

Diagnostic Exercise

From The Davis-Thompson Foundation*

Case #: **158** Month: **January** Year: **2021**

Title: Septicemic listeriosis in a calf

Contributor: Rachel Neto, DVM, MS, DACVP, College of Veterinary Medicine, Auburn University

Clinical History: Approximately 1-week-old Corriente heifer calf that did not receive colostrum within the first 48 hours after birth of age. It died naturally.

Necropsy Findings: The animal was in fair nutritional condition and had a dark purple, dry, shrunken umbilicus. The peritoneal cavity contained approximately 200 ml of light yellow to light red, thin, turbid fluid with multiple yellow friable clumps and membranes (fibrin) loosely adherent to the visceral serosa and adventitia of the umbilical arteries. The liver was mottled light brown and dark red with miliary, random, 1-3 mm diameter, tan, flat foci (Figure 1A). The rumen contained small amount of fibrous ingesta and some leaves. The abomasum had moderate amount of curdled milk and fewer shavings. The abomasal mucosa was diffusely dark purple and mildly edematous. Segments of mid jejunum were gas-distended and thin-walled. The mesocolon was moderately edematous. The ileum and spiral colon were unevenly dilated with mildly thickened walls and segmental hemorrhagic casts (Figure 2A). The ventral portion of the right cranial lung lobes had few patchy dark red, up to 5 mm diameter, flat foci. All carpal and tarsal joints contained small amounts of intra-articular fibrin and increased amounts of thin yellow synovial fluid.

Gross and Microscopic Images:

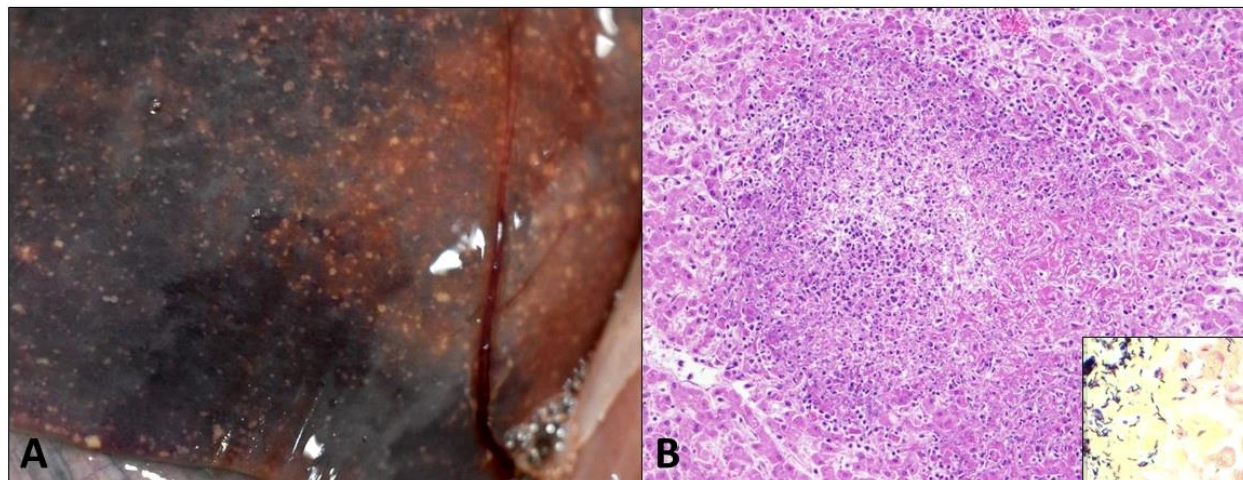


Figure 1 – Liver with miliary tan foci (A). Photomicrograph of the liver (B) and Gram stain highlighting intralésional short to pleomorphic bacilli (inset).

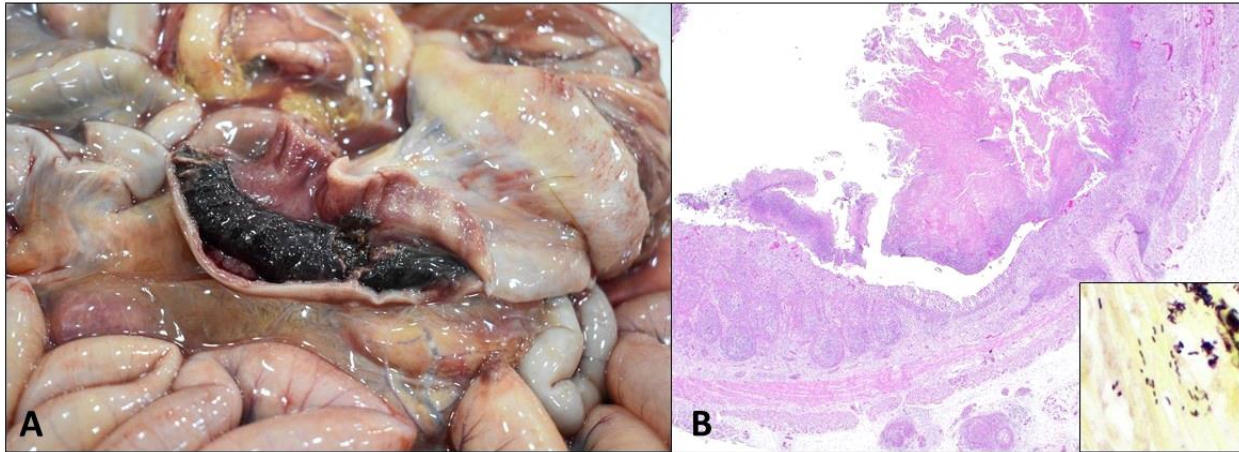


Figure 2 – Enteric luminal hemorrhagic casts (A). Photomicrograph of the affected intestine (H&E) (B) and Gram stain highlighting transmurial short to pleomorphic bacilli (inset).

Morphologic diagnoses:

1. Liver: Multifocal, random, acute, severe, necrosuppurative hepatitis, with myriad intracellular gram-positive bacilli.
2. Ileum: Transmural, acute, severe, ulcerative and fibrinosuppurative ileitis, with myriad transmural extra- and intracellular gram-positive bacilli.

Most likely etiology: *Listeria monocytogenes*

Ancillary tests: Fecal culture was negative for *Salmonella* sp. Aerobic culture of carpal joint swabs yielded pure moderate growth of *Listeria monocytogenes*. Myriad bacterial organisms exhibited strong immunoreactivity for *Listeria* sp. when performing immunohistochemistry of sections of the affected liver and intestine (Figures 3 and 4, respectively)

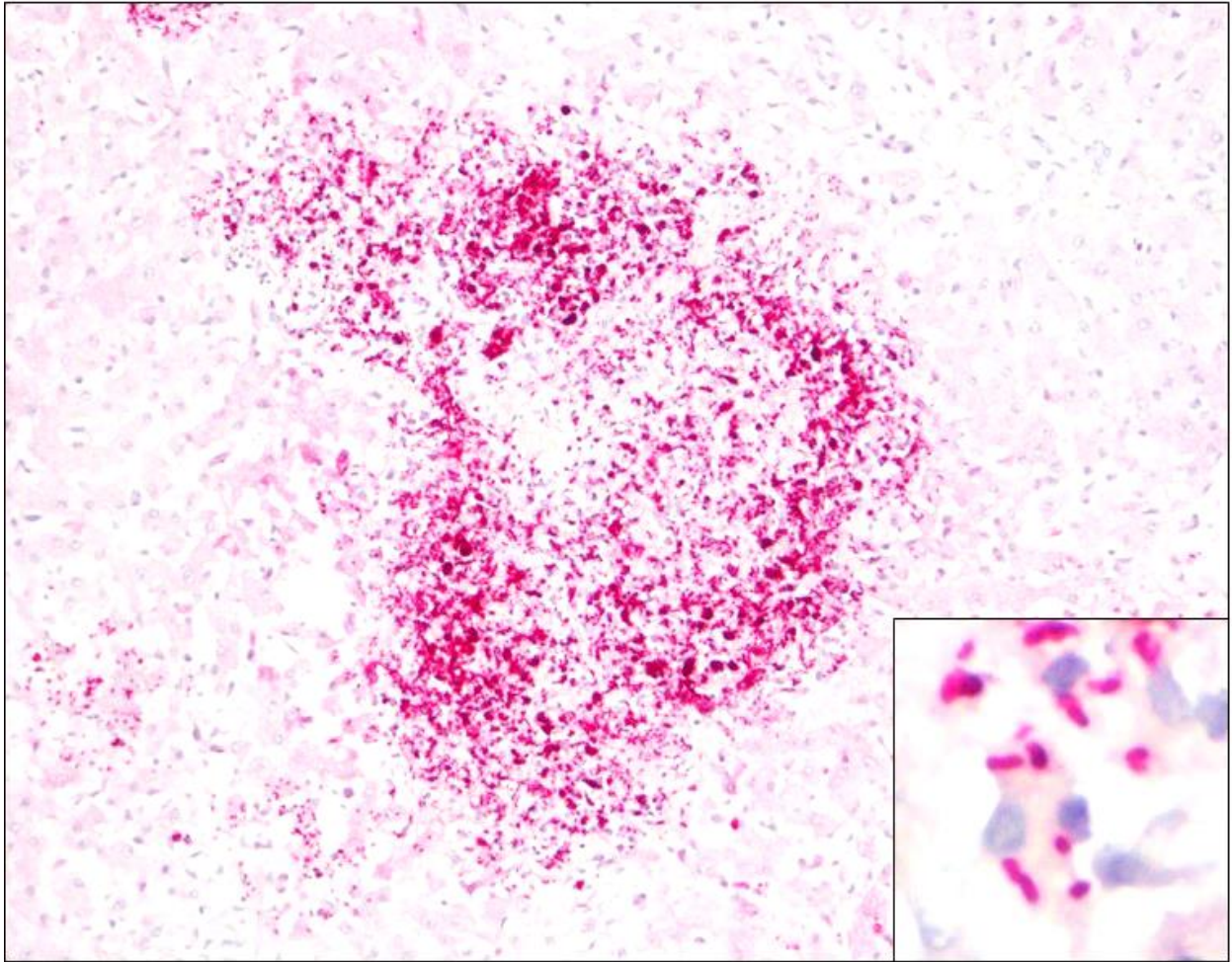


Figure 3. Liver with miliary random foci of lytic necrosis. Immunohistochemistry for *Listeria* sp. Details of intrahepatocellular bacteria (inset).

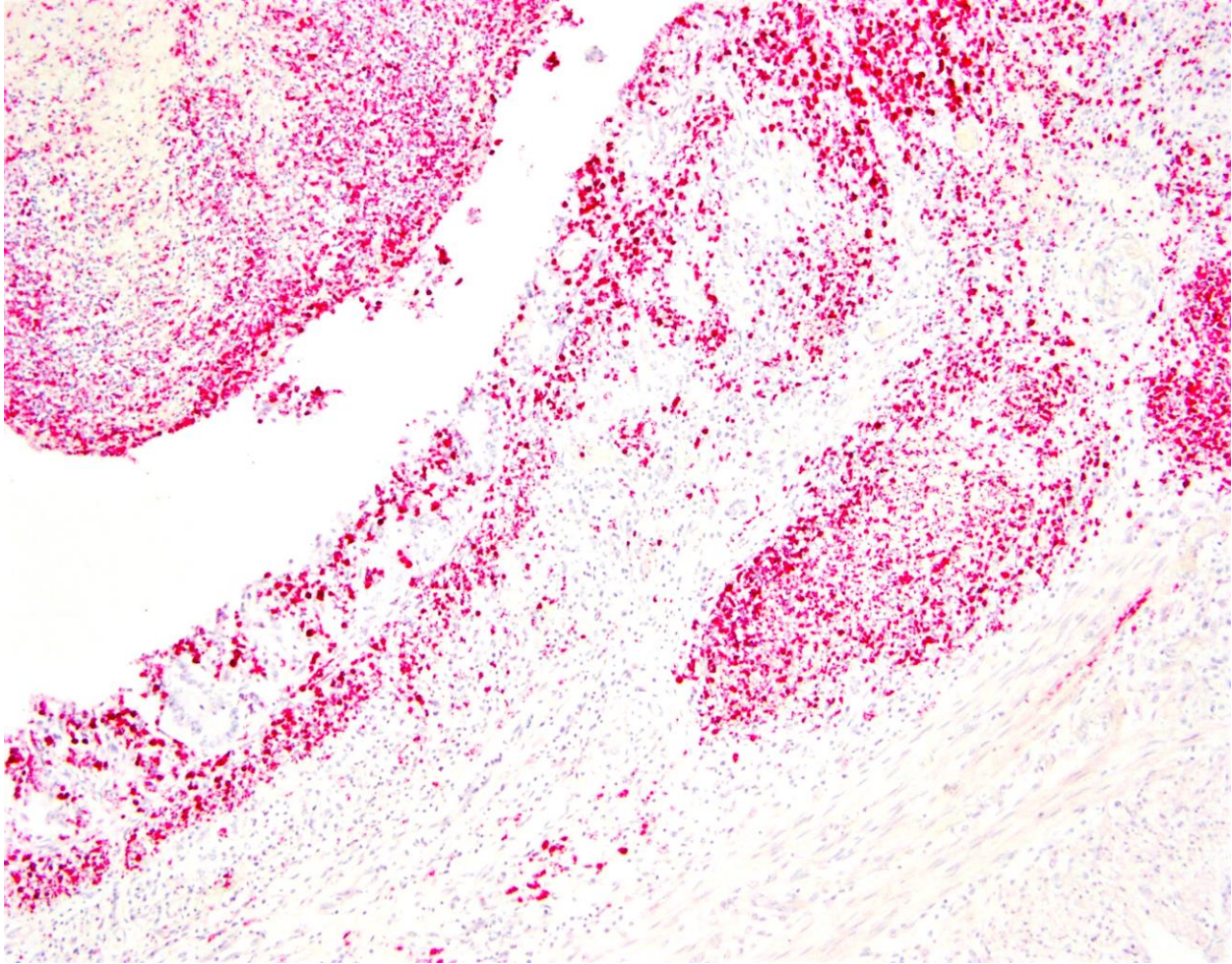


Figure 4. Ileum with severe transmural inflammation and necrosis. Immunohistochemistry for *Listeria* sp.

Discussion:

Additional significant findings in this animal included fibrinous peritonitis, fibrinous polyarthritis, and erosive fibrinosuppurative colitis. Overall, these are consistent with septicemic listeriosis, with the enteritis as the most likely portal of entry for bacterial translocation and hematogenous dissemination.

The signalment and clinical history provided for this animal are characteristic of failure of passive transfer (FPT) in neonates. In calves, FPT typically results in sepsis or septic shock, and possible routes of infection include ingestion, inhalation, umbilical or *in utero* infections (1). Common bacterial causes in newborn calves succumbing to septicemia include but are

not limited to *Escherichia coli* (most common), *Salmonella* sp., *Listeria monocytogenes*, *Pasteurella* sp., *Streptococcus* sp., *Leptospira* sp., and *Actinobacillus* sp. (1). Neonatal septicemia typically manifests as weakness, depression, absent or decreased suckle reflex, dehydration, fever or hypothermia, diarrhea, neurologic signs, hypopyon, pneumonia, swollen joints and/or umbilicus, or acute death (1).

Listeria monocytogenes is a gram-positive, facultative anaerobic bacillus with worldwide distribution and that can be isolated from a wide variety of tissues from healthy animals, such as tonsils and gut-associated lymphoid tissue, as well as from animal and human feces (2). The bacterium also thrives in extreme temperature variations (4-45°C), pH range (5-9) and, provided there are adequate moisture conditions, up to 2 years in the soil (2,3).

Listeriosis occurs sporadically and has been reported in many different mammals (including humans), birds and fish (2,4). The disease classically presents as three distinct forms that rarely coincide: i) infection of the pregnant uterus leading to abortion or stillbirth; ii) encephalomyelitis and/or meningoencephalitis; or iii) septicemia. Mastitis, conjunctivitis, otitis, gastroenteritis (2,5) and endocarditis (2) are less common manifestations of the disease. In adult ruminants, the most significant and common form is the central nervous system infection ("circling disease") with the characteristic affinity for the brainstem leading to rhombencephalitis with microabscesses, typically associated with feeding of silage with suboptimal fermentation (2).

Abortion cases most frequently occur in the last trimester of pregnancy, leading to expulsion of the infected fetus a few days later. Miliary necrosis in multiple viscera, notably the liver, as well as the lung, kidney, myocardium, spleen, and brain are reported findings in the aborted fetus. A distinguishing lesion observed in the bovine fetus is severe necrotizing colitis (3), which was also present in this case. Because of the often short interval of postnatal clinical signs and a pattern of lesions similar to that observed in aborted bovine fetuses, it has been speculated that septicemia in newborn calves may reflect a continuation of an intrauterine infection (6), possibly just prior to birth (7); however, validation of such pathogenesis is often problematic and other potential sources of infection such as fecal-oral, contaminated milk, bedding or water should be acknowledged (5).

An important additional discussion point is the different bacterial etiologies for acute hemorrhagic enterocolitis in calves. These include, but are not limited to, *Clostridium perfringens* type C, which typically affects neonates within the first hours or days of life, verotoxin-producing *E. coli* and *Salmonella* (8). Primary gastroenteric listeriosis with concurrent necrotizing hepatitis has been sporadically reported in the literature. Cases consisted of young cattle succumbing of the disease after ingestion of suspected spoiled feed (9,10).

In this case, it remains uncertain whether the lack of colostrum intake was secondary to illness from an ongoing intrauterine infection or, alternatively, a primary failure of passive transfer that led to a debilitated immune system and subsequent inability to modulate a postnatal *Listeria* sp. infection from a likely ingestion route of exposure.

In summary, the lesions observed in this calf resembled those expected in cases of bovine neonatal septicemia caused by other more common bacterial agents. Thus, necropsy

examination, histopathology and ancillary tests remain paramount to establish a definitive etiologic diagnosis in such cases.

References:

1. House A, Irsik M, Shearer J. Sepsis, Failure of Passive Transfer, and Fluid Therapy in Calves. EDIS 2008 (7).
2. Cantile C, Youssef S. Nervous system. In: Maxie, MG, ed. Jubb, Kennedy, and Palmer's Pathology of Domestic Animals, Vol I. 6th ed. Philadelphia, PA: Elsevier Ltd; 2016:362-363.
3. Schlafer DH, Foster RA. Female genital system. In: Maxie, MG, ed. Jubb, Kennedy, and Palmer's Pathology of Domestic Animals, Vol III. 6th ed. Philadelphia, PA: Elsevier Ltd; 2016:408-409.
4. Evans MG, Watson GL. Septicemic listeriosis in a reindeer calf. J Wildl Dis. 1987 Apr;23(2):314-317.
5. Hawkins IK, Ilha M, Anis E, Wilkes RP. Septicemia and meningoencephalitis caused by *Listeria monocytogenes* in two neonatal llamas. J Vet Diagn Invest. 2017 Sep;29(5):700-703.
6. Seimiya Y, Ohshima K, Itoh H, Murakami R. Listeric septicemia with meningitis in a neonatal calf. J Vet Med Sci. 1992 Dec;54(6):1205-7.
7. Glock RD, Miller K. Septicemic listeriosis in a calf. Iowa State Univ Vet. 1972 34(1):34-35.
8. Uzal FA, Plattner BL, Hostetter JM. Alimentary system. In: Maxie, MG, ed. Jubb, Kennedy, and Palmer's Pathology of Domestic Animals, Vol II. 6th ed. Philadelphia, PA: Elsevier Ltd; 2016:112-113; 184-191.
9. Fairley RA, Colson M. Enteric listeriosis in a 10-month-old calf. N Z Vet J. 2013 Nov;61(6):376-378.
10. Garcia JA, Micheloud JF, Campero CM, Morrell EL, Odriozola ER, Moreira AR. Enteric listeriosis in grazing steers supplemented with spoiled silage. J Vet Diagn Invest. 2016 Jan;28(1):65-9.

*The Diagnostic Exercises are an initiative of the **Latin Comparative Pathology Group (LCPG)**, the Latin American subdivision of The Davis-Thompson Foundation. These exercises are contributed by members and non-members from any country of residence. Consider submitting an exercise! A final document containing this material with answers and a brief discussion will be posted on the CL Davis website (http://www.cldavis.org/diagnostic_exercises.html).

Associate Editor for this Diagnostic Exercise: Ingeborg Langohr
Editor-in-chief: Claudio Barros