Clinical Case Report

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Brain abscess caused by chronic invasive actinomycosis in the nasopharynx

A case report and literature review

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Abstract

Rationale: Actinomycosis is a rare anaerobic, gram-positive bacterial infection caused by *Actinomyces*, which is part of the normal flora in the oral cavity and respiratory and female genitourinary tracts. The cervicofacial area is the most common site of involvement, and involvement of the central nervous system is rare.

Patient concerns: We report a case involving a 51-year-old woman who developed an actinomycotic brain abscess 15 months after the treatment of noninvasive nasopharyngeal actinomycosis, which recurred as an invasive form.

Diagnoses: Histopathological examination of the surgical specimens revealed actinomycosis.

Interventions: The patient was treated by surgical drainage of the brain abscess and long-term antibiotic treatment.

Outcomes: Follow-up brain imaging performed 12 months after surgery showed complete resolution of the brain abscess, and there were no further signs or symptoms of infection.

Lessons: Physicians should be aware of the typical clinical presentations of cervicofacial actinomycosis. Moreover, they should know that actinomycosis may mimic the process of malignancy at various anatomical locations.

Abbreviation: TMD = temporomandibular disorder.

Keywords: actinomycosis, brain abscess, fibrous dysplasia, headache, nasopharynx, temporomandibular disorder

1. Introduction

Actinomycosis is an extremely rare granulomatous and suppurative infectious disease that occurs in the cervicofacial (41%–55%), pulmonothoracic (15%–34%), and abdominopelvic (13%–20%) regions.[1–3] *Actinomyces* is a gram-positive, anaerobic bacteria and is a normal commensal in the human oral flora. Cervicofacial infection usually occurs in cases in which the organism is allowed to access the deeper tissues, such as those with a history of dental procedures, poor dental hygiene, or an immunocompromised state.[3–5] Although there are no precise epidemiological studies, actinomycosis has been reported in <100 cases per year worldwide.[3,6] The biological behavior of *Actinomyces* species ranges from chronic insidious growth, which is mainly represented by a painless indurated mass, to rapidly aggressive growth, which is characterized by invasion to the surrounding tissues and the formation of a painful pyogenic abscess.[3,7,8] We recently encountered a patient who developed an actinomycotic brain abscess 15 months after the treatment of chronic noninvasive nasopharyngeal actinomycosis, which recurred as an invasive form, and was successfully treated by surgical drainage of the abscess and antibiotic treatment. In this report, we describe the clinical course of this case and present a review of the relevant literature.

2. Case report

A 51-year-old woman with a 10-year history of severe trismus associated with temporomandibular disorder (TMD) that developed after multiple dental implant treatment visited our department with complaints of progressive headache and right facial hypoesthesia since 3 weeks. She had undergone several dental procedures, including bilateral modified condylotomy and coronoidectomy, for the treatment of TMD. However, her mouth opening remained limited, resulting in poor oral hygiene. Subsequently, she had been diagnosed with craniofacial fibrous dysplasia. In addition, she had been diagnosed with craniofacial actinomycosis involving the nasopharynx via endoscopic biopsy 15 months prior, and had received treatment with 20 million units/day of intravenous penicillin

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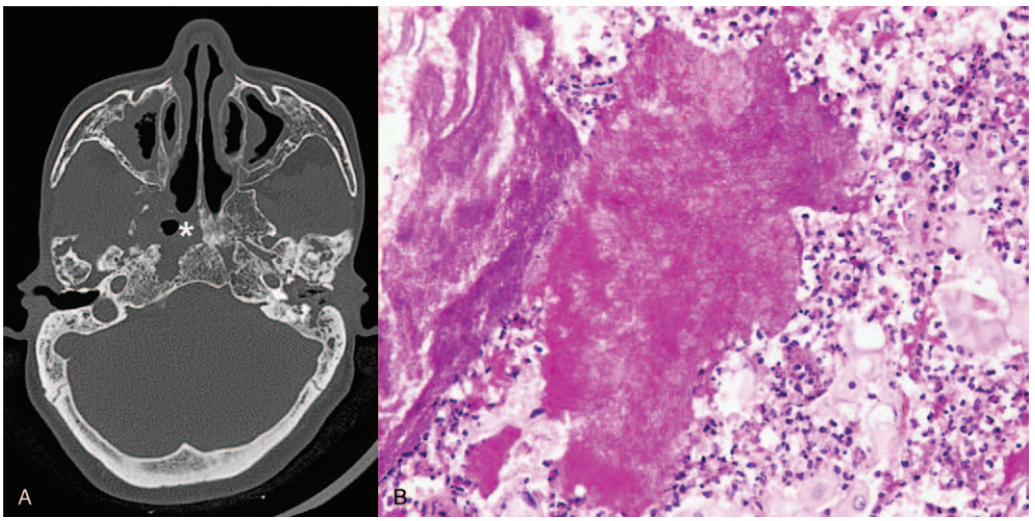

Figure 1. A, Initial plain computed tomography (CT) scan shows a 3.8-cm focal osteolytic lesion localized in the right nasopharynx (asterisk) and petrous apex. B, A photomicrograph shows positive periodic acid–Schiff (PAS) staining of *Actinomyces* colonies. The staining reveals radiating filamentous organisms within the sulfur granules (PAS, × 200).

G for 6 weeks followed by 500 mg of oral amoxicillin × 3/day for 6 months (Fig. 1A and B).

Nasal endoscopic examination at the current visit revealed a polypoid mass in the right nasopharynx with edema in the surrounding mucosa (Fig. 2A). Paranasal sinus computed tomography showed a bulging mass occupying the right nasopharynx and causing erosion of the pterygopalatine fossa, skull base, and lateral wing of the sphenoid (Fig. 2B). No

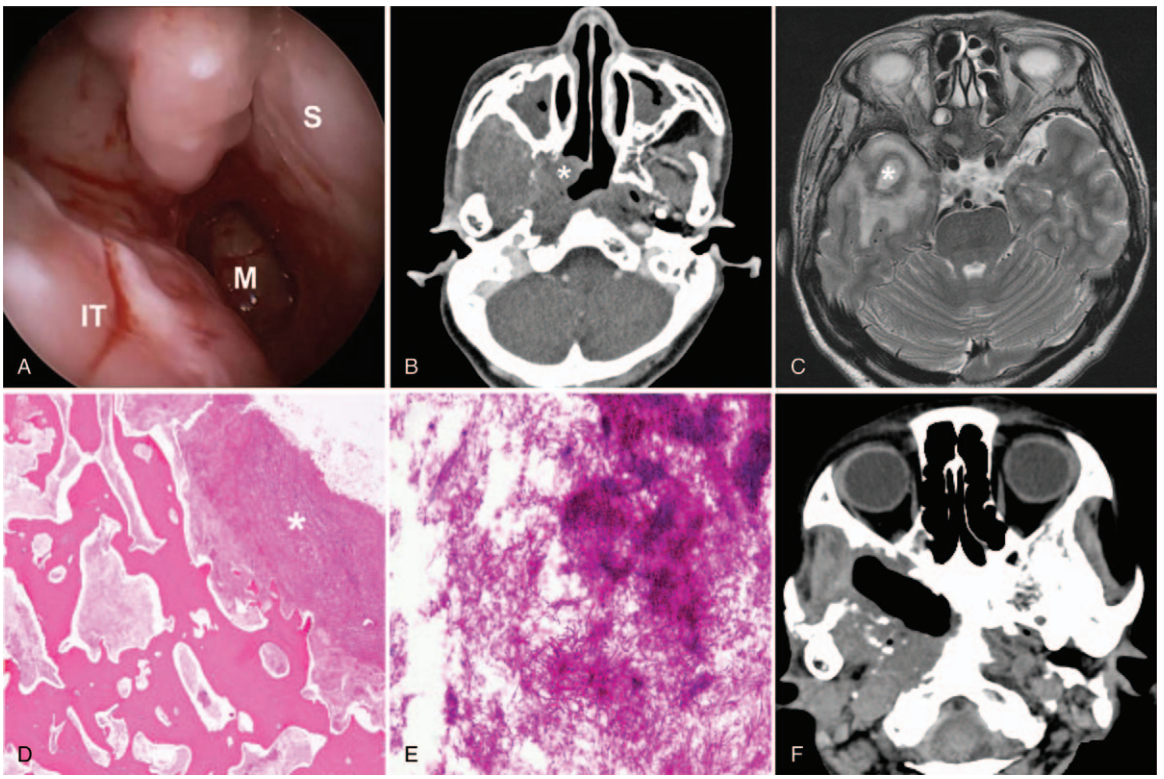

Figure 2. A, Nasoendoscopy reveals a polypoid mass (M) in the right nasopharynx. B, Axial contrast-enhanced computed tomography (CT) of the paranasal sinuses shows an exophytic and infiltrative mass (asterisk) in the right nasopharynx, with invasion of the pterygopalatine fossa, skull base, and lateral wing of the sphenoid. C, Axial T2-weighted brain magnetic resonance imaging (MRI) shows an intracranial extension in the right temporal lobe, which represents abscess formation with peripheral edema (asterisk). D, A photomicrograph (low-power view) of the surgically resected lesion shows sulfur granules (asterisk) filling the marrow space of the bone and associated with suppurative inflammation (hematoxylin and eosin staining, × 40). E, A photomicrograph (high-power view) shows periodic acid–Schiff (PAS)-positive *Actinomyces* colonies that show sulfur granules and branching filaments (PAS, × 1000). F, Axial contrast-enhanced brain CT performed after surgery shows complete resolution of the brain abscess in the right temporal lobe, with no recurrence. IT = inferior turbinate, S = septum.

abnormal laboratory findings were found to be relevant to the diagnosis of the polypoid mass. Moreover, she did not show signs of meningitis, such as fever, mental change, or nuchal rigidity. Malignancy was the presumptive diagnosis given the aggressive appearance, despite the lack of significant cervical adenopathy. An endoscopic biopsy was performed, and histopathological examination of the specimen demonstrated only suppurative inflammation without malignant cells. Because her headache and facial hypoesthesia were gradually progressive, we performed brain magnetic resonance imaging, which revealed an abscess in the right temporal lobe accompanied by a right-to-left midline shift (Fig. 2C). After 3 days of empirical antibiotic therapy, there was no improvement. Therefore, craniotomy with stereotactic guidance and evacuation of the brain abscess via a subtemporal approach were performed. During surgery, granulation tissue and a fibrinous yellow exudate were observed throughout the right petrous apex. Bacterial culture was obtained from the brain abscess, although no *Actinomyces* growth was revealed. Histopathological examination of the resected lesion, however, demonstrated Gram-positive filamentous sulfur granules, consistent with *Actinomyces* species, filling the marrow space of the temporal bone (Fig. 2D and E). After surgery, she received a 6-week course of intravenous teicoplanin at 400 mg/day and moxifloxacin at 400 mg/day, followed by a 6-month course of oral cefpodoxime at 100 mg × 2/day and levofloxacin at 500 mg/day for treatment of the invasive actinomycosis. Follow-up brain imaging at 12 months after surgery showed complete resolution of the brain abscess (Fig. 2F), and there were no further symptoms of infection, including headache and facial hypoesthesia. This study was approved by the institutional review board (IRB) at Yonsei University Gangnam Severance Hospital (IRB No. 3-2017-0342). Informed consent was given by the patients.

3. Discussion

We described a case involving a 51-year-old woman who developed an actinomycotic brain abscess 15 months after the treatment of noninvasive nasopharyngeal actinomycosis. Cervicofacial actinomycosis is the most frequent clinical form of this disease. It was first described as lumpy jaw syndrome and is often associated with an odontogenic infection. More than 30 species of pathogenic *Actinomyces* have been described, with *Actinomyces israelii* being the most common causative strain isolated from human specimens.[7,9,10] It can be difficult to diagnose actinomycosis, and incubation for at least 10 days in strictly anaerobic culture conditions is required for the isolation of *Actinomyces* species.[11] Macroscopically, large colonies of *Actinomyces* appear as yellow granules, termed as sulfur granules. Typical microscopic findings include filamentous, gram-positive, fungal-like pathogens within the sulfur granules.[12] There is no report on human-to-human transmission. The physiopathological pathway of cervicofacial actinomycosis is created only after the organism is allowed to cross the mucosal barrier in certain cases, such as those with poor oral hygiene, trauma to the oral mucosa, severe bisphosphonate-related osteonecrosis of the jaw, and/or immunosuppression.[11,13,14]

Because actinomycosis frequently mimics malignancy and other cervicofacial infections, including tuberculosis and nocardiosis, and spreads continuously and progressively, its diagnosis is often challenging and delayed.[11,15] In contrast with malignancy, cervicofacial actinomycosis should raise suspicion if a disproportionate adjacent bony destruction related to the soft tissue involvement is noted and is accompanied by the absence of cervical adenopathy.[13] In addition, histopathological diagnosis of actinomycosis is difficult because tissue specimens typically contain few sulfur granules and because cultures are negative in up to 70% cases.[9,12,16] Therefore, final diagnosis should be made based on clinical findings in combination with microbiological and/ or histopathological findings. Because of its rarity, a universally accepted classification system for this infection is unavailable, leading to several opinions regarding the origin, diagnosis, management, and treatment outcomes.[7,8]

Involvement of the central nervous system has been reported to occur in approximately 2% to 3% cases.[13,17,18] In the present case, the previous nasopharyngeal lesions presumably originated from an odontogenic infection and were adequately treated with antibiotics; however, actinomycosis recurred and progressed to the chronic invasive form because of the extremely poor oral hygiene. Involvement of the petrous apex and temporal lobe was assumed to be the result of direct extension from the nasopharynx via the Eustachian tube.

According to the findings in a limited number of studies, the criterion standard for the treatment of actinomycosis is long-term antibiotic therapy with or without surgical intervention. The drug susceptibility of *Actinomyces* species is limited and controversial,[10] and no randomized controlled trials have evaluated antibiotic regimens for cervicofacial actinomycosis. Surgical intervention, including drainage of voluminous abscesses, marsupialization of chronic sinus tracts, and/or debridement of necrotic tissues, is often necessary to not only establish a diagnosis but also alleviate the disease.[11]

4. Conclusion

We described a rare case of a highly aggressive actinomycotic infection causing brain abscess in a patient with poor oral hygiene. The case is clinically significant for the following reason. The patient's initial course was favorable as the disease was noninvasive. However, despite early diagnostic intervention and adequate antibiotic treatment, the nasopharyngeal lesion recurred as an invasion lesion and rapidly progressed to give rise to an extensive brain abscess with bony involvement. Therefore, physicians should be aware of the typical clinical presentations of cervicofacial actinomycosis. Moreover, they should know that actinomycosis may mimic the process of malignancy at various anatomical locations. Bacterial culture and identification of sulfur granules are the cornerstones of diagnosis, although careful attention is required to prevent misdiagnosis. Finally, the possibility of frequent relapses necessitates long-term follow-up after adequate treatment.

Author contributions

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Visualization: Ji Hyung Kim.
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Writing – review & editing: Haneul Lee, Kyung-Su Kim.

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