is commensurate with experience. It is worth noting that with juvenile animals (approximately less than 30 months of age), a specialized rib cutting tool may not even be necessary as the costochondral junctions have not yet ossified and can be easily cut with a knife.

Outline of the procedure

The following procedures have been adapted from those previously published (Booker and Janzen, 1991). The animal is placed in left lateral recumbency so that 1) the rumen is not obstructing other internal organs, and 2) the right cranioventral lung field can be easily visualized. After a thorough examination of the external carcass, a single, ventral paramedian incision is made from the mandibular symphysis to the anus. The hind limb is reflected following an incision through the subcutaneous tissue of the flank, the medial thigh muscles, and the coxofemoral joint. The skin is then removed distally down the limb until the stifle joint is exposed. Incisions proximal, medial and distal to the patella will allow the patella to be reflected as the synovial fluid is examined. Next, the forelimb is reflected dorsally by incising through the axillary tissue and skinning back over the abdomen and neck.

The esophagus and trachea are removed after severing of the hyoid apparatus and the dorsal pharynx, a dissection that occurs medial to each half of the mandible. An incision is made

down the dorsal aspect of the trachea to expose the lumen. The abdominal cavity is then opened utilizing an incision that follows the caudal aspect of the ribcage, and then extended along the dorsal and caudal aspects of the abdomen. The musculature can then be reflected ventrally. Luminal epithelium and contents of the various stomachs are examined, and the lymphoid tissue associated with the distal ileum are examined following an incision into the lumens of the respective organs.

Moving to the thoracic cavity, the dorsal aspect of each rib is severed immediately ventral to the transverse process. The ventral aspect of the ribs is then disarticulated from the sternum through the costochondral junctions and the entire ribcage is reflected cranially. Prior to examination of the lungs and heart, the caudal vena cava is identified, opened in a cranial-to-caudal direction, and inspected.

The surface and cross-section(s) of the cranial and caudal lung lobes are examined for abnormalities. The pericardial sac is then incised and the heart is exteriorized. A cross-section incision is made across the apex of the heart, removing approximately the "bottom" one third. Incisions are then made through the ventricular walls to examine the papillary muscles, interventricular septum, and left and right atrioventricular valves.

The aforementioned procedures will reveal gross pathological changes indicative of the cause of death in the majority of cases. Occasionally, however, no visible lesions are observed in these organs and further examination is necessary. In these cases, it is recommended to extract and/or examine additional tissues, including (but not limited to): tongue, esophagus, various lymph nodes, liver, gall bladder, kidneys, uterus, mammary glands, limbs and extremities including joints and musculature, and gonads.

While the order of prosection outlined here is what we have found to be most efficient, individual practitioners may prefer to prosect the carcass in a different order. Similar to an antemortem physical exam, our overall recommendation is to develop a consistent, standardized approach that the practitioner is comfortable with. This will prevent mistakes and enable the practitioner to focus on observing pathological changes while safely completing the procedure.

Remote diagnostics

The first validation of utilizing digital images to accurately categorize grossly visible pathological changes was reported over 2 decades ago (Wildman et al., 2000). Since that time, the quality of images and platforms used to transfer and store images have dramatically improved. A key component of producing diagnostic-quality images is a systematic approach to image capture, which focuses on the organs oriented in such a way that both common, and uncommon, disease processes can be readily identified. With a systematic approach and periodic validation of the methods being employed, diagnostic services and the geographic area in which they are offered, can be scaled.

References

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