Diagnostic Exercise
From The Davis-Thompson Foundation*

Case #: 137 Month: January Year: 2020

Answer Sheet

Title: Ram, right cardiac valves, endocarditis.

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**Diagnosis:** Heart (tricuspid and pulmonary valves), severe multifocal to coalescing chronic suppurative endocarditis associated with myriads of intralesional (gram-positive) bacterial cocci

**Typical Gross Findings:** Initially, inflamed cardiac valves are hemorrhagic and have an irregular, eroded endocardial surface. The inflammation and loss of endocardial surface are followed by thrombosis. In this phase, dark-red, friable, irregularly shaped and variably sized masses of fibrin
(thrombi) are seen adhered to the inflamed valve(s). Depending on the presence and viability of the causative bacteria and on the host response, one or more abscesses may form in the inflamed valve(s). This is a more chronic presentation of endocarditis and, although not present in all cases, was seen in this ram. An up to 4-cm, white to yellowish, irregular and vegetative mass was attached to the three leaflets of the right atroioventricular valve (Figures 1-3). Multiple 0.5 cm to 2.0 cm diameter nodules of the same aspect were adhered to the semilunar pulmonary valve. On cut surface, they were soft and drained purulent material (multifocal valvular abscesses).

**Typical Microscopic Findings:** The early phase of bacterial endocarditis is characterized by focal or multifocal loss of the endocardial surface accompanied by the presence of neutrophils and, possibly, bacteria. Large thrombi subsequently adhere to the eroded endocardial surface, consisting of large amounts of fibrin, erythrocytes and neutrophils. If the animal survives long enough, an abscess may develop at the affected site, filled with viable and degenerated neutrophils, sometimes associated with intrallesional bacterial, and surrounded by a fibrous capsule. The ram in this case had fibrinosuppurative and histiocytic endocarditis (Figure 5). Some areas of abscess formation surrounded by immature granulation tissue were present. Myriads of intrallesional bacterial cocci were observed on H&E (Figure 6), and a Gram stain revealed them to be gram positive. Bacterial culture confirmed the bacteria to be *Staphylococcus* sp.

![Figure 5](image-url)
Discussion: Only few reports of valvular endocarditis affecting sheep can be found in the literature. Most of them are in young animals between 12 weeks and 9 months of age. The classic pathogenesis of endocarditis involves persistent bacteremia leading to endothelial injury. A septic focus elsewhere in the body generally acts as the port of entry of bacteria; however, the primary infection site is not always present at the time of necropsy. In humans, bacteremia after long-term intravenous access is the main cause of valvular endocarditis, usually associated with congenital heart disease, degenerative valvular disease, diabetes, and rheumatic heart disease. In cows, traumatic peritoneal abscess, hepatic abscess, metritis and mastitis are generally considered the primary sites of bacteremia. Dogs are the major affected species among companion animals, with the main sources of systemic infection being urinary tract, skin and periodontal diseases. In the few previous reports of valvular endocarditis in sheep, the route of infection included contaminated caudectomy, hoof injury and chronic orchitis following a vasectomy procedure. In the present case, the muscular abscesses, which may have been caused by a contaminated injection, were probably the primary site of bacteremia. The subacute inflammation of the right stifle joint and the already healed arthritis of the right carpus joint seen at necropsy were also probable consequences of bacteremia. In a retrospective study of joint infections in 39 adult sheep, 6 of the animals had concomitant valvular endocarditis (Scott & Sargison, 2012). Commonly incriminated bacteria in suppurative lesions of ruminants include *Trueperella pyogenes*, *Mannheimia haemolytica*, *Staphylococcus* spp. and *Streptococcus* spp. In this case, the bacterial culture was positive for *Staphylococcus* sp.; further species identification is in progress.
The left atrioventricular valve is the most commonly affected valve in the majority of domestic species, followed by the aortic valve, probably because of the higher blood flow intensity through the left side of the heart. In contrast, in cattle, the right side of the heart is the most affected, with the pulmonary valve the most common, followed by the right atrioventricular valve. The most prevalent location of valvular endocarditis is not established in sheep, yet most of the reports show exclusive involvement of the right side of the heart, with vegetative lesions in the tricuspid and/or pulmonary valves (Aslani et al, 2015; LaHue & Parish 2015; Scott & Sargison, 2012). The sequela of valvular bacterial endocarditis in any species include (1) septic thromboembolism and secondary abscess formation or infarction in multiple organs and (2) valvular insufficiency leading to congestive heart failure. Common pathologic changes associated with congestive heart failure are pulmonary edema (left-sided heart failure) and passive hepatic congestion (right-sided heart failure). In this case, no hepatic lesions indicative of congestive right-sided heart failure were observed, and the pulmonary edema was attributed to the bacteremia and lung abscesses other than to the heart valve lesions, since they were on the right side.

References and Recommended Literature:

*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).

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