

THE CLINICAL AND LESIONAL PRESENTATION OF *ERYSIPELOTHRIX RHUSIOPATHIAE* INFECTION IN SHEEP

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Abstract

Erysipelothrix rhusiopathiae is a bacterium that poses a significant health threat in sheep, manifesting through a range of clinical signs and lesions. Clinical presentations of infection include fever, joint swelling characterized by arthritis, and systemic signs such as erythema and necrosis of the skin. Affected sheep may exhibit difficulty in movement or lameness, indicating discomfort and severe illness. Lesion formation often involves pronounced inflammation of the skin, and in advanced cases, there may be indications of septicemia. Furthermore, complications such as fibrinous pericarditis and endocarditis can arise in severe instances of the infection. Understanding the clinical and lesional manifestation of *Erysipelothrix rhusiopathiae* is crucial for effective diagnosis and management in sheep populations.

Key words: *Erysipelothrix rhusiopathiae*, sheep, clinical signs, lesions, septicemia.

INTRODUCTION

A wide variety of vertebrates, including pigs, sheep, and humans, are commensal hosts for the Gram-positive rod-shaped bacteria *Erysipelothrix rhusiopathiae* (Shimoji, 2000; Wang et al., 2010). There are many sources of infection of this bacterium in nature, as it may survive for weeks/months, even in extreme environments. In healthy pigs, the bacteria may be found in lymphoid tissues, especially in the tonsils, in 30-50% of cases, making them the most significant reservoir of infection (Opriessnig, 2012). Bacteria may be passed from infected to uninfected animals by faeces, urine, saliva, and nasal secretions (Mavrot et al., 2020; Opriessnig et al., 2012). Carriers, such as wild birds or other animals, may spread illness and infection via the soil, water, food, and bedding that animals eat or make direct contact with.

The pathogenicity of *E. rhusiopathiae* is associated with cellular attachment, intracellular invasion, and survival; the bacteria are capable of reproducing in phagocytic cells (Shimoji, 2000; Wang et al., 2010). Polyarthritis, which usually manifests in lambs between two and six months of age, is the most prevalent clinical presentation in sheep. The onset of chronic alterations in the joints is a key point in the

clinical symptomatology of this illness, which is marked by significant morbidity and low mortality (Mavrot et al., 2020). Infections of the skin, heart, lungs, and blood (septicemia) are among the other symptoms (Griffiths et al., 1991; Mavrot et al., 2020; Rad et al., 1998). As a result, the condition may have a major effect on animal welfare and the economy because of its associations with wastefulness, stunted development, and slaughterhouse condemnation.

There are several potential entry points for infection in lambs, including the skin (e.g., after molesting, shearing, or tail docking), the mouth, or the umbilical cord (Mavrot et al., 2020). Joints involving subchondral bone are the only sites of infection in chronic ovine erysipelas, according to the available information (Thompson et al., 2007; Wang et al., 2010). Joint pathology is the primary emphasis of the few histologic descriptions available for sheep (Ersdal et al., 2015).

The purpose of this study is to comprehensively investigate the clinical presentation, gross and microscopic lesions, and therapeutic response associated with *Erysipelothrix rhusiopathiae* infection in sheep. By documenting the progression of clinical signs, characterizing the pathological changes in affected tissues, and evaluating the efficacy of treatment strategies.

MATERIALS AND METHODS

The studies were conducted from 2021 to 2023 at a non-professional sheep breeding farm located in Domnesti, Teghes village, Ilfov County.

Animals

The farm on which the studies were carried out is a mixed-breed sheep farm. The flock totals 164 head, consisting of 6 breeding rams, about 80 breeding ewes, the remainder up to 164 being lambs, and cull ewes. The animals are farmed in a semi-intensive system, mainly for cheese production and secondarily for meat production, and are kept on pasture. The pastures used for sheep farming are natural pastures.

In the cold season, when calving takes place, the animals are kept in stalls in order to protect them from adverse climatic conditions (cold wind, snow, frost). The bedding in the stalls is made of straw and plant waste from fodder, which together with the animal's excrements form a straw bedding that provides a soft and warm bedding for the animals' rest and well-being. Pigs for family consumption are also kept on the same holdings, but in different sheds.

Sampling

Samples for bacteriologic and PCR examination from living animals were blood and joint fluid obtained by puncture, and from slaughtered animals, from joints, lymphoid structures, and the spleen.

Bacteriology

Samples were inoculated onto blood agar (BA). All samples were incubated in oxygen at 37°C for approximately 24 hours prior to initial examination. Isolates assessed as being *E. rhusiopathiae* after the first isolation were replated on Columbia Agar and reevaluated after 24 hours of incubation at 37°C. Isolates from all cases were confirmed by Api Coryne. Antibigrams were also performed for the isolates obtained.

PCR

DNA was isolated from approximately 200 µL of EDTA-blood or tissue samples by using the Qiagen QIAamp Cador (IndiSpin) Pathogen Mini Kit.

The detection kit used was EryRhu dtc-qPCR, with the amplification regime: Activation - 2 min at 95°C, Denaturation - 40 cycles of 5 sec at 95°C, Hybridisation/Extension - 20 sec at 60°C.

RESULTS AND DISCUSSIONS

Clinical Features

The farmer indicated that all the animals suffering from lameness were lambs of primiparous ewes that had difficulties in bonding and feeding them.

Four lambs had previously been slaughtered at this farm because of recumbency, swollen joints, and poor condition; 14 other lambs from those farms exhibited symptoms of lameness.

Although adult sheep did not exhibit any symptoms of pneumonia or lameness, the afflicted lambs did walk stiffly and had swollen joints.

Lameness was observed in lambs and ewes before this outbreak of polyarthritis about 3-4 years ago, the time corresponding with the first year of pig rearing on the farm.

In the clinical examination, the following parameters were assessed:

Body Condition Score (BCS):

A 5-point scale was used to evaluate the nutritional and physical condition of the animal:

1 - Emaciated: The animal is extremely thin with visible bones, no palpable fat, and signs of muscle wasting; typically, indicative of severe malnutrition or chronic illness, and may be near death.

2 - Thin: Bones are still prominent, but some fat may be palpable. Muscle mass is reduced. The animal appears underweight and may be clinically compromised.

3 - Moderate: Ideal body condition. The animal has a good balance of fat and muscle; bones are not visible but can be felt with slight pressure.

4 - Overweight: Noticeable fat deposits over ribs and tail head; the waist is less defined. There may be a risk of developing health complications.

5 - Obese: Excessive fat coverage with no palpable ribs or bone landmarks; movement may be impaired and there is an increased risk of metabolic disorders.

Affected Joints: All joints showing signs of inflammation, pain, or structural change were

identified and recorded, noting whether involvement was unilateral or bilateral and whether multiple joints were affected.

Pain on Palpation of Joints: A subjective 5-point pain scale was employed to quantify the animal's response during physical manipulation of the joint:

1 - Minimal pain: Mild discomfort with palpation, no overt behavioural signs of distress.

2 - Mild pain: Slight withdrawal or flinch response; discomfort noted but not severe.

3 - Moderate pain: Definite reaction to palpation such as pulling away, vocalization, or visible discomfort.

4 - Severe pain: Strong withdrawal, guarding behavior, or significant distress on palpation.

5 - Extreme pain: Intense reaction with inability to palpate thoroughly due to aggression, vocalization, or complete avoidance; indicates very high sensitivity and joint pathology.

Macroscopic Characteristics of Synovial Fluid: Joint fluid obtained via arthrocentesis was examined visually to assess indicators of inflammation or infection, including:

Color: Clear, yellow, or turbid.

Viscosity: Normal (stringy, high viscosity) vs. reduced (watery or thin).

Volume: Increased volume may indicate effusion.

Clarity: Transparent, mildly cloudy, or opaque, suggesting varying degrees of cellular infiltration.

Level of Joint Swelling: The degree of swelling observed or palpated was graded on a 3-point scale:

Slight: Minimal enlargement of the joint capsule; may only be noticeable on close inspection or palpation.

Moderate: Clearly visible swelling with some restriction of joint movement or function.

Severe: Pronounced swelling with significant joint distortion and likely loss of normal range of motion.

The age of the affected lambs was between 1 week and 4 months (Table 1), the most severe clinical manifestations being present in the youngest lambs, these also having the highest pain score (PS: 3-4), the most frequently affected joint was the carpal joint, found in 50% of the lambs. Only one lamb showed swelling of the area associated with the atlanto-occipital joint (*Articulatio atlantooccipitalis*) and inability to turn/roll the head.

It is known that the joint fluid from *Erysipelothrix rhusiopathiae* infection may have different appearances depending on the duration of the investigation. In this batch of lambs, the most prevalent appearance was serofibrinous, present in 61% of the animals.

Table 1. Clinical findings

ID	Sex	Age	Body Score	Affected joints	Pain Score	Swelling Level	Appearance of joint fluid
1	♀	2-month-old	3	Left + right carpal	2	Slight	Serofibrinous
2	♀	2-month-old	2	Left + right stifle	2	Moderate	Serofibrinous
3	♂	3-week-old	1	Left + right carpal	4	Moderate	Cloudy, fibrinous
4	♂	3-month-old	2	Left + right stifle	2	Moderate	Serofibrinous
5	♂	4-month-old	4	Left + right carpal	1	Slight	Cloudy, fibrinous
6	♀	3-month-old	2	Left + right carpal	2	Moderate	Serofibrinous
7	♀	2-week-old	1	Left + right tarsocrural	3	Severe	Cloudy, fibrinous
8	♀	3-month-old	2	Left + right carpal	2	Moderate	Serofibrinous
9	♀	4-week-old	2	Left + right stifle	3	Moderate	Serofibrinous
10	♀	2-week-old	1	Left + right tarsocrural	3	Severe	Cloudy, fibrinous
11	♀	4-week-old	2	Left + right stifle	3	Severe	Cloudy, fibrinous
12	♂	2-month-old	2	Left + right carpal	2	Moderate	Serofibrinous
13	♀	3-month-old	4	Left + right carpal	1	Slight	Serofibrinous
14	♀	1-week-old	1	Atlanto-occipital joint	3	Severe	-

♂ – male; ♀ – female

In general, polyarthritis in lambs is caused by microorganisms with the ability to cause bacteraemia and septicaemia. *Erysipelothrix rhusiopathiae* has this capacity, and its evolution in this flock could be related to a

colostrum deficiency, the farmer mentioning in the case history that the lambs came from mothers who had difficulties in accepting and feeding the newborns.

Pathology

There was a large volume of fibrinous exudate present at joint level and numerous necrotic lesions of the synovial membranes in the joints of the lambs that were slaughtered. Generally, there was an increased amount of cloudy synovial fluid, the joint capsule wall was thickened, and the synovial membrane was marked by hyperaemic lesions with a villous proliferation. In the most severely affected joints, there were erosions/ulcerations in the synovial cartilage. All lambs displayed abnormalities in carpal and tarsal joints; the majority were afflicted bilaterally. Just like the other lambs, the youngest one exhibited the same type of alterations in the atlanto-occipital joint and an accumulation of fibrinous liquid in the pericardium.

Therapy

After performing an antibiogram of the collected materials, sensitivity to the following antibiotics was established: penicillin, ampicillin, amoxicillin-clavulanic acid, ceftiofur, cefovecin, cefquinome, enrofloxacin, marbofloxacin, florfenicol and resistance to: doxycycline, tetracycline, erythromycin, clindamycin, sulfamethoxazole - trimethoprim, and vancomycin.

Because of the relatively small and varied weight between 10 and 30 kg, it was opted to administer ampicillin at a dose of 8 mg/kg for 5 days and, as an anti-inflammatory and analgesic, meloxicam at a dose of 1 mg/kg, for 3 days.

Although some of the lambs were left with a slight difficulty in walking following the treatment, it did not significantly influence their weight gain.

It was recommended either to remove the pigs from the farm, to vaccinate the flock against *Erysipelothrix rhusiopathiae* infection, or to implement working measures to prevent the transmission of the bacterium from pigs to sheep.

CONCLUSIONS

Erysipelothrix rhusiopathiae is a Gram-positive bacterium that affects a variety of vertebrates, including pigs, sheep, and humans. It is particularly found in the tonsils of pigs and is the main reservoir for the bacteria.

Sheep, especially lambs, are highly susceptible to infections caused by this bacterium, leading to conditions such as polyarthritis, septicaemia, and joint infections. These infections often manifest in young lambs and lead to symptoms like swollen joints, lameness, and severe pain.

The infected lambs showed clinical signs such as stiffness, swollen joints (especially the carpal joint), and pain. The joint fluid was mostly serofibrinous in appearance, indicating inflammation, and many lambs had cloudy, fibrinous fluid, indicative of bacterial infection and immune response.

Lesion analysis revealed fibrinous exudate, necrotic lesions in the synovial membranes, thickened joint capsules and, in severe cases, erosions in the synovial cartilage. These findings indicate significant joint damage due to the bacterial infection.

The condition, marked by significant morbidity, can affect animal welfare by causing pain and lameness, leading to difficulty in feeding. It can also have an economic impact due to weight loss, reduced growth, and condemnation at slaughter due to the infection. This highlights the importance of addressing both the clinical and environmental factors that contribute to the spread of infections like *E. rhusiopathiae*.

In conclusion, the outbreak of *Erysipelothrix rhusiopathiae* in lambs appears to be linked to the introduction of pigs to the farm, emphasising the importance of controlling the interaction between different animal species and implementing preventive measures such as vaccination and biosecurity protocols.

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