Osteomyelitis of the Odontoid Process Associated With Meningitis and Retropharyngeal Abscess
—Case Report—

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Abstract
A 52-year-old man complaining of headache and nuchal pain was treated initially under a diagnosis of bacterial meningitis. The meningitis resisted antibiotic therapy, and one week later was complicated by a ruptured retropharyngeal abscess, which led to the correct diagnosis of osteomyelitis of the odontoid process of the axis. His neck was immobilized in a high neck collar and the retropharyngeal abscess was treated by repeated drainage and irrigation. A long course of antibiotic administration finally resolved the infection. Osteomyelitis of the odontoid process is rare and presents with peculiar signs and symptoms. Careful consideration of the differential diagnosis is needed for the early detection of this potentially serious condition.

Key words: meningitis, retropharyngeal abscess, osteomyelitis, odontoid process, diabetes mellitus

Introduction
Osteomyelitis of the odontoid process of the axis is rarely encountered in clinical practice, and has never occurred as a cause of a spontaneously ruptured retropharyngeal abscess. We describe a case of osteomyelitis of the odontoid process which extended anteriorly causing retropharyngeal abscess, and simultaneously extended posteriorly causing meningitis.

Case Report
A 52-year-old man presented with high fever and headache associated with nuchal pain. The nuchal pain was exaggerated with neck motion, especially with rotation. The symptoms had worsened over the previous 2 weeks. Lumbar tap disclosed severe bacterial meningitis with an initial pressure of 24 cmH₂O and abnormal cerebrospinal fluid (CSF) findings of cell count 10208/μl with 85% neutrophils, protein 138 mg/dl, and glucose 110 mg/dl. Laboratory studies revealed a white blood cell (WBC) count of 19600/μl, C-reactive protein (CRP) of 54.0 mg/dl, and blood sugar of 292 mg/dl. He had a 3-year history of diabetes mellitus, which had been insufficiently controlled by medication with glibenclamide. Computed tomography (CT) of the head showed no abnormalities except for chronic maxillary sinusitis on the left. He had poor dentition with chronic periodontitis.

CSF culture did not yield any organisms. Therefore, intravenous antibiotic therapy was started with cefozopran hydrochloride 3 g/day and ampicillin 6 g/day combined with intrathecal injection of gentamicin sulfate 5 mg every other day. However, the CSF findings were not significantly improved and he began to complain of nasal obstruction and throat pain despite 1 week of intensive antibiotic therapy. Frequent expectoration of purulent sputum was noted. Pharyngeal inspection disclosed purulent discharge from the middle pharyngeal posterior wall (Fig. 1).

Lateral cervical radiography showed anterior swelling of the pharyngeal soft tissue, which had obstructed the choanae. Cervical magnetic resonance (MR) imaging demonstrated an abscess in the retropharyngeal space and degeneration of the odontoid process surrounded by abnormal soft tissues (Fig. 2). The spinal cord at the cranio cervical junction was moderately compressed by this epidural mass. MR imaging with gadolinium-
diethylenetriaminepenta-acetic acid (Gd-DTPA) demonstrated enhancement of the axis, infectious granuloma, the abscess wall, and the meninges anterior to the spinal cord (Fig. 2B). Bone scintigraphy with technetium-99m hydroxymethylene diphospho-
nate ($^{99m}$Tc-HMDP) demonstrated accumulation of the isotope at the craniocervical junction, consistent with osteomyelitis (Fig. 3). Radiography and CT of the cervical spine showed no bony changes at that time.

The diagnosis was meningitis and retropharyngeal abscess secondary to osteomyelitis of the odontoid process. The patient was placed in a Philadelphia cervical collar. He had no neurological signs related to spinal cord compression, so transoral decompression of the odontoid was not indicated. Instead, transoral drainage and irrigation of the abscess was performed repeatedly under local anesthesia. Culture of the pus identified Staphylococcus aureus. Based on the results of sensitivity tests and the bone marrow penetration rate of antibiotics, he was given antibiotic therapy with intravenous ciprofloxacin hydrochloride (CPFX) 600 mg/day and fosfomycin sodium (FOM) 4 g/day, and oral minocycline hydrochloride (MINO) 200 mg/day.

The patient’s high fever subsided and the retropharyngeal fistula closed 6 weeks after starting transoral irrigation. Three-dimensional cervical CT showed circumferential erosion of the dens (Fig. 4). WBC counts and CRP were normalized 2 months after admission. However, he still complained of moderate neck pain with rotation and during

![Fig. 1 Oropharyngeal photograph demonstrating purulent discharge (arrow) from the posterior wall of the middle pharynx.](image1)

![Fig. 2 Sagittal T1-weighted magnetic resonance (MR) images of the cervical spine demonstrating remarkably swollen structures around the odontoid process compressing the spinal cord and obstructing the choanae (A), and enhancement of the axis and abnormal soft tissues after injection of gadolinium-diethylenetriaminepenta-acetic acid (B). The enhanced area in contact with the ventral spinal cord suggests extension of the infection to the meninges (arrowheads), and the retropharyngeal abscess appears as a hypointense area (arrow). T2-weighted MR image showing the retropharyngeal abscess as a hyperintense area (C).](image2)
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Fig. 3 Bone scintigram with technetium-99m hydroxymethylene diphosphonate showing isotope accumulation at the craniocervical junction, strongly suggestive of osteomyelitis.

Fig. 4 Coronal three-dimensional computed tomography scan at the level of the odontoid process demonstrating circumferential bony erosion of the dens.

Fig. 5 T1-weighted magnetic resonance images 6 months after discharge showing the epidural soft tissue mass is still present (A) with contrast enhancement after gadolinium-diethylenetriaminepenta-acetic acid injection (B). The volume of the mass and compression of the spinal cord are reduced, suggesting that the osteomyelitis is resolving.

Straining at defecation. The CSF cell count and protein concentration fluctuated around 200/mcl and 150 mg/dl, respectively, even after 3 months of extensive antibiotic therapy. Repeat CT of the head and neck still depicted chronic maxillary sinusitis on the left, which was regarded as a possible source of infection. He underwent endoscopic sinus surgery for maxillary sinusitis and an antibiotic regimen was started consisting of oral chloramphenicol (CP) 1.5 g/day and MINO 200 mg/day. Although no apparently active infection was found in the maxillary sinus at surgery, his CSF values steadily improved and the nuchal pain diminished after surgery. He was discharged with the same antibiotic regimen of CP and MINO. Finally, after 6 months of prolonged antibiotic therapy, antibiotic administration was discontinued when the CSF values had improved to cell count 5/mcl and protein concentration 35 mg/dl. Neck pain was minimal on motion.

Follow-up cervical MR imaging 6 months after discharge found that odontoid erosion was still present but the epidural soft tissue mass and cervical cord compression were reduced (Fig. 5). Flexion/extension dynamic radiography detected no instability between C-1 and C-2.

Discussion

Spinal pyogenic osteomyelitis most frequently affects the lumbar spine. Odontoid involvement has been reported in only a few cases. Correct diagnosis of this disease is difficult and can be delayed due to the deep location in the neck and vague associated symptoms. Particularly when meningitis is conspicuous on laboratory examinations, as in our case, the underlying osteomyelitis tends to escape the attention of physicians and is
easily misdiagnosed as meningitis.\(^1,9\)^

The most common signs and symptoms include neck pain, fever, and myelopathy.\(^1,5\)^ Neck pain is characteristically augmented with neck motion, especially rotation.\(^8,13,14\) Myelopathy may develop as a form of foramen magnum syndrome due to upper cervical cord compression by the epidural granuloma or epidural abscess.\(^1,4\) High fever is usually present as a sign of infection. Inflammation markers such as erythrocyte sedimentation rate, CRP, and WBC count are highly elevated.

Spinal tap sometimes discloses findings consistent with bacterial meningitis.\(^1,9\)^ This is easily understood as the odontoid peg lies in proximity to the thecal sac. Dorsal spread of the infection around the odontoid would cause epidural abscess or meningitis.\(^7,14\)^ Ventral spread of the infection could cause a retropharyngeal abscess.\(^11\)

Retropharyngeal abscess is a rare entity in current practice, and is usually found in children because the lymph nodes in that space during childhood are subject to infection, whereas these lymph nodes disappear in adulthood. Adult cases are rare and causes other than lymph node infection should be investigated.\(^5\)^ In our case, the spontaneously ruptured retropharyngeal abscess provided a clue to the correct diagnosis of odontoid osteomyelitis.

A previous review of 15 cases of odontoid osteomyelitis identified several risk factors for the disease.\(^1,5\)^ The leading predisposing factor was diabetes mellitus followed by advanced age, drug abuse, and perioral infection. In our case, the patient had a history of diabetes mellitus and chronic periodontitis. He also had chronic maxillary sinusitis, treatment of which resulted in remission of the disease, although it was not clear whether the sinusitis was the focus of the osteomyelitis.

Radiography is not as helpful as might be expected among radiological investigations, because osseous changes only become evident several weeks after the onset.\(^1,9\)^ Also, widening of the retropharyngeal soft tissue on lateral cervical radiography is easily missed by the inexperienced.\(^9\) MR imaging is the best modality for the diagnosis of odontoid osteomyelitis.\(^9,10,12\)^ MR imaging is sensitive to soft tissue changes including abscess formation, and infectious granuloma shows good enhancement with Gd-DTPA. The affected odontoid process appears as low intensity on T\(_1\)-weighted images and high intensity on T\(_2\)-weighted images.\(^9,12\)^ Spinal cord compression by a granuloma is also best evaluated by MR imaging, and such information is critical for the decision on surgical intervention. Bone scintigraphy with \(^99\)mTc-HMPD has high sensitivity for the detection of osteomyelitis, but the specificity and resolution are unsatisfactory.\(^12\)

The most common causative organism is \(S.\) aureus, as in osteomyelitis of other areas.\(^3,12,15,16\)^ Once the diagnosis is established, the patient’s neck is immobilized and antibiotics effective against \(S.\) aureus should be administered immediately. High-dose antibiotic therapy for at least 4 weeks is the rule for the treatment of osteomyelitis.\(^3,12\)^ In addition to the sensitivity of the pathogens, the penetration rate of the antibiotics should be taken into consideration. CPFX, FOM, MINO, and CP were used in the present case, based on sensitivity testing against \(S.\) aureus, all of which penetrate into the bone marrow in high concentration. If neurological deterioration due to spinal cord compression by a granuloma or epidural abscess is present, transoral decompression of the granuloma or affected odontoid process is mandatory.\(^2,6,7,14,15\)^ Posterior fusion of C-1 and C-2 may be required later if instability between C-1 and C-2 becomes evident by dynamic radiography.\(^2,6,7,15,16\)

Osteomyelitis of the odontoid process should be considered in the differential diagnosis for a patient with severe neck pain complicated by meningitis which is refractory to antibiotics. Perioral infection and diabetes mellitus are particular indicators for this potentially serious disease.

References

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