Myocardial infarctions due to *Erysipelotrix rhusiopathiae* infection in an adult sheep

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Introduction

Erysipelotrix rhusiopathiae is a gram-positive bacterium that causes infection in animals and humans. Its economic importance has been reported particularly in swine, but domestic poultry, cattle, and sheep may also be involved (Brooke and Riley, 1999; Wang et al., 2010). Natural infections have also been described in ducks, horses, dogs, mice, and wildlife species (Cross and Eamens, 1987). Human infection, commonly seen as erysipeloid, usually occurs following contact with infected animals.

Case history

An 18-month-old, female, cross-breed sheep was referred for necropsy to the Department of Veterinary Sciences of Messina University at the end of 2013. The animal had been grazed together with 100 other sheep in a transhumant system. The reported clinical signs were drooling, vomiting, cessation of rumination and lactation, wheezing, and runny nose, followed by generalized muscle weakness and lethargy. The animal had gradually lost weight until spontaneous death. A complete necropsy was performed. Samples of selected organs (muscle, perirenal fat, lung, joints, heart, liver and kidneys) were partially fixed in 10% neutral buffered formalin for histological investigations according to standard procedures and partially stored at –80 °C for microbiological and biomolecular analysis. Standard bacteriological assays were carried out on affected organs to detect common bacteria. Biomolecular laboratory tests for the presence of *E. rhusiopathiae* DNA sequence were performed. Total DNA was extracted from the mitral and aortic valves by means of a QIAmp DNA mini kit (QIAGEN, Hilden, Germany) and used in a PCR test targeted to the 23S ribosomal region of *Erysipelothrix* spp. using universal primers to amplify a species-specific DNA sequence as previously described (Takeshi et al., 1999). Application of the sequencing protocol on the PCR products permits species identification.

Results

At necropsy, abundant foamy exudates in the trachea and bronchi were present and pleural hemorrhages were observed. Gross pathology showed left heart hypertrophy, with multiple coalescing grayish to white foci surrounded by hyperemia occupying the entire thickness of the left ventricular wall (Fig. 1A). The mitral valve and the aortic ostium showed a severe acute endocarditis characterized by irregular friable vegetations (Fig. 1B). A voluminous necrotic area between the cortex and the medulla was detected in the right kidney (Fig. 1C). No other macroscopic lesions were observed.

Histological examination showed fibrotic mitral and aortic valve flaps surrounded by irregular endocardial vegetations composed of thick, amorphous masses of fibrin and scattered inflammatory cells (especially granulocytes). Myocardial infarctions were mainly composed of granulation tissue with occasional blood vessels, abundant fibroblasts, rare fibrocytes, neutrophils, and scattered necrotic foci (Fig. 1D). The subepicardial areas of the infarcts showed highly vascularized granulation tissue and occasional fibroblasts in an abundant fibrillar matrix. Several intramural small arteries showed severe vessel wall necrosis. A voluminous necrotic area infiltrated by inflammatory mixed cells was found in the kidney. Bacteriological analysis revealed multiple nonpathogenic bacteria probably due to poor tissue preservation. PCR-DNA testing to identify *Erysipelothrix* spp. revealed a positive line of 288 bp. (Fig. 2). The se-

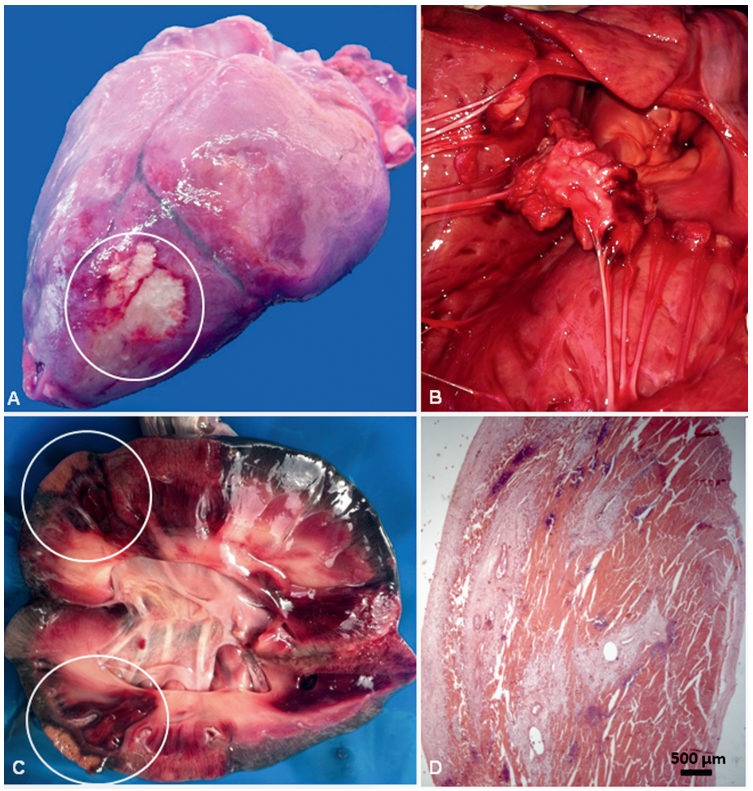

Figure 1: A. Voluminous grayish to white coalescing necrotic foci surrounded by hyperemia occupying the left ventricular wall. B. Mitral valve, severe acute endocarditis. C. Right kidney, voluminous necrotic area between the cortex and the medulla. D. Multiple areas of subacute to chronic myocardial infarction mainly composed of granulation tissue with occasional blood vessels, abundant fibroblasts, neutrophils and scattered necrotic foci. Hematoxylin and eosin. Bar: 500 µm.

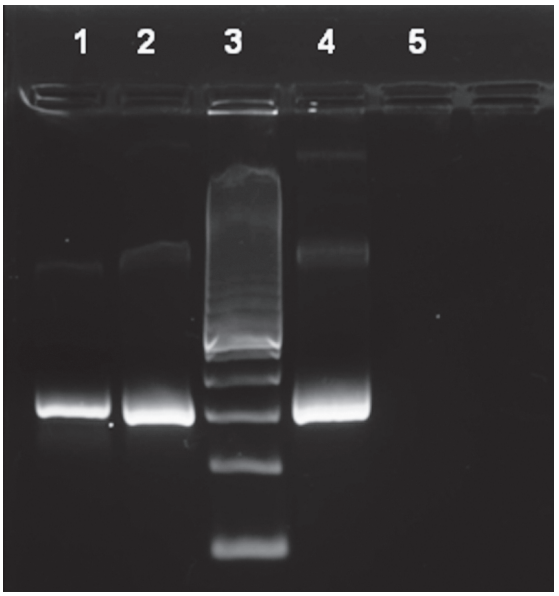

Figure 2: PCR analysis of mitral and aortic valve homogenates to detect *Erysipelothrix rhusiopathiae*. Lane 1–2: positive samples showing a specific line of 288 bp. Lane 3: MW ladder 100 bp. Lane 4: positive control. Lane 5: negative control.

quence analysis showed complete overlapping with the 23S rDNA of *E. rhusiopathiae* sequence.

Discussion

This report describes a case of cardiac and renal infarctions secondary to endocarditis caused by *E. rhusiopathiae* infection in a sheep. Vegetative endocarditis is an uncommon form of infection in this species, and spontaneous cardiac infarction is unusual in small ruminants. Endocarditis and infarctions secondary to thromboembolic phenomena due to fragmentation of valvular proliferations were detected during a routine necropsy. The most common manifestations of *E. rhusiopathiae* infection in sheep are polyarthritis and lameness (Ray, 1930; Marsh, 1931; Henderson et al., 1952; Giles, 1981; Ersdal et al, 2015). Other reported forms of infection are valvular endocarditis (Stamp and Watt, 1947; Chineme et al., 1973; Maclachlan, 1978), abortion (Schmitz and Sonn, 1984), pneumonia, septicemia (Nicolas et al., 1980; Griffiths et al., 1991; Rad et al., 1998; Ersdal et al., 2015), cutaneous infections (Whitten et al., 1948; Griffiths et al., 1991), and multiple spleen abscesses (Afnan and Tadjbackche, 1974). The most serious manifestation of the infection is septicemia to which endocarditis seems to be linked (Gorby and Peacock, 1988).

Unfortunately, the source of the organism could not be determined. Domestic swine are believed to be the most important animal *reservoir* of infection principally due to contact with infected animals, their products or waste. Control of reservoir populations is impossible because of the widespread distribution of the bacterium, the large variety of animal hosts, and its ability to persist in the environment. No pigs were present on the farm, and information about contact with feral pigs or wildlife species during grazing was not available. Infection is usually percutaneous in sheep, entry being gained through docking, castration wounds, shear wounds and abrasion acquired during dipping (Rad et al., 1998). No report of management interventions in this sheep were reported by the owner.

The occurrence of these unusual lesions underscores the need to improve diagnostic investigations using biomolecular laboratory assays to identify lesion etiology. Finally, this report corroborates previous findings that *E. rhusiopathiae* can cause infective endocarditis in sheep, though it is rarely the cause of death in this species.

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