

Establishing a diagnosis: Physical examination of cattle

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Abstract

The physical examination may be becoming a lost art. Perhaps every generation of veterinarians has had the same feeling as they see more and more technology enhancing our ability to reach a diagnosis, but at the same time replacing some of the time-tested techniques of the physical examination. I am certainly not against technological advances—most of us at academic institutions are drawn there because of the advanced diagnostic equipment available to us. I am chagrined, however, by the growing dependence upon imaging, laboratory evaluation, and other sophisticated techniques to make a diagnosis when often a physical examination and a very simple confirmatory test would reach the same conclusion in less time and for less cost. My goal in this presentation is to review the techniques of physical examination for both the part-time bovine veterinarian, as well as the experienced bovine veterinarian. There is no question that the combination of excellent physical examination and rational use of sophisticated diagnostic equipment will achieve the optimal results.

Key words: bovine, diagnosis, physical exam

Résumé

L'examen physique est-il en train de se perdre? Chaque génération de vétérinaires a peut-être le même sentiment que d'une part l'accès à plus de technologies nous permet d'établir un diagnostic plus facilement mais que d'autre part ces technologies remplacent certaines des techniques éprouvées de l'examen physique. Je ne suis certainement pas contre les avancées technologiques car en fait la plupart d'entre nous en milieu académique y sommes attirés en raison de la disponibilité d'appareils de diagnostic sophistiqués. Toutefois, je suis peiné de constater notre dépendance accrue à l'imagerie, à l'évaluation en laboratoire et à d'autres techniques sophistiquées pour établir un diagnostic alors qu'un examen physique et un simple test de confirmation permettraient d'arriver à la même conclusion en moins de temps et à moindre frais. Mon but dans cette présentation est de passer en revue les techniques de l'examen physique tant pour le praticien bovin à temps partiel que pour le vétérinaire bovin plus chevronné. Il est hors de doute que la combinaison d'un bon examen physique avec l'utilisation rationnelle d'appareils de diagnostic sophistiqués permettra d'atteindre les meilleurs résultats.

Introduction

We often hear the term “complete physical examination,” but how often do we perform one? The truth of the matter is that we do not need to perform a complete physical examination on every patient, nor do we have the time. We routinely perform what might be called a “standard physical examination” which includes a brief review of all important body systems. Based on the history and the results of the standard physical examination, we then perform 1 or more focused physical examinations. If we performed all of the focused physical examinations that we knew, we would then perform a “complete physical examination.” However, let's not argue over semantics. Let us try to learn how to efficiently evaluate an animal by use of the standard physical examination and how to focus on particular areas to gain the most information possible from a physical examination.

There are many ways to approach a physical examination; many correct ways. The approach that I will use in this paper is to begin with observation at a distance and then examination of the restrained animal. I will then discuss the acquisition of vital signs and basic auscultation, concluding with regional focused examinations beginning at the head. Because neurological examination is frequently difficult and confusing, I will spend a bit more time on that aspect.

The Exam at a Distance

I believe that physical examination of cattle should begin with observation of the animal from a distance. This is particularly important when one suspects neurological or musculoskeletal disease. The animal should be observed at rest for several minutes and then in motion. Note the general condition of the animal and the breed, as some neurological diseases are heritable. When the animal is at rest, pay particular attention to the animal's awareness of its surroundings that reflects cerebral function. Note if the animal is depressed, hyper-excited, or otherwise responsive to external stimuli, if it is head-pressing, wandering aimlessly, vocalizing abnormally, behaving abnormally or aggressively. Diseases such as polioencephalomalacia, lead poisoning, nervous ketosis, bovine spongiform encephalopathy, rabies, brain or pituitary abscess, nervous coccidiosis, and salt poisoning/water deprivation cause these signs. Before the animal is disturbed, observe the character and rate of respiration, look for a jugular pulse (indicative of right heart failure), and for signs of abdominal pain like bruxism, restlessness, kick-

ing at the belly, or straining. Also, look carefully for muscle fasciculation, twitching of the ears or eyelids, tail position and switching and abnormal attempts at swallowing, which may indicate nervous system or metabolic disease such as hypomagnesemia, lead toxicity, tetanus, or rabies. Lameness is often detectable in cattle at rest by observing how the animal bears or shifts weight on the limbs. An easy way to assess weight bearing is to observe how far the dewclaws are from the ground. If the dewclaws are higher on one side, the animal is not bearing full weight on that side. Abdominal contour should also be assessed at a distance and from behind the animal. While the animal is in the open and not confined in a chute, careful attention should be paid to the muscle mass, particularly over the rump and hindquarters. In unilateral neurological disease, as well as chronic upper limb lameness, atrophy of the muscles will occur, and asymmetry of the muscles will be obvious.

If the animal is recumbent, observe if and how it rises. It is best to observe an animal in motion as it moves away from and towards the examiner, as well as from each side. To optimally evaluate gait, it should move at its own pace with only slight prompting from an assistant. It should be driven and not led (unless it is very well halter broken) so that the head and neck are free to move. The carriage of the head and neck sometimes give important clues about neurological disease. Observation should be carried out from directly behind the animal and then from each side, with particular attention being paid to the carriage and placement of the legs, to the ability of the animal to walk in a straight line, to knuckling, and to other signs of weakness. If hind-limb ataxia is suspected, the animal should be pulled from side to side by the tail so that the examiner can assess if the animal is able to place its back feet under itself correctly. Another important observation to make when the animal is moving is to assess its vision. The menace response can be misleading in cattle, particularly young cattle. Therefore, cattle suspected of blindness should be moved through a maze or an obstacle course where they will have to turn to avoid running into objects. In this way, their visual capacity can be properly assessed.

The Exam up Close

The next part of the physical examination is conducted with the animal restrained in a head chute. The order in which most of the examination is conducted is not important, except that the rectal exam should be conducted at or near the end of the examination. The following description is the sequence that I usually follow: in dairy cattle particularly, it is often important to collect urine to check for ketonuria. This can most easily be accomplished without catheterization if it is done before the cow is "disturbed" by the physical examination. Stroke the vulva or perineum without touching any other part of the cow. Bulls will often urinate if their sheath is grasped at the orifice and "shaken" vigorously for

30 seconds. If the animal is lying in a stall and rises when the examiner approaches, it will frequently urinate and defecate spontaneously.

Rectal temperature, pulse, and respiration should always be measured. If the examiner stands on the left side of the animal while taking the temperature, rumen motility can be assessed simultaneously. After measuring and recording the temperature and assessing rumen motility, auscult the heart for rate, rhythm, and murmurs. Remember that in order to auscultate the heart, the head of the stethoscope must be pushed cranially behind the elbow and humerus. This is especially true in heavily muscled beef cattle.

Next, listen to the lung fields and record the respiratory rate. Reference ranges for mature cattle are as follows: RR (12 to 36 bpm); HR (50-80 bpm); rectal temp (100.5 to 102.5°F, 38 to 39°C); rumen contractions (2 to 3 in 2 minutes). For calves, these values are RR (20 to 50 bpm); HR (90 to 112 bpm); rectal temperature (101.4 to 103.4°F, 38.5 to 39.5°C). It is important to remember that lung sounds in cattle are usually quieter than they are in horses and small ruminants, therefore, careful attention must be paid to detect abnormalities. The most frequent change in the lung sounds of cattle (except feedlot cattle perhaps) is simply an increase in the normal breath sounds which is caused by tachypnea. Heart failure, pulmonary disease, excitement, exertion, or elevated body temperature (which may be due to infection, exertion or high environmental temperature) may cause tachypnea. Except for pulmonary disease and pulmonary edema secondary to left heart failure, all of these other conditions will cause a simple elevation in respiratory rate and effort which is accompanied by louder than normal sounds, but which is not accompanied by crackles, wheezes, increased bronchial sounds or areas of dullness. In my experience, the most frequent abnormal lung sound is increased large airway or bronchial sounds which are indicative of lung consolidation. It is a misconception that consolidated bovine lungs produce areas of dullness on auscultation. Often severe pneumonia in cattle is accompanied simply by increased large airway sounds, but not crackles and wheezes. If areas of diminished or absent lung sounds are noted, one should suspect pleural effusion or lung abscess. It is critical to differentiate between true lung sounds and upper airway (nasal, laryngeal, pharyngeal and tracheal) sounds. Referred upper airway sounds can be heard loudly in the thorax, but if one listens over the trachea and pharyngeal area, the sounds are louder. Also, most sounds associated with breathing that are audible without a stethoscope are associated with the upper airway. Inspiratory sounds are usually associated with a narrowing of the lumen of the upper airway. Audible grunts are occasionally heard, and these are consciously made sounds that usually reflect pain or severe disease that may not involve the respiratory tract. In young cattle, percussion of the thorax may help detect lung consolidation or pleural fluid, but this technique has been of limited value to me in older cattle, particularly beef cattle.

After auscultating the thoracic cavity, move to the abdominal cavity and perform simultaneous auscultation and percussion (pinging) on both sides of the abdomen. Tests for abdominal pain can be conducted at this point. These include the withers pinch test and the xyphoid pressure test. The withers pinch test is performed by abruptly and firmly squeezing the animal's right dorsal midline over the withers. The interpretation of the test is as follows: the animal ventro-flexes and grunts—positive for cranial abdominal pain; the animal ventro-flexes and does not grunt—negative for cranial abdominal pain; animal neither ventro-flexes or grunts nor shows signs of discomfort—inconclusive results.

After completion of examination of the thoracic and abdominal cavities, one moves to the head of the animal. Hydration is best assessed by measuring eyeball recession and tenting of the skin of the neck. The values for assessing dehydration (Table 1) have been validated for calves by Constable et al, but not for mature cattle. Anecdotally, I feel that the values for skin tent are probably similar in calves and cattle.

In suspected neurological cases, it is very important to do a thorough examination of the head, mouth and neck region. Begin by observing the animal from directly in front. One can observe the positions of the ears, eyelids, lips, and eyeballs. After observing the animal's head, the examination of the head and neck begins by noting the temperature of the ears. Cold ears indicate hypocalcemia or shock. Look in the ears for otitis externa.

The oral examination follows. One should always be mindful of rabies before examining the mouth of cattle, especially those suspected to have neurological disease, choke, or bloat. Gloves and protective clothing should be worn before examining the mouth of any animal with central nervous system disease. Look at the lips, gums, dental pad, hard palate, and tongue for color, vesicles, and ulcerations. Gingival mucous membrane color and capillary refill time are much more difficult to assess and interpret in cattle than in horses. Vulvar mucous membrane pallor is usually easier to detect (except in bulls and steers). While examining the gums, check the incisors for eruption, color, wear, and soundness. Grasp the tongue (a towel helps) and pull it to one side assessing consistency and muscle tone as you do. Look for ulceration, foreign body or ranulae on the underside of the tongue. Examine the cheek teeth for wear, points, attrition or overgrowth, and the buccal mucosa for lacerations, ulceration or blunting of the papillae. "Impacted cud" may be in the cheek or under the tongue. Pull the tongue to the other side and repeat. Smell the breath and oral cavity for a necrotic odor, ammonia or ketones. Visual examination of the oropharynx can sometimes

be accomplished with the use of a speculum (like a Drinkwater gag) and a flashlight. The torus lingua makes visualization of the pharynx difficult in some cases. Be ready to catch brief glimpses, especially when the animal bellows. Retropharyngeal masses, perforations, ulceration, and laryngeal lesions may be observed in this manner. Optimal visualization of the pharynx, larynx, and esophagus is obtained by endoscopy. Traumatic pharyngitis (usually iatrogenic), necrotic laryngitis, chondritis, etc. can be visualized by nasal endoscopy. (Note: bovine nasal passages are smaller relative to body weight, than equine.) The esophagus can be examined for ulceration, laceration, choke, etc. Unlike the equine stomach, the ruminant forestomachs and abomasum cannot be examined easily by endoscopy. To examine the throat manually, insert the hand into the mouth while pushing the tongue between the cheek teeth nearest you. Do not keep your arm in the mouth for too long as the animal cannot breathe and may struggle and bite.

Cranial Nerve Exam

Proceed with a systematic evaluation of the cranial nerves, beginning with the second cranial nerve. A menace response can be elicited in cattle, as with other species, by moving a hand or other object toward the eye. A positive response is blinking of the eye with or without an attempt to move. One must be very careful when examining cattle to avoid creating wind with the hand or other object, as this may give a false menace response. Animals that cannot see can still perceive the movement of the hand and may react to the air movement on the eyelashes. Also, in young calves, many normally visual calves will not have a menace response. The menace response is a "learned" response and they do not perceive the need to flinch yet. The menace response assesses the optic nerve (II), the cerebral cortex, and the facial (VII) nerve. The optic and oculomotor (III) nerves are involved in the pupillary light reflex (PLR). To evaluate the PLR, with the animal in a dark place, shine a bright light into each pupil and observe that pupil, as well as the pupil in the other eye. If the pupil into which the light is shined constricts, then the *direct* PLR is intact. This means that cranial nerves II and III, as well as the retina, on that side are intact. If the pupil in the other eye also constricts, then the *consensual* PLR is intact. This means that in addition to cranial nerves II and III on the first side, cranial nerve III on the opposite side is also intact. The same procedure is repeated for the other eye. If the PLR is intact, but there is no menace response, the lesion is in the cerebral cortex. This occurs in polioencephalomalacia and lead poisoning. The position and movement of the eyeball

Table 1. Assessing hydration in calves (from Walker and Constable, *J Am Vet Med Assoc*, 1998).

% dehydration	0	2	4	6	8	10	12	14
eyeball recession (mm)	0	1	2	3	4	6	7	8
skin tent duration (secs)	2	3	4	5	6	7	8	9

is under the control of the oculomotor, trochlear (IV), and abducens (VI) nerves. Dysfunction of these nerves results in strabismus. The most common and important clinical strabismus in cattle is probably the dorso-medial strabismus associated with some cases of polioencephalomalacia.

The trigeminal nerve (V) provides sensation to the face and motor function to the muscles of the jaw. Pulling the jaws apart and assessing the strength of the muscles assesses the function of the masseter muscle. In order to assess sensation of the head and face, place a piece of straw into the nasal cavity or gently touch the eyelashes. When the lashes are touched, the animal should blink her eye; this is the palpebral reflex. Another cause of an absent or delayed palpebral reflex is lactic acidosis in diarrheic calves. The mechanism for this is unknown. Table 2 is a guide to interpreting the menace response, PLR, and palpebral reflex.

Cattle with facial nerve paralysis will have a drooped ear, ptosis, and atonic lips. Occasionally saliva will drip out of the affected side of the mouth. Facial paralysis is seen most often with listeriosis and ear infections. The vestibular system is composed of the auditory nerves and ganglia, and the vestibular apparatuses in the middle ear. Clinical signs associated with dysfunction of the vestibular system include head tilt, circling, and loss of balance. Cattle with unilateral lesions tilt their heads and lean toward the lesion; recumbent cattle lie with the lesion side down. If the lesion is peripheral (such as an otitis interna), horizontal nystagmus will be present, and the slow phase is toward the lesion. Central lesions are associated with a vertical or rotary nystagmus. A combination of dysfunction of cranial nerves VII and VIII can be seen in either brainstem disease (listeriosis) or peripheral disease (ear infection) because the facial nerve passes through the petrous bone via the internal acoustic meatus with the auditory nerve. Cattle with deficits of the glossopharyngeal (IX), vagus (X), and spinal accessory nerves (XI) usually present with abnormal vocalization, dysphagia (trouble swallowing or regurgitating out of the nose) or abnormal breathing sounds. Pharyngeal paralysis can usually be assessed best by allowing the cow or animal to eat or drink. Sometimes this is difficult because sick cattle will not eat, especially in a strange environment. Alternatively, water can be administered via a dose syringe and the cow's ability to swallow can be assessed. Endoscopic examination is helpful in determining if nerve dysfunction exists. The hypoglossal nerve supplies motor innervation to the tongue. The tongue's function is assessed by grasping it and pulling it out and to each side. Unilateral lesions may result in the tongue sticking out 1 side of the mouth.

Other Tips

After the completion of the examination of the head, one should palpate the neck concentrating on the submandibular lymph nodes, the skin and musculature of the neck and trunk, and finally the superficial cervical or prescapular lymph nodes. These lymph nodes should be approximately as big as one's index finger. When examining the rear legs, the prefemoral lymph nodes should be palpated. Dependent edema, indicating circulatory failure or hypoproteinemia, will be noted when the ventral part of the jaw, thorax, and abdomen are examined. When moving from the head to the rear of the animal, move your hand over the back to detect subcutaneous emphysema, parasites or neoplasm, and skin lesions. Particular attention should be paid to the joints of the rear legs. Palpation of the stifle joint and hock joint may reveal accumulation of synovial fluid. Palpation of the stifle joint is best accomplished by first locating the middle patellar ligament, then sliding the fingers medially until the next hard structure is encountered...this is the medial patellar ligament. There should be a depression in the space between the ligaments. Similarly, a soft depression should exist between the middle patellar ligament and the lateral patellar ligament. If the ligaments are difficult to palpate because the space between these ligaments is filled and very firm to the touch, then there is substantial distention of the stifle joint. This can be seen in both septic and non-septic conditions, such as rupture of the cranial cruciate ligament. One easy way to differentiate between foot lameness and upper-leg lameness or neurologic disease of the rear limbs is by lifting the rear legs. Animals with a foot lesion will often kick violently when the back leg is lifted, while those with upper-leg lameness and neurological disease will not. Occasionally, lameness and neurological disease can be confused, especially by owners.

While standing behind the animal just prior to rectal exam, the last part of the neurological exam can be conducted. Tail tone can be assessed by picking the tail up and noticing the ability of the animal to clamp down, and by assessing the tone of the anus and sensation around the perineal area.

The Non-reproductive Abdominal Examination per Rectum

The rectal examination is an extremely valuable diagnostic technique, seldom appreciated until the practitioner is faced with a challenging G.I. case in a 300 lb (136 kg) calf or a sheep. The key to garnering the most from a rectal exam is

Table 2. Reflexes involving the eye.

Menace	Absent	Absent	Absent	Present
PLR	Absent	Present	Present	Present
Palpebral reflex	Present	Present	Absent	Absent
Interpretation	II or retinal deficit	Cerebral cortical deficit	VII or <i>orbicularis oculi</i> muscle deficit	V deficit

in knowing which structures are usually palpable and which are not. There is no standard accepted sequence in which the abdomen is examined per rectum, so I will simply discuss each quadrant beginning with the left dorsal and proceeding clockwise. Before beginning, let me point out 3 things that should always precede a rectal exam:

1. Rectal temperature measurement. Cattle often develop pneumorectum following a rectal exam.
2. Pinging. Pneumorectums ping, confusing the examiner.
3. Collection of feces for occult blood (if indicated). Certainly not a routine procedure, so try to think ahead. After a rectal, false positives may occur for 24 hours or more.

Now we are ready:

- Pelvic exam. The pelvis has many ridges and bumps that become more prominent when you palpate with the suspicion of a pelvic fracture. Remember that cattle have a large prominent symphysis pubis and a step-like sacroiliac junction. Fractures or luxations can best be identified by rocking or walking the animal. Patient compliance is essential. Pay particular attention to crepitus and asymmetry. There are several lymph nodes in the pelvis that may go unnoticed in a healthy cow, but become very enlarged in lymphosarcoma.
- Left dorsal quadrant. The dorsal sac of the rumen is palpable several centimeters cranial to the pelvic brim. Sometimes the rumen extends to the pelvic canal. Size, consistency, gas caps, and relative position of the rumen can be assessed. LDA's are not palpable per rectum, but the rumen may feel displaced medially. The left kidney is usually midline, but may be to either side depending on the fullness of the rumen.
- Right dorsal quadrant. The right kidney lies cranial to and to the right of the left kidney and the caudal pole can be felt in some cattle. The aorta and vena

cava run along the dorsal midline and can be palpated. Occasionally the cecum in a healthy cow will be in or near the pelvic brim, but usually it cannot be identified. Spiral colon and small intestines are not palpable in a normal cow. In cattle with obstructions, they may be subtly or obviously distended, but any palpable intestine (other than cecum) is abnormal. RDA is seldom palpable but abomasal volvulus is often palpable. Torsed abomasa are palpable at the furthest extent of the reach in the right mid-to-dorsal quadrant.

- Right ventral quadrant. Distended intestines may be palpated here and are interpreted as in the RDQ. A distended, displaced or torsed cecum is usually palpated easily in the right ventral or dorsal quadrant or in the pelvic canal. It is much more caudally situated than an RTA. In vagal indigestion, the right ventral sac of the rumen is prominent. It is occasionally palpable in normal cattle.
- Left ventral quadrant. Usually, only the ventral sac of the rumen is present. The urinary bladder may lie on either side of midline beneath the uterus, but it is usually flaccid and not always easily located.

Other abnormalities that can be detected by rectal examination include pneumorectum, which results in the rectum being tightly adhered to the arm like a sleeve, while the examiner's arm and hand seem more freely movable than usual. Acites may cause the rumen to float. Adhesions due to peritonitis may give a feeling of roughness to the serosal surfaces, or may create a tearing sensation as immature fibrinous adhesions are broken down, or may severely restrict movement in the abdomen if extensive firm adhesions are present.

Of course, a complete physical examination is not warranted in every case, but it is important to know how to perform one for those cases in which the diagnosis is not obvious.