

# **OTOLARYNGOLOGY**

## **HEAD and NECK**

### **SURGERY**

**CLINICAL REFERENCE GUIDE**

**Seventh Edition**

**Raza Pasha, MD**  
**Justin S. Golub, MD, MS**  
**Alexander Chern, MD**





9177 Aero Drive, Suite B  
San Diego, CA 92123

email: [information@pluralpublishing.com](mailto:information@pluralpublishing.com)  
website: <https://www.pluralpublishing.com>

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# PREFACE TO THE SEVENTH EDITION

Not sure how one is supposed to define precisely when a midlife crisis begins. I'm not saying I'm going to live past 108, but it sure feels like it. And these editions . . . my God . . . enough with these editions. As far as I can tell, there's no real reason to plan anything long-term anymore. Honestly with AI and Neurolink today how is knowledge going to be distributed tomorrow anyway? Through letters in a book? I doubt it. I'm thinking the robots take over in another 10 years and we'll have to redefine life from carbon-based to silicon/lithium biochemistry. Relationships will be technosexual. I mean that'll be the new banner of woke-theists. Human relationships will be like vinyl. You may appreciate the nostalgia of it all but who can compete with a soulmate without a soul? Nonetheless, next edition will be the quantum edition, a joint colab with Lumon Industry. It'll be injected directly into the anterior cingulate cortex using wave technology or something like that. It'll be super easier to digest but you'll sacrifice a little empathy and impulse control.

That being said, this odd edition number 7 will continue as it does—save lives, both patients and residents. This book is high protein, keto-based info without the refined carbs and sugars. Think the Otolaryngological Tiktok. Updated to the last second into 2025 with every chapter getting a solid refresh. So keep it in your pocket or by your toilet and scroll, rather than page turn for those dopamine hits. It's really all you need.

Welcome also our newest authors, plucked out of a pool of academics that are worth their weight in cryptocurrency. And for my co-editors, Alex and Justin, these guys are warriors in quest of truth and precision; gladiators actually, afraid of absolutely nothing except for maybe a misplaced semicolon. I mean that'll keep them up all night. I owe them my sanity and you owe them a hip, hip, hooray for keeping this book alive. Seriously, it wouldn't have happened without them.

Moving on. Embrace, entrust, digest the truth within the cult that is this edition. And if by chance you catch a misstep or flagrant foul, feel free to report it to the authorities at [PashaGolubGuide@gmail.com](mailto:PashaGolubGuide@gmail.com). Here at Lumon we appreciate any good-willed suggestions and perhaps may reward you with a Chinese finger trap, customized eraser, or for the well-deserved, a waffle party!

R. Pasha @DJPa5ha (IG)

Dig deep!! Find the Prefaces from the previous editions by scanning the QR code below.





# ABOUT THE EDITORS



**Raza Pasha, MD**, as an official quinquagenarian focuses on all things healthy, obsessing over longevity remedies and mindfulness. His very much seasoned practice in Houston thrives as he moves in packs with students and residents, appreciating any audience that will listen to his banter. His CV momentum is slowing down, as he has stripped most of his board titles and business roles as he has settled into family, friends, and music production. There's not a podcast he hasn't heard, and

will debate to death the existence of an advanced ancient civilization or the physiology of the immortal jellyfish. He may pull out a few more publications by year end, but more likely you'll see him out and about at a restaurant deep in conversation or on an EDM festival tour mainstage as DJPa5ha.



**Justin S. Golub, MD, MS**, is an Associate Professor of Otolaryngology–Head and Neck Surgery and Vice Chair of Faculty Development at the Columbia University Vagelos College of Physicians and Surgeons and New York–Presbyterian/Columbia University Irving Medical Center. He attended Emory University School of Medicine, residency at the University of Washington in Seattle, and fellowship in neurotology at the University of Cincinnati. He obtained a masters in biostatistics/patient-oriented research at the Columbia University Mailman School of Public Health. He is the author of more than a hundred peer-reviewed research publications and has co-edited five books. Dr. Golub runs a research program and clinical trial investigating the brain effects of age-related hearing loss. He has lectured internationally and his research has been reported in the national press, including *The New York Times*. He is also a leading pioneer in transcanal endoscopic ear surgery. When not toiling on books with Drs. Pasha and Chern, he enjoys skiing, running, and sipping Nutella-laced espresso at his home in Westchester County, New York.



**Alexander Chern, MD**, is an Assistant Professor of Otorhinolaryngology–Head & Neck Surgery at the Hospital of the University of Pennsylvania. He recently completed his fellowship in neurotology at Johns Hopkins and his residency training in otolaryngology–head and neck surgery at NewYork-Presbyterian Hospital (Columbia/Weill Cornell). He earned his medical degree from Vanderbilt University School of Medicine and completed his undergraduate studies at Yale University.

Dr. Chern is the author of numerous peer-reviewed publications, book chapters, and educational articles on hearing loss. His research interests center on the intersection of musicality, hearing, and cognition. In his spare time, he enjoys cooking and dining with friends and family, playing the violin, and creating latte art.

# CONTRIBUTORS

**Syed F. Ahsan, MD**

Otologist/Neurotologist  
Head and Neck Surgery  
Kaiser Permanente-Orange  
County, California  
Anaheim, California  
*Chapter 8*

**Isaac L. Alter, AB**

Medical Student  
Columbia University Vagelos  
College of Physicians and  
Surgeons  
New York, New York  
*Appendix B*

**Brittany R. Barber, MD, MSc,  
FRCSC**

Associate Professor  
Head and Neck Surgical Oncology  
Department of Otolaryngology-  
Head and Neck Surgery  
University of Washington  
Seattle, Washington  
*Chapter 9*

**Sarah Y. Bessen, MD, MPH**

Resident Physician  
Department of Otolaryngology-  
Head and Neck Surgery  
Johns Hopkins University School  
of Medicine  
Baltimore, Maryland  
*Chapters 9 and 11*

**Yi Cai, MD**

Assistant Professor  
Director of Sleep Surgery  
Otolaryngology-Head and Neck  
Surgery  
Columbia University Irving  
Medical Center

New York, New York  
*Chapter 5*

**Angela Cao, MD**

Fellow  
Pediatric Otolaryngology  
Division of Pediatric  
Otolaryngology-Head and  
Neck Surgery  
Cincinnati Children's Hospital  
Cincinnati, Ohio  
*Chapter 10 and Appendix D*

**Ian F. Caplan, MD**

Resident Physician  
Department of Otolaryngology-  
Head and Neck Surgery  
New York Presbyterian Hospital  
Columbia University Irving  
Medical Center  
Weill Cornell Medicine  
New York, New York  
*Chapter 1*

**Matthew L. Carlson, MD**

Professor of Otolaryngology and  
Neurosurgery  
Neurotology Fellowship Program  
Director  
Department of Otolaryngology  
Mayo Clinic  
Rochester, Minnesota  
*Chapter 8*

**Sara A. Charney, MS, CCC-SLP**

Speech-Language Pathologist  
Department of Otolaryngology-  
Head & Neck Surgery  
Mayo Clinic-Arizona  
Phoenix, Arizona  
*Chapter 3*

**Jenny X. Chen, MD, EdM**

Assistant Professor  
Department of Otolaryngology-  
Head and Neck Surgery  
Johns Hopkins University School  
of Medicine  
Baltimore, Maryland  
*Appendix C*

**Michael Z. Cheng, MD**

Resident Physician  
Department of Otolaryngology-  
Head and Neck Surgery  
Johns Hopkins Medicine  
Baltimore, Maryland  
*Chapters 1 and 2*

**Alexander Chern, MD**

Assistant Professor  
Department of  
Otorhinolaryngology-Head &  
Neck Surgery  
University of Pennsylvania  
Philadelphia, Pennsylvania  
*Chapter 8*

**Valerie Cote, MD, CM, FAAP,  
FRCSC**

Assistant Professor  
Pediatric Otolaryngology  
CHEO, University of Ottawa  
Ottawa, Ontario, Canada  
*Chapter 10*

**Francis Deng, MD**

Assistant Professor  
Russell H. Morgan Department  
of Radiology and Radiological  
Science  
Johns Hopkins University School  
of Medicine  
Baltimore, Maryland  
*Appendix C*

**Kaitlyn M. Frazier, MD**

Assistant Professor

Department of Otolaryngology-  
Head and Neck Surgery  
Johns Hopkins University School  
of Medicine  
Baltimore, Maryland  
*Chapter 4*

**David A. Gudis, MD**

Chief, Division of Rhinology and  
Anterior Skull Base Surgery  
Department of Otolaryngology-  
Head and Neck Surgery  
Columbia University  
New York, New York  
*Chapter 1*

**Amanda Hu, MD, FRCSC**

Clinical Associate Professor,  
Director of the Pacific Voice  
Clinic  
Division of Otolaryngology-Head  
& Neck Surgery  
University of British Columbia  
Vancouver, Canada  
*Chapter 3*

**Olivia A. Kalmanson, MD, MS**

Resident Physician  
Department of Otolaryngology-  
Head and Neck Surgery  
University of Colorado Anschutz  
School of Medicine  
Aurora, Colorado  
*Chapter 8*

**Peggy E. Kelley, MD**

Clinical Director Pediatric  
Otolaryngology  
Children's Surgical Services  
Providence St. Vincent Medical  
Center  
Portland, Oregon  
*Chapter 10*

**Carol Li, MD**

Assistant Professor

Division of Pediatric  
Otolaryngology-Head and  
Neck Surgery  
Cincinnati Children's Hospital  
Medical Center  
Cincinnati, Ohio  
*Chapter 10, Appendix D*

**Gabriela Lilly, MD**  
Assistant Professor—Laryngology  
Department of Otolaryngology-  
Head and Neck Surgery  
Oregon Health and Science  
University  
Portland, Oregon  
*Chapter 3*

**Sallie M. Long, MD**  
Assistant Professor  
Department of Otolaryngology-  
Head and Neck Surgery  
Medical College of Georgia at  
Augusta University  
Augusta, Georgia  
*Chapters 4 and 7, Appendix A*

**John P. Marinelli, MD**  
Fellow  
Otology/Neurotology  
Department of Otolaryngology  
Mayo Clinic  
Rochester, Minnesota  
*Chapter 8*

**Theodore R. McRackan, MD,  
MSCR**  
Professor  
Department of Otolaryngology-  
Head and Neck Surgery  
Medical University of South  
Carolina  
Charleston, South Carolina  
*Chapter 8*

**Elliot Morse, MD, MHS**  
Assistant Professor

Department of Otolaryngology-  
Head and Neck Surgery  
NYU Langone  
New York, New York  
*Chapter 3*

**Jason C. Nellis, MD**  
Assistant Professor  
Facial Plastic and Reconstructive  
Surgery  
Department of Otolaryngology-  
Head and Neck Surgery  
Johns Hopkins  
Baltimore, Maryland  
*Chapters 8, 9, and 11*

**Richard Chan Woo Park, MD**  
Associate Professor  
Rutgers New Jersey Medical  
School  
Hackensack University Medical  
Center  
Newark, New Jersey  
*Chapter 7*

**Raza Pasha, MD**  
Clinical Assistant Professor  
UTMB School of Medicine  
University of Houston College of  
Medicine  
Adjunct Professor  
Texas Southern University  
Division of Health Science  
Pasha Snoring and Sinus Center  
Houston, Texas  
*Chapter 5*

**Priyesh Patel, MD**  
Associate Professor and Residency  
Program Director  
Department of Otolaryngology-  
Head and Neck Surgery  
Vanderbilt University Medical  
Center  
Nashville, Tennessee  
*Chapter 9*

**Apoorva T. Ramaswamy, MD**

Assistant Professor  
Department of Otolaryngology  
Ohio State Wexner Medical Center  
Columbus, Ohio  
*Chapter 3*

**Lauren T. Roland, MD, MSCI**

Assistant Professor  
Department of Otolaryngology-  
Head and Neck Surgery  
Washington University in St Louis  
St. Louis, Missouri  
*Chapters 1 and 2*

**Daniel Schuster, MD**

Clinical Assistant Professor  
Department of Otolaryngology-  
Head and Neck Surgery  
Vanderbilt University Medical  
Center  
Nashville, Tennessee  
*Chapter 6*

**Sarek A. Shen, MD, MS**

Resident Physician  
Department of Otolaryngology  
and Head and Neck Surgery  
Johns Hopkins University  
Baltimore, Maryland  
*Chapter 11*

**Andre Shomorony, MD**

Fellow  
Facial Plastic and Reconstructive  
Surgery  
Department of  
Otorhinolaryngology-Head &  
Neck Surgery  
University of Pennsylvania  
Philadelphia, Pennsylvania  
*Chapter 9*

**Daniel B. Spielman, MD**

Assistant Professor  
Department of Otolaryngology-  
Head & Neck Surgery

MedStar Georgetown University  
Hospital  
Washington, DC  
*Chapter 1*

**Danielle R. Trakimas, MD, MSE**

Resident Physician  
Department of Otolaryngology-  
Head and Neck Surgery  
John Hopkins Hospital  
Baltimore, Maryland  
*Chapter 7*

**Forest W. Weir, MD**

Assistant Professor  
Department of Otolaryngology-  
Head and Neck Surgery  
Medical College of Georgia at  
Augusta University  
Augusta, Georgia  
*Chapter 7*

**Rachel Weitzman, MD, MPH,  
MS**

Resident Physician  
Department of Otolaryngology-  
Head and Neck Surgery  
New York-Presbyterian Hospital  
Columbia/Weill Cornell  
New York, New York  
*Chapter 9*

**Sarah K. Wise, MD, MSCR**

Professor  
Department of Otolaryngology  
Emory University  
Atlanta, Georgia  
*Chapters 1 and 2*

**Deborah X. Xie, MD**

Assistant Professor  
Department of ENT and Skull  
Base Surgery  
Barrow Neurological Institute  
Phoenix, Arizona  
*Chapter 6*

# COMMON ABBREVIATIONS IN OTOLARYNGOLOGY-HEAD AND NECK SURGERY

3D	3 dimensional	BC	bone conduction
5-FU	5-fluorouracil	BCC	basal cell carcinoma
A-E	aryepiglottic	BID	twice a day
AA	arytenoid abduction	BiPAP	bilevel positive airway pressure
ABG	arterial blood gas, air-bone gap	BMT	bilateral myringotomy and tubes
ABI	auditory brainstem implant	BOA	behavioral observation audiometry
ABR	auditory brainstem response	BPD	bronchopulmonary dysplasia
AC	air conduction	BPPV	benign paroxysmal positional vertigo
ACE	angiotensin converting enzyme	BTE	behind the ear
AHI	apnea-hypopnea index	BUN	blood urea nitrogen
AI	apnea index	CAPE-V	Consensus Auditory-Perceptual Evaluation of Voice
AIDS	acquired immunodeficiency syndrome	CBC	complete blood count
AJCC	American Joint Commission on Cancer	cGy	centigray
ALD	assisted listening device	CHL	conductive hearing loss
ALS	amyotrophic lateral sclerosis	CIC	completely in canal
ANA	antinuclear antibody	CMV	cytomegalovirus
AOM	acute otitis media	CN	cranial nerve
APAP	auto-titrating positive airway pressure	CNS	central nervous system
ASA	aspirin	COM	chronic otitis media
ASSR	auditory steady-state response	COMMANDO	combined mandibulectomy and neck dissection operation
AVM	arteriovenous malformation	CPA	cerebellopontine angle, conditioned play audiometry
BAEP	brainstem auditory evoked potential	CPAP	continuous positive airway pressure
BAER	brainstem auditory evoked response	CROS	contralateral routing of sound
BAHA	bone-anchored hearing aid	CRP	C-reactive protein

CRS	chronic rhinosinusitis	EOG	electrooculography
CSA	central sleep apnea	ESR	erythrocyte sedimentation rate
CSF	cerebrospinal fluid	ESS	endoscopic sinus surgery
CT	computed tomography	ET	Eustachian tube, endotracheal
CTA	computed tomographic angiography	ETD	Eustachian tube dysfunction
CVA	cerebrovascular accident	ETT	endotracheal tube
cVEMP	cervical vestibular evoked myogenic potential	EUA	examination under anesthesia
CXR	chest x-ray	FB	foreign body
dB	decibel	FEES	functional endoscopic evaluation of swallowing
dB HL	decibel hearing level	FEESST	functional endoscopic evaluation of swallowing with sensory testing
dB SL	decibel sensation level	FESS	functional endoscopic sinus surgery
dB SPL	decibel sound pressure level	FEV	forced expiratory volume
DCR	dacryocystorhinostomy	FNA	fine-needle aspiration
DDx	differential diagnosis	FOM	floor of mouth
DISE	drug-induced sleep endoscopy	FTA-ABS	fluorescent treponemal antibody-absorption test
DL	direct laryngoscopy	FTSG	full-thickness skin graft
DLB	direct laryngoscopy and bronchoscopy	FVPTC	follicular variant of papillary thyroid carcinoma
DLBE	direct laryngoscopy, bronchoscopy, and esophagoscopy (panendoscopy)	GABHS	group A $\beta$ -hemolytic streptococci
DPOAE	distortion product otoacoustic emissions	GCS	Glasgow Coma Scale
Dx	diagnosis	GERD	gastroesophageal reflux disease
EAC	external auditory canal	GI	gastrointestinal
EBV	Epstein-Barr virus	GPA	granulomatosis with polyangiitis (Wegener)
ECA	external carotid artery	GRBAS	grade, roughness, breathiness, asthenia, strain
ECG	electrocardiogram	GSPN	greater superficial petrosal nerve
ECMO	extracorporeal membrane oxygenation	Gy	gray
ECoG	electrocochleography	H&N	head and neck
ECS	extracapsular spread	HA	hearing aid, headache
EEG	electroencephalography	HBO	hyperbaric oxygen
EGFR	epidermal growth factor receptor		
EJV	external jugular vein		
EMG	electromyogram		
END	elective neck dissection		
ENG	electronystagmography		
ENoG	electroneuronography		



HFSNHL	high frequency sensorineural hearing loss	KTP	potassium titanyl phosphate
HHT	hereditary hemorrhagic telangiectasia	LAD	lymphadenopathy
HINT	hearing-in-noise test	LARP	left anterior, right posterior semicircular canal pair
HIV	human immunodeficiency virus	LCA	lateral cricoarytenoid muscle
HL	hearing level, hearing loss	LDH	lactate dehydrogenase
HNSCC	head and neck squamous cell carcinoma	LDL	loudness discomfort level
HPV	human papilloma virus	LEMG	laryngeal electromyography
HSV	herpes simplex virus	LES	lower esophageal sphincter
I&D	incision and drainage	LFT	liver function test
IAC	internal auditory canal	LMA	laryngeal mask airway
ICA	internal carotid artery	LP	lumbar puncture
ICP	intracranial pressure	LPR	laryngopharyngeal reflux
IDDSI	International Dysphagia Diet Standardization Initiative	LSPN	lesser superficial petrosal nerve
IFN	interferon	LTB	laryngotracheobronchitis
Ig	immunoglobulin	MBS	modified barium swallow
IHC	inner hair cell, immunohistochemistry	MBSS	modified barium swallow study
IIH	idiopathic intracranial hypertension	MCL	medial canthal ligament
IJV	internal jugular vein	MDL	microdirect laryngoscopy
IL	interleukin	MDLB	microdirect laryngoscopy and bronchoscopy
IM	intramuscularly	ME	middle ear
IMF	intermaxillary fixation ( <i>see</i> MMF)	MEE	middle ear effusion
IMRT	intensity-modulated radiation therapy	MEN	multiple endocrine neoplasia
IS	incudostapedial (joint)	MHL	mixed hearing loss
ISSNHL	idiopathic sudden sensorineural hearing loss	MMA	maxillomandibular advancement
ITC	in the canal	MMF	maxillomandibular fixation
ITE	in the ear	MND	modified neck dissection
ITM	in the mouth	MRA	magnetic resonance angiography
IVIG	intravenous immunoglobulin		
JNA	juvenile nasopharyngeal angiofibroma		

MRI	magnetic resonance imaging	OSAS	obstructive sleep apnea syndrome
MRND	modified radical neck dissection	OTC	over-the-counter
MRSA	methicillin resistant <i>Staphylococcus aureus</i>	OTE	over-the-ear
MSLT	multiple sleep latency test	oVEMP	ocular vestibular evoked myogenic potential
MWT	maintenance of wakefulness test	OW	oval window
Mφ	macrophage	PAP	positive airway pressure
NCCN	National Comprehensive Cancer Network	PB max	phonetically balanced maximum
ND	neck dissection	PCA	posterior cricoarytenoid muscle
NET	nerve excitability test	PCR	polymerase chain reaction
NF	neurofibromatosis	PDT	percutaneous dilational tracheotomy
NHL	non-Hodgkin lymphoma	PE	physical examination, pressure equalization, pulmonary embolus
NIHL	noise-induced hearing loss	PEEP	positive end-expiratory pressure
NOE	naso-orbitoethmoid	PEG	percutaneous endoscopic gastrostomy
NP	nasopharynx	PET	pressure equalization tube, positron emission tomography
NPC	nasopharyngeal carcinoma	PLM	periodic leg movement
NPO	nothing by mouth	PLMD	periodic limb movement disorder
NREM	nonrapid eye movement	PONV	postoperative nausea/vomiting
NSAID	nonsteroidal anti-inflammatory drug	PORP	partial ossicular replacement prosthesis
NSTI	necrotizing soft tissue infection	PPI	proton-pump inhibitor
OAE	otoacoustic emissions	PROS	PIK3CA-related overgrowth spectrum
OC	oral cavity	PSG	polysomnography
OCR	ossicular chain reconstruction	PT	prothrombin time
OE	otitis externa	PTA	pure-tone average, peritonsillar abscess
OHC	outer hair cell	PTH	parathyroid hormone
OM	otitis media	PTT	partial thromboplastin time
OMC	ostiomeatal complex	PVFD	paradoxical vocal fold motion disorder
OME	otitis media with effusion	PVFM	paradoxical vocal fold motion
OP	oropharynx		
ORIF	open reduction internal fixation		
ORL	otorhinolaryngology		
OSA	obstructive sleep apnea		

QOL	quality of life	SNHL	sensorineural hearing loss
RALP	right anterior, left posterior semicircular canal pair	SPL	sound pressure level
RAST	radioallergosorbent test	SQ	subcutaneous
RDI	respiratory disturbance index	SML	suspension
REM	rapid eye movement	SRT	speech (spondee) reception threshold
RERA	respiratory effort-related arousal	SSD	single-sided deafness
RF	rheumatoid factor, radiofrequency	SSNHL	sudden sensorineural hearing loss
RFFF	radial forearm free flap	SSx	signs and symptoms
RLN	recurrent laryngeal nerve	STSG	split-thickness skin graft
RPA	retropharyngeal abscess	T&A	tonsillectomy and adenoidectomy
RRP	recurrent respiratory papillomatosis	TA	thyroarytenoid muscle
RSTL	relaxed skin tension line	TB	tuberculosis
RTOG	Radiation Therapy Oncology Group	TCA	tricyclic antidepressant, trichloroacetic acid
RW	round window	TEOAE	transiently evoked otoacoustic emissions
Rx	treatment	TEP	tracheoesophageal puncture
SC	subcutaneous	TFT	thyroid function test
SCC	squamous cell carcinoma, semicircular canal	TGDC	thyroglossal duct cyst
SCM	sternocleidomastoid	TID	three times a day
SDB	sleep-disordered breathing	TL	total laryngectomy
SIADH	syndrome of inappropriate antidiuretic hormone	TLM	transoral laser microsurgery
SL	sensation level	TM	tympanic membrane
SLE	systemic lupus erythematosus	TMJ	temporomandibular joint
SLN	superior laryngeal nerve	TNF	tumor necrosis factor
SLP	superficial lamina propria, speech-language pathologist	TNM	tumor, node, metastasis
SMAS	superficial musculoaponeurotic system	TORCH	toxoplasmosis, other, rubella, cytomegalovirus, herpes simplex virus
SMG	submandibular gland	TORP	total ossicular replacement prosthesis
SML	suspension microlaryngoscopy	Trach	tracheostomy, tracheotomy, tracheostomy tube, tracheotomy tube
		TSH	thyroid-stimulating hormone

TVC	true vocal cord	VEMP	vestibular evoked myogenic potential
TVF	true vocal fold	VF	vocal fold
U/S	ultrasound	VFSS	videofluoroscopic swallow study
UARS	upper airway resistance syndrome	vHIT	video head impulse testing
UES	upper esophageal sphincter	VNG	videonystagmography
UP3	uvulopalatopharyngo- plasty	VOR	vestibulo-ocular reflex
UPPP	uvulopalatopharyngo- plasty	VPI	velopharyngeal insufficiency
URI	upper respiratory infection	VRA	visual response audiometry
VBI	vertebrobasilar insufficiency	VZV	varicella zoster virus
VC	vocal cord	W/U	workup
VCD	vocal cord dysfunction ( <i>see</i> PVFD)	XRT	radiation therapy
VDRL	venereal disease research laboratory	YAG	yttrium aluminum garnet
		ZMC	zygomaticomaxillary complex

# CHAPTER

# 1

## Rhinology

Ian F. Caplan, David A. Gudis, Michael Z. Cheng, Lauren T. Roland,  
Sarah K. Wise, and Daniel B. Spielman

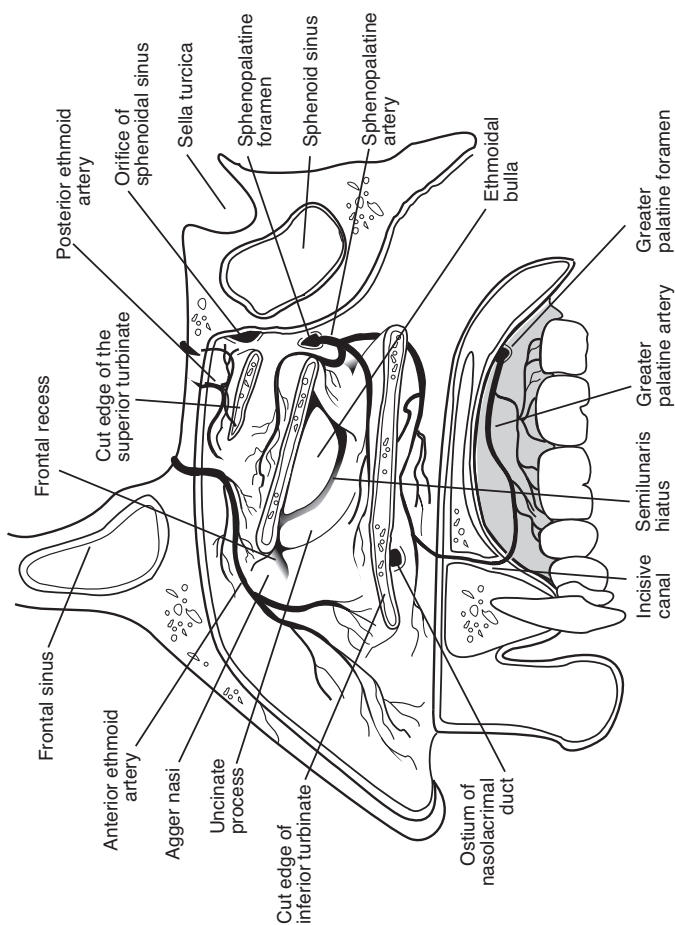
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## ANATOMY OF THE NOSE AND PARANASAL SINUSES

### Paranasal Sinus Anatomy

#### Lateral Nasal Wall (Figure 1–1)

- **Turbinates (Conchae):** three to four bony shelves (inferior, middle, superior, and supreme [normal variant]) covered by erectile mucosa, serve to increase the interior surface area; function to warm, moisten, and filter airflow
- **Meatuses:** spaces located beneath each turbinate
  1. **Inferior Meatus:** contains orifice of nasolacrimal duct (**Hasner valve**)
  2. **Middle Meatus:** drainage pathway of frontal, anterior ethmoid, and maxillary sinuses
  3. **Superior Meatus:** drainage pathway of sphenoid and posterior ethmoid sinuses
- **Uncinate Process:** sickle-shaped thin bony part of ethmoid bone covered by mucoperiosteum; anteriorly attaches to lacrimal bone; inferiorly attaches to inferior turbinate; superiorly attaches to lamina papyracea (80%), roof of ethmoid (base of skull), or middle turbinate
- **Ethmoid Infundibulum:** 3D pyramidal space lateral to the uncinate process that houses drainage of the maxillary and anterior ethmoid sinuses with the frontal sinus drainage depending on the uncinate insertion (*see below*)
- **Recess Terminalis:** blind pouch in the infundibulum created when the uncinate inserts superiorly into the lamina papyracea
- **Semilunar Hiatus:** 2D space between the uncinate process and the ethmoid bulla that empties the ethmoid infundibulum
- **Sphenopalatine Foramen:** foramen in lateral nasal wall posterior to the maxillary sinus; contains sphenopalatine artery, sensory nerve fibers, and secretomotor fibers (parasympathetic fibers from vidian nerve to pterygopalatine ganglion)
- **Concha Bullosa:** pneumatized turbinate (middle turbinate most common), may result in nasal obstruction or obstruction of the ostiomeatal complex
- **Paradoxical Middle Turbinate:** middle turbinate that is “turned” medially instead of laterally
- **Ostiomeatal Complex (OMC):** region of the anterior ethmoid containing the uncinate process, ethmoid infundibulum, ethmoid bulla, and drainage pathway of the maxillary, frontal, and anterior ethmoid sinuses; lateral to the middle turbinate
- **Nasal Fontanelles:** areas of the lateral nasal wall where no bone exists, located above the insertion of the inferior turbinate, may be the site of accessory maxillary ostia



**FIGURE 1-1.** Anatomy of the lateral nasal wall including vascular supply.

- **Nasolacrimal Sac and Duct:** sac is in lacrimal fossa of the orbit where lacrimal bone meets frontal process of maxilla; duct courses inferiorly within lacrimal bone anterior to uncinate process and opens into the inferior meatus via **Hasner valve**, located 3–6 mm anterior to level of maxillary sinus ostium

## Frontal Sinus

- **Embryology:** last to develop; does not pneumatize until 5–6 years old
- **Volume at Adult:** 4–7 mL by 12–20 years old (5–10% aplastic/hypoplastic)
- **Drainage:** frontal recess into the anterior middle meatus most commonly medial to the uncinate (when uncinate attaches superiorly to the lamina papyracea) or lateral to the uncinate (when uncinate attaches superiorly to skull base or middle turbinate)
- **Vasculature:** supraorbital and anterior ethmoidal arteries, ophthalmic (cavernous sinus) and supraorbital (anterior facial) veins
- **Innervation:** supraorbital nerve (CN V<sub>1</sub>)
- **Frontal Recess:** drainage pathway between the frontal sinus and middle meatus; bounded by the agger nasi cell anteriorly, ethmoid bulla posteriorly, lamina papyracea laterally, and middle turbinate medially
- **Frontal Sinus Infundibulum:** space that drains into frontal recess, superior to the agger nasi cells
- **Foramina of Breschet:** small venules that drain the sinus mucosa into the dural veins; can serve as conduit for infection resulting in intracranial spread
- **Frontal Cells:** anterior ethmoid cells that pneumatize into frontal sinus and displace the frontal recess; may cause obstruction or persistent disease; may be anteriorly based adjacent to agger nasi or posteriorly based adjacent to ethmoid bulla
  1. **Supra agger cell:** anterior lateral ethmoid cell superior to agger nasi; does not enter frontal sinus
  2. **Supra agger frontal cell:** anterior lateral ethmoid cell superior to agger nasi that pneumatizes into the frontal sinus
  3. **Supra bulla cell:** cell superior to bulla ethmoidalis; does not enter frontal sinus
  4. **Supra bulla frontal cell:** cell superior to bulla ethmoidalis that pneumatizes into the frontal sinus
  5. **Supraorbital ethmoid cell:** *see p. 8*
  6. **Frontal septal cell:** medial cell of the anterior ethmoid or frontal sinus adjacent to the intersinus septum that displaces the outflow tract laterally and posteriorly

## Maxillary Sinus

- **Embryology:** first to develop in utero, biphasic growth at 3 and 7–18 years old



- **Volume at Adult:** typically 15 mL (largest paranasal sinus)
- **Drainage:** ethmoid infundibulum (middle meatus, 10–30% have accessory ostium)
- **Vasculature:** branches of maxillary artery and corresponding veins to facial vein/pterygoid plexus
- **Innervation:** branches of maxillary nerve (CN V<sub>2</sub>)
- **Adjacent Structures:** lateral nasal wall, alveolar process of maxilla (contains second bicuspid and first and second molars), orbital floor, posterior maxillary wall (contains pterygopalatine fossa housing the maxillary artery, pterygopalatine ganglion, and branches of CN V<sub>2</sub>)

## Ethmoid Sinus

- **Embryology:** three to four cells at birth (most developed paranasal sinus at birth), formed from 5 ethmoturbinals (1 = agger nasi, uncinata; 2 = middle turbinate; 3 = superior turbinate; 4–5 = supreme turbinate; *may vary by source*)
- **Lamellae of Ethmoid Bone (anterior to posterior):** 1 = uncinata process, 2 = bulla ethmoidalis, 3 = basal lamella of middle turbinate, 4 = lamella of superior turbinate
- **Volume at Adult:** 10–15 aerated cells, total volume of 2–3 mL (adult size at 12–15 years old)
- **Drainage:** anterior cells drain into ethmoid infundibulum (middle meatus), posterior cells drain into sphenoethmoidal recess (superior meatus)
- **Vasculature:** anterior and posterior ethmoid arteries (from ophthalmic artery), branches of sphenopalatine artery; Figure 1–2 shows the distance relationships of anterior and posterior ethmoid arteries and optic foramen to the anterior lacrimal crest (“**24/12/6 mm rule**”); maxillary and ethmoid veins (cavernous sinus)
- **Innervation:** anterior and posterior ethmoidal nerves (from nasociliary nerve, CN V<sub>1</sub>)
- **Adjacent Structures:** skull base, anterior ethmoid artery (roof of anterior ethmoid cells), nasal cavity, orbit
- **Agger Nasi Cell:** most anterior of ethmoid cells found anterior and superior to middle turbinate attachment to the lateral wall; posterior wall of the agger nasi cell forms the anterior wall of the frontal recess
- **Ethmoid Bulla:** first anterior ethmoid cell posterior to the uncinata process; anterior ethmoid artery courses superior and posterior to this cell
- **Basal (Ground) Lamella of the Middle Turbinate:** bony attachment of middle turbinate to lateral nasal wall that separates anterior and posterior ethmoid cells; **anterior** part inserts vertically into **cribriform plate**, **middle** part inserts obliquely into lamina papyracea, **posterior** third attaches to lateral nasal wall horizontally