A large invasive chondroblastoma on the temporomandibular joint and external auditory canal: a case report and literature review

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Abstract

Background: Chondroblastomas, which account for approximately 1% of all bone tumors, typically occur in long bones, such as the femur, humerus, and tibia. However, in extremely rare cases, they may also occur in the craniofacial region where the tumor is often found in the squamous portion of the temporomandibular joint (TMJ) and in the temporal bone.

Case presentation: This case report describes a large chondroblastoma (diameter, approximately 37 mm) that occurred in the TMJ. The tumor was sufficiently aggressive to destroy the TMJ, mandibular condyle neck, external auditory canal (EAC), mandibular fossa of the temporal bone, and facial nerve. The tumor was completely excised using a pre-auricular approach. The EAC and surgical defect were successfully reconstructed using a temporoparietal fascia flap (TPFF) and an inguinal free fat graft. There was no local tumor recurrence at the 18-month follow-up visits. However, the patient developed sensory neural hearing loss, and his eyebrow paralysis worsened, eventually requiring plastic surgery.

Conclusion: Large, invasive chondroblastomas of the TMJ can be completely removed through a pre-auricular approach, and the resulting surgical defect can be reconstructed using TPFF and free fat grafts. However, preoperative evaluation of the facial nerve and auditory function is necessary. Therefore, a multidisciplinary approach is essential.

Keywords: Chondroblastoma, Temporomandibular joint, Pre-auricular approach, Temporoparietal fascia flap, Inguinal fat graft, Multidisciplinary approach

Background

Chondroblastomas are cartilaginous neoplasms that account for approximately 5% of all benign tumors [1] and approximately 1% of all bone tumors [2]. Moreover, 70% of these neoplasms are reported in long bones, such as the femur, proximal humerus, and proximal tibia [3]. Only 7% of chondroblastomas occur in the craniofacial region, and only 70 cases of chondroblastoma of the temporal bone were reported until 2011 [4, 5]. In the craniofacial region, chondroblastomas typically occur in the squamous portion of the temporal bone and in the temporomandibular joint (TMJ). This is because the bones comprising the skull base develop from cartilage cells [6]. Most chondroblastomas of the long bones occur during the teenage years, but in the craniofacial region, they are known to occur between 30 and 40 years of age [7]. The ratio of male-to-female prevalence is approximately 2:1 [8].
The chondroblastoma reported in this paper was uncommonly large (diameter, approximately 37 mm), occurred in the craniofacial region, and involved the TMJ, temporal bone, and neck of the mandibular condyle. Although it was a benign tumor, it was aggressive and destroyed adjacent anatomical structures. We report this case because it illustrates a method for the successful excision of this type of tumor, and the successful reconstruction of the resulting large defect.

Case presentation
History and physical examination
A 52-year-old man was referred to our department by an otolaryngologist for an evaluation of a mass that was detected on his TMJ, using computed tomography (CT) and magnetic resonance imaging (MRI). The patient had an operative history that included the repair of a hernia and a ruptured cruciate ligament, but with no other specific medical history. The patient’s chief complaints were swelling and asymmetry of his right TMJ area, which occurred approximately 2 weeks before the first visit. He also experienced tenderness in the TMJ area upon palpation, but without spontaneous pain. In addition, paralysis of the right eyebrow was observed, suggesting that the mass had damaged the temporal branch of the facial nerve. The detected mass was then fixed and confirmed. The EAC swelling was confirmed by the otolaryngologist. The mandible deviated to the right at the maximum intercuspal position. The maximum mouth opening was limited to 30 mm. The patient had a history of TMJ dislocation approximately 25 years earlier.

Imaging findings
CT clearly showed a mass of eccentric soft tissue (approximately 37 × 28 × 28 mm) surrounding the right TMJ and extending into the right pterygoid space; the tissue had also eroded the temporal bone of the skull base. In addition, bone destruction (having the appearance of being moth eaten) was observed in the right mandibular condyle neck (Fig. 1A). The CT scan showed mild thickening of the tympanic membrane (Fig. 1B, arrow) and fluid collection in the EAC (Fig. 1C, arrow). These findings were tentatively diagnosed as external otitis by the radiologist. T2-weighted MRI showed that the tumor was a well-marginated, ovoid-shaped mass.
with multiple inhomogeneous lobes; the tumor had an intermediate signal similar to that of the gray matter. The deeper areas of the mass showed bright signals, such as those found in the central necrosis of the mass (Fig. 1D).

**Surgical procedure**
Under general anesthesia, complete surgical excision was performed using a pre-auricular approach. Local anesthesia (2% lidocaine with 1:100,000 epinephrine) was injected into the temporal and pre-auricular skin regions to reduce intraoperative bleeding and postoperative pain. Access was obtained via an extended pre-auricular (hockey-stick) incision, with an oblique anterosuperior extension into the hair-covered temporal region (Fig. 2A). To reach the main mass, blunt dissection was performed up to the temporal fascia, and bleeding control was achieved by ligating the superficial temporal artery and vein. The tumor was carefully separated from the condyle and the mandibular fossa of the temporal bone to achieve its complete removal (Fig. 2B). The tumor had invaded the anterior articular disc of the TMJ, necessitating partial resection of half of the disc. After tumor excision, peripheral ostectomy of the neck of the condyle and mandibular fossa of the temporal bone was performed using round burs. The neurosurgeon confirmed that the bony erosion of the mandibular fossa was severe enough to expose the dura mater of the brain, but no perforation of the dura was observed. As the probability of cerebrospinal fluid leakage was extremely low, no further surgical procedures were required. The tumor was observed to have also destroyed the anterior wall of the right EAC. An otolaryngologist confirmed that the tympanic membrane was intact. An absorbable gelatinous foam packing was applied in front of the tympanic membrane to maintain the remaining EAC. The EAC defect was covered using a temporal fascia flap pedicled to the deep temporal fascia layer (Figs. 2C and D).

After complete removal of the tumor, the remaining defect was extensive. If the defect had remained, there would have been a substantial risk of facial depression and secondary infection due to the accumulation of fluid and blood in the dead space. To compensate for the extensive volume loss, a free fat graft from the right inguinal region (Fig. 2E) was performed on the right TMJ. The transplanted inguinal free fat graft was connected to the remaining articular disc and covered by the pedicled TPFF (Fig. 2F).

**Pathologic examination**
Pathologic examination revealed a cellular tumor composed of multifocal chondroid tissue (Fig. 3A, above the line) and sheets of tumor cells (Fig. 3A, below the line). Ovoid to polygonal multinuclear cells (Fig. 3A, arrow) comprised the tumor tissue, each having occasional nuclear grooves and eosinophilic cytoplasmas. Osteoclast-like giant cells and pericellular lace-like calcifications (Fig. 3B) were also identified. The pathologic examination confirmed the chondroblastoma diagnosis.
Postoperative course
One month after the operation, the patient had not developed trismus, but the paralysis of the right eyebrow remained. In addition, the patient complained of tinnitus in his right ear. After 7 months, a follow-up MRI revealed resolved muscle edema at the right masseter and pterygoid. In addition, stable coverage of the defect in the temporal bone was achieved with the inguinal free fat graft (Fig. 4A, arrow), and there was no evidence of chondroblastoma recurrence. The swelling and asymmetry of the right TMJ area decreased, and the maximum mouth opening range was maintained at 28 mm. Postoperatively, the paralysis of the patient’s right eyebrow worsened, and right eyelid ptosis developed; supra-brow excision and blepharoplasty were required, after consulting with plastic surgeons, 8 months after the operation. At the 18-month follow-up, the patient demonstrated normal occlusion and no masticatory disturbance. An MRI did not reveal any newly developed, abnormally enhanced lesions or any evidence of local recurrence (Fig. 4B).

Discussion
Literature review
We reviewed the cases of 11 individuals with craniofacial chondroblastoma who were described in 11 previously published papers (Table 1 [9–19]). Including our case, the review included five male and seven female patients (median age, 44.5 years; range, 27–66 years). In eight cases, the radiographic examinations revealed destroyed the TMJ and mandibular condyle; temporal bones were affected in five cases. In four cases, the chondroblastomas affected the anatomical structures of the middle ear, producing hearing loss. In some cases, the clivus and sphenoid sinuses were destroyed. In the earliest (1971) included case, curettage was used to remove the lesion, but it recurred and remained. Therefore, a second operation was required. In addition, there was a tendency for...
Table 1 Summary of characteristics for patients with craniofacial chondroblastomas (from 11 reports)

| Author (year) | Age/sex | Site                                      | Size (mm)            | Symptoms                                      | Surgical methods                                      | Reconstruction | Recurrence (follow-up period) |
|---------------|---------|-------------------------------------------|----------------------|-----------------------------------------------|-------------------------------------------------------|---------------|-------------------------------|
| Bae et al. (1971) [9] | 30/M    | Frontozygomatic area • Anterior superior EAC | Not described        | • Temporal area swelling                       | • 1st OP: curettage                                    | Not described  | No recurrence (2 years)       |
| Liu et al. (2015) [10] | 27/M    | TMJ • Mandibular condyle • Temporal bone | Not described        | • TMJ swelling                                 | • Subtotal excision (extended pre-auricular, temporal approach) | Not described  | No recurrence (1 year)        |
| Watanabe et al. (1999) [11] | 43/F    | TMJ • Temporal bone • Middle ear • EAC | 15 x 20              | • Chronic otorrhea media                      | • Complete excision (retro-auricular approach)         | Surgical defect (Temporal muscle flap) | No recurrence (4 years)     |
| Toro et al. (2005) [12] | 57/F    | TMJ • Mandibular condyle                   | 20 x 20              | • TMJ swelling                                 | • Complete excision (pre-auricular approach to deep sub-fascia) | Not described  | No recurrence (1 year)        |
| Kim et al. (2015) [13] | 38/M    | Temporal bone • Zygomatic arch            | Not described        | • Temporal area swelling                       | • Complete excision (middle cranial fossa approach)   | Not described  | No recurrence (1.25 years)   |
| Liu et al. (2015) [14] | 49/F    | Mandibular condyle                        | 20                   | • TMJ swelling                                 | • Complete excision (pre-auricular approach)          | Not described  | No recurrence (8 years)       |
| Hiraumi et al. (2016) [15] | 27/F    | Clivus • Carotid canal                    | 28 x 20 x 19         | • Headache                                     | • Complete excision (endoscopic endonasal approach)   | Surgical defect (nasoseptal mucosal flap) | No recurrence (3 months)   |
| Marano et al. (2019) [16] | 64/M    | TMJ • Middle cranial fossa • Superior semicircular canal • Foramen spinosum • Facial nerve • Otic capsule | Not described        | • Vertigo                                      | • Complete excision (transpetrosal-transzygomatic approach) | Eardrum, EAC (temporal fascia flap) | No recurrence (5 years)      |
| Long et al. (2020) [17] | 46/M    | Mandibular condyle                        | 21 x 10 x 17         | • TMU pain, swelling                          | • Complete excision (pre-auricular approach)          | Not described  | No recurrence (1.5 years)     |
| Tomioka et al. (2020) [18] | 20/F    | Sphenoid sinus                            | 22 x 20              | • Dizziness, Headache                         | • Complete excision • Rhinoscopic surgery              | Not described  | Not described                 |
| Tomioka et al. (2020) [19] | 66/F    | TMJ • Temporal bone • Middle cranial fossa • EAC | 35 x 25 x 20         | • Hearing loss                                 | • Complete excision (modified auriculotemporal approach via U-shaped incision) • Endoscopic surgery | Panial bone (temporal muscle flap, titanium mesh plate) | No recurrence (5.5 years)   |
| Present case | 52/M    | TMJ • Mandibular condyle • Temporal bone • EAC | 28 x 28 x 37         | • TMJ swelling, asymmetry                     | • Complete excision (pre-auricular approach)          | Anterior wall of the EAC (temporal fascia flap) | No recurrence (1.5 years)     |

TMJ, temporomandibular joint; EAC, external auditory canal; OP, operation
treatments to involve complete excisions. The preauricular approach was used in five cases. Three cases used the endoscopy and rhinoscopy, and one case employed the middle cranial fossa approach. To reduce damage to the anatomical structures around the TMJ and minimize postoperative dysfunction, the middle cranial fossa approach has also been used in recent years. The advantage of this approach is that it is easy to secure a surgical field and access the dura mater [19]. In addition, some cases used the transpetrosal-transzygomatic approach, the modified auriculotemporal approach using a U-shaped incision, and the retro-auricular approach. Reconstruction using the temporalis muscle flap was performed in two cases, and there were two cases that involved the use of the temporal fascia layer and one that used the nasoseptal flap. In two cases, reconstruction of the surgical defect was performed using a fat graft. In 11 cases, the treatment resolved the chondroblastoma.

When the tumor occurs in the craniofacial region, as in the present case, pain in the pre-auricular region, occlusal abnormalities, trismus, and TMJ clicking have been reported. Further, the patient may also experience palatal abnormalities, trismus, and TMJ clicking have been resolved the chondroblastoma. It was performed using a fat graft. In 11 cases, the treatment resolved the chondroblastoma.

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used minimally invasive surgery to avoid worsening the SNHL. Preoperatively, the patient complained of eyebrow muscle paralysis, which might have been expected due to tumors affecting the temporal branch of the facial nerve. Paralysis of the right eyebrow and ptosis of the right eyelid worsened after the operation. This observation suggests that additional facial nerve damage was caused intraoperatively due to electric cautery or overly aggressive traction.

Complete surgical excision is the most effective treatment for a chondroblastoma. When en bloc excision is not possible, curettage may be considered as a treatment option. The recurrence rate following complete surgical excision is 20%; however, when treated with curettage, there is a 50% probability of recurrence [26]. In our case, the tumor was very large and had aggressive characteristics, prompting the decision to perform a complete surgical excision, with wide margins. This was chosen over curettage to reduce the chance of recurrence.

The reconstruction of damaged craniofacial areas, especially at the cranial base, is a very delicate operation. The TPFF receives its blood supply from the superficial temporal artery and has a high survival rate, even after radiation therapy. In addition, deep and superficial temporal fascia layers have the advantage of being thin, flexible, and adjustable in length; therefore, they are useful for reconstructing skull base defects. The TPFF is used to reconstruct lateral skull base defects and prevent CSF leakage; they are also used to rebuild defects in the ventral skull base by passing the TPFF through the infra-temporal fossa. The modified TPFF can be used to reconstruct anterior skull base defects via the supraorbital epidural corridor [27]. The use of a superficial temporal fascia flap to reconstruct a burned ear has been reported [28].

Although most authors insist that the surgical excision of chondroblastomas is the most effective treatment, there is an argument that suggests that invasive methods should be avoided. Among the recently published papers, several cases involving the use of a microscope and an endoscope have been reported. The microsurgical instruments were used to access the main mass by drilling through the tympanic region and the mandibular condyle. Although a safety margin could not be obtained, there was the advantage of preserving the functioning of the cochlea, facial nerve, jugular vein, and TMJ. Recurrence was observed in some of the cases treated in this manner; however, they were well managed using radiotherapy [29].

There is a debate about the role of radiation therapy in chondroblastoma treatment. In one report, radiation therapy helped prevent recurrence after complete resection of the chondroblastoma [30]. Thus, radiation therapy may be considered to reduce the frequency of chondroblastoma recurrence, but it also increases the possibility of malignancy. Therefore, radiotherapy is not essential [31].

**Conclusion**

A large, aggressive chondroblastoma affecting the TMJ was successfully removed using a pre-auricular approach. The EAC and resulting surgical defect were reconstructed using TPFF and inguinal fat grafts. Postoperative complications may occur, depending on the degree of tumor invasion into the surrounding anatomical structures, and a close multidisciplinary approach was necessary.

**Abbreviations**

TPFF: Temporoparietal fascia flap; CT: Computed tomography; MRI: Magnetic resonance imaging; PTA: Puretone audiometry; SNHL: Sensorineural hearing loss

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**Authors’ contributions**

HYB has conceived and drafted the manuscript. YJJ and DMR performed the surgery. HKK performed the pathologic examination. YJJ, SOH, HYL, and YJS reviewed the paper. The authors read and approved the final manuscript.

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**Declaration**

**Ethics approval and consent to participate**

No consent to participate was obtained since the data collected was retrospective and did not include information of personal identification. This case report was approved by the institutional review board (IRB) of Kyung Hee University Hospital at Gangdong (KH-HMC 2021-03-056).

**Consent for publication**

Not applicable

**Competing interests**

The authors declare that they have no competing interests.

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**References**

1. Calvert N, Wood D (2017) Use of denosumab in recurrent chondroblastoma of the squamous temporal bone: a case report. Clin Case Rep 5:411-413. https://doi.org/10.1002/ccr3.838

2. Ben Salem D, Aloumi M, Dumouset E, Ponnelle T, Justrabo E, Martin D et al (2002) Chondroblastoma of the temporal bone associated with a persistent hypoglossal artery. Acta Neurochir (Wien) 144:1315-1318. https://doi.org/https://doi.org/10.1007/s00701-002-1025-3
3. Huivos AG, Marcove RC (1973) Chondroblastoma of bone: a critical review. Clin Orthop Relat Res. 95:300-312. https://doi.org/10.1097/00003086-197309000-00039, 5

4. Bertoni F, Unni KK, Beabout JW, Harner SG, Dahlin DC (1987) Chondroblastoma of the skull and facial bones. Am J Clin Pathol 88:1-9. https://doi.org/10.1093/ajcp/88.1.1, 1

5. Hatano M, De Donato G, Falcioni M, Sanna M (2011) Chondroblastoma of the temporal bone. Acta Otolaryngol. 131:890-895. https://doi.org/10.3109/00016649.2011.566579, 8

6. Stapleton CJ, Wallcott BP, Linskey KR, Kahle KT, Nahed BV, Asaad WF (2011) Temporal bone chondroblastoma with secondary aneurysmal bone cyst presenting as an intracranial mass with clinical seizure activity. J Clin Neurosci 18:857-860. https://doi.org/10.1016/j.jocn.2010.11.004, 6

7. Kondoh T, Hamada Y, Kamei K, Seto K (2002) Chondroblastoma of the mandibular condyle: report of a case. J Oral Maxillofac Surg 60:198-203. https://doi.org/10.1053/joms.2002.29823, 2

8. Mahammad D, Chingiz R, Elchin A, Farinaz I, Vugar Q (2017) Chondroblastoma of the TMJ: case report. Balk J Dent Med 21:176-178. https://doi.org/10.1515/bjdm-2017-0030, 3

9. Cares HL, Terplan K (1971) Chondroblastoma of the skull. Case report. J Neurol Surg 35:614-618. https://doi.org/10.3171/jns.1971.35.5.0614, 5

10. Longo F, Calìfano L, Zupi A, Fulciniti F (1999) Chondroblastoma of the temporomandibular joint: case report with cytopathologic and histopathologic study. J Oral Maxillofac Surg 57:1372-1375. https://doi.org/10.1016/S0278-2391(99)00155-6, 1

11. Watanabe N, Yoshida K, Shimomi H, Kurono Y, Mogi G (1999) Temporal bone chondroblastoma, Otolaryngol Head Neck Surg 121:327-330. https://doi.org/10.1016/S0194-5998(99)70201-9

12. Toro C, Robioni M, Ferro D, Sembionio S, Zeman N, Polit i M (2005) Chondroblastoma of the mandibular condyle: case report of an extremely uncommon tumor. Oral Oncol. Extra 4:132-136. https://doi.org/10.1016/j.toxo.2005.03.001, 7

13. Bian LG, Sun QF, Zhao WG, Shen JK, Tirakotai W, Bertalanffy H (2005) Chondroblastoma arising in the temporal bone: a case report and literature review. J Oral Maxillofac Surg 57:1372-1375. https://doi.org/10.1016/S0278-2391(05)00078-4, 1

14. Kim SM, Hong SW, Ryu DJ, Huh JK (2015) Chondroblastoma of the temporomandibular joint lateral capsula: a case report. Cranio 33:307-312. https://doi.org/10.1080/08869634.2015.1097305, 4

15. Liu J, Ahmadpour A, Bewley AF, Lechpammer M, Bobinski M, Shahlaie K (2015) Chondroblastoma of the clinoid: case report and review. J Neurol Surg Rep 76:e258-e264. https://doi.org/10.1055/s-0035-1564601, 02

16. Hiraiumi H, Arakawa Y, Yamamoto N, Sakamoto T, Ito J (2016) Temporal bone chondroblastoma totally invisible on MRI. Auris Nasus Larynx 43:468-471. https://doi.org/10.1016/j.anl.2015.12.005, 4

17. Marano R, do Nascimento Neto CD, Mayrink G, Tajra R, Gaigher E (2019) A rare case of chondroblastoma of the temporomandibular joint: a case report. Oral Maxillofac. Surg. Cases 5:100102. https://doi.org/10.1016/j.joms.2019.100102, 3

18. Long L, Li Z, Tang Y (2020) Chondroblastoma in the sphenoid sinus. Ear Nose Throat J. https://doi.org/10.1016/j.ento.2020.01.006, 4

19. Tomioka T, Yamada S-I, Yoshimura N, Gibo T, Otagiri H, Itoh R et al (2020) Chondroblastoma arising in the temporal bone: a case report and literature review. J Oral Maxillofac Surg Med Pathol 32:251-256. https://doi.org/10.1016/j.joms.2020.01.006, 4

20. Inwards CY (2007) Update on cartilage forming tumors of the head and neck. Head Neck Pathol. 167-74. https://doi.org/10.1097/01.s121.05-007-0015-4, 1

21. Schajowicz F (2012) Histological typing of bone tumors. Springer Science & Business Media, p 37. https://doi.org/10.1007/978-3-642-84902-2

22. Torres-Mora J, Chou MM, Wenger DE, Oliveira AM, Sim FH, Franco M (2012) Aneurysmal bone cyst: An update on recent molecular advances. AJSP: Reviews & Reports 17:25-30. https://doi.org/10.1097/PCR.0b013e31824992d8, 1

23. Esmaeelinejad M, Sohabi M (2018) Surgical approaches to the temporomandibular joint. In Temporomandibular Joint Pathology - Current Approaches and Understanding. https://doi.org/10.10572/interchopen.74141

24. Yokoyama J, Yoshimoto H, Ito S, Obha S, Fujimaki M, Ikeda K, Yazawa M, Fujimya N, Hanaguti M (2011) Successful function-preserving therapy for chondroblastoma of the temporal bone involving the temporomandibular joint. Case Rep Oncol 4:74-81. https://doi.org/10.1159/000324640, 1

25. Deng M, Long X, Cheng A, Cheng Y, Cai H (2009) Modified trans-oral approach for mandibular condylotomy. Int J Oral Maxillofac Surg 38:374-377. https://doi.org/10.1016/j.ijom.2009.01.020, 4

26. Chavan SS, Yenni V, Kulkami M (2012) Chondroblastoma of squamos part of the tempo-parietal region of skull vault: a case report and review of literature. N Am J Med Sci 4:199-202. https://doi.org/10.1016/j.amjms.2011.03.014, 1

27. Vinciguerra A, Veil€auld B, Eliezer M, Kaci R, Kania R, Herman P (2021) Functional treatment of temporal bone chondroblastoma: retrospective analysis of 3 cases. Eur Arch Otorhinolaryngol 278:1271-1276. https://doi.org/10.1007/s00405-020-06203-4, 4

28. Harner SG, Cody DT, Dahlin DC (1979) Benign chondroblastoma of the temporal bone: Otolaryngol Head Neck Surg 87:229-236. https://doi.org/10.1016/S0278-2391(79)80071-4

29. Flowers CH, Rodriguez J, Naseem M, Reyes MM, Verano AS (1995) MR of benign chondroblastoma of the temporal bone. AJNR Am J Neuroradiol 16(2):414-416