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Silent invader: a case of *Actinomyces*-induced mandibular osteomyelitis

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Abstract

Background: *Actinomyces*-associated osteomyelitis predominantly affects the long bones and is rarely reported in the maxillofacial region. Moreover, its clinical presentation can be atypical, presenting diagnostic challenges and increasing the risk of delayed or inappropriate treatment. ***Case presentation:*** We present a case report of a 42-year-old male who developed acute mandibular osteomyelitis secondary to *Actinomyces* infection. The patient did not exhibit the typical clinical signs and symptoms of acute osteomyelitis. Instead, his initial presentation to his general medical practitioner closely resembled a routine odontogenic infection, leading to an initial misdiagnosis and delayed management. ***Conclusion:*** This case highlights the diagnostic challenge associated with identifying osteomyelitis caused by *Actinomyces* in the absence of classic signs and symptoms of an *Actinomyces* infection.

Introduction

Osteomyelitis is a rare acute or chronic inflammatory process of bone secondary to an infectious process. It primarily results from infections caused by bacteria, fungi, or mycobacteria. Osteomyelitis is thought to occur following trauma or ischaemia (Momodu & Savaliya, 2023). It mainly affects the long bones but has been shown to occasionally infect the jawbones. Facial osteomyelitis is a process whereby inflammation occurs in the facial bones, and it is more often found in the mandible due to its poor blood supply (David Bienvenue *et al*., 2021; Prasad *et al*., 2014). Patients with osteomyelitis typically present with facial swelling, pain, trismus, and occasionally fever and lymphadenopathy (Galal Omami & Wiggins, 2023). Plain radiographs are usually the first diagnostic modality to consider; however, radiographic changes can take up to two weeks to manifest (Hatzenbuehler & Pulling, 2011). Osteomyelitis can be classified as acute (<2 weeks), subacute (between 2 weeks and 3 months), and chronic (>3 months). It can spread through the bloodstream from nearby soft tissues or joints, via direct inoculation into the bone from trauma or surgery, or in cases of osteomyelitis in the lower limb, particularly from diabetic foot infections associated with vascular insufficiency (Gupta *et al*., 2020; Kremers *et al*., 2015). Bone biopsy and pus cultures are essential to obtain a definitive diagnosis (Momodu & Savaliya, 2023).

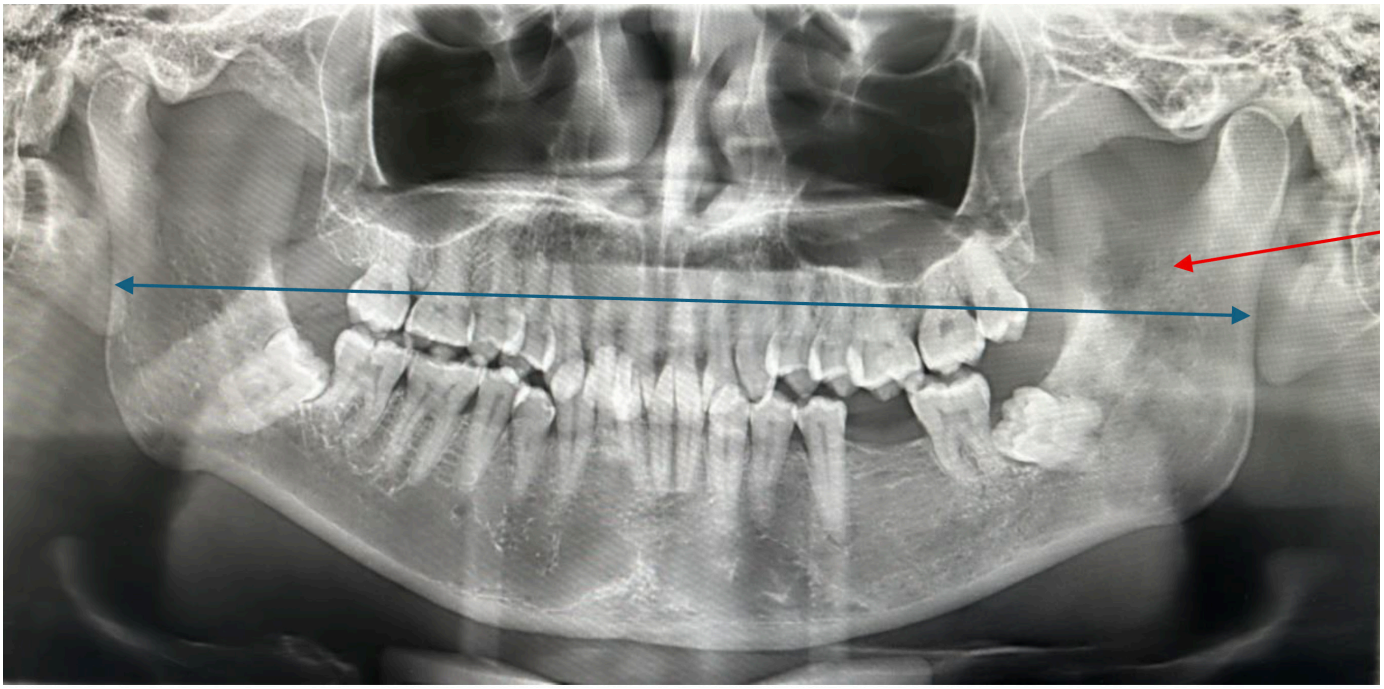

Figure 1. The Orthopantomograph taken at the initial consultation with the OMS team shows an ill-defined radiolucency inferior to the left sigmoid notch and the base of the coronoid process (red arrow). The blue double-headed arrow represents the level of the axial CT slice, shown in Figure 2.

We report a case of acute mandibular osteomyelitis of *Actinomyces* origin that was successfully treated with surgical debridement and long-term oral antibiotics.

Case description/presentation

In August 2024, a 42-year-old male was referred by his General Medical Practitioner (GP) to the University of Otago Maxillofacial Surgery team (OMS) for management of unilateral left-sided facial swelling with trismus. Two weeks prior to his presentation to the University, he had experienced self-limiting swelling in his left lower jaw and had presented to his GP. The GP suspected temporomandibular joint pain and recommended that he take over-the-counter analgesics to manage his pain. Over the following week, he developed increasing difficulty in opening his mouth, and the pre-existing swelling extended to involve the left cheek and the left temporal region. The patient returned to his GP and was started on a course of oral amoxicillin and clavulanic acid. The condition failed to improve and resulted in an onward referral to the OMS service.

On his initial presentation to the Maxillofacial Department, the patient was febrile and tachycardic, but his pain had not notably worsened over the past week. The patient also reported a past medical history of latent Tuberculosis (TB). Physical examination showed a firm, tender, extraoral swelling over the left ramus of the mandible extending to the left temporal region. He denied any altered sensations in his face and jaws. Trismus was noted, with mouth opening limited to about 10mm. Intraoral examination revealed no soft tissue swelling or purulent discharge and the left parotid duct was patent, and the saliva appeared colourless. Laboratory investigations revealed neutrophilia and slightly deranged liver enzyme profiles, but his renal function was within normal limits. Differential diagnosis at this stage included an odontogenic infection or soft/hard tissue infection of an undetermined location, but also the possibility of parotitis and osteomyelitis of the mandible, possibly secondary to TB. Also, it was difficult to completely exclude potential neoplastic disease in the parotid region.

An orthopantomogram taken to investigate for an odontogenic cause revealed radiopacities about the patient's left angle and region just inferior to the sigmoid notch (Figure 1). The patient's mandibular condyles appeared normal and enlocated while the maxillary sinuses appeared clear and free of obvious pathology. In the left posterior mandible, the second molar was fully erupted, and the third molar was mesio-angularly impacted along with an ill-defined rarefaction noted in the left ascending ramus, distant to the impacted third molar. A more detailed assessment using a CT scan revealed a distinct area of radiolucency inferior to the base of the coronoid extending posteriorly below the sigmoid notch. This was associated with multiple perforations in the overlying buccal cortex, and the radiolucency appeared to extend into the periapical region of the impacted left mandibular third molar (Figures 2 and 3).

The patient underwent a surgical exploration of his left ramus of mandible under a general anaesthetic during which the lower left third molar (#38) was surgically removed, and the lesion associated with its root was aggressively curetted to obtain tissue for both microbiology and for histological examination (Figure 4). Informed consent was obtained for this procedure. Postoperatively, the patient was managed in the hospital and received IV amoxicillin clavulanic acid and appropriate analgesia. The specimen sent for microbiology demonstrated the presence of *Actinomyces* organisms alongside a growth of *Neisseria* species. The organisms were reportedly sensitive to the penicillin group of antibiotics. The patient's white cell counts, which were elevated to begin with, resolved to normal levels by postoperative day 1.

Histopathology revealed a soft tissue abscess, with features consistent with osteomyelitis, and some reactive new bone formation, along with the presence of *Actinomyces* 'sulphur granules' (Figure 5). No foreign bodies or granulomas were seen. Based on the finding of *Actinomyces* in the left

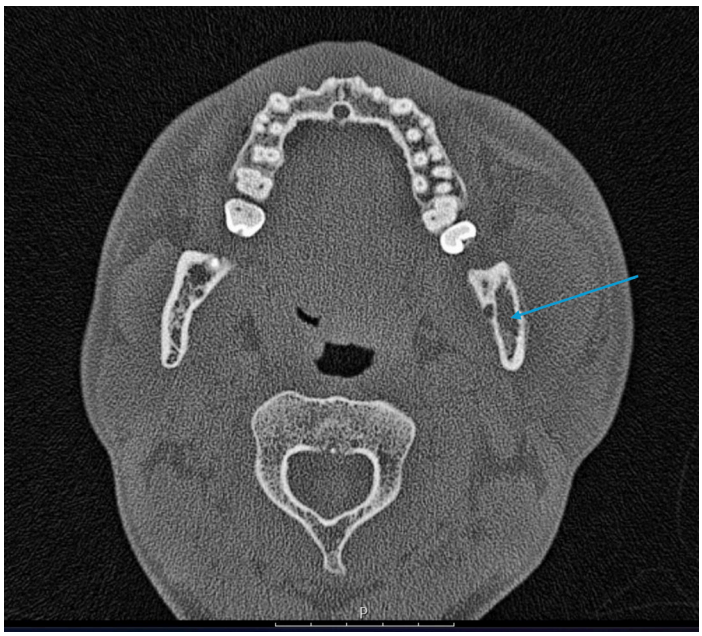

Figure 2. CT Head (axial) at level of mandibular foramen showing loss of trabeculation in the left ascending ramus.

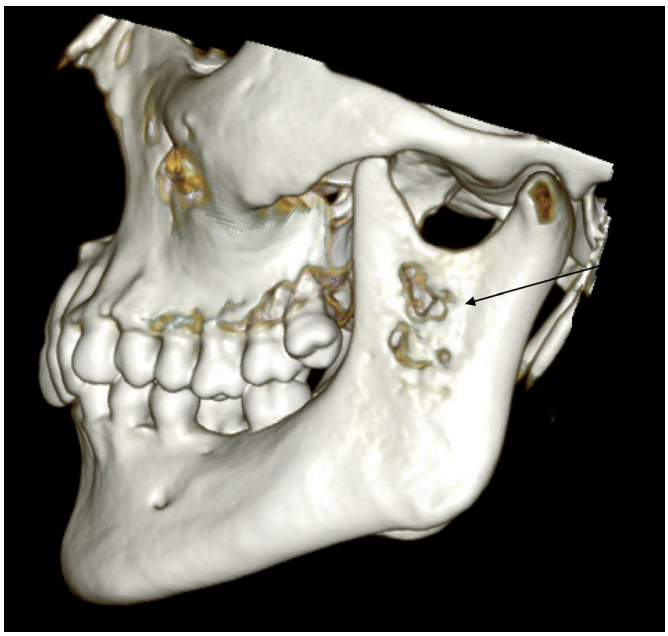

Figure 3. 3D Reconstruction of the left mandibular ramus demonstrating buccal cortical breach (see arrow).

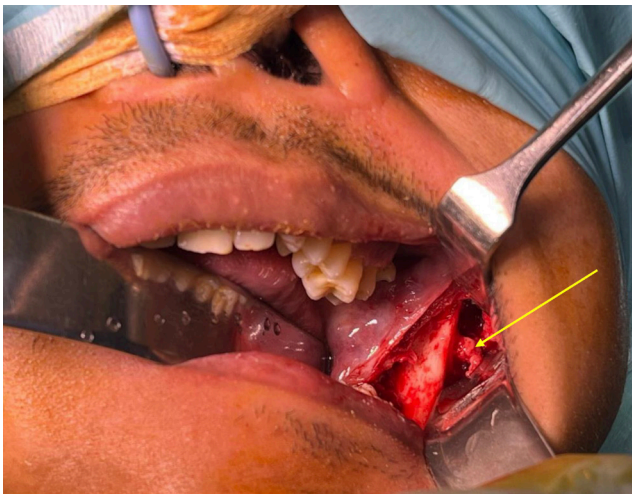

Figure 4. Intraoperative view of the left mandibular ramus showing soft tissue granulation extending through buccal cortex.

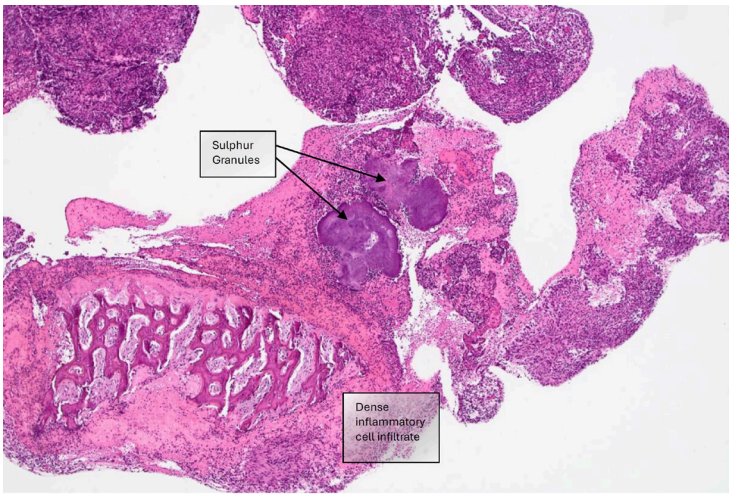

Figure 5. Photomicrograph of mandibular biopsy specimen showing characteristic sulphur granules of *Actinomycosis* infection.

mandible, the patient was discharged home on a 6-month course of oral amoxicillin and clavulanic acid, as advised by the hospital's Infectious Disease Team. He was instructed to have his liver function status monitored with the help of his GP. At his 4-week postoperative review, the patient reported complete resolution of his pain, had no extraoral or intraoral swelling and his mouth opening had improved to 25mm. The patient's symptoms fully resolved by the next outpatient clinic review in February 2025, and he regained the full range of jaw movements.

Discussion

Osteomyelitis occurs most commonly in males (3:1) between the ages of 20 and 60 years, with a peak incidence between 40 and 50 years. It is most prevalent in areas of lower socioeconomic status and has not been observed to favour any racial group (Sharma *et al*., 2021). *Staphylococcus aureus* accounts for 44% of cases of osteomyelitis. There is an estimated global incidence of 21.8 cases per 100,000 person-years. Despite improvements in hygiene and healthcare, challenges remain, particularly in developing countries. Associated conditions include dialysis, malnutrition, diabetes, IV drug use or immunosuppression (Gupta *et al*, 2021; Jha & Chaudhary, 2022).

While osteomyelitis of the long bones is commonly caused by *Staphylococcus aureus,* osteomyelitis of the jaw can also occur from infections with anaerobic or aerobic bacteria such as *Streptococci, Peptostreptococci, Fusobacterium, Prevotella, and Actinomyces.* Acute osteomyelitis refers to an infection that occurs prior to the development of sequelae, typically within two weeks of disease onset. Most patients with acute osteomyelitis typically present within days to weeks following the initial infection, without evidence of bone necrosis (Bury *et al*., 2021). It is considered chronic once there is development of necrotic bone resulting in the formation of sequestra. Thus, the histopathological findings, rather than duration of infection, dictate the categorisation of osteomyelitis as acute or chronic (Panteli & Giannoudis, 2016).

Osteomyelitis can be further classified by its mechanism of infection as hematogenous or non-haematogenous. With hematogenous osteomyelitis, bacteria are seeded into bone secondary to a bloodstream infection. This condition is occurs commonly in children, older adults, and immunocompromised populations. The well-perfused metaphyses in long bones make it a common site for haematogenous infections (Bury *et al*, 2021). Non-haematogenous osteomyelitis occurs from direct inoculation in the setting of surgery or trauma or with spread from contiguous soft tissue and joint infections.

Osteomyelitis caused by *Actinomyces* more commonly affects the long bones rather than the mandible. Despite our patient having acute osteomyelitis due to *Actinomyces*, there was no evidence of purulence intraorally, which is atypical compared with the usual clinical presentation of acute osteomyelitis. Instead, this patient's initial clinical presenting symptoms were more consistent with an infection of dental origin. Multiple discharging sinuses, which are often associated with *Actinomyces* infections, were absent in this patient.

Plain film radiography offers low sensitivity in early stages of disease, but could be performed as initial imaging (Bury *et al*, 2021). A bone biopsy is crucial to obtain a histopathological confirmation for osteomyelitis alongside an aerobic and anaerobic pus culture to identify the causative agent which would help to direct antimicrobial therapy (Momodu & Savaliya, 2023). Swabs from infected sites are discouraged due to the possibility of false-negative cultures. Differential diagnoses for osteomyelitis can include nocardiosis, tuberculosis, or malignancy, given similar imaging results but varying in the site of infection (Sharma *et al*., 2021).

Management of osteomyelitis is typically a combination of surgical and medical interventions. The surgical debridement of infected and necrotic bone to allow for more optimal penetration of antibiotics may require hospitalisation for intravenous administration (Momodu & Savaliya, 2023). Culture and antimicrobial sensitivity testing are essential for targeted treatment (Dym & Zeidn, 2017). A Full Blood Count (FBC) of a patient with osteomyelitis may show leukocytosis with elevated neutrophils, as was the case in our patient. There may also be an elevation of non-specific inflammatory markers, such as C-reactive protein

(CRP) and Erythrocyte Sedimentation Rate (ESR) (Sharma *et al*., 2021).

Osteomyelitis when caused by *Actinomyces*, is often diagnosed late. Osteomyelitis of the jaw is more common in the mandible than the maxilla, probably due to the mandible's poorer vascularisation and also its structural resemblance to a long bone. This condition may arise from untreated or longstanding dental infections. *Actinomyces* are gram-positive, facultative anaerobic bacteria that commonly colonise the human oral cavity, urogenital tract, and gastrointestinal tract. A distinctive histological finding in *Actinomyces* infection is the presence of 'sulphur granules' (Bush & Vazquez-Pertejo, 2023). *Actinomyces*, being a commensal organism, is very difficult to distinguish between normal flora colonisation and an active infection (Sharma *et al*., 2021). Traumatic inoculation is the most likely cause for *Actinomyces* infection of deep tissues. *Actinomyces israelii* is the most frequently identified species in cervicofacial actinomycosis due to its abundance in the oral cavity and its ability to invade deeper tissues following trauma or surgery (Sezer *et al*., 2017). The spread of *Actinomyces* into deeper jaw tissues can lead to the development of osteomyelitis, which presents with pain, fever, malaise, and localised swelling. Approximately 75% of facial osteomyelitis cases present with pain, while 54% exhibit facial swelling (Dobaria EG; Cohen HL, 2023; Gupta *et al*, 2020). Cervicofacial actinomycosis, a chronic infection caused by bacteria of the *Actinomyces* species, may also result from mandibular osteomyelitis. Diagnosis often requires a tissue biopsy and culture, as actinomycosis can be mistaken for other conditions. Treatment typically involves both surgical debridement to remove infected tissue and long-term antibiotics for complete eradication of the infection.

While acute osteomyelitis has a favourable prognosis with early intervention, chronic osteomyelitis has a recurrence rate of approximately 30% within 12 months. Therefore, early detection and treatment, including the use of antimicrobial therapy, are necessary to minimise complications. Recurrence rates are high if a patient becomes immunocompromised or experiences further trauma, especially in the same region. Aggressive treatment, regular follow-up and good patient compliance are crucial for successful management and early detection of recurrence (Lima *et al*, 2014).

Conclusion

Mandibular actinomycosis is an uncommon but clinically challenging condition. Clinical vigilance, leading to an appropriate diagnosis, comprehensive treatment, coupled with patient education and good compliance with therapy, were the cornerstones of this patient's successful treatment outcome.

Author contributions

Both authors contributed to conception or design of the work, patient care, drafting and critical revision of the article, and final approval of the version to be published.

Conflict of interest statement

The authors declare no conflict of interest.

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