RadCases

Head and Neck Imaging

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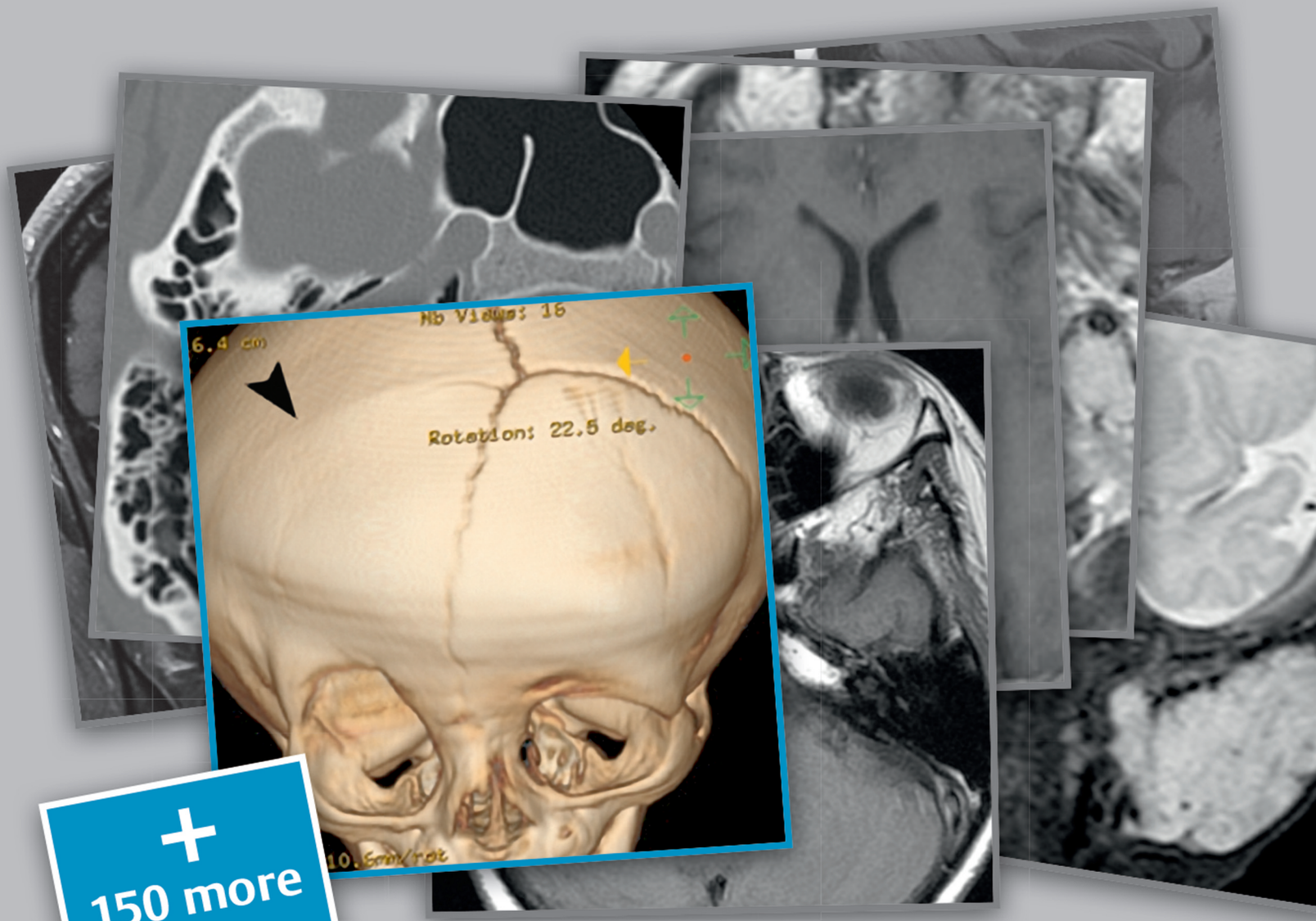

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RadCases Head and Neck Imaging

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Library of Congress Cataloging-in-Publication Data

Names: Shah, Gaurang, author. | Wesolowski, Jeffrey (Jeffrey Robert), author. | Choi, Jeanie (Jeanie M.), 1973- author. | Friedman, Elliot R., author.
Title: RadCases head and neck imaging / Gaurang Shah, Jeffrey Wesolowski, Jeanie Choi, Elliot R. Friedman.
Other titles: Head and neck imaging | RadCases.
Description: First edition. | New York : Thieme, [2016] | Series: RadCases | Includes bibliographical references and index.
Identifiers: LCCN 2016022119 (print) | LCCN 2016022904 (ebook) | ISBN 9781604061932 (paperback) | ISBN 9781604061949 (eBook) | ISBN 9781604061949
Subjects: | MESH: Head—radiography | Neck—radiography | Diagnostic Imaging—methods | Diagnosis, Differential | Case Reports
Classification: LCC RC936 (print) | LCC RC936 (ebook) | NLM WE 700 | DDC 617.5/107572—dc23
LC record available at https://lccn.loc.gov/2016022119

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New York, NY 10001 USA
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www.thieme.com

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70469 Stuttgart, Germany
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Sector-2, Noida-201301
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+91 120 45 566 00, customerservice@thieme.in

Thieme Publishers Rio de Janeiro, Thieme Publicações Ltda.
Edifício Rodolpho de Paoli, 25º andar
Av. Nilo Peçanha, 50 – Sala 2508
Rio de Janeiro 20020-906, Brasil
+55 21 3172 2297

Printed in the United States by Sheridan Press

ISBN 978-1-60406-193-2

Also available as an e-book:
eISBN 978-1-60406-194-9

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RadCases Series Preface

The ability to assimilate detailed information across the entire spectrum of radiology is the Holy Grail sought by those preparing for the American Board of Radiology examination. As enthusiastic partners in the Thieme RadCases Series who formerly took the examination, we understand the exhaustion and frustration shared by residents and the families of residents engaged in this quest. It has been our observation that despite ongoing efforts to improve Web-based interactive databases, residents still find themselves searching for material they can review while preparing for the radiology board examinations and remain frustrated by the fact that only a few printed guidebooks are available, which are limited in both format and image quality. Perhaps their greatest source of frustration is the inability to easily locate groups of cases across all subspecialties of radiology that are organized and tailored for their immediate study needs. Imagine being able to immediately access groups of high-quality cases to arrange study sessions, quickly extract and master information, and prepare for theme-based radiology conferences. Our goal in creating the RadCases Series was to combine the popularity and portability of printed books with the adaptability, exceptional quality, and interactive features of an electronic case-based format.

The intent of the printed book is to encourage repeated priming in the use of critical information by providing a portable group of exceptional core cases that the resident can master. The best way to determine the format for these cases was to ask residents from around the country to weigh in. Overwhelmingly, the residents said that they would prefer a concise, point-by-point presentation of the Essential Facts of each case in an easy-to-read, bulleted format. This approach is easy on exhausted eyes and provides a quick review of Pearls and Pitfalls as information is absorbed during repeated study sessions. We worked hard to choose cases that could be presented well in this format, recognizing the limitations inherent in reproducing high-quality images in print. Unlike the authors of other case-based radiology review books, we removed the guesswork by providing clear annotations and descriptions for all images. In our opinion, there is nothing worse than being unable to locate a subtle finding on a poorly reproduced image even after one knows the final diagnosis.

The electronic cases expand on the printed book and provide a comprehensive review of the entire subspecialty. Thousands of cases are strategically designed to increase the resident's knowledge by providing exposure to additional case examples—from basic to advanced—and by exploring "Aunt Minnie's," unusual diagnoses, and variability within a single diagnosis. The search engine gives the resident a fighting chance to find the Holy Grail by creating individualized, daily study lists that are not limited by factors such as radiology subsection. For example, tailor today's study list to cases involving tuberculosis and include cases in every subspecialty and every system of the body. Or study only thoracic cases, including those with links to cardiology, nuclear medicine, and pediatrics. Or study only musculoskeletal cases. The choice is yours.

As enthusiastic partners in this project, we started small and, with the encouragement, talent, and guidance of Tim Hiscock at Thieme, we have continued to raise the bar in our effort to assist residents in tackling the daunting task of assimilating massive amounts of information. We are passionate about continuing this journey, hoping to expand the cases in our electronic series, adapt cases based on direct feedback from residents, and increase the features intended for board review and self-assessment. As the American Board of Radiology converts its certifying examinations to an electronic format, our series will be the one best suited to meet the needs of the next generation of overworked and exhausted residents in radiology.

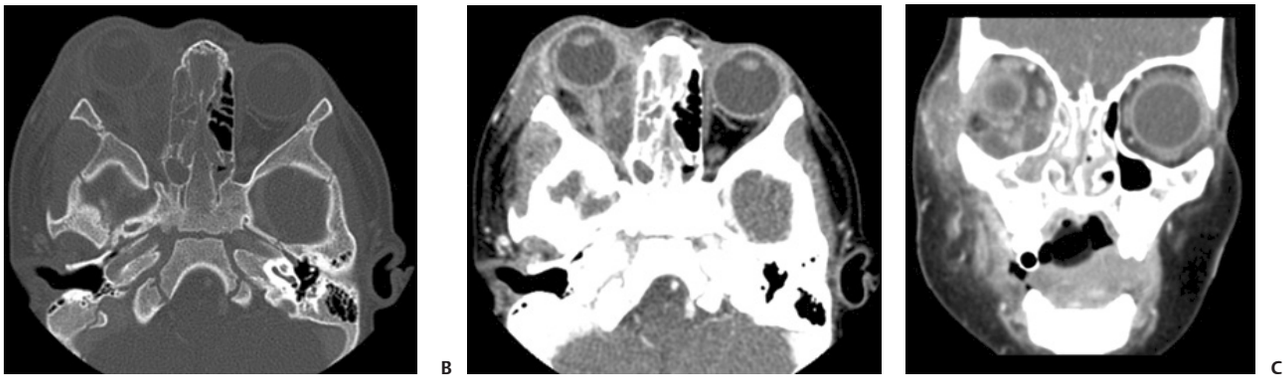
Jonathan Lorenz, MD
Hector Ferral, MD
Chicago, IL

Preface

This *Head and Neck Imaging* contribution to the RadCases series is a highly useful asset to the radiologist, otolaryngologist, and head and neck surgeon. The practitioners in this field are some of the finest diagnosticians in medicine. They have to be. And the best way to prepare for a career as a head and neck specialist is to study all aspects associated with the field so that you can develop your skills during training and on the job. Certainly, the use of radiology stands at the forefront of medical analysis in most medical fields and at the very top of the list for the head and neck practitioner. Using the best tools—such as this book and its associated online cases—will assist you as you strive for perfection.

In this volume, the many cases cover a wide selection of patient presentations. As is typical with the RadCases series format and the cases covered, this book is written for the radiology trainee and resident to help prepare for the American Board of Radiology examination. This volume is a useful tool that readers can go back to again and again, and its breadth, in addition to the supplemental cases available online, will assist in gaining board certification. Radiology residents will be encouraged by the scope of the covered specialties and subspecialties. The volume builds one's confidence, not only to correctly answer questions on the board exam, but—and more importantly—as a real-life radiologist dealing with the most important people in a doctor's life: the patients.

Case 1

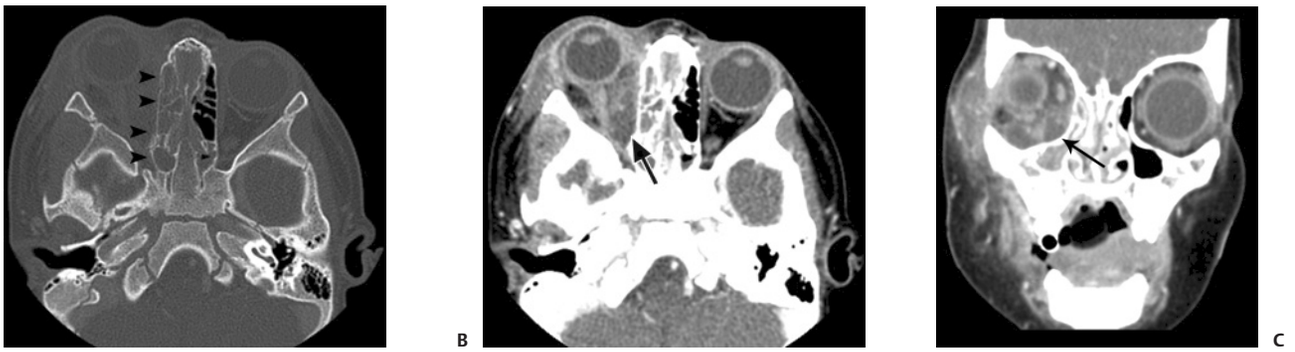


A B C

■ Clinical Presentation

A 7-year-old girl presents with painful right orbital proptosis.

■ Imaging Findings



(A–C) Axial postcontrast CT images of bone **(A)** and soft tissue **(B)**; algorithms were obtained along with a coronal soft tissue reformat **(C)**. There is extensive right periorbital and intraorbital soft tissue swelling. A rim-enhancing fluid collection is present along the right lamina papyracea (*arrow*). The adjacent right ethmoid sinuses are extensively opacified (*arrowheads*).

■ Differential Diagnosis

- ***Subperiosteal abscess:*** By far, the most likely diagnosis given the ethmoid sinus disease, fluid collection, and adjacent inflammatory changes.
- *Orbital pseudotumor:* Can present with painful proptosis and postseptal inflammatory changes; however, fluid collection is not a feature of this disease process and there is no association with paranasal sinus disease.
- *Orbital rhabdomyosarcoma:* Presents as a retro-orbital lesion; however, usually is a painless process without associated preseptal soft tissue and sinus infiltration.

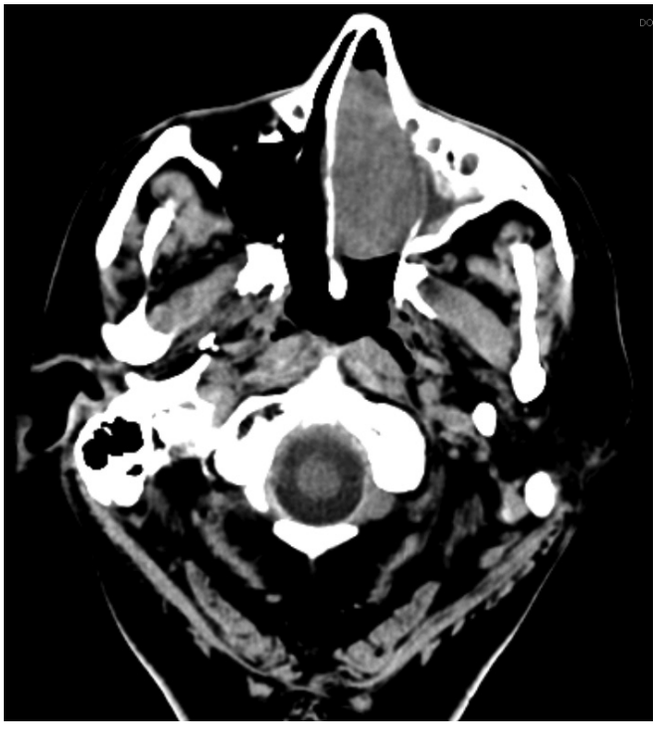
■ Essential Facts

- Orbital infectious processes are generally divided into preseptal and postseptal.
- Preseptal "periorbital" cellulitis can be due to several causes including trauma, dental disease, and adjacent soft tissue inflammatory disease.
- Postseptal "orbital" cellulitis is almost always seen in the associated setting of paranasal sinus (ethmoid or frontal) disease. Bony destruction, however, does not always occur, as bacteria can travel via venules between the sinuses and the orbit. Intravenous antibiotics must be administered.
- Subperiosteal abscess is the extreme end of the spectrum of orbital cellulitis, usually presenting as fluid collection between the lateral rectus and the lamina papyracea. Surgical treatment is often required to prevent further complications, such as optic nerve compression.

✓ Pearls & × Pitfalls

- ✓ Orbital postseptal cellulitis is almost always seen secondary to adjacent paranasal sinus disease.
- × Orbital cellulitis requires IV antibiotics to avoid complications such as cavernous sinus thrombosis and intracranial extension of infection.
- × Subperiosteal abscesses often require drainage to avoid further complication of visual loss due to elevated intra-orbital pressure.

Case 2



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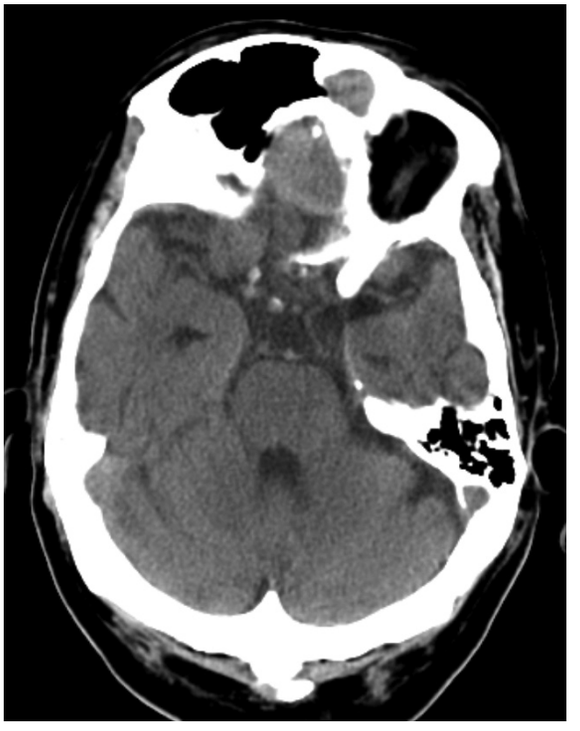


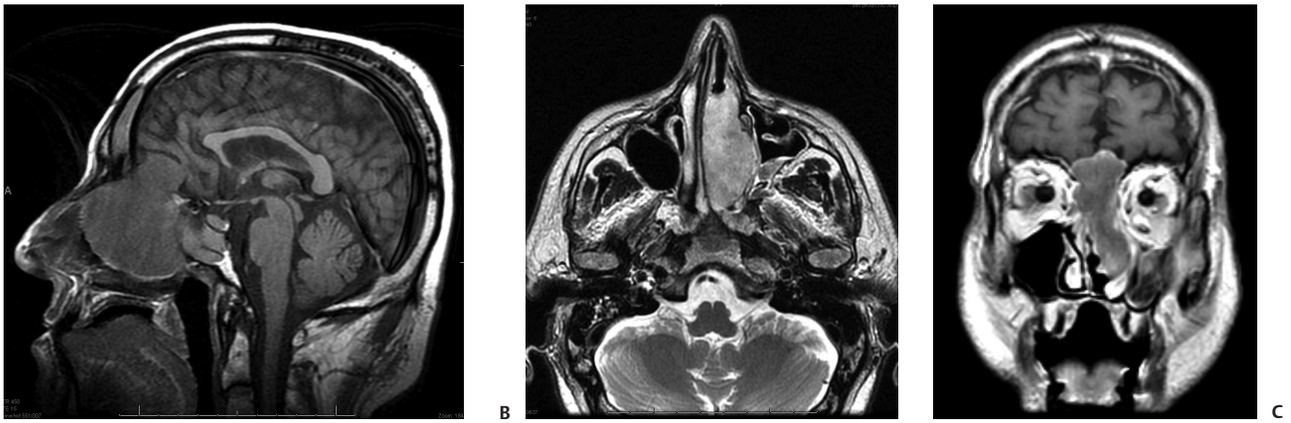
B

■ Clinical Presentation

A 59-year-old man presents with diminished sense of taste and smell and nasal congestion.

An expansile, lobulated, mildly hyperattenuating soft tissue mass is seen at left nasal cavity, extending intracranially into the floor of anterior cranial fossa. MRI of sinonasal region was performed.

■ Imaging Findings



(A–C) MRI of maxillofacial region shows a large, expansile, lobulated sinonasal mass with intermediate high T1 signal, heterogeneous but predominantly intermediate to high T2 signal, and patchy postcontrast enhancement extends into the region of olfactory groove.

■ Differential Diagnosis

- ***Esthesioneuroblastoma:*** A dumbbell-shaped mass with a waist at cribriform plate, inferior extension at upper nasal cavity, and superior intracranial extension with peripheral tumor cyst at tumor–brain margin most likely represents an esthesioneuroblastoma.
- *Sinonasal squamous cell carcinoma:* It is more common in maxillary antrum than the nasal cavity. Also, on postcontrast studies, the intensity of enhancement is less avid.
- *Olfactory meningioma:* Predominantly intracranial; exhibits dural tail and rarely invades the nasal cavity.
- *Sinonasal undifferentiated carcinoma:* Usually seen in older population; very aggressive mass is seen, not confined to cribriform plate.
- *Sinonasal lymphoma:* It is mainly confined to sinonasal region and does not enhance as avidly.

■ Essential Facts

- Bimodal peak in second and sixth decades. It is usually seen in adolescent or middle-aged patient presenting with unilateral nasal obstruction and mild epistaxis.
- It could be polypoid when small and dumbbell-shaped when large.
- Vascular neoplasm of olfactory groove with epicenter below the floor of anterior cranial fossa. Erosive skull base changes and intracranial extension are very common.

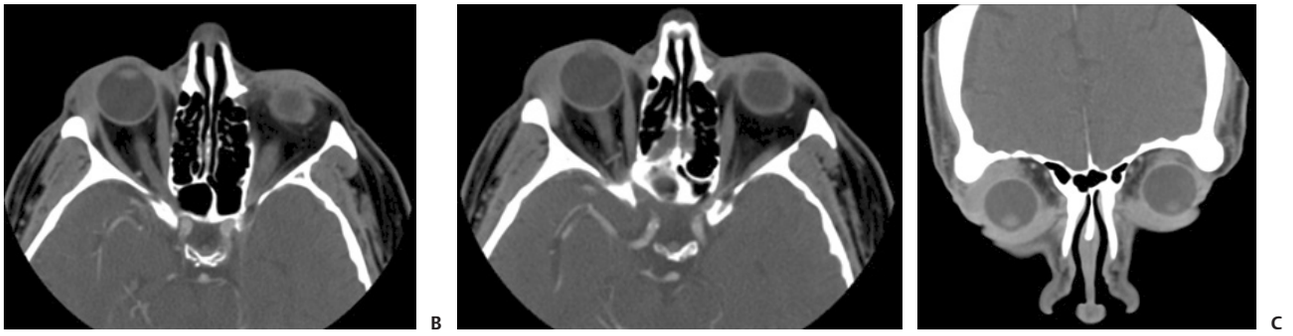
■ Other Imaging Findings

- On CT, a homogenously enhancing mass causing enlargement of nasal cavity with simultaneous bone destruction of cribriform plate area is common.
- On MRI, low to intermediate T1 signal mass, which exhibits intermediate to high T2 signal and elevated homogenous tumor enhancement. There may be a cyst at the tumor–brain interface that displays high T2 signal.

✓ Pearls & × Pitfalls

- ✓ A dumbbell-shaped mass with a waist at cribriform plate, inferior extension at upper nasal cavity, and superior intracranial extension with peripheral tumor cyst at tumor–brain margin most likely represents an esthesioneuroblastoma.
- × Areas of hemorrhage within tumor can result in heterogeneous tumor matrix.

Case 3

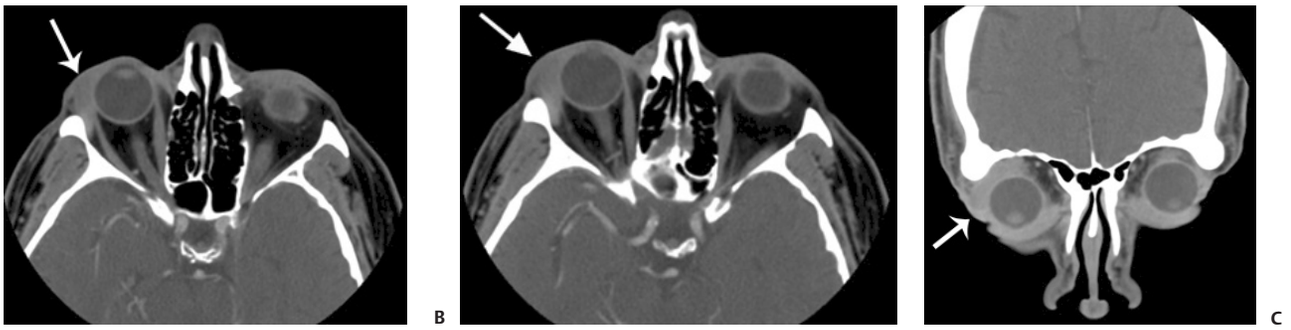


A B C

■ Clinical Presentation

A 40-year-old man presents with facial swelling.

■ Imaging Findings



(A–C) Axial and coronal contrast-enhanced CT images of the orbits. There is diffuse enlargement of the right lacrimal gland (*arrow*) without adjacent stranding. The remainder of the orbit has a normal appearance.

■ Differential Diagnosis

- ***Lacrimal gland lymphoma:*** In a patient with diffuse asymmetrical enlargement of the gland, this ranks highly on the list of differential diagnoses.
- *Sjögren or other lymphoid lesions:* This would be a good second choice from the list, as it also can present with diffuse enlargement.
- *Salivary gland tumor:* Less likely, as such cases tend to present with a focal mass within the affected gland.

■ Essential Facts

- Lacrimal gland lesions are typically divided into inflammatory (sarcoid, infection, etc.) and neoplastic processes (lymphoid tumors and salivary gland lesions), as these are the tissues that make up the gland.
- Inflammatory and lymphoid lesions tend to affect the gland diffusely, whereas salivary gland tumors tend to be more focal.
- Patients with lacrimal gland lymphoma may be asymptomatic or complain of visual change or cosmetic alterations.
- Lacrimal gland lymphomas constitute ~50% of lacrimal gland tumors and, as noted previously, typically present with diffuse glandular enlargement on cross-sectional imaging.
- Diagnosis is confirmed on biopsy. Full body workup must be performed in such patients to assess for distant disease which will alter therapy.

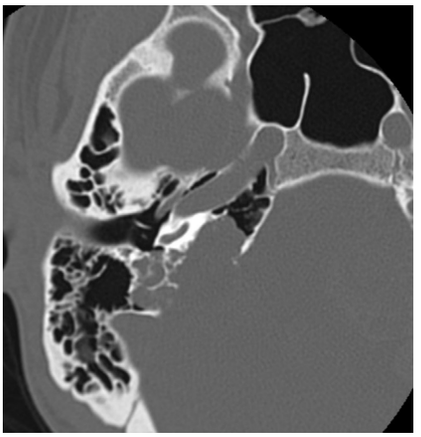
■ Other Imaging Findings

- MRI can be helpful in suggesting a lymphoid lesion.
- Relative T2 shortening and restricted diffusion can be seen in such cases, likely due to increased cellularity of the lesions.

✓ Pearls & × Pitfalls

- ✓ Inflammatory processes, lymphoid and salivary gland tumors make up the majority of lacrimal gland lesions.
- ✓ Of tumors, 50% tend to be lymphoid in origin, whereas the remainder are usually salivary gland neoplasms.
- × Full body staging must be performed in patients with lacrimal gland lymphoma to assess the full extent of disease.

Case 4



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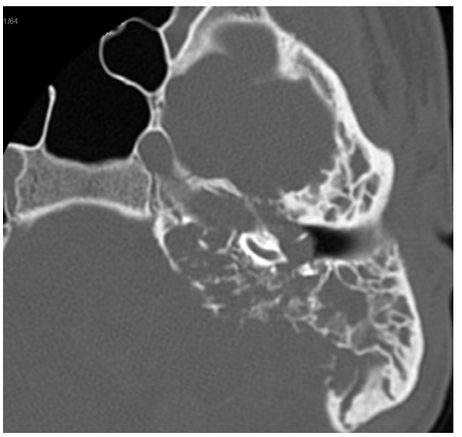


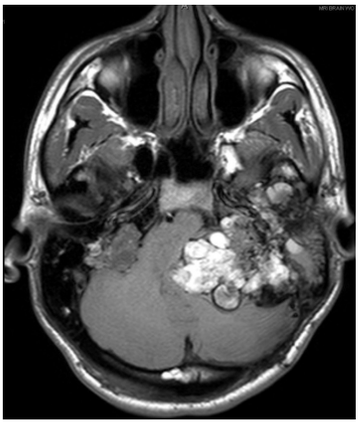
B

Clinical Presentation

A 20-year-old presents with progressive bilateral sensorineural hearing loss, pulsatile tinnitus, and right facial nerve palsy.

Further Work-up

CT scan of temporal bones shows irregular, destructive processes at bilateral temporal bones. MRI of posterior fossa is performed.



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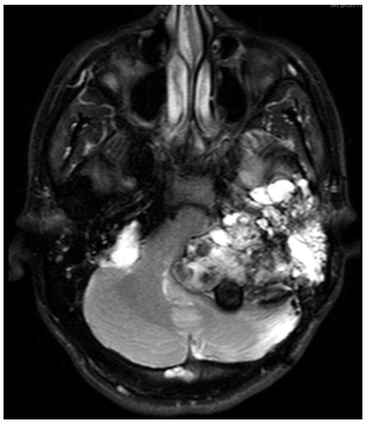

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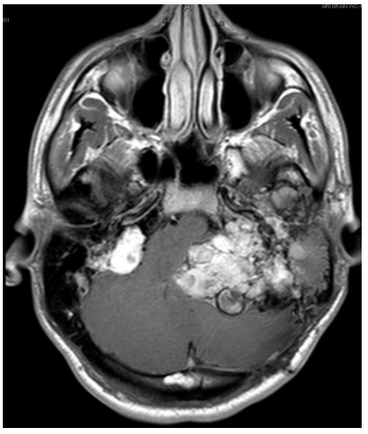

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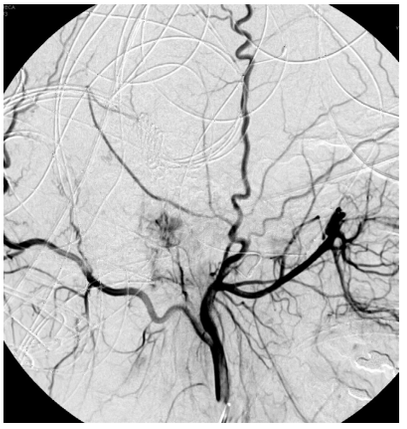
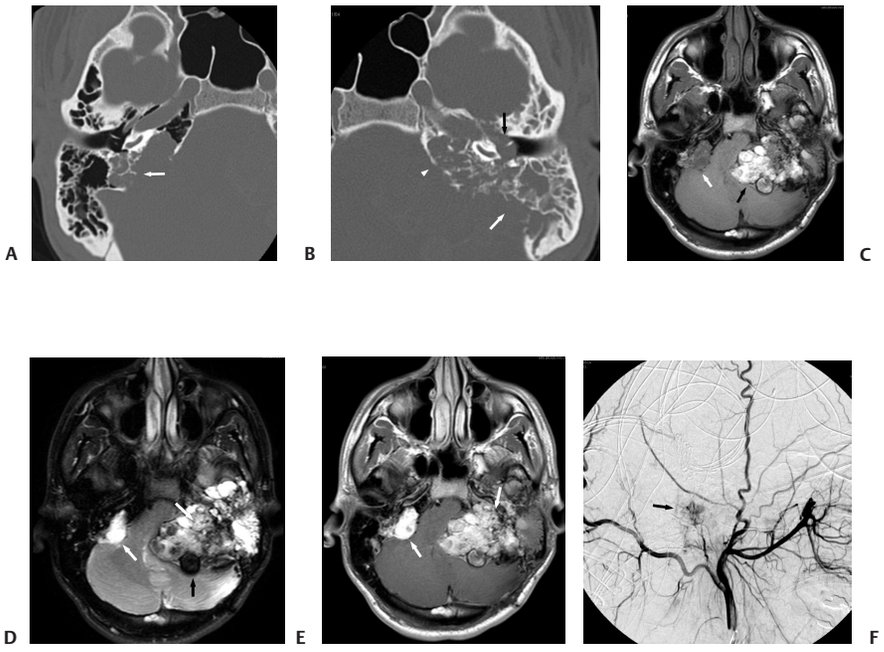


F

■ Imaging Findings



(A) An irregular destructive infiltrating right temporal bone mass (*white arrow*) arising posterior to the cochlea in the retrolabyrinthine area. **(B)** An irregular destructive infiltrating left temporal bone mass arising from the retrolabyrinthine area (*white arrow*) extending into the petrous apex (*white arrowhead*) and into the middle ear cavity (*black arrow*). **(C)** T1-weighted image exhibits large, irregular, lobulated, bilateral temporal bone masses. The smaller right-sided mass exhibits low T1 signal (*white arrow*), whereas the larger left-sided mass has lobulations with high T1 signal (*black arrow*) as well as low T1 signal. **(D)** T2-weighted image shows bilateral heterogeneous masses with high T2-signal areas suggestive of vascular masses (*white arrows*). Some of the high T1 signal lobulations exhibit low T2 signal, suggestive of hemorrhagic products (*black arrow*). **(E)** Post-contrast images exhibit intense enhancement of low T1 and high T2 signal areas (*white arrows*). Very little enhancement is seen at hemorrhagic lobulations. **(F)** Endovascular angiography of right external carotid artery (ECA) shows tumor blush supplied by ascending pharyngeal artery (*black arrow*).

■ Differential Diagnosis

- ***Endolymphatic sac tumor (ELST):*** Destructive soft tissue lesion originating in the retrolabyrinthine posterior surface of petrous temporal bone, involving semicircular canals and vestibule and spreading to middle ear cavity.
- *Schwannoma of jugular foramen:* The lesion is centered in jugular foramen and does not involve the retrolabyrinthine temporal bone.
- *Cholesterol granuloma petrous apex:* The lesion is centered in petrous apex and the whole lesion exhibits high T1 signal on MRI.
- *Metastatic deposits from renal cell carcinoma or papillary thyroid carcinoma:* These lesions are very destructive and do not exhibit any calcification of the posterior limb. It also lacks the high T1 signal foci on MRI.
- *Jugulotympanicum and glomus jugulare paraganglioma:* The lesion is centered in the jugular foramen and then involves the middle ear and does not involve the retrolabyrinthine temporal bone.

■ Essential Facts

- Slow-growing but aggressive adenomatous or cystadenomatous tumor arising from low columnar or cuboidal cellular lining of the endolymphatic sac.
- Most lesions are spermatic, but 15% of patients with von Hippel-Lindau (VHL) disease develop ELST.
- Sensorineural hearing loss is present in all the patients. Other symptoms include facial nerve palsy, pulsatile tinnitus, and vertigo.
- Treatment includes complete surgical dissection with white margins. Presurgical embolization is performed to contain perioperative bleeding. Radiation therapy is for unresectable lesions or nonsurgical candidates.

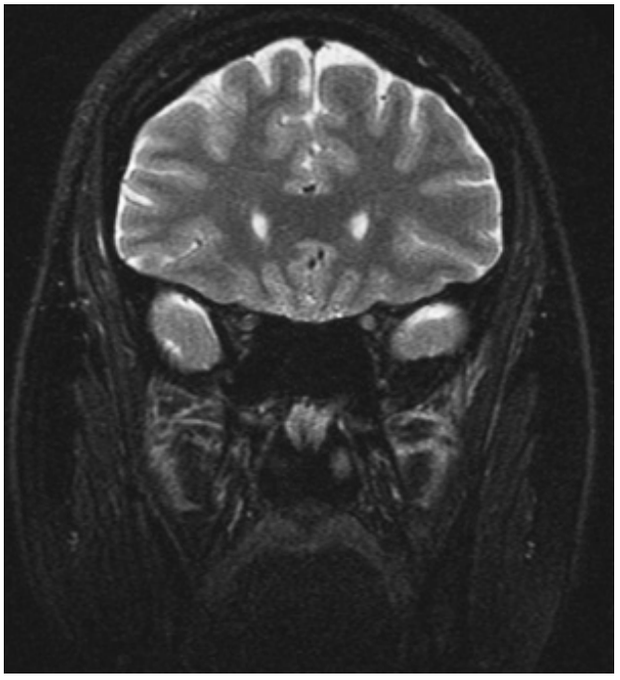
■ Other Imaging Findings

- On CT, a thin rim of calcification is seen along the posterior margin of tumor with presence of spiculated calcifications within the mass.
- On MRI, a majority exhibit foci of high T1 signal along the margin or within the mass, presence of flow voids, and heterogeneous contrast enhancement.
- On angiography, a hypervascular tumor blush is seen.
- Vascular supply is seen from ECA and, when more than 3 cm in size, also from internal carotid artery and posterior circulation.
- MRA and MRV are needed to evaluate vascular relationships.

✓ Pearls & × Pitfalls

- ✓ Destructive lesion centered at the retrolabyrinthine portion of the posterior surface of the petrous temporal bone with presence of bony spicules on CT and high T1 signal foci and flow voids on MRI in a patient with sensorineural hearing loss.
- × On detection of ELST, check patient and family history for VHL. In that case, screening of the patient for cerebellar and spinal cord hemangioblastoma, pheochromocytoma, renal cell carcinoma, and renal and pancreatic cysts should be performed.

Case 5



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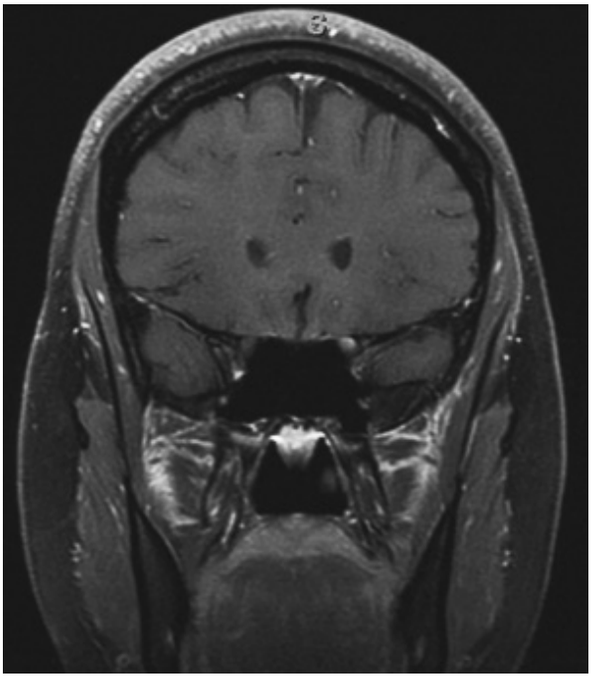
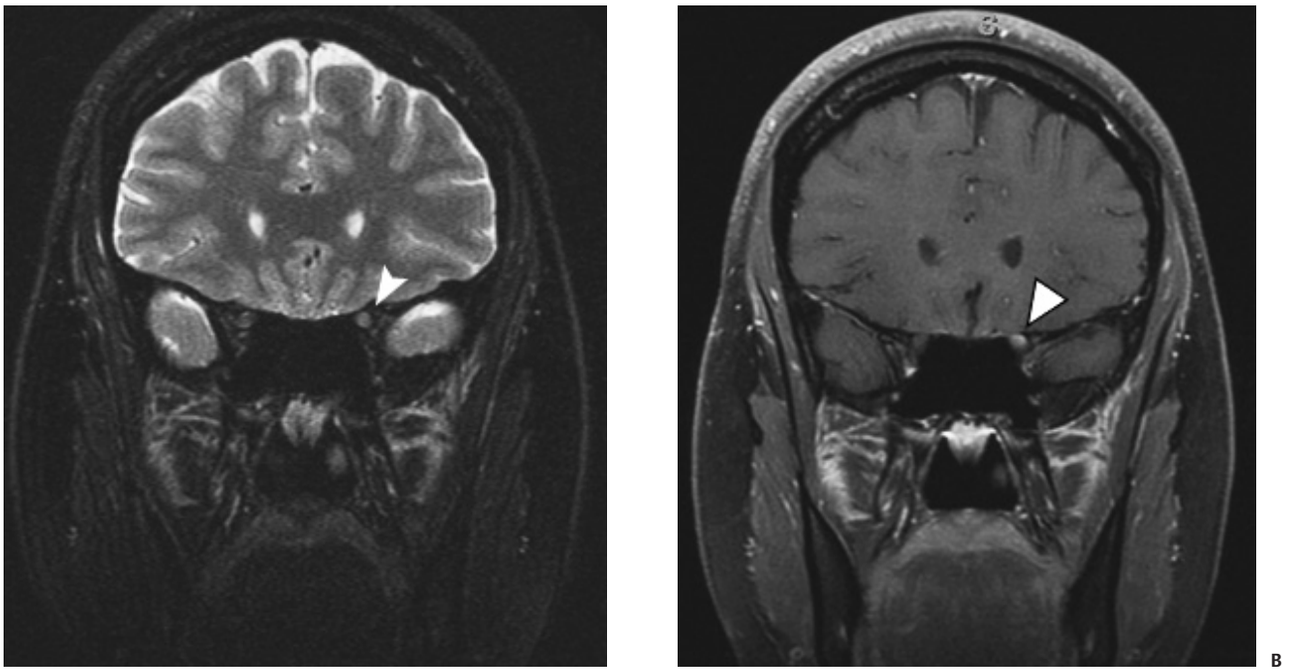


B

■ Clinical Presentation

A 28-year-old woman presents with decreased left eye vision over 1 week with accompanying left eye pain.

■ Imaging Findings



A B

Coronal T2 **(A)** and T1 postcontrast images with fat saturation **(B)** were obtained and demonstrate a slightly enlarged left optic nerve with mild T2 prolongation and contrast enhancement (*arrowheads*).

■ Differential Diagnosis

- ***Demyelinating optic neuritis:*** In a young woman with this clinical presentation, enhancement and T2 prolongation of the affected nerve would strongly suggest this diagnosis.
- *Optic nerve glioma:* Less likely diagnosis, given the age of the patient and the onset and type of clinical findings. However, a small/early tumor could have a similar appearance.
- *Lyme disease:* Radiographically can appear identical to optic neuritis. Therefore, one must correlate with clinical setting, particularly with regard to rashes, arthralgias, and other CNS findings.

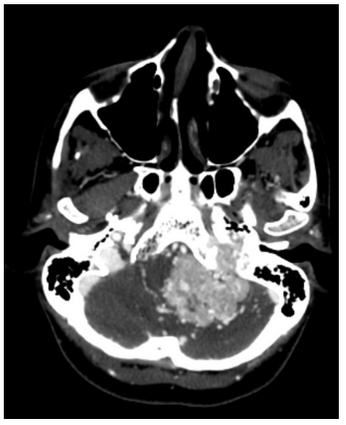
■ Essential Facts

- Optic neuritis is an idiopathic inflammatory demyelinating disorder of the optic nerves. Can involve any segment of the nerve including the chiasm.
- Can be an isolated episode. However, 30 to 40% of such patients will go on to have multiple sclerosis.
- Clinically, affected patients will present with vision loss (often involving loss of color vision) and eye pain.
- Most patients will recover spontaneously. Corticosteroids may be of benefit to hasten improvement.
- Disease involvement with concomitant spine involvement (and lack of brain imaging findings) is known as Devic disease or neuromyelitis optica.

✓ Pearls & × Pitfalls

- ✓ Optic neuritis can be bilateral in ~25 to 30% of cases.
- × Multiple sclerosis can be seen in such patients, as noted above, and thus evaluation of brain parenchyma on available imaging sequences is advised.
- × Other disease processes can involve the optic nerve (such as Lyme disease, HIV, and TB) and produce a similar radiographic appearance.

Case 6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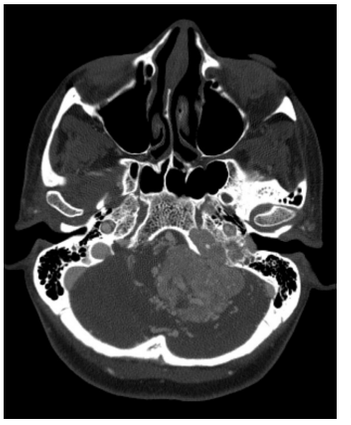
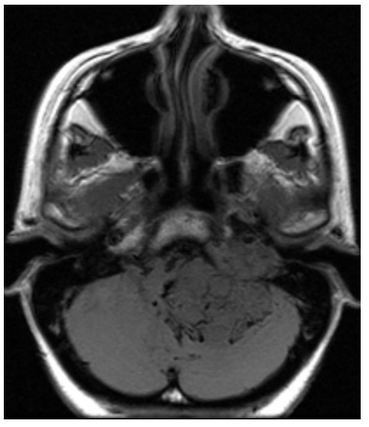

B

■ Clinical Presentation

A 40-year-old woman presents with pulsatile tinnitus, hearing loss, and progressively worsening headaches with new symptoms of nausea, vomiting, unsteady gait, and dysphagia.

■ Further Work-up

MRI of posterior fossa is performed.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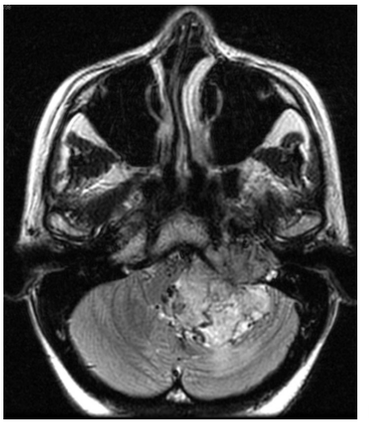
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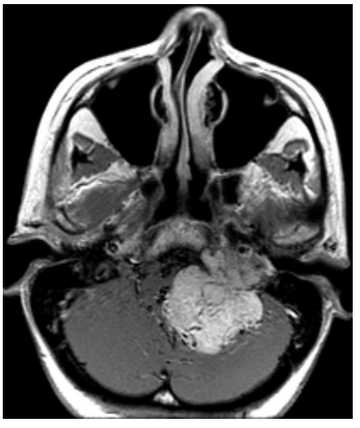
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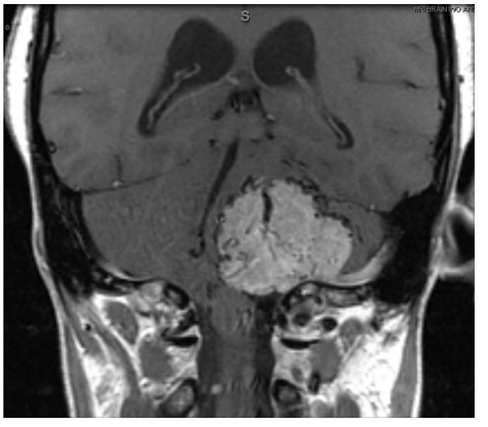
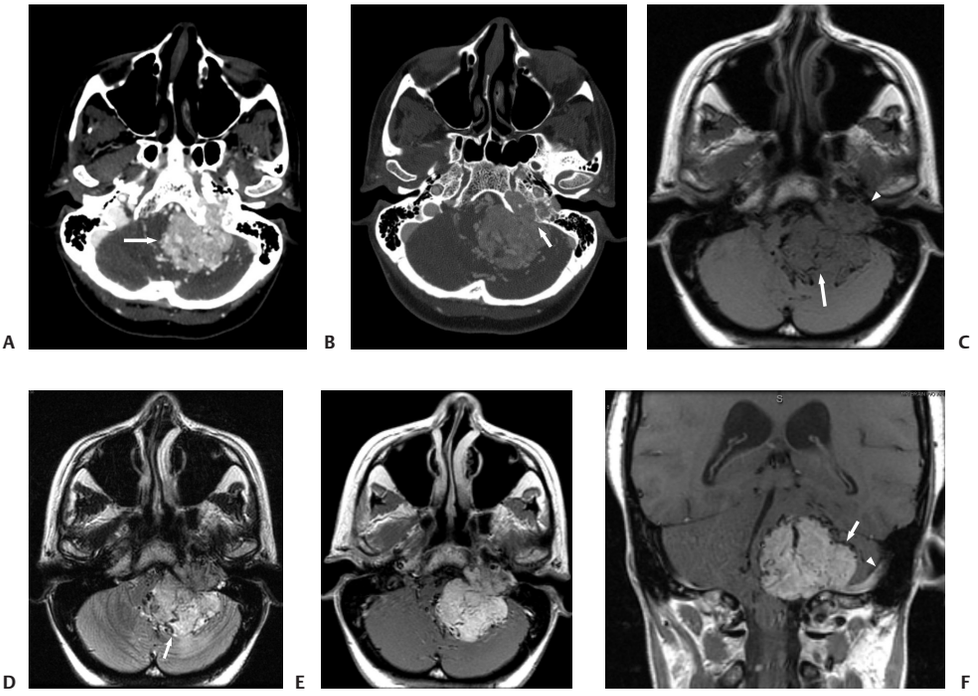

F

■ Imaging Findings



(A) Postcontrast CT shows a densely enhancing, large, lobulated posterior fossa mass (*arrow*) extending into an enlarged left jugular foramen. Enhancing serpentine blood vessels are visualized within and around the mass. **(B)** Bone window exhibits permeative erosive margins of enlarged jugular foramen with erosion of jugular spine (*arrow*). **(C, D)** Large lobulated, dumbbell-shaped intermediate T1 signal and high T2 signal extra-axial posterior fossa mass with a large number of high velocity flow voids (*arrow*) extending into the jugular fossa. **(E, F)** An intensely enhancing jugular fossa mass (*arrow*) with large flow voids is in close proximity to the left sigmoid sinus.

■ Differential Diagnosis

- ***Glomus jugulare paraganglioma:*** Jugular fossa mass without extension into middle ear cavity with permeative bone changes along the margins of jugular fossa on CT, erosion of jugular spine, and presence of flow voids on MRI.
- *Jugular foramen meningioma:* Permeative/hyperostotic bony changes are seen on CT and dural tail on MRI.
- *Jugular foramen schwannoma:* Smooth enlargement of jugular foramen is seen on CT with dumbbell-shaped spread along the course of cranial nerves IX to XI.
- *High riding or dehiscent jugular bulb:* Smooth enlargement of jugular foramen with intact bony margins on CT without evidence for a soft tissue mass.

■ Essential Facts

- Arises from glomus bodies which are composed of chemoreceptor cells, derived from primitive neural crests.
- There is a 4:1 female-to-male predominance; common age group is 40 to 60.
- Most common clinical presentation is objective feeling of pulsatile tinnitus.
- Sporadic disease is multicentric ~5% of the time. However, when familial, the incidence of multicentricity can reach from 25 to 50%.
- Treatment: surgery only for smaller masses, radiation only for older population, both surgery and radiation for larger lesions. Presurgical embolization is increasingly used.

■ Other Imaging Findings

- On CT, erosion of jugular spine with permeative, erosive margins of jugular fossa.
- On MR, intermediate T1 signal. In case of subacute hemorrhage within the tumor, salt-and-pepper appearance may be seen with high-signal "salt" areas due to subacute hemorrhage. High velocity low T1 signal flow voids represent pepper. On T2-weighted images, the mass appears hyperintense.
- On angiography, a hypervascular mass is seen with enlarged arteries supplying the mass with intense tumor blush and early venous drainage. Most common arterial supply is from ascending pharyngeal branch of external carotid artery.
- On CT-PET, intense F^{18}-FDG uptake is seen. This is useful to monitor response to therapy and detection of metastasis.

✓ Pearls & × Pitfalls

- ✓ A permeative destructive jugular fossa mass on CT with salt-and-pepper appearance on MRI and multiple high velocity flow voids in a middle-aged woman with pulsatile tinnitus is the most common presentation.
- × Metastatic lesions to jugular fossa and highly vascular jugular fossa schwannoma can have a similar imaging appearance.