Temporal bone chondroblastoma totally invisible on MRI

Harukazu Hiraumi, MD, PhD (1)(2), Yoshiki Arakawa, MD, PhD (3), Norio Yamamoto, MD, PhD (2), Tatsunori Sakamoto, MD, PhD (2), Juichi Ito, MD, PhD (2)

(1) Department of Otolaryngology, Head and Neck Surgery, Iwate Medical University
(2)Department of Otolaryngology, Head and Neck Surgery, Kyoto University, Graduate School of Medicine
(3)Department of Neurosurgery, Kyoto University, Graduate School of Medicine

Corresponding author
Harukazu Hiraumi
Address: 19-1, Uchimaru, Morioka, Iwate, 020-8505, Japan
Phone +81-19-651-5111
FAX +81-19-652-8642
E-mail hhiraumi@ent.kuhp.kyoto-u.ac.jp

Abstract

We report a case of temporal bone chondroblastoma that was totally invisible on MRI. The patient was a 64-year-old man who presented with several months history of vertigo. The CT scan with bone window setting showed destruction of the temporomandibular joint, the floor of the middle cranial fossa, and the superior semicircular canal. Calcific foci were seen within the tumor. On MR imaging, the tumor, situating mainly medial to the temporomandibular joint, showed no signal on both T1- and T2-weighted images. The tumor was not enhanced with gadolinium. In summary, the tumor was totally signal negative or "invisible" on pre- and postcontrast T1- and T2-weighted images. The tumor was resected through transpetrosal – transzygomatic approach.

Introduction

Chondroblastoma is a rare benign cartilaginous tumor that commonly affects the epiphysis of a long bone. Chondroblastoma development in the temporal bone is extremely rare, and only approximately 80 cases have been reported [1]. The tumor usually arises in the squamous portion of the temporal bone and affects the floor of the middle cranial fossa and temporomandibular joint. Chondroblastoma is histologically benign, but is clinically aggressive. A complete surgical resection of the tumor is the gold standard for treatment [2]. Upon CT scans, chondroblastoma of the temporal bone is characterized by the presence of a lobulated, expansive mass and is accompanied by bone destruction. In some cases, there is punctuate calcification within the mass [2]. On MRI, the lesion may demonstrate variable signal intensities on T1- and T2-weighted images. The tumor usually shows low intensity on T1 images and low to high intensity on T2 images [3]. Despite the high variability of signal intensity, MRI in the previously reported cases clearly illustrated the extent of the tumors. Herein, we report a case with temporal bone chondroblastoma that was signal negative on both T1- and T2-weighted MR images, and diagnosis was difficult only with MRI.

Case presentation

A 64-year-old man was referred to Kyoto University Hospital because of a temporal bone tumor. He had been suffering from vertigo for several months. At the first clinic, he underwent MRI and was diagnosed with an old small infarction in the brain stem. He was diagnosed as having no temporal bone lesions except for right middle ear fluid collection. The vertigo increased gradually, and the patient consulted a second doctor. The patient underwent a CT scan and was then referred to our center. The CT scan in the

bone window setting showed a temporal bone tumor around the temporomandibular joint (Fig. 1-A). The tumor was accompanied by destruction of the floor of the middle cranial fossa and the foramen spinosum. The tumor also invaded the superior semicircular canal (Fig. 1-B, C), which was suspected as a cause of vertigo. There were calcific foci observed within the tumor. The average of air conduction and bone conduction level between 500 Hz and 2000 Hz was 45.0 dBHL and 33.3 dBHL, respectively.

Upon MR imaging, the mesotympanum and mastoid cavity were filled with effusion. The tumor was located medial to the temporomandibular joint and showed no signal on either T1- or T2-weighted images (Fig. 2). The floor of the temporal lobe was mildly compressed, but the intra-dural invasion was not evident. A new MR study with gadolinium was conducted. On T1-weighted images with gadolinium, the tumor was not enhanced and showed no signal (Fig. 3). In summary, the tumor was totally signal negative or “invisible” on pre- and postcontrast T1- and T2-weighted images. Biopsy through the ear drum showed that the tumor was a chondroblastoma. The tumor invaded the middle fossa dura, the facial nerve, and the otic capsule, and we planned surgery to achieve gross total removal. The tumor was resected through transpetrosal-transzygomatic approach. After a combined preauricular and postauricular skin incision, canal wall down mastoidectomy was conducted. The ossicular chain was intact. The malleus and the incus were removed. The squamous portion of the temporal bone, the root of the zygoma, and the posterior half of the zygomatic arch was transiently removed. The temporomandibular joint was disarticulated and the medial wall of the mandibular fossa was removed to provide full access to the tumor. The tumor invaded the otic capsule of the superior semicircular canal, tympanic portion of the facial nerve, the middle fossa dura, and the carotid canal. The otic capsule and the facial nerve were dissected with a small knife. The tumor invading the middle fossa dura and the carotid canal were coagulated with a bipolar forceps (Fig. 4). The ear drum and the posterior wall of the external auditory canal were reconstructed with temporal fascia. The space was obliterated with abdominal fat. Ossicular chain reconstruction was not conducted. The postoperative course was uneventful. He did not show facial palsy after the surgery. The post-operative air conduction and bone conduction hearing threshold were 63.3 dBHL and 45.0 dBHL, respectively. The histopathological examination showed a proliferation of tumor cells with chromatin-rich nuclei and hemosiderin deposits in the cytoplasm accompanied by giant cells (Figure 5). Chondroid matrix and chicken-wire calcifications were also observed. The tumor was

diagnosed as a chondroblastoma. The patient is free from tumor 5 years after the operation.

Discussion

Chondroblastoma is an uncommon primary cartilaginous tumor of bone. CT imaging provides intraosseous tumor expansion and MRI delineates the extent of intracranial involvement. MRI findings of chondroblastoma are highly variable. Jee et al. [4] reported the MRI findings of chondroblastoma occurring in the epiphysis or apophysis. The T1-weighted MRI images showed low to intermediate signal intensity throughout the lesion. On T2-weighted images, 10 of the 22 lesions were hypointense and 12 were hyperintense. The reasons for the hypointensity on T2-weighted images are attributed to the hypercellularity of the chondroblasts, abundant immature chondroid matrix, calcifications, and hemosiderin deposition [4]. The temporal bone chondroblastoma shows similar findings on MRI [2,5]. Enhancement characteristics are typically mild to moderate, and maybe intense [6]. Although MR images of previous cases well illustrated the extent of the lesion and was recommended as a work-up [1], it failed to lead to the diagnosis in our present case. In our patient, the lesion was signal negative on T1-weighted images, T1-weighted images with gadolinium, and T2-weighted images. These MRI findings made this case a diagnostic challenge.

The negative signal on T1-weighted images, T1-weighted images with gadolinium, and T2-weighted images cannot be explained by the hypercellularity and abundant chondroid matrix. In giant-cell tumors of bone, lesions with large amounts of hemosiderin deposition have been reported to show low signal intensity on MRI [7]. In the present case, the tumor cells contained abundant hemosiderin deposition, which was combined with calcifications to cause a hypointense image on the MRI. Because partial hemosiderin deposition is not an uncommon finding in bone tumors [7], care should be taken not to overlook such lesions.

Conclusion

We report a case of temporal bone chondroblastoma which was totally signal negative or “invisible” on pre- and postcontrast T1- and T2-weighted images.

Figure Legends

Figure 1. High-resolution CT of the right ear showing a bone destructive tumor situated medial to the mandibular fossa (white arrowhead) (A). The tumor destructed the anterior wall of the attic and the foramen spinosum. The tumor invaded the superior semicircular canal (white arrow), the fallopian canal in the tympanic portion (B), and the floor of the middle cranial fossa (C).

Figure 2. Coronal T1-weighted (A) and T2-weighted (B) MR images showing a hypointense tumor in the right temporal bone (white arrow head). The temporal lobe was mildly compressed. Axial T2-weighted (C) MR images also showed that the tumor was hypointense (white arrow head). The mastoid cavity was filled with effusion (arrow).

Figure 3. On axial (A, B) T1-weighted MR images with gadolinium, the tumor was not enhanced and signal negative (white arrow head). The middle meningeal artery (black arrow) and the tympanic portion of the facial nerve (white arrow) were detectable and seemed intact.

Figure 4. Intraoperative findings after the tumor removal. The geniculate ganglion and the tympanic portion of the facial nerve (white arrow head) and the stapes (white arrow) were preserved. The head of the mandible (black arrow) was disarticulated and pulled caudally.

Figure 5. The histopathological examination showed a proliferation of tumor cells with chromatin-rich nuclei and hemosiderin deposits in the cytoplasm accompanied by giant cells (H&E stain, original magnification A: X100, B: X400).

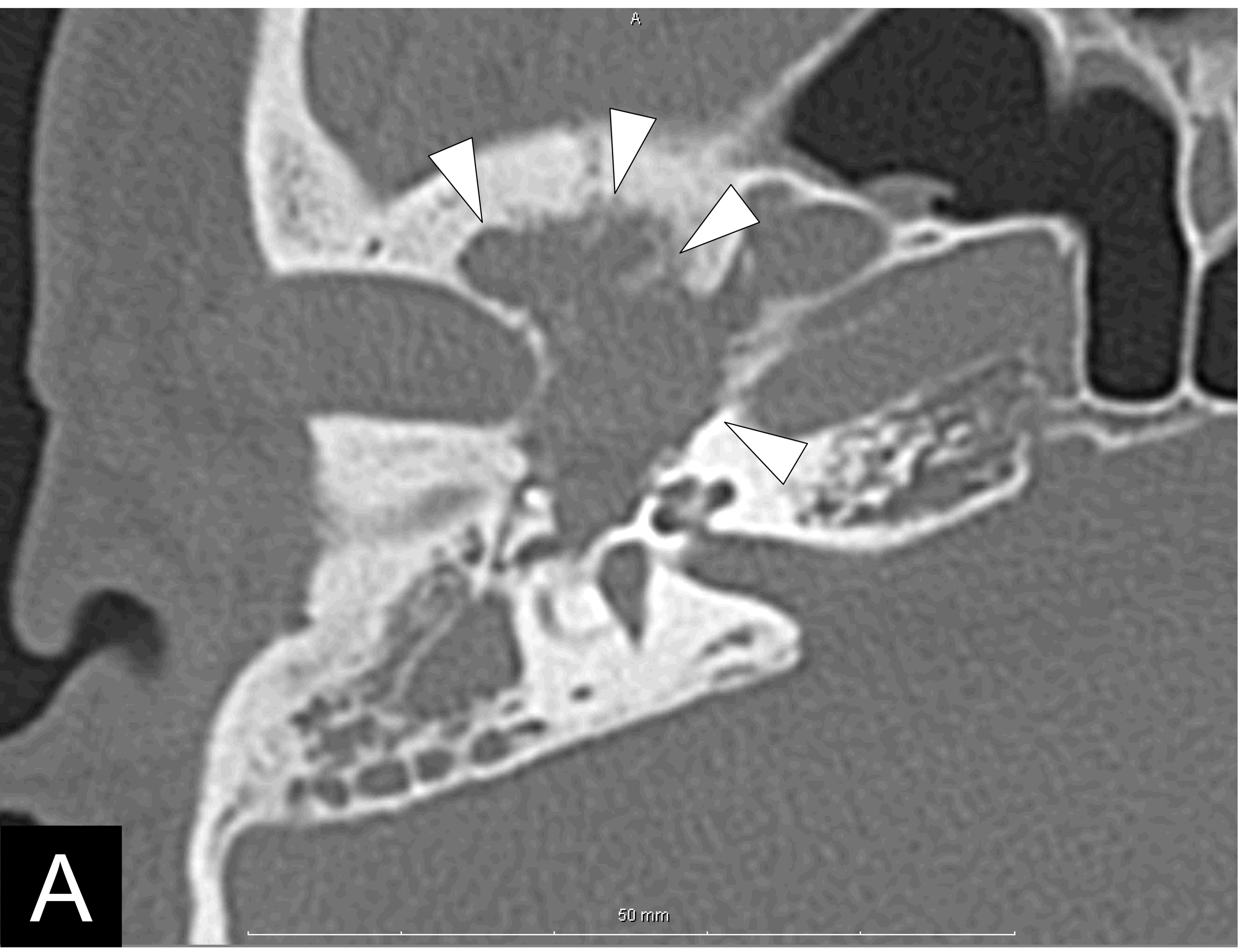
Acknowledgments
This study was reported at the Korea Japan Joint Meeting of Otorhinolaryngology-Head and Neck Surgery 2010 (KJ meeting 2010) held in Seoul, Korea in 2010.

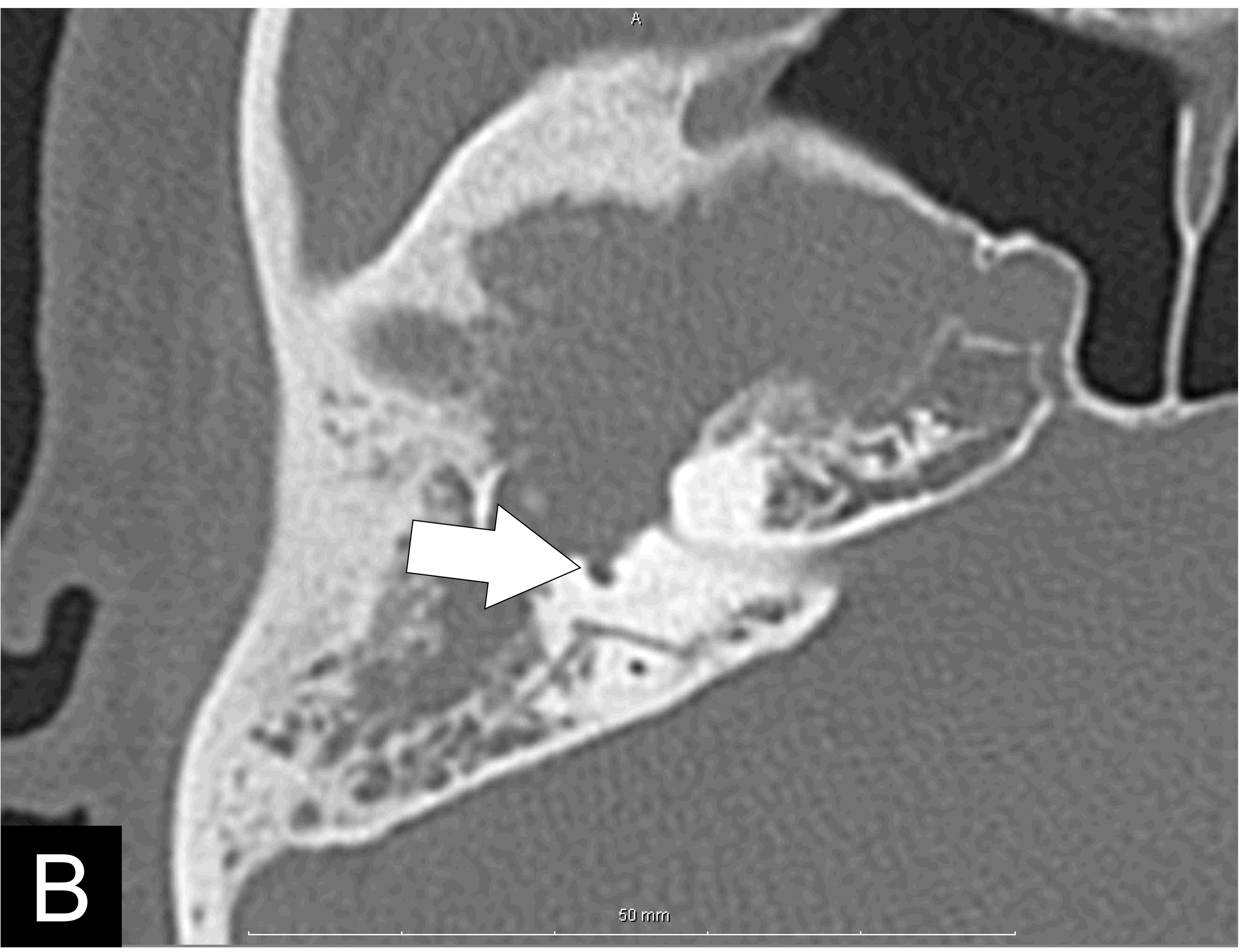
Conflict of Interest

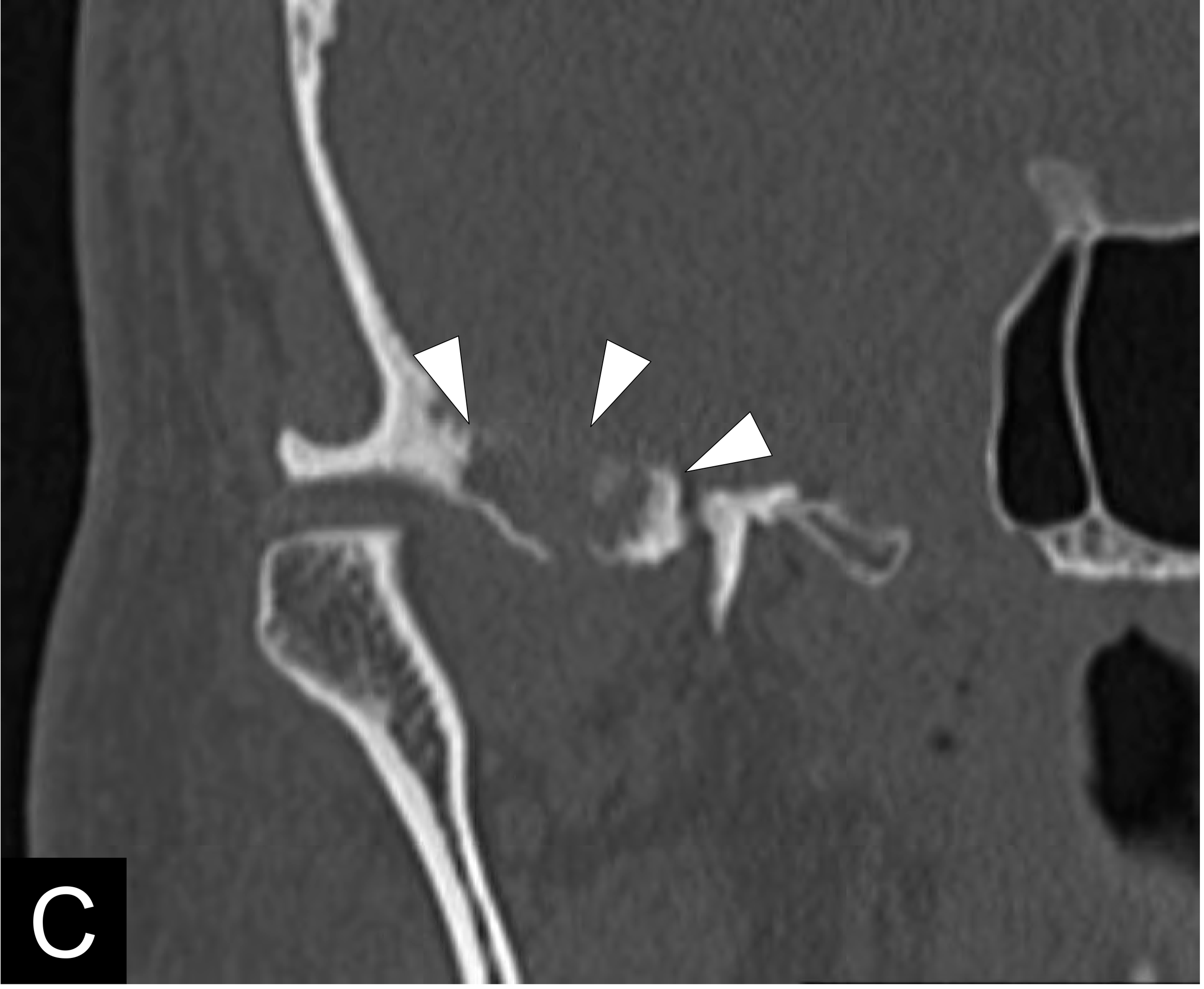
We do not have a financial relationship with the organization that sponsored the research or any other conflicts of interest.

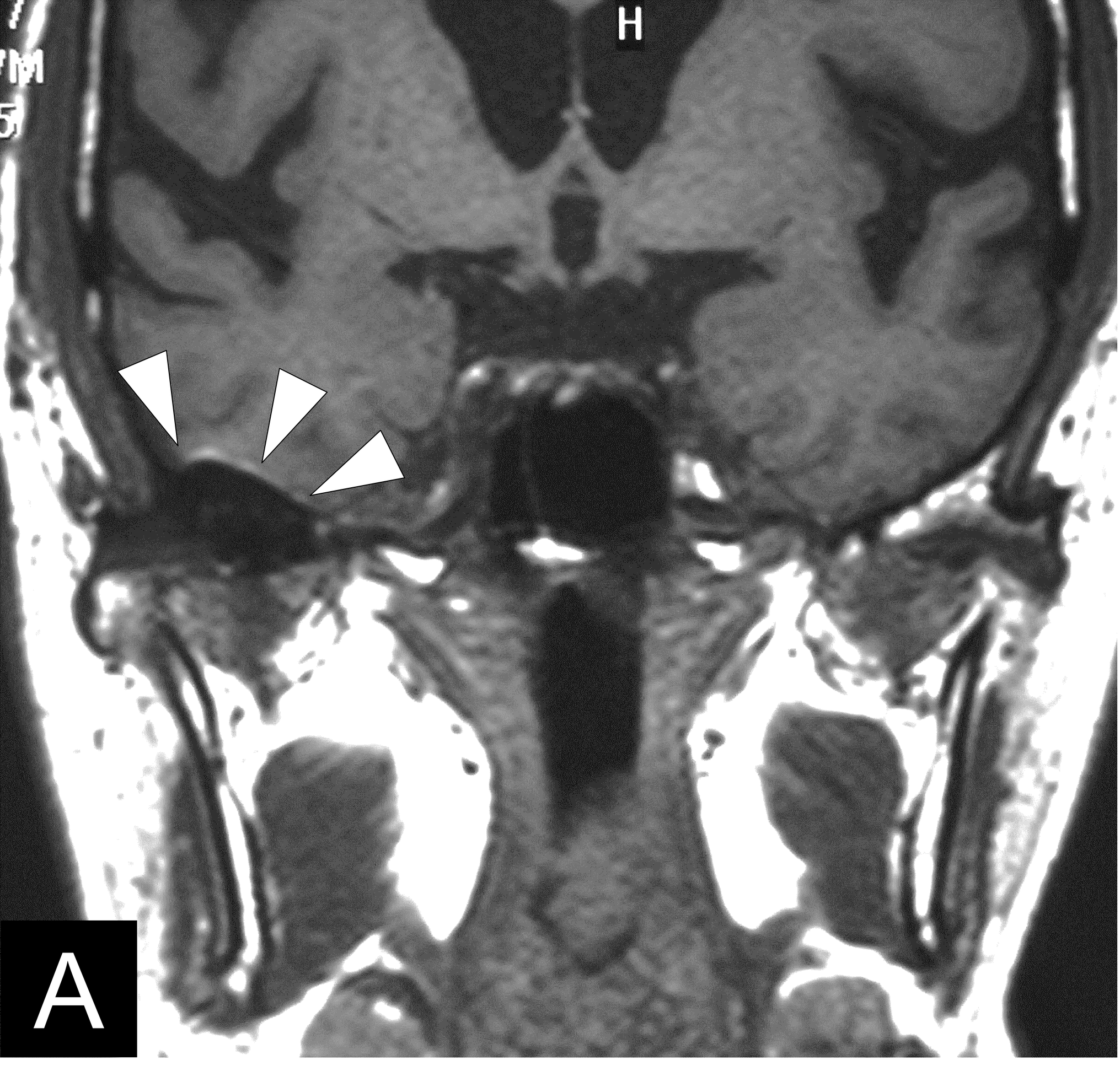
References

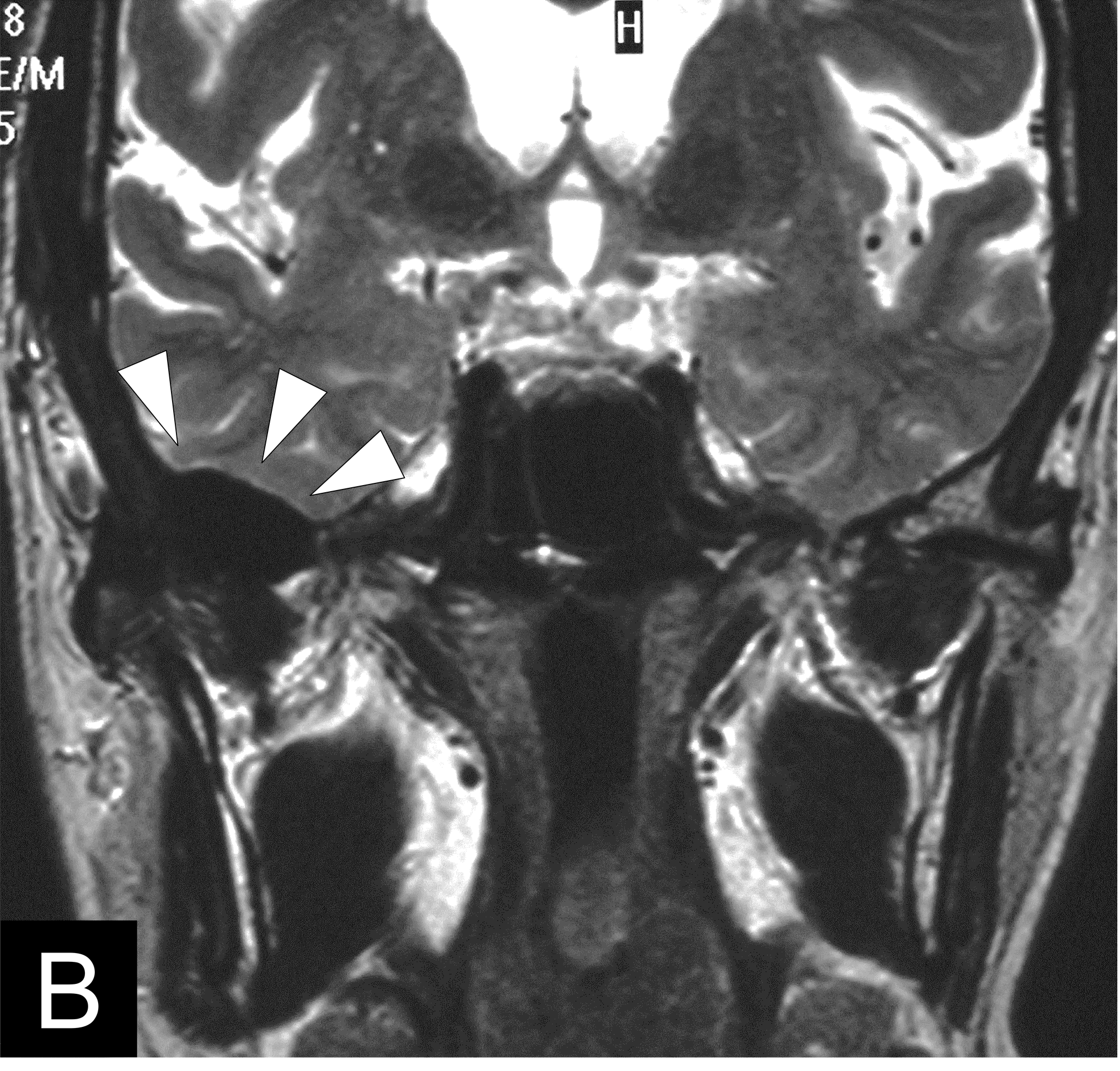
1. Reid LB, Wong DS, Lyons B. Chondroblastoma of the temporal bone: a case series, review, and suggested management strategy. Skull base reports 2011; 1:71-82.
2. Moon IS, Kim J, Lee HK, Lee WS. Surgical treatment and outcomes of temporal bone chondroblastoma. Eur Arch Otorhinolaryngol 2008; 265:1447-1454.
3. Hatano M, De Donato G, Falcioni M, Sanna M. Chondroblastoma of the temporal bone. Acta Otolaryngol 2011; 131:890-895.
4. Jee WH, Park YK, McCauley TR, Choi KH, Ryu KN, Suh JS, et al. Chondroblastoma: MR characteristics with pathologic correlation. Journal of computer assisted tomography 1999; 23:721-726.
5. Flowers CH, Rodriguez J, Naseem M, Reyes MM, Verano AS. MR of benign chondroblastoma of the temporal bone. AJNR Am J Neuroradiol 1995; 16:414-416.
6. Tan JH, Miyakoshi A, Mafee MF. Imaging of fibro-osseous lesions of the temporal bone. Operative Techniques in Otolaryngology-Head and Neck Surgery 2014; 25:96-109.
7. Aoki J, Tanikawa H, Ishii K, Seo GS, Karakida O, Sone S, et al. MR findings indicative of hemosiderin in giant-cell tumor of bone: frequency, cause, and diagnostic significance. AJR Am J Roentgenol 1996; 166:145-148.

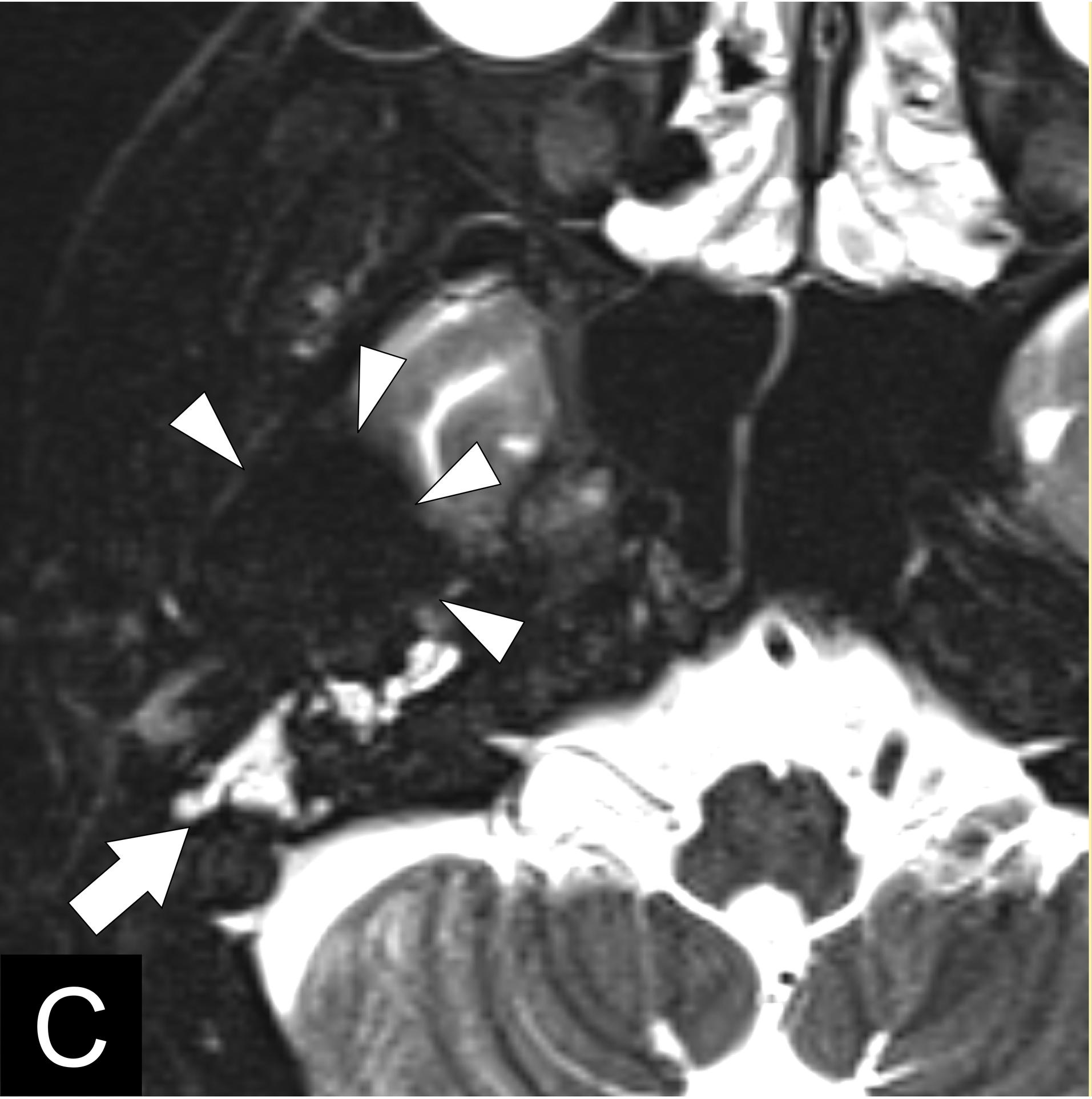

A
50 mm
A

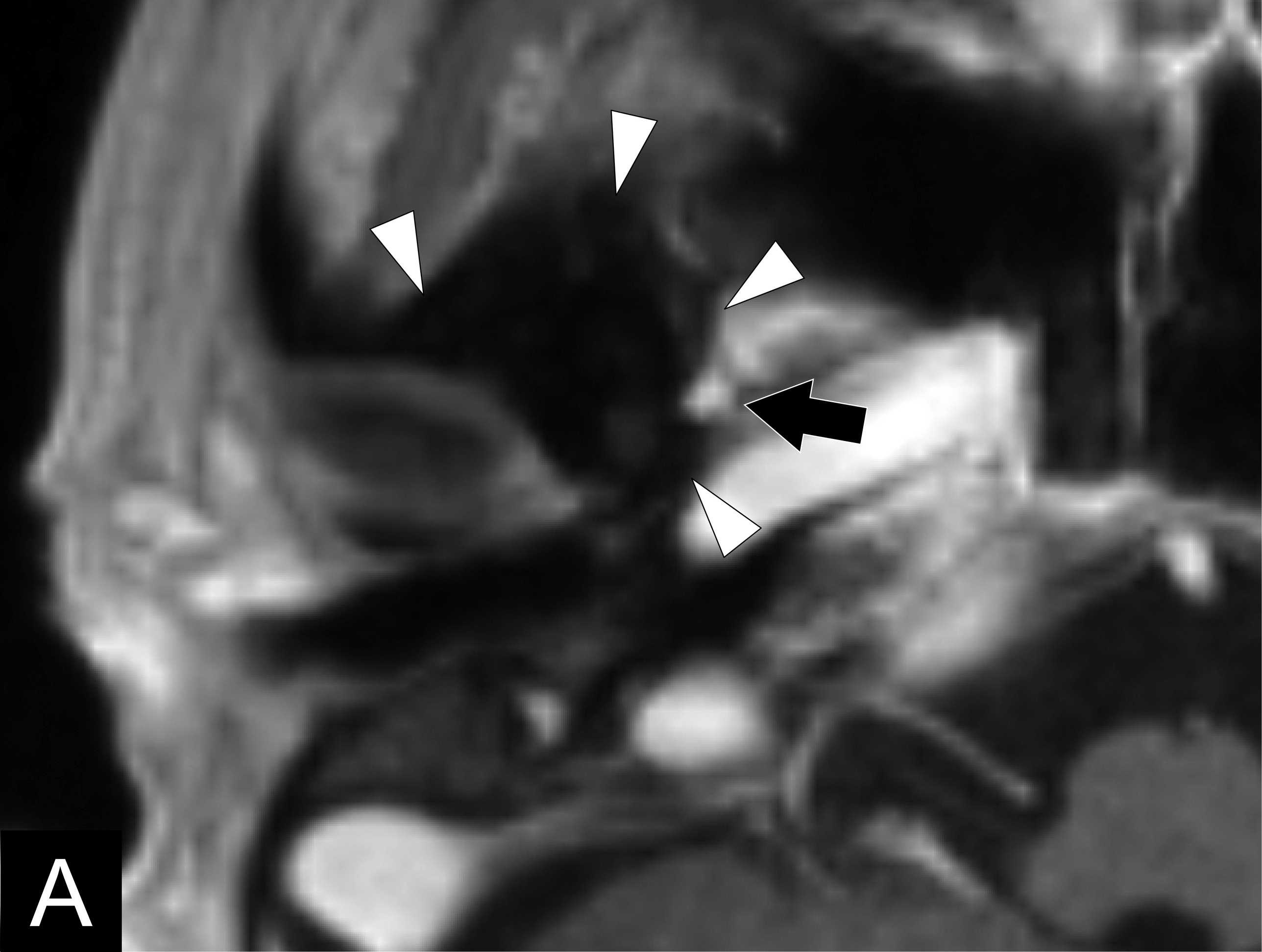

A
B
50 mm

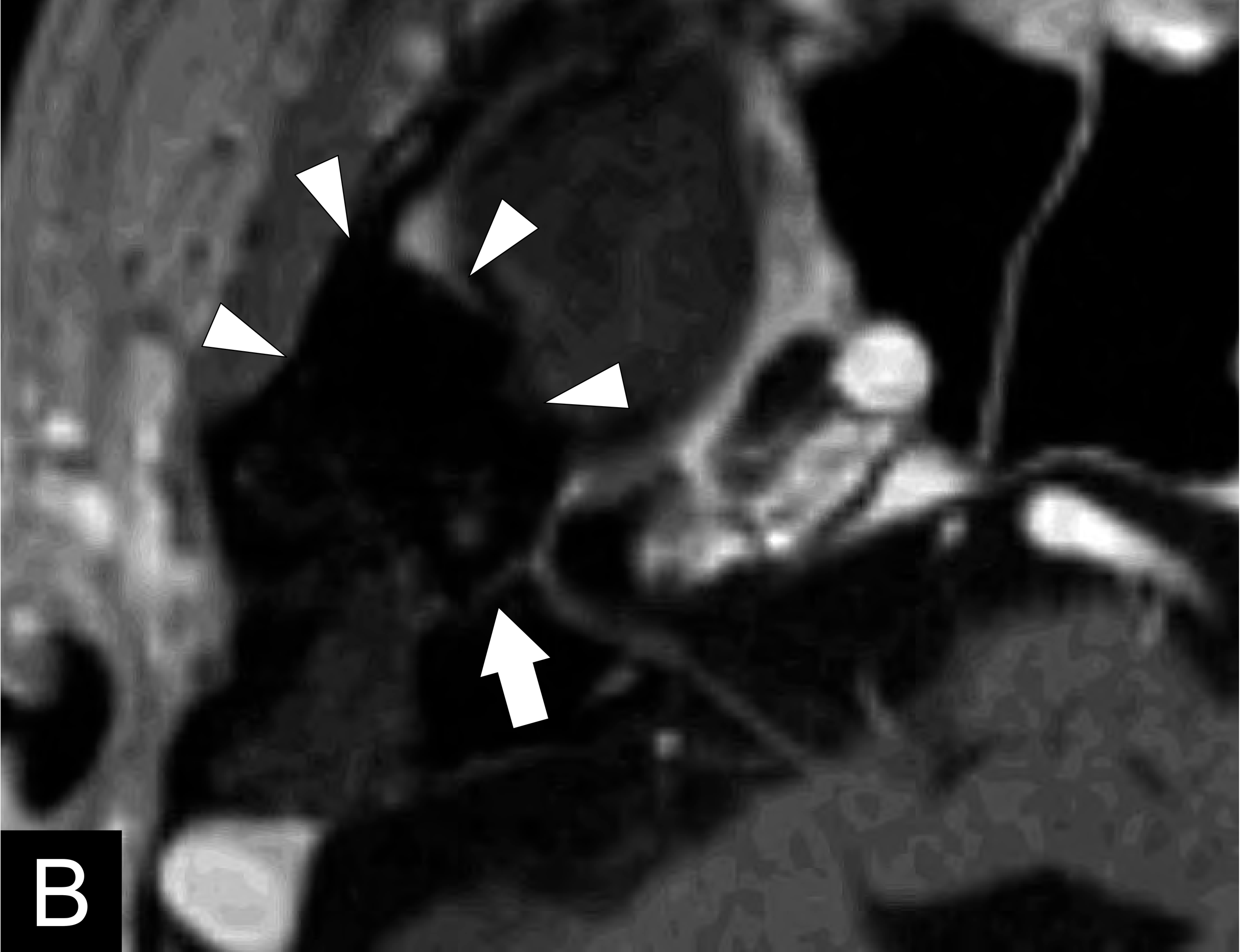

C

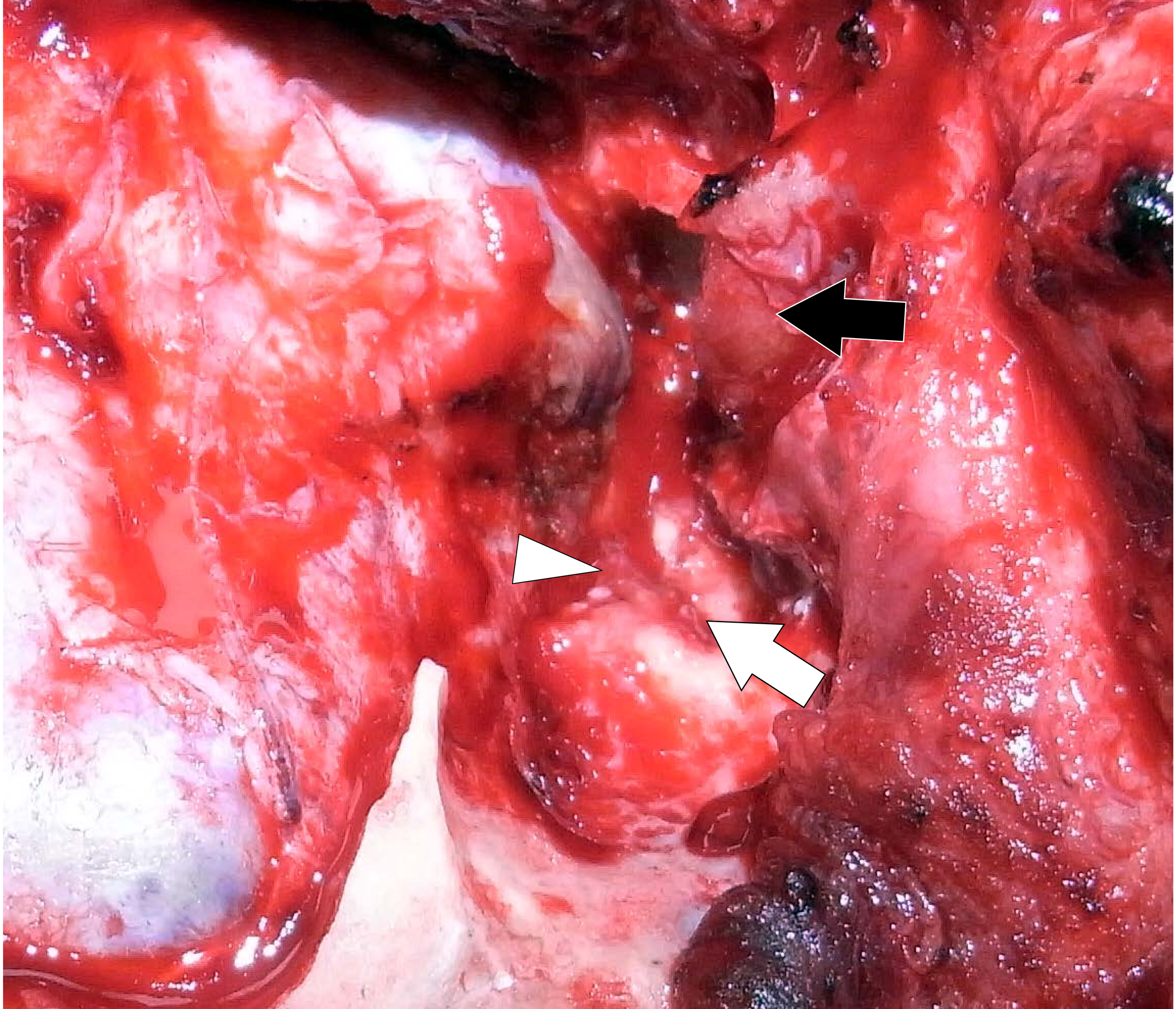

H
A

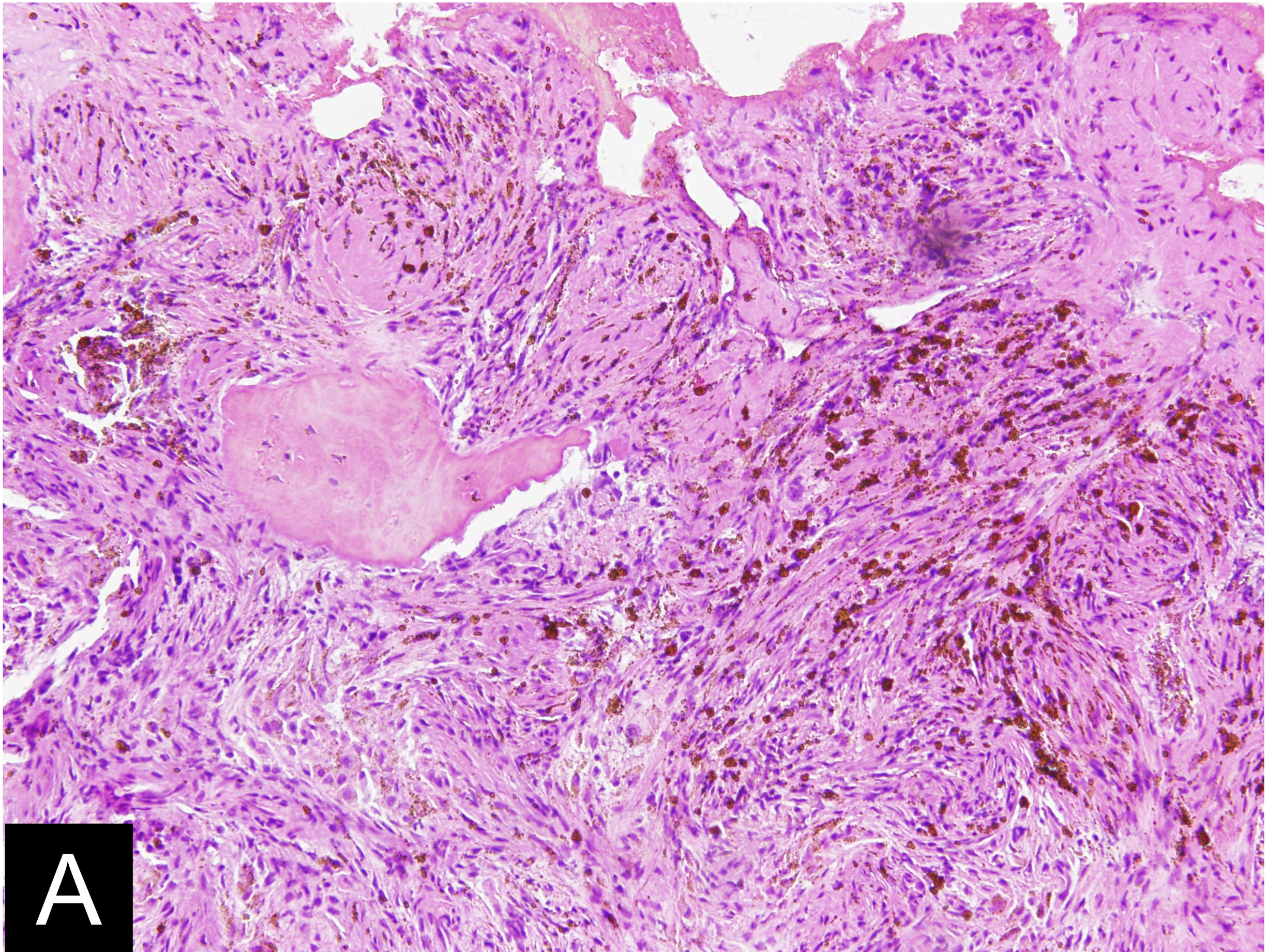

8
E/M
5
H
B

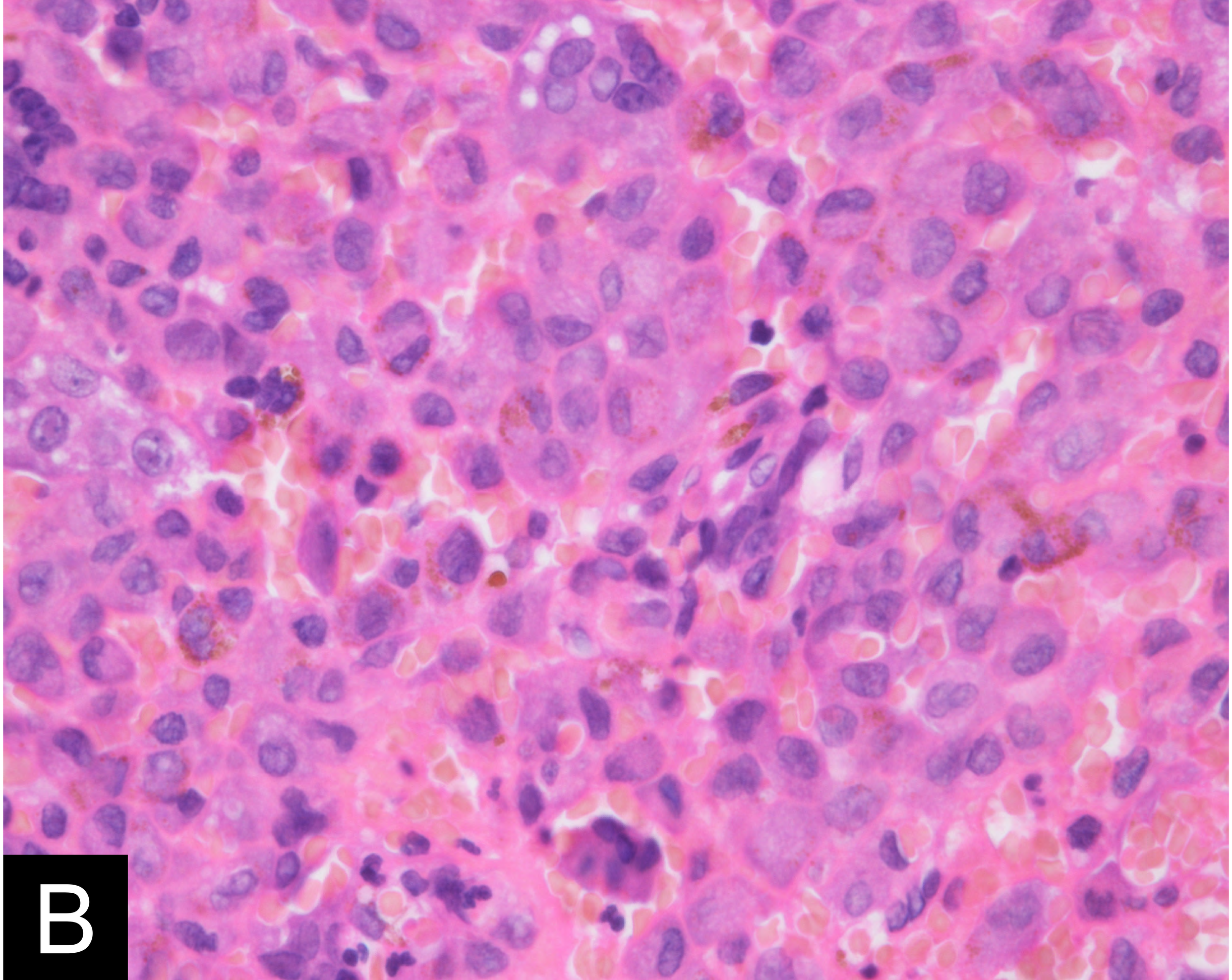

C


A


B




A


B