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Review Article

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Actinomycosis in head and neck region of pediatric patients: a review

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ABSTRACT

The majority of cases of actinomycosis are of odontogenic origin and related to the perimandibular region with other sites of primary actinomycosis in the head and neck region include the tongue, paranasal sinuses, middle ear, larynx, lacrimal passage, and thyroid gland. Actinomycosis is an uncommon infection caused by Actinomyces species, facultative anaerobic bacteria that are part of the normal flora in the oropharynx, gastrointestinal tract, and female genital tract. The risk factors for actinomycosis in the pediatric age group are dental caries, trauma, debilitation, and poorly controlled diabetes mellitus. The pathogenesis of the actinomycosis in the head and neck region is often unclear. The hallmark of actinomycosis is the spread of infection which fails to respect the tissue or fascial planes. The organism causing actinomycosis is often difficult to isolate from culture and the differential diagnosis is extensive which prompts clinicians to name the actinomycosis the masquerader of the head and neck area. This clinical entity in pediatric patients may mimic malignancy or granulomatous disease in the head and neck region. Clinicians must be aware of typical presentations of actinomycosis in the head and neck region. Bacterial cultures and histopathological study are the cornerstones of the diagnosis of actinomycosis, however, particular conditions are needed to find the exact diagnosis. The treatment of actinomycosis includes a combination of surgery and antibiotic therapy. Surgery is an important adjunctive to medical therapy in patients with extensive lesions of actinomycosis. Actinomyces species are uniformly susceptible to penicillin. This review article discusses the etiopathology, epidemiology, clinical manifestations, diagnosis, and current treatment of the actinomycosis in the head and neck region of pediatric patients.

Keywords: Actinomycosis, Head and neck region, Pediatric patients, Sulfur granules

INTRODUCTION

Actinomycosis is an extremely rare infection of soft tissue caused by gram-positive, anaerobic bacteria and uncommon in the pediatric age group. It is characterized by purulent granulomatous infection associated with the sinus tract, passing from the anatomical barrier, relapse after antibiotic treatment, chronicity, and mass-like lesion. 2,3

Actinomyces are normal flora in the oral cavity, gastrointestinal tract, and female genitourinary tract.⁴ Actinomycosis can be found in patients with poor dental

hygiene, oral surgery, dental surgery, and manipulation.⁴ The damage to oral mucosa by radiation, previous abdominal surgery and infection to lungs due to aspiration are also an important cause for actinomycosis.⁵ Actinomycosis often affects middle-aged persons.⁶ Pediatric patients are rarely affected by actinomycosis and constitute less than 3% of all actinomycosis.⁷

The diagnosis of pediatric head and neck or cervicofacial actinomycosis is usually delayed because of its low prevalence and lack of awareness of clinicians. The clinicians especially pediatric otorhinolaryngologists, pediatricians, and dentists must be aware of its potential

prevalence as well as therapeutic management of the actinomycosis in the pediatric age group, particularly in the head and neck region. Because of its rarity, there is a high chance of missing its diagnosis and appropriate treatment resulting in substantial morbidity and mortality. Inappropriate or delayed treatment of pediatric patients is at risk of developing life-threatening complications.⁸

The aim of the study was to discuss the etiopathogenesis, epidemiology, clinical manifestations, diagnosis, and treatment of actinomycosis in the head and neck region of pediatric patients.

Methods of literature search

Multiple systematic methods were used to find current research publications on actinomycosis in the head and neck region of pediatric patients. We started by searching the Scopus, Pubmed, Medline, and Google Scholar databases online. A search strategy using PRISMA (Preferred reporting items for systematic reviews and meta-analysis) guidelines was developed. This search strategy recognized the abstracts of published articles, while other research articles were discovered manually from the citations.

Randomized controlled studies, observational studies, comparative studies, case series, and case reports were evaluated for eligibility. There were total numbers of articles 74 (32 case reports; 34 cases series; 8 original articles). This paper focuses only on actinomycosis in the head and neck region of pediatric patients. This paper examines the epidemiology, etiopathogenesis, clinical manifestations, diagnosis, and treatment of actinomycosis in the head and neck region.

This analysis provides a foundation for future prospective trials of pediatric actinomycosis in the head and neck region. It will also serve as a catalyst for additional study into actinomycosis and its manifestations in the head and neck region of pediatric patients along with early diagnosis and treatment.

History

Although actinomycosis was first documented in 1826, the details of microbiology and pathogenesis of this disease have been much newer. Actinomycosis was first detected in cattle.

Lebance had found actinomycotic lesions in cattle and them as erroneously as osteosarcoma. ¹⁰ First case of actinomycosis in human beings was described by Langenbeck in 1845 but this case was not published until 40 years later. ¹¹ This disease was recognized in 1854 by Graefe and first published in 1857 and was the work of Lebert. ¹⁰

Actinomycosis is an uncommon disease that was described the first time in man by Israel in 1878 and Beck described the clinical manifestations of actinomycosis patients in 1906. 12,13 Head and neck actinomycosis in the pediatric age group is a rare clinical entity and is caused by an inhabitant of normal oral flora. In clinical practice, actinomycosis is often misdiagnosed as neoplasm or granulomatous disease.

Epidemiology

Actinomycosis is an uncommon disease that has been reported around the world. Before the development of antibiotics, this clinical entity was more common than it is now and the severe cases resulting in mortality could be found. The lower incidence of actinomycosis is related to the widespread use of antibiotics, as Actinomyces is sensitive to several antibiotics.

Better oral hygiene and water fluoridation and preventive dentistry contribute to the diminished frequency of actinomycosis. ¹⁴ The peak incidence of actinomycosis is reported in the fourth to fifth decades of life. ¹⁵ Patients of the male gender are more commonly affected than women with a ratio of 3:1. ¹⁶ Cervicofacial actinomycosis is the commonest type of actinomycosis and the lumpy jaw syndrome which is originated from odontogenic infection is the commonest clinical presentation which represent approximately 60% of all the documented cases. ¹⁷

Actinomycosis is also responsible for maxillary osteomyelitis in patients with odontogenic maxillary sinusitis. Throat is affected by actinomycosis in approximately 15 to 20% of cases. Less than 10% of cases of actinomycosis are diagnosed before surgery. Actinomycosis involves the head and neck part of the body in approximately 50% of cases, the chest/lungs in approximately 30% of the cases, and the abdomen in 20%, although this infection can become disseminated. Actinomycosis can affect any age group from childhood to age 90 years, but the majority of patients are between the age of 30 to 60 years. There is no racial predilection and male to female ratio of involvement is 3 or 4 to 1. 22

Etiopathogenesis

Actinomyces are usually commensals in the human oropharynx and are particularly found in gingival cervices, palatine tonsillar crypts, periodontal pockets, and dental plaques, as well as carious teeth.²³ Actinomycosis is often considered an endogenous infection triggered by a breach in the mucosal lining.¹⁷ The most important cause for cervicofacial actinomycosis is Actinomyces israelii.

Actinomyces viscosus, Actinomyces naeslundii and Actinomyces odontolyticus are occasionally found. Actinomyces cause chronic, slowly developing infections, particularly when the normal mucosal lining is breached by trauma, surgery, or preceding infection.²⁴ A jaw fracture, oral cavity surgery, infected tooth socket, deep periodontal pockets, and tooth canal can serve as points of entry for microorganisms followed by the development of

actinomycosis. A breach in the integrity of the mucosal membranes and the presence of devitalized tissue may result in the invasion of the deeper structures of the body and result in illness.²⁵

Clinical presentations

Actinomycosis typically presents with an indurated mass and sometimes shows a draining sinus tract. The actinomycosis mass in the head and neck region of the children are typically slow progressive painless one and evolve into multiple abscesses with drainage sinus tracts (Figure 1) on the skin surface or oral mucosa. It affects the cervicofacial area in approximately 50% of total cases. Cervicofacial involvement of actinomycosis can be seen as soft tissue swelling, ulcerations, abscesses, and mass which can be mistaken with malignancy.²

Sometimes the sinus tracts express a typical thick yellow exudate with characteristics of sulfur granules. Actinomycosis can affect the soft tissue of the neck and present with neck masses. Lymphatic spread and cervical lymphadenopathy are uncommon findings.

However, cervicofacial actinomycosis is the most common involvement in humans, and the most common site for diagnosed actinomycosis is the perimandibular region.² The angle of the jaw is the most frequent location for actinomycosis.² The palate may be affected by actinomycosis which often results in oronasal fistula because of erosion of bony part of the palate (Figure 2). The male to female ratio is 3:1.²

This infection can be seen at any age but is most prevalent in the middle age group.²⁷ The most common systemic clinical manifestations are low-grade fever, lethargy, chills, and some weight loss.²⁸ Actinomycosis should be considered in the differential diagnosis of pediatric patients presenting with a palpable mass, pain with sinus tract in head and neck region in addition to malignancy.^{29,30}

Diagnosis

The diagnosis of actinomycosis is often delayed because of its indolent natural history and absence of overt inflammatory symptoms and signs. The diagnosis of head and neck actinomycosis is often difficult and especially during differentiation between the malignant lesions, nocardiosis, or mycobacterial infections. There is usually nonspecific mild biological inflammatory syndrome in actinomycosis infection. The gold standard technique for diagnosis of actinomycosis in the head and neck region is a histopathological examination and bacterial culture of the abscess in suspected bony lesions if osteomyelitis is suspected.31 Use of culture, staining, histopathological examination and polymerase chain reaction (PCR) are useful techniques for the diagnosis of actinomycosis.³² Prolonged bacterial cultures in anaerobic media are required to confirm the bacterium and typical microscopic findings include necrosis with yellowish sulfur granules

and filamentous gram-positive fungal-like microorganisms.



Figure 1: A pediatric patient showing actinomycosis in post-aural area with draining sinus tract.

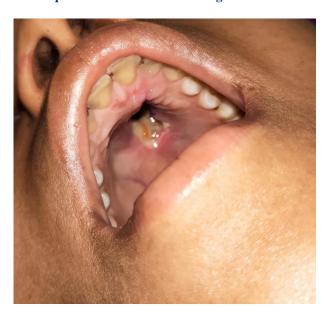


Figure 2: A pediatric patient with palatal actinomycosis with erosion of hard palate.

Although a positive culture of Actinomyces is the gold standard for diagnosis, growing Actinomyces may be difficult in the clinical setting. The culture of Actinomyces requires fresh specimens, a specific anaerobic transport medium, and a longer duration for the growth of the bacterium. A study shows that positive culture ranges from 23% to 60%.³³ Another aspect of delayed diagnosis is difficulty growing Actinomyces species anaerobically in the laboratory. Actinomycosis is often difficult to diagnose

based on clinical features and direct identification, and/or detection of infecting organism from the clinical specimen may be laborious, so nucleic acid probes and PCR techniques have been developed for rapid and accurate identification. In one study of pediatric cases, the diagnosis of actinomycosis was based only on histology (sulfur granules, ray fungus) in 38% of cases and positive cultures in 58% of cases.³⁴ The bacterial culture of the bone samples has to be incubated for two weeks as bacteria commonly decrease their growth capacities in case of chronic osteomyelitis.³⁵ For diagnosis of actinomycosis involving bone such as osteomyelitis of the jaws, molecular testing is considered a suitable method. Thus, this molecular method is recommended even for bone biopsies that were used for histopathology.³⁶

CT scans can be done to reveal the mass in the head and neck region of pediatric patients. Mass at the oral cavity such as palate or neck mass can be found in CT scans and radiological findings may confuse with malignant tumors. Blood chemistry is usually within the normal limit and a Complete blood count (CBC) report may show anemia and leukocytosis.³⁷ Erythrocyte sedimentation rate (ESR) is often elevated in patients with actinomycosis.³⁷ Magnetic resonance imaging (MRI) demonstrates the extension of the actinomycosis lesions in soft tissues. It shows solid enhancing lesions with infiltration of the infections to the surrounding tissues. The radiographic appearance of the lesion is interpreted as a neoplastic process arising from the head and neck region; however, the infectious etiology is suspected in presence of signs or symptoms suggestive of infection.

Treatment

Before the antibiotic treatment era, the prognosis of actinomycosis was poor. Currently, effective treatment includes combined surgical management and antibiotics. Treatment, therefore, centered on surgical intervention and high dose long-term antibiotic treatment. Surgical treatment often requires drainage of the voluminous abscess, marsupialization of chronic sinus tracts, surgical excision of the recalcitrant fibrotic lesion, and/or debridement of necrotic tissue in cases of osteomyletic tissues.³⁸ So, surgery should aim for total resection of the actinomycotic lesion and thorough debridement of neighboring tissues. Maxillary sinus involvement is treated by the Caldwell-Luc approach or endoscopic debridement of the maxillary sinus and sphenoidotomy for the involvement of the sphenoid sinus. In case of bone involvement, curettage and ablating sequestra are required. Before the era of antibiotics, the outcome of the head of the neck actinomycosis in the pediatric age group as unfavorable. In the present day, several antibiotics are used for the treatment of actinomycosis including penicillin, erythromycin, tetracycline, clindamycin, imipenem, streptomycin, and cephalosporins. Actinomyces species are less susceptible to streptomycin, fluoroquinolones, fosfomycin, and other aminoglycosides.³⁹ Actinomycosis responds to several antibiotics, however, the mainstay of therapy for years has been penicillin. A species of Actinomycosis has shown resistance to penicillin. Ampicillin acts equally well, but semisynthetic penicillinlike nafcillin and dicloxacillin are less effective. There are no extensive data regarding the duration of antimicrobial therapy in such patients, but the duration of antimicrobials can be reduced in patients with extensive surgical resection of the infected tissues. The traditional prolonged course of antimicrobial therapy is up to 6 to 12 months of treatment which can likely be shortened if optimal surgical resection of infected tissue has been done with lack of bone involvement and if the satisfactory response of the patient is rapidly observed. However, several observations have been reported satisfactory outcomes with 4 to 6 weeks of antimicrobial treatment. 40 The duration of treatment is 2 to 4 weeks of high dose intravenous penicillin followed by 3 to 6 months of oral penicillin. In the case of penicillin allergy, tetracycline is helpful, although some clinicians prefer minocycline.

Clindamycin, doxycycline, or erythromycin can be substituted in case of allergy to penicillin. ³⁴ Oral forms of cephalosporins are usually not effective. In the case of penicillin and tetracycline allergy, erythromycin can be recommended. The important aspect of antibiotics in actinomycosis is long-term use. Treatment of dental caries and/or apical abscess often needs dental avulsions. Sometimes surgical intervention may be limited to incision and drainage of the abscess, but commonly more aggressive surgery is required to debride all the infected tissue, especially for severely necrotic lesions or those that fail to resolve by antibiotic alone. ^{41,42}

Implications in patient care

The main implication for clinicians in managing patients with actinomycosis is to be aware of different clinical types of actinomycosis. Indeed, the diagnosis is usually crucial for getting an accurate diagnosis. Surgery can be planned in complicated cases, but the cornerstone of treatment is prolonged antimicrobial therapy with beta-lactams such as penicillin or amoxicillin. ^{43,44} Preventive measures are needed for limiting the occurrence of actinomycosis. Reduction of alcohol consumption and improvement of dental hygiene may limit the occurrence of actinomycosis.

CONCLUSION

Actinomycosis is a rare chronic disease in pediatric patients caused by Actinomyces. Pediatricians or pediatric otolaryngologists should have awareness of typical clinical manifestations of actinomycosis in the head and neck region. Clinicians must be aware that actinomycosis mimics the malignancy or tuberculosis in the head and neck region. Bacterial cultures and histopathological studies are cornerstones of diagnosis and also need particular care to prevent misdiagnosis. Prolonged bacterial cultures in anaerobic conditions are needed for exact identification of the bacterium and the typical

microscopic findings like necrosis with yellowish sulfur granules and filamentous gram-positive fungal-like pathogen. Pediatric patients with actinomycosis require a prolonged high dose of penicillin G or amoxicillin and the duration of therapy is approximately three months along with optimal surgical resection of the infected tissues. Specific preventive measures like dental hygiene may limit the occurrence of actinomycosis.

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