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 
\textit{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 suppurrative infectious disease that occurs in the cervicofacial (41%−55%), pulmonothoracic (15%−34%), and abdominopelvic (13%−20%) regions.\textsuperscript{[1−3]} 
\textit{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.\textsuperscript{[3−5]} Although there are no precise epidemiological studies, actinomycosis has been reported in <100 cases per year worldwide.\textsuperscript{[3,6]} The biological behavior of \textit{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.\textsuperscript{[4,7,8]} 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 cervicofacial actinomycosis involving the nasopharynx via endoscopic biopsy 15 months prior, and had received treatment with 20 million units/day of intravenous penicillin
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...
abnormal laboratory findings were found to be relevant to the
abnormality of the polyoid 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 supplicative
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, consis-
tent with Actinomyces species, filling the narrow space of the
temporal bone (Fig. 2D and E). After surgery, she received a 6-
week course of intravenous teicoplanin at 400mg/day and
moxifloxacin at 400mg/day, followed by a 6-month course of
oral cefpodoxime at 100mg x 2/day and levofloxacin at 500mg/
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 hypo-
esthesia. This study was approved by the institutional review board
(IRB) by 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. Cervi-
cofacial 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 Actino-
myces israelii being the most common causative strain isolated
from human specimens. 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. 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 gran-
ules. 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.
Because actinomycosis frequently mimics malignancy and
other cervicofacial infections, including tuberculosis and noco-
drosis, and spreads continuously and progressively, its diagnosis
is often challenging and delayed. 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
vascular adenopathy. 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. 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.

Involvement of the central nervous system has been reported to
occur in approximately 2% to 3% cases. 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 controver-
sial, 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.

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 re-
curred 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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