**MAXILLARY ACTINOMYCOSIS IN A CROSS-BRED COW: DIAGNOSIS AND TREATMENT WITH LIMITED RESOURCES**

**Abstract**

Bovine actinomycosis or lumpy jaw in cattle is caused by *Actinomyces bovis* which produces a chronic rarefying osteomyelitis of facial masticatory bones. A 3.5-year-old cross-bred cow with a history of gradually increasing swelling on the left maxillary region was presented for treatment at VCC, VCRI, Theni. Clinical examination revealed a hard, painless, immovable mass with no discharge. Hence, for diagnosis, fine needle aspiration biopsy (FNAB) was taken and the smear was stained with Gram staining. This revealed filamentous Gram-positive bacteria with surrounding Gram-negative club-shaped structures characteristic of actinomycosis. After confirming actinomycosis, the animal was treated with antibiotics, non-steroidal anti-inflammatory drugs and iodides. Along with this TissueAid bolus was advised for oral administration along with topical application with glycerine and magnesium sulphate. Symptomatic recovery was observed in the animal on subsequent visits.

**Introduction**

Actinomycosis is a less commonly reported bacterial infection, that affects the bones of the skull, especially the mandible and maxilla. Bovine actinomycosis, also called Lumpy Jaw, is primarily caused by a gram-positive, microaerophilic to anaerobic, filamentous bacterium called *Actinomyces bovis* (Willey *et al*., 2017). They are normal inhabitants of the oronasal, upper respiratory and digestive tracts (Roa *et al*., 2012). Animals are predisposed to actinomycosis either through the mucosal damage by sharp objects ingested along with feed, through oral ulcers induced by viral infections or due to dental problems. Following the entry and colonization of the bacteria, localized inflammation and tissue necrosis occur. This creates a conducive environment for bacterial proliferation and persistence, leading to chronic, granulomatous osteomyelitis. The lesion may also extend deep into the bony tissues and the adjacent soft tissue. Bovine actinomycosis is characterized by hard painful swelling, with fistulous tract discharging pus that resembles sulphur granules. The bacterium is also known to produce chronic nodular suppurative lesions in soft tissue at various anatomical sites (Gensa, 2018).

A tentative diagnosis of the disease is made based on the physical examination and clinical signs (Radostits *et al*., 2007). The preferred direct identification technique is gram staining of the pus or the biopsy samples, bacterial isolation can be attempted using anaerobic culture media, but it is challenging. Imaging techniques such as radiography and ultrasonography are useful in determining the extent of the lesion and its progression. However, bacterial isolation and imaging may not always be possible in resource-limited settings. We report a case of maxillary actinomycosis in a cross-breed cow, which was diagnosed based on clinical signs and gram staining in a basic veterinary facility.

**Case presentation and diagnosis**

A 3.5-year-old crossbred cow was presented to the Veterinary Clinical Complex, Veterinary College and Research Institute, Theni with a history of swelling in the left maxillary region for the past 6 months without any discharge. The vital parameters such as rectal temperature was 104.1⁰F and heart rate was 68 beats/ min. Clinical examination revealed a left distorted jaw carrying an asymmetrical hard mass. The mass felt firm, immovable and painful on palpation. The mass was irregularly polygonal, measuring 111.6 mm in length medially and 57.47 mm laterally. Its width ranged from 124.37 mm at the widest point to 116.05 mm at the narrowest region (Fig. 1). The animal remained alert with excessive lacrimation, salivation and enlarged left submandibular lymph node. Oral examination revealed the absence of any foreign body or feed impaction. The sample was collected using a fine needle by aspiration and sent for cell cytology and microbiological investigation.

**Results**

Cytology revealed the presence of mature neutrophils, mesenchymal and osteocytes. Gram staining of the smear from fine needle aspiration (FNAB) revealed the presence of Gram-positive, purple-coloured, long filaments and short V, Y and T-shaped structures (Fig. 2). They were surrounded by club-shaped structures which stained Gram-negative. This is characteristic of *Actinomyces* or ray fungus.

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| Fig. 1: 3.5-year-old cross bred cow showing hard mass in the left maxillary region. | Fig. 2: Gram staining of smear obtained through FNAB revealing long filaments and short V, Y and T shaped gram-positive bacteria with surrounding Gram-negative club shaped structures. |

**Treatment**

The cow was administered with Inj. Benzathine penicillin @ 15 mg/kg body weight, Inj. Flunixin @ 2 mg/kg, Inj. Chlorpheniramine maleate @ 10 mg/kg intramuscularly for 5 days. Further orally, bolus Tissue Aid and bolus containing Meloxicam (100 mg) + Paracetamol (1800 mg) + Serratopeptidase (50 mg) @ 1 bolus/ day for 3 days were given. Along with this Potassium Iodide @10 gm daily for 10 days was given. Glycerine and Magnesium sulphate was advised for topical application.

**Discussion**

Lumpy jaw is a chronic rarefying osteomyelitis of the jaw bone in cattle caused by endogenous infection of commensal bacteria *Actinomyces bovis*. Actinomyces belongs to the family *Actinomycetaceae* under the order *Actinomycetales* which also includes *Corynebacteriaceae*, *Mycobacteriaceae*, and *Nocardiaceae* families. Most of the bacteria in this order have mycolic acid in their cell walls but the level varies making them to be acid-fast or non-acid-fast organisms. *Actinomyces* are non-acid-fast bacteria with less mycolic acid in their cell wall. They are Gram-positive, non-motile, non-spore-forming but filamentous bacteria that remain as a transitional form between bacteria and fungi.

*Actinomyces bovis* in cattle, *Actinomyces israelii* in humans rarely in pigs& cattle and *A. viscosus* in dogsare the most prevalent species (Könönen and Wade, 2015; Mohamed *et al*., 2011). Actinomycosis is sporadic in occurrence but common in cattle and has been reported worldwide, infrequently reported in pigs, dogs, horses, goats and humans. Common areas of infection in cattle are cheek muscles, mandible and maxillary bones. Whereas in pigs, the udder and in horses, wither and poll are commonly affected (Constable *et al.*, 2017)**.**

Actinomycosis of jaw bones may induce pain, further interfering with prehension, mastication, proper digestion and respiration. Eventually leading to dyspnoea, partial starvation, progressive loss of condition, weight loss with intermittent diarrhea, bloat etc. contributing to significant economic loss. The condition has to be differentiated from abscesses of the cheek muscles and throat region, actinobacillosis, neoplasm of bones, tooth infection, fractures of jaw bones and bone sinusitis (Radostits *et al*., 2007). In case of abscess or actinobacillosis, the mass is movable and generally localized in soft tissue. The consistency of the pus varies depending on the duration of infection. Whereas in the case of actinomycosis, the mass is immovable and the pus discharged is yellow resembling sulphur granules.

*Actinomyces* establish a chronic, suppurative, granulomatous infection. Unlike the classical pathogens, *Actinomyces* do not produce any exotoxins but they are capable of evading the host immune response by producing biofilms, cell-associated /extracellular polymers such as dextran, levan, *N*-acetylglucosamine-rich slime polysaccharides enabling them to attach to own or foreign surfaces (Gajdács and Urbán, 2020). Additionally, they possess certain types of fimbriae for adhesion and for co-aggregation with other bacteria in soft tissue lesions.

The most preferred samples for diagnosis of Actinomycosis are smears from aspiration biopsy and crushed pus. Fine needle aspiration biopsy (FNAB) is more safer, quicker, convenient, inexpensive and less invasive technique that can be performed with minimal facilities (Wong *et al*., 2011). Biopsy samples are generally more effective for diagnosing actinomycosis since the lesion is sterile in approximately 50% of cases, rendering swab samples less reliable. Diagnosis is based on clinical examination, Gram staining of the biopsy, microbial culture, cytology and imaging techniques. Among them, Gram staining is considered the gold standard test and a more sensitive test with most of clinical forms (Valour *et al*., 2014). The bacteria appear as Gram-positive tangled filaments surrounded by Gram-negative club-shaped structures which protect them from phagocytosis, thereby establishing a chronic infection (Wong *et al*., 2011).

Mandibular actinomycosis in bovines has been reported from various parts of India in recent years (Rajesh kumar and Archanakumari, 2017; Dhillon *et al*., 2020; Ganapathi *et al*., 2022). Renu Singh *et al*., (2017) reported a nasal form of actinomycosis. In most of the cases, diagnosis is based on clinical examination and staining characteristics.

Penicillin, Streptomycin, Oxytetracycline, Bacitracin, Cloxacin, Dicrystin-DS, and Isoniazid are effectively used for the treatment of actinomycosis in bovines (Ganapathi *et al*., 2022). In this case study Inj. Benzathine Penicillin along with Inj. Flunixin and Inj. Chlorpheniramine maleate were given intramuscularly for 5 days. Tissue Aid and Potassium iodide were also advised orally. Tissue Aid is a proprietary ayurvedic product that is known to reduce inflammation. Potassium iodide is considered as the treatment of choice for actinomycosis which is given until the animal develops iodism maximum for 10 days (Radostits *et al*., 2007). Glycerine and Magnesium sulphate was advised for topical application to reduce the swelling. Bovine actinomycosis was treated successfully by parenteral administration of Penicillin and Streptomycin along with oral administration of potassium iodide as reported by ( Pal *et al*., 2008 and Patel *et al*., 2016). Whereas Constable *et al.*, 2017 and few others reported slow intravenous administration of 10% solution of sodium iodide @ 70mg/ Kg was also effective. Surgical debridement and Cryo- therapy using liquid nitrogen and be effective in advanced and poor responders.

Prompt treatment intervention is crucial for managing actinomycosis before the lesion progresses and becomes fibrosed. Early diagnosis and treatment are important, as the onset of the disease may not be readily apparent. The disease can be prevented by avoiding factors that can lead to oral lacerations, such as sharp objects or dental issues, as these predispose animals to the condition. Additionally, animals discharging pus discharge should be isolated, as this may lead to environmental contamination, even though the disease is generally considered non-contagious and is primarily associated with predisposing oral lacerations. Proper preventive measures and proactive management are key to addressing this challenging condition effectively. Examination of the animal on subsequent visits revealed the animal responded symptomatically well to the treatment.

**Conclusion**

Bovine actinomycosis or lumpy jaw occurs as a chronic, endogenous, suppurative infection affecting bones of mastication in cattle. It is an economically important disease, especially in dairy cattle because it interferes with prehension and mastication leading to reduced feed intake and production. The condition is effectively diagnosed based on the staining of pus or smears from samples obtained through FNAB. Fine needle aspiration biopsy is a more sensitive and cost-effective technique for diagnosing bovine actinomycosis. The disease is treated using a combination of antibiotics and iodides. Early diagnosis and treatment are crucial in actinomycosis management. The disease can be prevented by avoiding factors that can lead to oral lacerations.

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