Review Article

Actinomycosis in Head-and-Neck Region – A Review

Santosh Kumar Swain

Department of Otorhinolaryngology and Head and Neck Surgery, IMS and SUM Hospital, Siksha "O" Anusandhan University, Bhubaneswar, Odisha, India

Abstract

Actinomycosis is an uncommon chronic disease caused by filamentous *Actinomyces*, a Gram-positive anaerobic bacterium that usually colonizes in the human oral cavity, digestive tract, and genital area. Actinomycosis is rarely seen chronic infectious disease in the head-and-neck region. The clinical presentations are often nonspecific and mimic several diseases of the head-and-neck area such as malignancy and tuberculosis. Moreover, investigations such as imaging, fine-needle aspiration, and biopsy are often nonspecific. The diagnosis of actinomycosis is still difficult for the diagnosis at present time. Bacterial culture and histopathological study are the cornerstones of the diagnosis but a particular situation is needed to get the exact diagnosis. The prolonged bacterial cultures in anaerobic conditions are required to confirm the bacterium and classical microscopic findings like necrosis with yellowish sulfur granules and filamentous Gram-positive fungal-like pathogens. The surgical excision of the lesion/mass along with appropriate antibiotic therapy is important treatment options. Clinicians must be aware of the typical clinical presentations of actinomycosis in the head-and-neck region as it may mimic the malignant process in the head-and-neck area. Actinomycosis patients need prolonged high doses of penicillin G or amoxicillin and the period of antimicrobial treatment can be shortened to a minimum of 3 months in patients in whom optimum surgical resection of the infected tissues has been useful.

Keywords: Actinomyces, *Actinomyces israelii*, cervicofacial actinomycosis, head-and-neck region

Introduction

Actinomycosis is an uncommon bacterial disease that has been identified for over a century. Actinomycosis is a Greek word which compromises "Aktino" meaning the radiating appearance of sulfur granules and "mykos" meaning mycotic disease.[1] Actinomycosis is a slowly progressive infection and it occurs by anaerobic or microaerophilic, nonspore-forming, Gram-positive, nonacid fast bacteria of the genus *Actinomyces*.[1] The most commonly identified species in Actinomycosis infection is *Actinomyces israelii*. There are three distinct clinical forms such as cervicofacial, abdominopelvic, and thoarcopulmonary, and cervicofacial being the most common type.[2] The typical presentation of actinomycosis is indurated mass, sometimes with a draining sinus tract.[3] Actinomycosis is notoriously difficult to diagnosis at the presentation. Actinomyces are filamentous Gram-positive bacilli and often belong to commensals of the human being in the oropharynx, oral cavity, urogenital tract, and other important anatomical places.[3] The diagnosis of the head and neck or cervicofacial actinomycosis is usually delayed because of its low prevalence and lack of awareness of clinicians. The clinicians, especially otorhinolaryngologists and dentists must be aware of its potential prevalence as well as therapeutic management of the actinomycosis. 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 patients is at risk of developing life-threatening complications. This review article aims to discuss the etiopathogenesis, epidemiology, clinical manifestations, diagnosis, and treatment of actinomycosis in the head-and-neck region.

Methods of Literature Search

Multiple systematic methods were used to find the current research publications on actinomycosis in the head-and-neck region. We started by searching the Scopus, PubMed, Medline,

Address for correspondence: Dr. Santosh Kumar Swain, Department of Otorhinolaryngology and Head and Neck Surgery, IMS and SUM Hospital, Siksha "O" Anusandhan University, K8, Kalinga Nagar, Bhubaneswar - 751 003, Odisha, India.
E-mail: santoshvoltaire@yahoo.co.in

Access this article online

Quick Response Code:

Website: www.matrixscimed.org

DOI: 10.4103/mtsm.mtsm_14_21

How to cite this article: Swain SK. Actinomycosis in head-and-neck region – A review. Matrix Sci Med 2022;6:1-5.

Received: 17-10-2021, **Revised:** 20-10-2021,
Accepted: 01-11-2021, **Published:** 25-01-2022

and Google Scholar databases online. A search strategy using Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines was developed. This search strategy recognized the abstracts of published articles, whereas 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; and 8 original articles). This article focuses only on actinomycosis in the head-and-neck region. This article 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 in actinomycosis in the head-and-neck region. It will also serve as a catalyst for the additional study into actinomycosis and its manifestations in the head-and-neck region along with early diagnosis and treatment.

Epidemiology

Actinomycosis is an uncommon disease which described first time in human by Israel in 1878 and Beck described the clinical manifestations of actinomycosis patients in 1906.[4,5] There is virtually no data available on the prevalence of head and neck actinomycosis. Head-and-neck actinomycosis is the most common clinical type of actinomycosis, and the lumpy jaw syndrome is usually associated with odontogenic infection, the most common clinical manifestations, representing around 60% of all documented cases.[6] *Actinomyces* are also responsible for maxillary sinus osteomyelitis in patients with odontogenic maxillary sinusitis.[7] The incidence of actinomycosis is usually low. Pulverer documented the annual incidence of actinomycosis in Cologne, West Germany is 1 in 83,000 people.[8] Another report showed 57 cases in 36 years in low with annual hospitalization varying between 17,000 and 53,000.[9] Most review shows approximately one patient of actinomycosis per year in the majority of the medical centers.[10] Actinomycosis affects the head-and-neck region in approximately 50% of cases, the chest in approximately 30% of the cases, and the abdomen in 20%, although this infection can become disseminated.[11] Actinomycosis can affect any age group from childhood to age 90 years, but majority of patients are between the age group of 30 − 60 years.[10] There is no racial predilection, and male-to-female ratio of involvement is 3 or 4–1.[10]

Etiopathology

Initially, the actinomycosis was considered of fungal etiology (mycos) because of the slow growth and filamentous appearance of *Actinomyces*. Then, it was confirmed that these microorganisms were bacteria.[9] The morphology of the *Actinomyces* reveals filaments much narrower than fungal hyphae and bacillary forms as well, and the reproduction happens through binary fission instead of spore formation or budding.[9] Moreover, *Actinomyces* are killed by antibiotics such as penicillin and erythromycin but are not affected by any antifungal medications such as amphotericin B.[9] Actinomycosis is an infection caused by Gram-positive, nonspore-forming, nonmotile, and anaerobic to microaerophilic filamentous bacterial rods. *Actinomyces* species are saprophytic bacteria, found in the oral cavity and gastrointestinal tract. Actinomycosis is a very uncommon infection caused by different microorganisms of the genus *Actinomyces*, where *Actinomyces israelii* is the most common agent in humans. However, *A. viscosus, A. naeslundii, A. odontolyticus, A. meyeri, A. pyogenes, A. gerencseriae, A. georgiae, A. graevenitzii,* and *A. neuii* can also be associated with pathogenesis of this infection.[12] *A. bovis* is the causative agent of actinomycosis in cattle and has never been detected in humans.[13] *Actinomyces* are considered as normal oral microbiota, where they act as commensals of the periodontal pockets, dental plaques, caries, calculus, and gingival crevices.[14] Nevertheless, they may become pathogenic by accessing submucosa of the oral cavity through an open door.

The mucosal breach is a prerequisite for the establishment of the infection. Mucosal breaks play a vital role for giving access to a microaerophilic environment favorable for such infection [Figure 1]. This bacterium usually shows a low grade of virulence and commonly seen in the saliva and dental plaque. In certain situations which compromise the anatomical barriers and host susceptibility, the actinomyces species become pathogenic and results in actinomycosis.[15] Actinomycosis in the head-and-neck region is commonly associated with gingivitis, gingival trauma, dental caries, dental extraction, infection in erupting secondary teeth, chronic tonsillitis, mastoiditis, or otitis, diabetes mellitus, malnutrition, immunosuppression, and local injury to the tissue by surgical procedure, neoplastic disease, or irradiation.[16] Actinomycosis is a subacute to chronic bacterial infection which is characterized by contiguous spread, granulomatous, and suppurative inflammation with multiple abscesses formation and sinus tracts that may discharge sulfur granules.[17] The tonsillar actinomycosis may be implicated with the destructive cervicofacial form of the disease. The parapharyngeal space and paralaryngeal area may be affected by possible spread directly through the tissues.

Clinical Manifestations

The incidence of symptomatic patients with actinomycosis is quite low. This infection is seen in children to the elderly age group up to the age group of 90 years, and most reviews show a mean age in the 40 years.[18] The cervicofacial actinomycosis often affects tissues around the upper jaw (maxilla) or lower jaw (mandible). Rarely, it affects the temporomandibular joint. The actinomycosis infection usually presents with chronic and fluctuant mass and is often found at the border of the mandible which slowly progresses to a larger mass within weeks or months.[19] The symptoms are usually nonspecific. Pain is uncommon, and the patient may present with a slight fever occurs in more than 50% of the patients.[6] In the majority

of cases, the symptoms and signs of the infections such as fever, cervicofacial pain, erythema, and edema or swelling are absent. In the early period of infection, the lesions show woody consistency, mimicking the neoplasm, but with the progression of the infection, fistulas appear in this area. There may be associated with a sensation of superficial tension around the mass/lesion. Initially, the mass in the head-and-neck region may be surrounded by induration or erythema; later it becomes tender, on account of central necrosis.[20] Although the lymphatic spread is not the mode of spread of this infection, regional lymphadenopathy is documented in up to 40% of the cases.[9] The surrounding tissue is usually firm and often described as woody induration. The skin over the mass in actinomycosis appears as purple-red, but the majority of the patients present no such sign. The disease may show slow progressive painless swelling, evolving into multiple abscesses with the presence of draining sinus tracts on the skin surface [Figure 2] or the oral mucosa, sometimes presenting a typical thick yellow exudate with characteristic sulfur granules.[21] Patients with actinomycosis in the oropharynx or involving the palatine tonsils may present with discomfort in the throat and even whitish mass over the tonsils. Actinomycosis of the pharynx may result in dysphagia or dyspnea. The differential diagnosis of tonsillar actinomycosis includes tonsillar neoplasms, tumors of the parapharyngeal space, and inclusion cysts.[22] The clinical manifestations of this infection may be mimic to tuberculosis and carcinoma, so actinomycosis can easily be mistaken for this infective condition.[23,24] Some cases of actinomycosis result in the central nervous system (CNS) infection by direct extension through paranasal sinuses, orbits, ear canal, and perineural, where it causes involvement of the trigeminal ganglion through the foramen ovale.[25]

Actinomycosis has been reported from virtually every location of the head-and-neck region. The submandibular space is the most common site of cervicofacial actinomycosis where fistulization is often seen in the skin of the submandibular triangle. The next common location is the cheek and also often affects the parotid gland. Actinomycosis in the cheek occasionally affects the masseter space and leads to trismus. Periapical actinomycosis is documented in the oral surgery literature, often in association with previous trauma to the tooth or any dental procedure. Actinomycosis of the tongue is uncommon but may present as a painful nodule and affect the lateral part of the mobile tongue. The soft tissues of the neck and face can be affected.[26] The temporal bone is rarely affected by actinomycosis. The mechanism for the involvement of the temporal bone is thought to be a direct spread of the infection through the Eustachian tube. The clinical manifestations are similar to chronic otitis media, except that the infection is resistant to conventional courses of chronic otitis media.[27] Actinomycosis usually spreads by contiguous growth to surrounding tissues. However, it can spread hematogenously, and the disease can affect the CNS or become disseminated. In the case of CNS involvement, differentiating actinomycosis and nocardiosis are often crucial in selecting the antibiotic therapy. The common CNS complication is brain abscess followed by meningitis and subdural abscess.[28] Actinomycosis in the head-and-neck area should be included in the differential diagnosis when the patients are presenting chronic drainage sinus.[28]

Diagnosis

The clinical diagnosis of actinomycosis is often difficult as its onset is nonspecific, and the differential diagnosis includes a wide range of diseases.[29] The diagnosis of head-and-neck actinomycosis is often delayed, because of its low prevalence and lack of awareness among health professionals regarding pitfalls associated with the diagnosis process. Actinomycosis has been called the masquerader of the head and neck. The variable clinical presentations may mimic malignancy rather than the infective process. The diagnosis of actinomycosis at the time of hospitalization is correct in less than 10% of

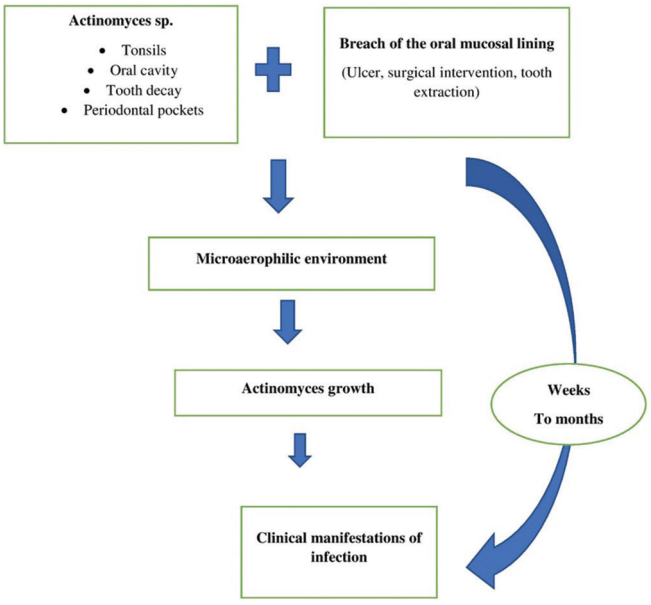

Figure 1: Pathophysiology of the head-and-neck actinomycosis

Figure 2: Actinomycosis mass with the sinus tract in the mandibular area

cases.[30] The histopathological study usually confirms the diagnosis. The microscopic analysis reveals an outer zone of granulation tissue consisting of collagen fibers around the central purulent loculations which contain abundant neutrophils which surround multiple sulfur granules. These sulfur granules are seen as a basophilic mass with a radiating border of eosinophilic clubs with routine staining.[16] Sulfur granules consist of *Actinomyces* colonies which grossly resemble sulfur grains. These are yellowish macroscopic structures firm in consistency and seen to the naked eye, ranging from 100 to 1000 μm in diameter.[16] Sometimes, these are not seen, requiring microscopic sections of the samples collected through abscess or fistula walls to be identified.[31] If the drainage from the sinus tract is seen, this can be sent for Gram stain and culture, which may detect the organism. Aspiration of material from a fluctuant abscess cavity may be utilized for culture. The characteristic sulfur granule is occasionally found on fine-needle aspiration histology. The *Actinomyces* are very difficult to grow in culture, with <30% of the cultures are positive. These bacteria are normal commensals in the oral cavity of the human being. For establishing the diagnosis of actinomycosis, typical findings in the histological study of the infected tissues reveal an outer zone of granulation tissue and a central zone of necrosis with many granules which represent microcolonies of *Actinomyces*.[32] Actinomycosis has been called as masquerader of the head-and-neck region, and its differential diagnosis is extensive due to its nonspecific clinical presentations. The radiological pictures in actinomycosis are nonspecific. Computed tomography scan often shows a soft-tissue mass with low attenuation, sometimes abscess formation, and an inconsistent degree of contrast enhancement.[33] Conventionally, the mass by actinomycosis is indistinct and surrounded by inflammatory changes on other tissues.

Treatment

As the diagnosis of actinomycosis is often difficult and clinical presentation is usually a soft-tissue mass of unknown etiology, surgery becomes an important option for both diagnosis and treatment of actinomycosis.[34] The treatment is based on a combination of surgical excision and long-term antibiotic therapy. The surgical treatment is usually indicated for resection of the necrotic tissue, curettage of the bone, excision of sinus tracts, and drainage of the abscess. Surgical intervention of the lesion reduces the bacterial load by mechanical debridement and aeration.[35] The surgical intervention is needed for drainage of the voluminous abscesses, marsupialization of the sinus tracts, excision of the recalcitrant fibrotic lesion, and/or debridement of the necrotic tissue or osteomyelitis lesion.[36] The actinomycotic lesions of the tooth such as dental caries and/or apical abscesses are often required dental avulsions. The treatment of actinomycosis consists of oral administration of penicillin and patient often show complete regression of the lesion with this antibiotic.[5] Penicillin acts as the first-line antibiotic, despite the lack of consensus regarding the most appropriate dose regimen.[37] One case of middle ear actinomycosis showed a good response after tympanomastoidectomy with 3–6 months of treatment with penicillin.[38] Similar to skull base osteomyelitis, gallium scintigraphy is useful to assess the duration of the treatment in actinomycosis. This test can be repeated every 3–4 weeks during the antibiotic treatment and the antibiotic should be given for 1 week after a normal scintigraphy report. Scintigraphy can be performed as follow-up after 1 month to ensure the absence of subclinical recurrence.[39] Patients who are allergic to penicillin can take other classes of antibiotics such as macrolides, rifampicin, clindamycin, tetracyclines, lincomycin, or chloramphenicol.[37]

Preventive measures such as low alcohol abuse and improvement of dental hygiene may reduce the improvement of dental hygiene, may limit the occurrence of cervicofacial, pulmonary, and central nervous of cervicofacial, pulmonary, and CNS actinomycosis.

Conclusion

Actinomycosis is an uncommon soft-tissue infection caused by Gram-positive, anaerobic bacteria. It is often misdiagnosed infection that may show an acute or indolent process. When the clinical suspicion is high, the actinomycosis is usually confused with other chronic inflammatory diseases and malignancy. Approximately 50% of cases of actinomycosis affect the head-and-neck region. The microorganism is very difficult to culture with a wide range of differential diagnoses. Hence, actinomycosis is notoriously difficult to diagnose at presentation. Surgery is helpful for both diagnosis and treatment of actinomycosis, although long-term antibiotic treatment is an important part of therapy. Penicillin and tetracycline are the most commonly recommended antibiotics. Because of its rarity, clinicians may miss the diagnosis and delay the treatment which results in substantial morbidity and mortality. An early diagnosis of actinomycosis in the head-and-neck region helps the clinician for timely appropriate treatment which can avoid morbidity and unwarranted surgery.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Moniruddin AB, Begum H, Nahar K. Actinomycosis: An update. Med Today 2010;22:43-7.
2. Samant S, Sandoe J, High A, Makura ZG. Actinomycosis mimicking a tonsillar neoplasm in an elderly diabetic patient. Br J Oral Maxillofac Surg 2009;47:417-8.
3. Valour F, Sénéchal A, Dupieux C, Karsenty J, Lustig S, Breton P, *et al.* Actinomycosis: Etiology, clinical features, diagnosis, treatment, and management. Infect Drug Resist 2014;7:183-97.
4. Paulo CO, Jordão S, Correia-Pinto J, Ferreira F, Neves I. Actinomycosis, a lurking threat: A report of 11 cases and literature review. Rev Soc Bras Med Trop 2018;51:7-13.

5. Karanfilian KM, Valentin MN, Kapila R, Bhate C, Fatahzadeh M, Micali G, *et al.* Cervicofacial actinomycosis. Int J Dermatol 2020;59:1185-90.
6. Oostman O, Smego RA. Cervicofacial actinomycosis: Diagnosis and management. Curr Infect Dis Rep 2005;7:170-4.
7. Saibene AM, Di Pasquale D, Pipolo C, Felisati G. Actinomycosis mimicking sinonasal malignant disease. BMJ Case Rep 2013;2013:bcr2013200300.
8. Richtsmeier WJ, Johns ME. Actinomycosis of the head and neck. CRC Crit Rev Clin Lab Sci 1979;11:175-202.
9. Weese WC, Smith IM. A study of 57 cases of actinomycosis over a 36-year period. A diagnostic 'failure' with good prognosis after treatment. Arch Intern Med 1975;135:1562-8.
10. Ahmed S, Ali M, Adegbite N, Vaidhyanath R, Avery C. Actinomycosis of tongue: Rare presentation mimicking malignancy with literature review and imaging features. Radiol Case Rep 2019;14:190-4.
11. Goldberg MH. Diagnosis and treatment of cervicofacial actinomycosis. Oral Maxillofac Surg Clin North Am 2003;15:51-8.
12. Sadeghi S, Azaïs M, Ghannoum J. Actinomycosis presenting as macroglossia: Case report and review of literature. Head Neck Pathol 2019;13:327-30.
13. Könönen E, Wade WG. Actinomyces and related organisms in human infections. Clin Microbiol Rev 2015;28:419-42.
14. Esteves LS, Henriques ÁC, Silva CÁ, Cangussu MC, Ramos EA, Estrela C, *et al.* Actinomycosis is not frequent in the periapex but is a persistent lesion. Braz Dent J 2017;28:688-93.
15. Ablanedo-Terrazas Y, Ormsby CE, Reyes-Terán G. Palatal actinomycosis and kaposi sarcoma in an HIV-infected subject with disseminated *Mycobacterium avium-intracellulare* infection. Case Rep Med 2012;2012:679728.
16. Brook I. Actinomycosis: Diagnosis and management. South Med J 2008;101:1019-23.
17. Hirshberg A, Tsesis I, Metzger Z, Kaplan I. Periapical actinomycosis: A clinicopathologic study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2003;95:614-20.
18. Wang YH, Tsai HC, Lee SS, Mai MH, Wann SR, Chen YS, *et al.* Clinical manifestations of actinomycosis in Southern Taiwan. J Microbiol Immunol Infect 2007;40:487-92.
19. Belmont MJ, Behar PM, Wax MK. Atypical presentations of actinomycosis. Head Neck 1999;21:264-8.
20. Saramago SM, Cominho JC, Proença SS, Conde PJ, Nunes FM. Pelvic actinomycosis mimicking pelvic malignancy. Rev Bras Ginecol Obstet 2019;41:463-6.
21. Swain SK, Sahu MC, Baisakh MR, Banerjee A. Extranodal tuberculosis of the head and neck. Apollo Med 2018;15:122.
22. Swain SK. Palatine tonsil: An unusual location of rhinosporidiosis. Indian J Health Sci Biomed Res (KLEU) 2021;14:392-5.
23. Volpi L, Ferreli F, Bignami M, Pistochini A, Meloni F, Karligkiotis A, *et al*. A rare localization of actinomycosis mimicking ulcerative malignancy. Case Rep Otolaryngol 2013;2013:323210.
24. Swain SK, Behera IC, Sahu MC. Primary sinonasal tuberculosis: Our experiences in a tertiary care hospital of eastern India. Egypt J Ear Nose Throat Allied Sci 2017;18:237-40.
25. Lubomski M, Dalgliesh J, Lee K, Damodaran O, McKew G, Reddel S. *Actinomyces* cavernous sinus infection: A case and systematic literature review. Pract Neurol 2018;18:373-7.
26. Swain SK, Sahana R. Deep neck space infection in the paediatric age group – A review. Pediatr Pol Pol J Paediatr 2020;95:169-74.
27. McCann A, Alvi SA, Newman J, Kakarala K, Staecker H, Chiu A, *et al.* Atypical form of cervicofacial actinomycosis involving the skull base and temporal bone. Ann Otol Rhinol Laryngol 2019;128:152-6.
28. Ravindra N, Sadashiva N, Mahadevan A, Bhat DI, Saini J. Central nervous system actinomycosis – A clinicoradiologic and histopathologic analysis. World Neurosurg 2018;116:e362-70.
29. Carinci F, Polito J, Pastore A. Pharyngeal actinomycosis: A case report. Gerodontology 2007;24:121-3.
30. Rubin MM, Krost BS. Actinomycosis presenting as a midline palatal defect. J Oral Maxillofac Surg 1995;53:701-3.
31. Sharkawy AA. Cervicofacial actinomycosis and mandibular osteomyelitis. Infect Dis Clin North Am 2007;21:543-56.
32. Mohanty S. Actinomycosis of faucial tonsil masquerading as oropharyngeal malignancy. Indian J Otolaryngol Head Neck Surg 2006;58:82-4.
33. Allen HA, Scatarige JC, Kim MH. Actinomycosis: CT findings in six patients. AJR Am J Roentgenol 1987;149:1255-8.
34. Moturi K, Kaila V. Cervicofacial actinomycosis and its management. Ann Maxillofac Surg 2018;8:361-4.
35. Swain SK, Sahu MC. Retropharyngeal abscess leading to fatal airway obstruction in a child – A case report. Pediatr Pol 2016;91:370-3.
36. De D, Dogra S, Kanwar AJ, Saikia UN. Actinomycosis presenting as a destructive ulcerated plaque on the palate and gingiva. J Am Acad Dermatol 2011;65:1235-6.
37. Oukessou Y, Ait Elkerdoudi M, Abada RL, Mahtar M. Complicated actinomycosis of the temporal bone: A historical case report. Eur Ann Otorhinolaryngol Head Neck Dis 2015;132:227-9.
38. Sobol SE, Samadi DS, Wetmore RF. Actinomycosis of the temporal bone: A report of a case. Ear Nose Throat J 2004;83:327-9.
39. Bouccara D, Simon-Blancal V, Rodallec M, Cyna-Gorse F, Mosnier I, Fantin B, *et al.* Osteomyelitis of the base of the skull of otosinus origin. Study of a series of five recent cases. Ann Otolaryngol Head Neck Surg 2007;124:25-32.