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Ultrasonography of the spleen in 50 healthy cows☆

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Abstract

This paper describes the ultrasonographic appearance, location and size of the spleen in 50 healthy commercial milk cows destined for slaughter. The intercostal spaces of the left thoracic wall were scanned with a 3.5 MHz linear transducer. In each intercostal space, the appearance of the splenic parenchyma, the dorsal and ventral margins and the distance between them, and the diameter of the splenic vessels were recorded.

The spleen was seen in intercostal spaces 7–12. It was 2.0–5.0 cm thick, and tapered ventrally. The splenic capsule appeared as an echogenic line. The splenic parenchyma consisted of numerous small regularly spaced echoes, and vessels within the parenchyma appeared as anechoic round to oval or elongated images. The long axis was oblique, running caudodorsal to cranioventral. The distance from the dorsal margin of the spleen to the midline of the back was greatest in the 7th intercostal space (60.9 ± 6.81) and smallest in the 12th intercostal space (12.7 ± 2.85 cm). The extent of the spleen was greatest in the 8th intercostal space (24.9 ± 10.77 cm) and smallest in the 12th intercostal space (9.5 ± 5.38 cm). The mean diameter of the splenic vessels ranged from 0.66 ± 0.28 to 0.90 ± 0.65 cm, depending on the intercostal space scanned.

Ultrasonography of the spleen in healthy cows provides information that can be used as a reference when examining cattle with suspected splenic disease.

Keywords: Ultrasonography; Healthy cows; Spleen; Normal values

1. Introduction

In cattle, the spleen lies almost vertically on the cranial end of the dorsal sac of the rumen and the cranial surface of the reticulum on the left side of the abdomen. It extends from the dorsal ends of the last two ribs to the costochondral junctions of the 7th and 8th ribs (Nickel et al., 1987). The spleen has a number of functions including extramedullary production of haematopoietic cells, recognition and removal of abnormal blood cells, bacteria and parasites, and the production of lymphocytes and specific antibodies in many septicaemic diseases (Radostits et al., 2000; Stöber, 2002). In many infectious processes, the spleen enlarges to perform its functions better. Penetration of a foreign body from the reticulum into the spleen may cause suppurative splenitis. Haematogenous spread of disease to the spleen may occur in septicaemic or pyogenous processes. Although the spleen is often involved in bacterial or parasitic diseases such as babesiosis or anthrax, signs of splenic disease are not usually foremost in the clinical presentation. Tumours also occur in the spleen with lymphoma being the most important (Radostits et al., 2000; Stöber, 2002).

There are no characteristic symptoms of splenic disease and no specific methods for the examination of the spleen in cattle. In contrast to horses, the spleen cannot be examined by rectal palpation. Moreover, there

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are no laboratory tests that are specific for the spleen. In cattle, the reticulum (Braun et al., 1993a) and the lungs (Braun et al., 1997), but not the spleen, can be evaluated by radiography (Sicher, 1995). Although laparoscopy (Anderson et al., 1993) and left flank exploratory laparotomy allow visualisation of the spleen, these are invasive procedures.

Ultrasonography is an ideal, non-invasive method for examining the bovine spleen. In cattle with traumatic reticuloperitonitis, ultrasonography has been used to evaluate changes in the spleen such as fibrinous adhesions and abscesses (Braun, 2003; Braun et al., 1993b, 1998). Ultrasonography has been used to detect tumours, trauma and torsion of the spleen in dogs (Nyland et al., 2002) and tumours, haematomas and abscesses of the spleen in horses (Reef, 1998) but, to our knowledge, detailed information about the ultrasonographic appearance of the normal bovine spleen and its vessels has not been reported although some information of the normal sonographic findings of the spleen is given by Braun (1997). The goal of the present study was to investigate these features.

2. Material and methods

2.1. Cows

Fifty clinically healthy Swiss Braunvieh and Simmental commercial cows destined for slaughter were examined. The cows ranged in age from 2.3 to 11 years (mean, 4.8 years) and weighed 436–699 kg (mean, 539.8 kg). The cows were unsedated and standing during the examination.

2.2. Ultrasonographic examination of the spleen

The ultrasonographic examinations were performed using a realtime scanner and a 5.0-MHz linear transducer (Concept 2000, Dynamic Imaging Ltd., Pameda AG). The examination procedure has been described by Sicher (1995).

The left lateral thorax was clipped from the caudal border of the forelimb and scapula to the caudal aspect of the last rib and from the transverse processes of the thoracic vertebrae to the ventral midline. Remaining hair was removed with depilatory cream (Depilatorium, Veterinaria AG). After the application of transmission gel (Aquasonic, Polymed), each intercostal space was scanned, beginning dorsally and progressing ventrally with the transducer held parallel to the ribs. The left ventral thorax was scanned with the transducer held parallel to the long axis of the cow to determine the extent of the spleen in this region.

The spleen was first assessed subjectively by evaluating its echogenic pattern and noting whether the parenchyma appeared homogeneous or heterogeneous. We also recorded whether the splenic blood vessels could be visualised and, if so, their appearance, and whether the splenic capsule appeared as an echogenic line separating the splenic parenchyma from adjacent structures. The location of the spleen was determined by measuring the extent to which it could be seen in each intercostal space. Measurements were made on cross-sectional views of the spleen and at maximum inspiration (see Fig. 1). The positions of the dorsal and ventral borders of the spleen were determined in relation to the midline of the back. The visible extent of the spleen in a given intercostal space was determined by subtracting the distance between the dorsal splenic margin and the midline of the back from the distance between the ventral splenic margin and the midline. The diameters of the splenic vessels were measured electronically on the ultrasonogram by means of the two cursors, noting if the vessels were viewed in longitudinal or cross-section.

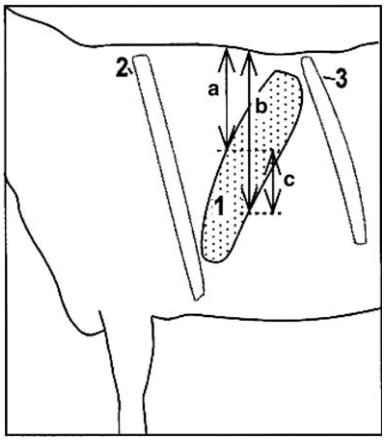

Fig. 1. Schematic representation of the determination of position and extent of the spleen via ultrasonography in a cow. 1 – spleen; 2 – 6th rib; 3 – 13th rib. (a) dorsal margin of the spleen; (b) ventral margin of the spleen; (c) extent of the spleen.

2.3. Post mortem findings

All cows were slaughtered within three days following the end of the study. Each spleen was palpated, and its exterior and cut surfaces were examined macroscopically.

2.4. Statistics

Statistical calculations were performed by use of the calculation program SPSS/PC+ according to the method of Norusis (1990).

3. Results

The spleen was situated between the rumen and left abdominal wall in all cows. The visceral surface of the spleen lay against the cranial aspect of the dorsal sac