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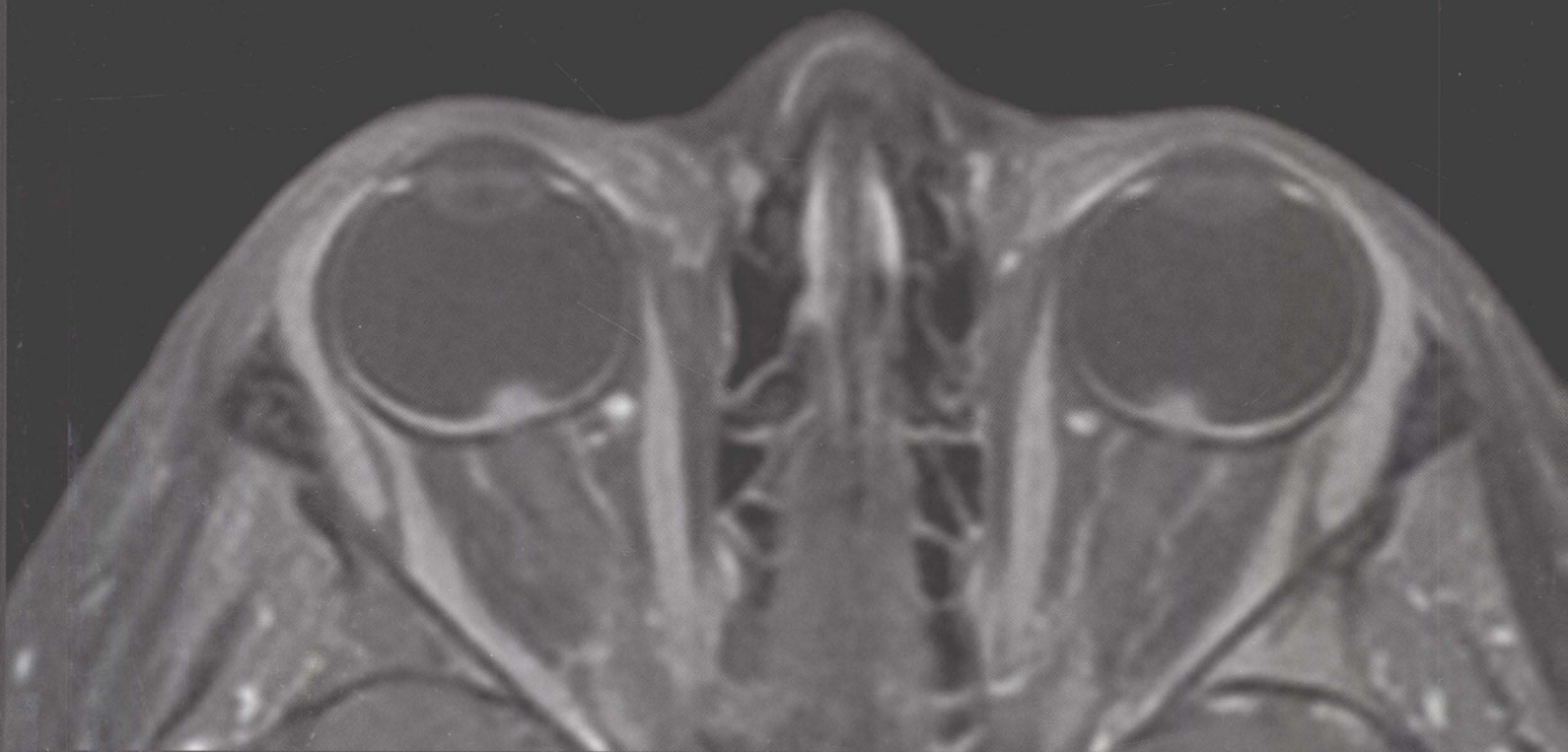
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NEURORADIOLOGY: THE REQUISITES

**4TH**  
EDITION

# Head and Neck Imaging

CASE REVIEW SERIES



DAVID M. YOUSEM, MD, MBA

ELSEVIER  
SAUNDERS

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Baltimore, Maryland

CASE REVIEW

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*To all the residents, fellows, and trainees preparing  
for examinations and the world to follow, and to  
all the practicing radiologists uncomfortable with  
head and neck radiology (95% of us??):  
Good luck. I hope this is helpful on your journey.*

*To Kelly, my partner now and forever:*

*To my kids and extended family:*

**You** are in every second of my life, every day and  
every way. Thank you for the love and support ...  
always and all ways.

—DMY



I have been very gratified by the popularity and positive feedback that the authors of the *Case Review* series have received on the publication of the latest editions of their volumes. Reviews in journals and online sites as well as word-of-mouth comments have been uniformly favorable. The authors have done an outstanding job in filling the niche of an affordable, easy-to-access, case-based learning tool that supplements the material in *The Requisites* series. I have been told by residents, fellows, and practicing radiologists that the *Case Review* series books are the ideal means for studying for oral board examinations and subspecialty certification tests.

Although some students learn best in a non-interactive study book mode, others need the anxiety or excitement of being quizzed. The selected format for the *Case Review* series (which consists of showing a few images needed to construct a differential diagnosis and then asking a few clinical and imaging questions) was designed to simulate the Board examination experience. The only difference is that the *Case Review* books provide the correct answer and immediate feedback. The limit and range of the reader's knowledge are tested through scaled cases ranging from relatively easy to very hard. The *Case Review* series also offers feedback on the answers, a brief discussion of each case, a link back to the pertinent *Requisites* volume, and up-to-date references from the literature. In addition, we have recently included labeled figures, figure legends, and supplemental figures in a new section at the end of the book to provide the reader more information about the case and diagnosis.

Because of the popularity of online learning, we have been rolling out new editions with electronic content as well. We also have adjusted to the new (non-oral) Boards format, which will be electronic and largely case-based. The *Case Reviews* are now hosted online at [www.expertconsult.com](http://www.expertconsult.com), powered by Inkling. The interactive test-taking format allows users to get real-time feedback, "pinch-and-zoom" figures for easier viewing, and links to supplemental figures and online references. Personally, I am very excited about the future. Join us.

**David M. Yousem, MD, MBA**

This is the fourth edition of 200 head and neck cases that I have prepared for the *Case Review Series (CRS)*. I wrote this edition with the kind and considerate help of Katy Meert, Content Development Specialist at Elsevier, who worked hard to format and review my cases so that they met the specifications of the new CRS electronic format. This new electronic offering through [www.expertconsult.com](http://www.expertconsult.com) is a hybrid of the textbook and the fully interactive CRS product we had previously offered. It is now more light and nimble but still very effective in teaching you head and neck radiology.

As I look at my career in neuroradiology (now that I am in my mid-50s), the most gratifying moments have been twofold: (1) having someone come up to me and say "I read your book (*Neuroradiology: The Requisites* or *Head and Neck Imaging: Case Review*) and it helped me get through the Boards. I really enjoyed it," or (2) having someone who I have employed/trained/written letters for get his or her green card and/or become a U.S. citizen. Those two events, passing the Boards and getting a green card, are very special moments.

I hope that this contribution to the literature will allow more people to feel comfortable with head and neck imaging. This is a neat area of radiology, and if you know it well, you add significant value to your imaging team *and* the clinicians. The skull base surgeons, plastic surgeons, dermatologists, oral surgeons, endocrinologists, and otorhinolaryngologists will gravitate to you if you show interest and expertise. You can become the "go to" person for a finite field of radiology in your group. That is special.

I want to thank all my residents and fellows who have inspired me to continue to write textbooks and casebooks that they find valuable. The worth of *Case Review* books is unquestioned. They apply the knowledge base to the interpretation of images that can benefit patient care. *Case Review* books reinforce the didactic teachings of other literature. They allow the development of pattern recognition that is so critical to "knowing" a diagnosis at a glance.

Thank you to Nafi Aygun for the help on the third edition and for his expertise in head and neck imaging. Thanks to the Neuroradiology Division at Johns Hopkins Medical Institutions.

I am proud to submit, for your perusal, *Head and Neck Imaging: Case Review*, Fourth Edition.

**David M. Yousem, MD, MBA**



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# Opening Round



## CASE 1



Figure 1-1

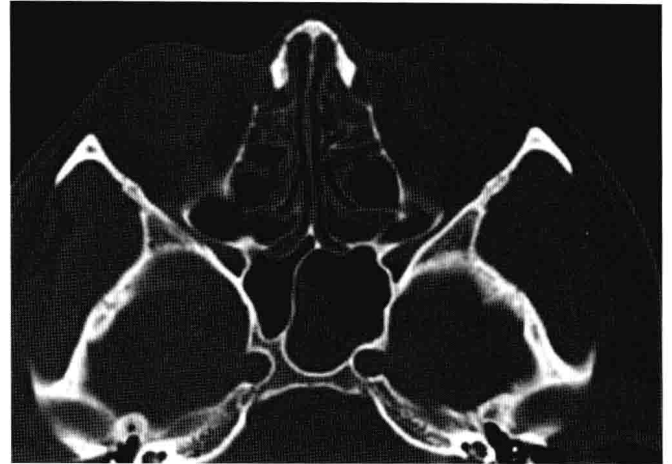


Figure 1-2

**HISTORY:** A young adult complains of nasal congestion and a runny nose.

- Which of the following would be included in the differential diagnosis for the imaging findings presented? (Choose all that apply.)
  - Sinonasal polyposis
  - Mucocele
  - Acute sinusitis
  - Acute on chronic sinusitis
- Which of the following is *true* about sinusitis?
  - Acute sinusitis in a patient who is receiving a bone marrow transplant is associated with increased mortality.
  - Acute sinusitis in a patient who is receiving a bone marrow transplant is associated with transplant rejection.
  - Chronic sinusitis in a patient who is receiving a bone marrow transplant is associated with decreased mortality.
  - Screening for sinusitis in a patient receiving a bone marrow transplant has little value.
- The routes of paranasal sinus drainage include which of the following?
  - Frontal sinuses to nasolacrimal duct
  - Maxillary sinus to inferior meatus
  - Posterior ethmoid to sphenothmoidal recess
  - Anterior ethmoid to agger nasi
- What finding is not indicative of chronic sinusitis?
  - Air-fluid levels
  - Mucosal thickening
  - Osteitis
  - Polyps
  - Mucous retention cysts

See Supplemental Figures section for additional figures and legends for this case.

## CASE 1

## Acute Sinusitis

1. **C and D.** The presence of an air-fluid level implies acute sinusitis. Mucosal thickening may occur with acute or chronic sinusitis. Polyps are usually typical of chronic sinusitis. Osteitis is usually a long-term consequence.
2. **A.** Acute sinusitis in a patient undergoing bone marrow transplantation has direct effect on long-term prognosis. Hence clinicians often scan the patient before bone marrow transplantation and treat sinusitis as needed.
3. **C.** Frontal sinuses drain to the frontal recess; the maxillary sinus drains to the ostium and infundibulum and then to the middle meatus, posterior ethmoid, and sphenoid sinus via the sphenoethmoidal recess. The anterior ethmoids also drain to the middle meatus.
4. **A.** An air-fluid level is a finding indicative of an acute process. Mucosal thickening can occur in acute or chronic sinusitis. Osteitis, mucous retention cysts, and polyps occur in chronic sinusitis.

## Comment

## Imaging Findings

The imaging findings that imply acute sinusitis include new mucosal thickening, air-fluid levels (Figure S1-1), and air bubbles in sinus secretions (Figure S1-2) even in the absence of an air-fluid level. The misconception that mucosal edema/thickening occurs only in chronic sinusitis is rampant, but this

author, who underwent serial imaging of himself during the course of 14 days of antibiotics and intranasal steroid therapy, demonstrated that mucosal thickening appears and resolves over that period of time along with symptoms.

## Sites of Obstruction

When reviewing cases of chronic and acute sinusitis, clinicians should note the potential obstructive sites that may be the underlying cause of the sinusitis. Radiologists should report on areas of mucosal thickening and narrowings of the maxillary sinus ostia, hiatus semilunaris, infundibulum, and middle meatus in cases of maxillary and ethmoid sinusitis. For frontal sinusitis, the frontal (ethmoidal) recess and middle meatus should be scrutinized. For posterior ethmoid and sphenoid sinusitis, the spheno-ethmoidal recess should be assessed for obstruction.

## Pathogens

Viral and bacterial microorganisms are the usual culprits in an immunocompetent individual with acute sinusitis. Rhinoviruses, influenza virus, parainfluenza virus, and respiratory syncytial virus are the leading viral pathogens. *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis*, *Streptococcus pyogenes*, and *Staphylococcus aureus* constitute the usual bacteria.

## Reference

Wittkopf ML, Beddow PA, Russell PT, Duncavage JA, Becker SS. Revisiting the interpretation of positive sinus CT findings: a radiological and symptom-based review. *Otolaryngol Head Neck Surg*. 2009;140(3):306-311.

## Cross-Reference

*Neuroradiology: The Requisites*, 3rd ed, 425.

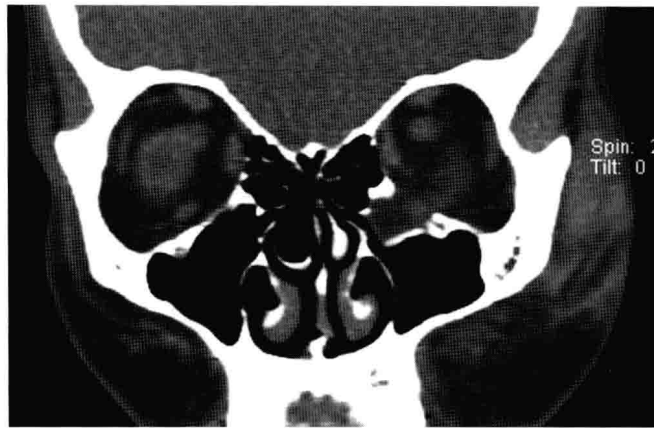


Figure 2-1

**HISTORY:** A young man complains of eye pain and has contusions after being punched in the left side of the face.

- Which facial bone or bones appear to be fractured in Figure 2-1? (Choose all that apply.)
  - Orbital floor
  - Lamina papyracea
  - Anterior maxillary spine
  - Zygomatic arch
- With regard to orbital fractures, which of the following is *true*?
  - The lamina papyracea is fractured more commonly than the orbital floor.
  - The orbital floor is fractured more commonly than the orbital rim.
  - The orbital roof is fractured more commonly than the lateral orbital wall.
  - The orbital septum is fractured more commonly than the orbital spine.
- What is the difference between a trap door deformity (single fracture swinging downward) and Bombay door deformity (two fracture fragments swinging downward) of the orbital floor?
  - The number of fragments depressed
  - The incidence of diplopia
  - The coincidence of medial orbital wall fracture
  - The age of the fracture
- Which of the following is correlated with the degree of early and late enophthalmos?
  - Orbital fracture volume
  - Size of hematoma
  - Concurrent hyperthyroidism
  - Entrapment

See Supplemental Figures section for additional figures and legends for this case.

## CASE 2

## Facial Fracture

1. **A and B.** The orbital floor and its common wall with the medial orbit (the lamina papyracea) are fractured.
2. **B.** The orbital floor is fractured more commonly than the other walls. After fractures of the floor, the most common fractures are of the lamina papyracea, then the rim, and then the lateral orbital wall.
3. **A.** The incidence of diplopia is the same. There is no difference in the coincidence of medial orbital wall fracture or age of the fracture.
4. **A.** The orbital fracture volume and the degree of floor depression are well correlated with the presence of enophthalmos and/or hypoglobus.

## Comment

## Complications of Orbital Fractures

The long-term complications of orbital fracture include enophthalmos and diplopia. The former is more commonly associated

with higher volume orbital fractures with greater displacement of orbital contents. Diplopia after repair of orbital fractures occurs at a higher frequency if the initial computed tomographic scan at the time of injury shows extraocular muscle enlargement. In this example, the orbital floor fragment rotates like a trap door (Figure S2-1).

## Incidence of Facial Bone Fractures

In children, mandibular fractures outnumber orbital fractures, and motor vehicle accidents are the most common scenarios of injury. At all ages, nasal bone fractures predominate.

LeFort fractures include those that affect the maxilla (LeFort I), the orbital floor (LeFort II), and the lateral orbital walls (LeFort III). Fractures of the pterygoid plates consistently accompany these LeFort fractures.

## Reference

Jin HR, Lee HS, Yeon JY, Suh MW. Residual diplopia after repair of pure orbital blowout fracture: the importance of extraocular muscle injury. *Am J Rhinol*. 2007;21(3):276-280. doi:10.2500/ajr.2007.21.3024

## Cross-Reference

*Neuroradiology: The Requisites*, 3rd ed, 188-189, 341-342.



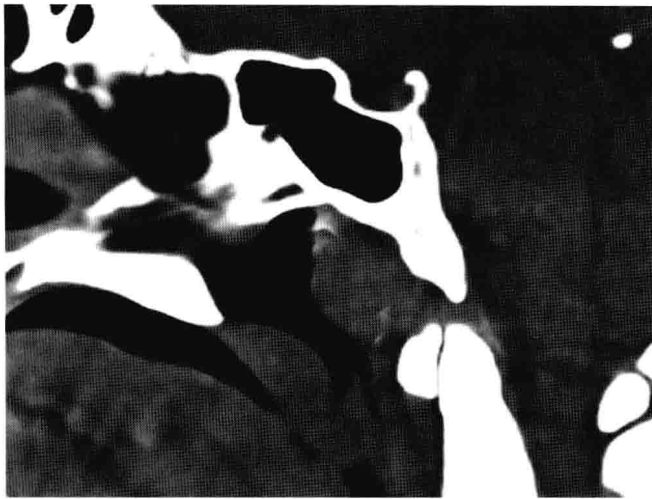


Figure 3-1

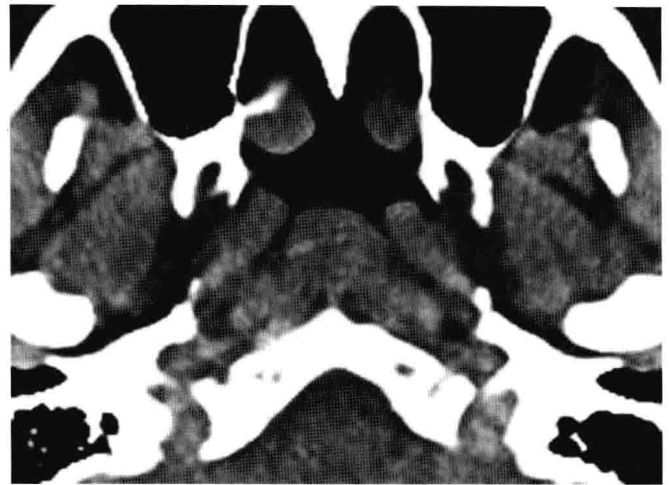


Figure 3-2

**HISTORY:** A 52-year-old woman presents with ear congestion.

1. Which of the following would be included in the differential diagnosis for the imaging findings presented? (Choose all that apply.)
  - A. Lymphoid hyperplasia
  - B. Lymphoma
  - C. Tornwaldt cyst
  - D. Juvenile nasopharyngeal angiofibroma (JNA)
2. What type of lymphoma has a predilection for the nasopharynx?
  - A. Hodgkin lymphoma
  - B. Burkitt lymphoma
  - C. Undifferentiated carcinoma
  - D. Non-Hodgkin lymphoma
3. What is the best imaging finding that suggests lymphoid hyperplasia rather than tumor?
  - A. High signal on T2-weighted image
  - B. Striated enhancement pattern
  - C. Crenated nodularity
  - D. Cyst formation
4. What is the most common cause of obstructive sleep apnea in children?
  - A. Tonsillar enlargement
  - B. Uvular hypertrophy
  - C. Adenoidal hypertrophy
  - D. Lingual thyroid glands

## CASE 3

## Adenoidal Hypertrophy

1. **A and B.** Lymphoid hyperplasia and lymphoma may look alike, and both should be included in the differential diagnosis. Tornwaldt cysts are midline cysts of low density. Juvenile nasopharyngeal angiofibroma is more likely to occur in a teenaged boy and not in a 52-year-old woman.
2. **D.** The non-Hodgkin lymphoma has a predilection for the nasopharynx; it is usually a diffuse-type, large-cell cancer. Undifferentiated carcinoma is not a lymphoma.
3. **B.** High signal on T2-weighted image in lymphoid hyperplasia is uncommon, and so it would not help in determining lymphoid hyperplasia. The striated appearance suggests lymphoid hyperplasia.
4. **C.** Adenoidal hypertrophy can lead to cardiovascular complications, including pulmonary hypertension and right-sided heart failure. Although lingual thyroid glands can cause obstructive sleep apnea in children, it is a rare condition and not the most common cause.

## Comment

## Associations with Lymphoid Hyperplasia

Lymphoid hyperplasia (Figure S3-1 sagittal and Figure S3-2 axial) can affect the nasopharyngeal adenoidal tissue, the palatine tonsils, and the lingual tonsil tissue. It may be associated with lymph node enlargement as well. Most cases are reactive to adjacent inflammation, such as an upper respiratory or

sinonasal tract infection; however, chronic illnesses such as human immunodeficiency virus (HIV) disease, collagen vascular diseases, and immunosuppressive conditions (such as that after organ transplantation) may also lead to such enlargements. Patients with atopic or seasonal allergies may have more lymphoid tissue present. Epstein-Barr virus (EBV) is the virus most closely associated with adenoidal hypertrophy, which is problematic because EBV also is associated with nasopharyngeal carcinoma. However, virtually all viruses can cause enlargement of the adenoidal pad in children and even in an adult whose adenoids had previously atrophied.

## Effect of Lymphoid Hyperplasia

Adenoidal hypertrophy can lead to snoring, chronic mouth breathing, obstructive sleep apnea, and otitis media. Secondary right-sided heart failure and pulmonary hypertension may coexist.

## Age and Nasopharyngeal Adenoidal Prominence

Adenoidal tissue enlarges in the first decade of life, but by the end of the second decade, it should regress. When tissue in the nasopharynx is enlarged in an adult, particularly if obstructing the eustachian tube, the clinician should consider the possibility of carcinoma and lymphoma. A linear striated enhancement pattern provides reassurance that the condition is simply adenoidal hypertrophy of a benign nature.

## Reference

Rout MR, Mohanty D, Vijaylaxmi Y, Bobba K, Metta C. Adenoid hypertrophy in adults: a case series. *Indian J Otolaryngol Head Neck Surg.* 2013;65(3):269-274. doi:10.1007/s12070-012-0549-y

## Cross-Reference

*Neuroradiology: The Requisites*, 3rd ed, 441-442.