



# *The Neurosurgical Atlas*

The Pioneer and Global Leader in Promoting Technical  
Excellence in Operative Neurosurgery

Aaron A. Cohen-Gadol, MD, MSc, MBA

*The Stead Family Chair*

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Indiana University Department of Neurosurgery



The Neurosurgical Atlas by Aaron Cohen-Gadol, M.D.

Volumes

Cases

Grand Rounds

About



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Neurosurgical Atlas

**VOLUMES**

The most comprehensive collection of advanced microneurosurgical techniques

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**What's Inside**

- Preface
- Neuroradiology
- Principles of Cranial Surgery
- Cranial Approaches
- Cerebrovascular Surgery
- Brain Tumors
- Cranial Base Surgery
- Cranial Nerve Compression Syndromes
- Epilepsy Surgery
- Emergency Neurosurgery and Trauma
- Spinal Cord Surgery
- Medical Student Guide for Matching in Neurosurgery
- Transition to the "Real" World for Residents and Fellows

**What's New?**

These items have been recently updated since **March 26, 2018.**

- Skull Anatomy
- Cavernous Sinus Anatomy
- Preface
- Spinal Vascular Anatomy
- Spinal Vascular Malformations
- Neuromyelitis Optica (NMO)
- Multiple Sclerosis (MS)
- Acute Disseminated Encephalomyelitis (ADEM)

**Explore novel 3D models in our chapters for a new level of learning.**



Achieve an unprecedented understanding of complex brain and skull base pathoanatomy while exploring our novel 3D interactive models. The models will be dispersed in different chapters throughout the site and **more models will be added weekly.**

[View an example](#)

*The Neurosurgical Atlas* is the most respected resource dedicated to providing neurosurgical education and research to neurosurgeons worldwide to advance patient care. Many countries depend on the *Atlas* for the care of their patients.

# Awards and Global Reach



## *Neurosurgical Atlas*

### *Impact*

Vilehelm Magnus Medal Awarded 2022  
**(Referred to as the Nobel Prize in Neurosurgery)**

2M users from 211 countries (60% non-US)

70k users per month

Partnerships with:





# Pushing Boundaries

## Setting new standards for technical excellence

To preserve neurological function and improve lives.





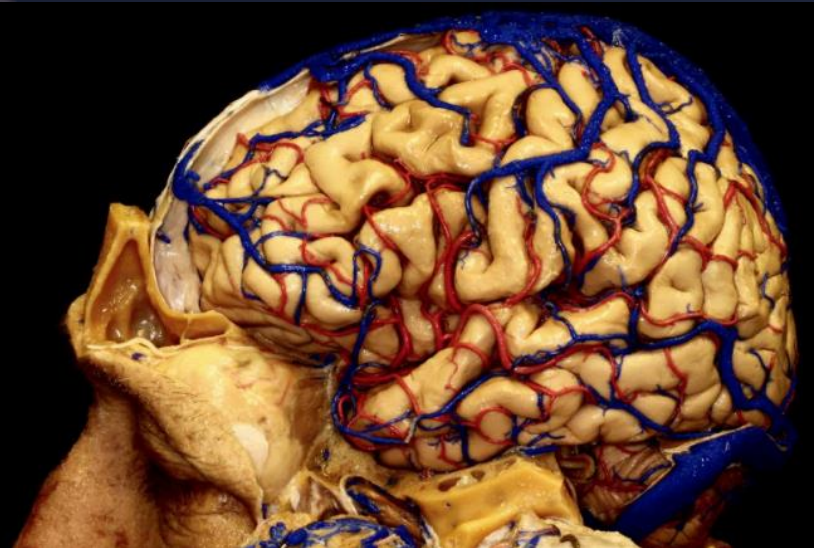
# The Need for the *Neurosurgical Atlas*

- Technical education has not evolved in brain surgery.
  - Journals share research but don't show "how to."
  - The textbooks or other media aren't applied enough.
  - Focus of academic research has been in basic science.
  - The "accepted" risks of brain surgery by patients
- The unspoken secrets of technical excellence remained a secret
- In 2007, the goal became to create the "bible", or the "Atlas"
- **The Atlas systematically and critically investigates every minor or major surgical maneuver to begin the era of scientific evaluation of microsurgical excellence.**

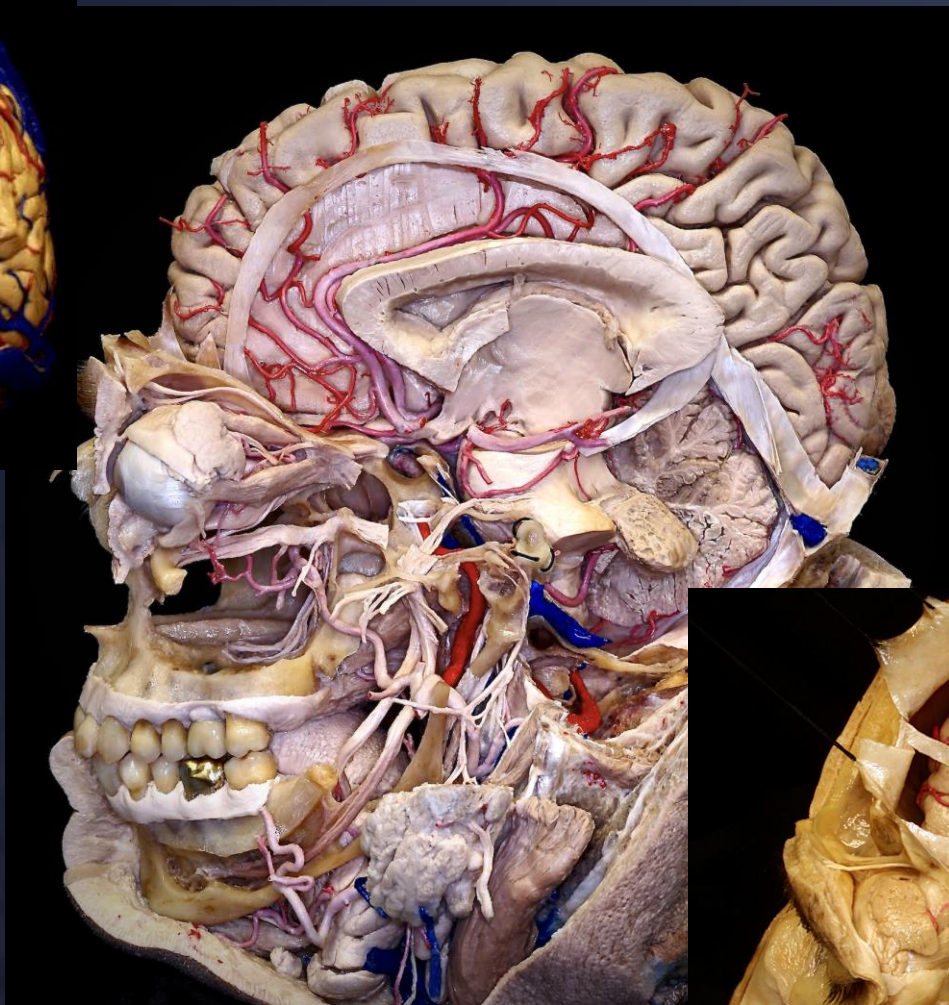
# Innovation and Research



- Advance the *art and innovation* in *operative neurosurgery*.
- Collaborations with Stanford University (Yeditepe in Turkey and U of Wisconsin.)
- Advance minimally invasive endonasal surgery to improve outcomes.
- The *Atlas/Stanford* collaboration is the most advanced platform for introduction of new techniques in the world.
- Surgeons across the globe spend time in the lab to sharpen their skills.
- The fellowship is the most sought after, attracting best talent.
- Expanding the neuroanatomical knowledge and technical skills.

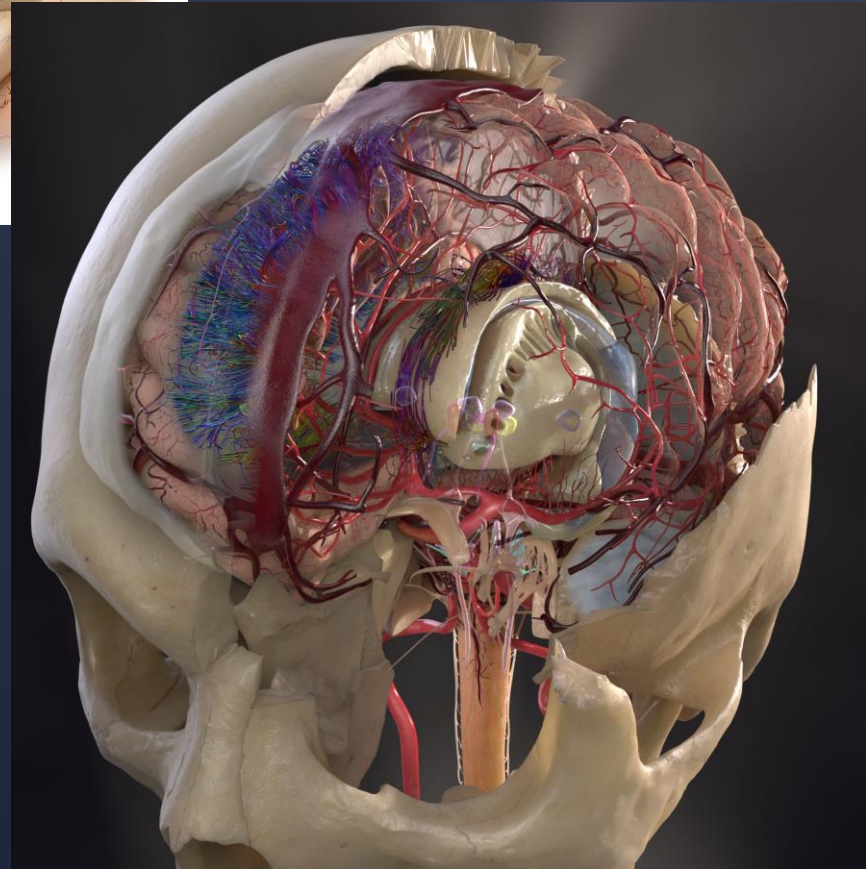
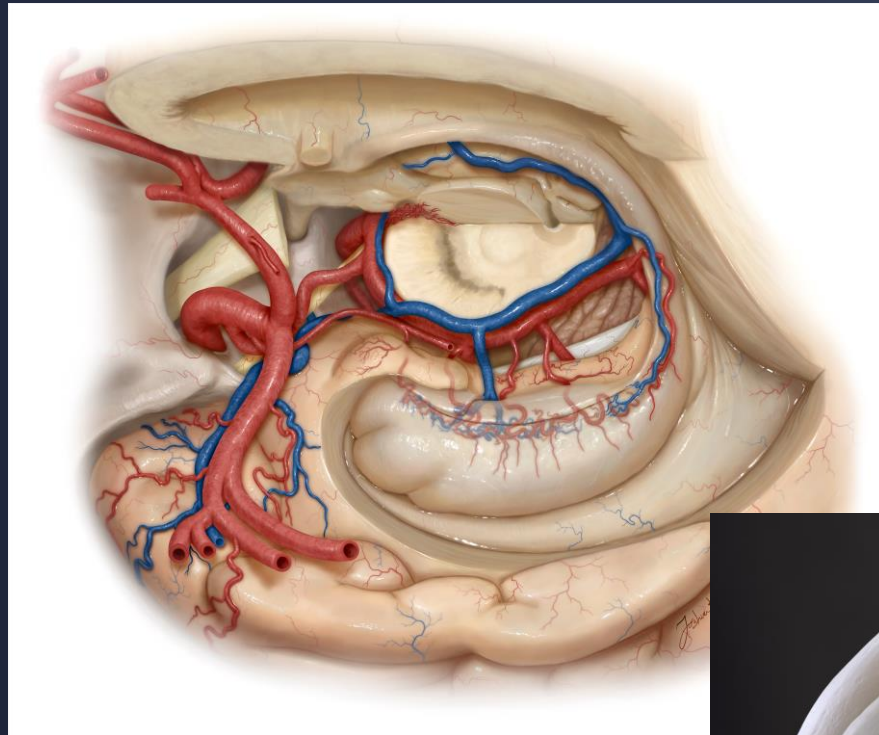
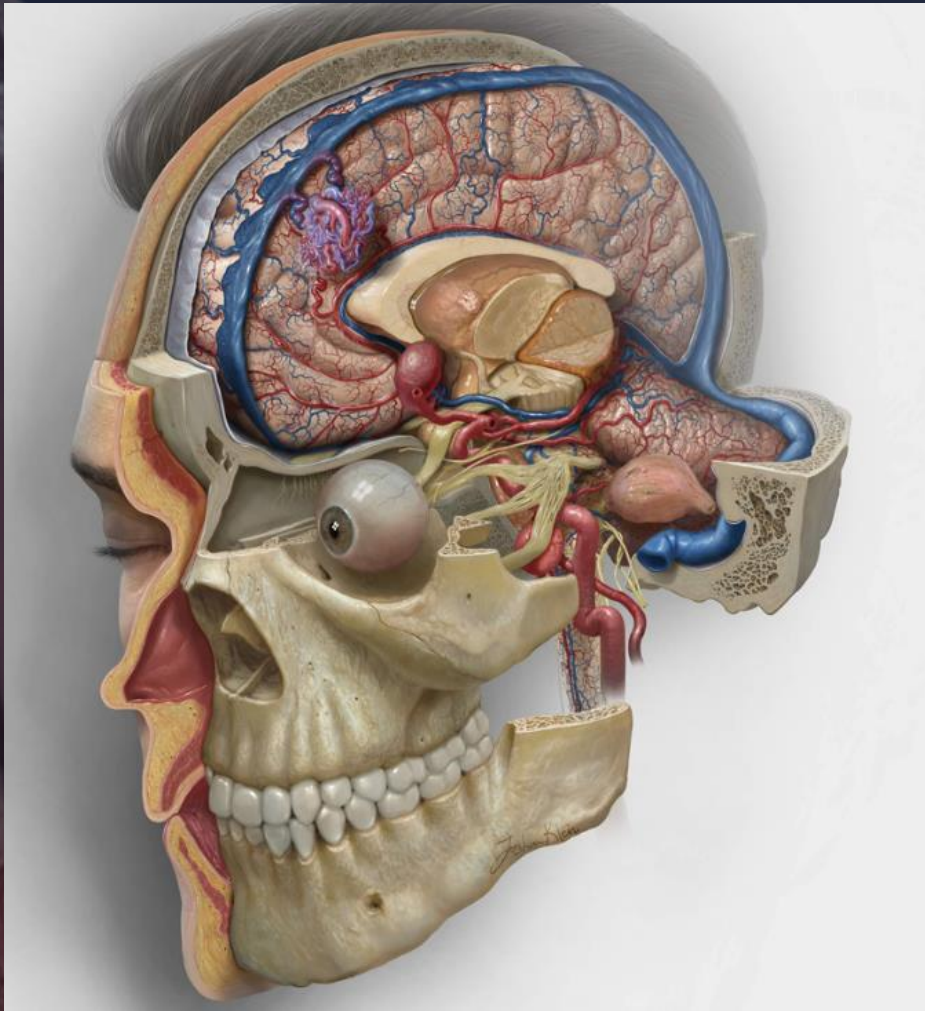


Before



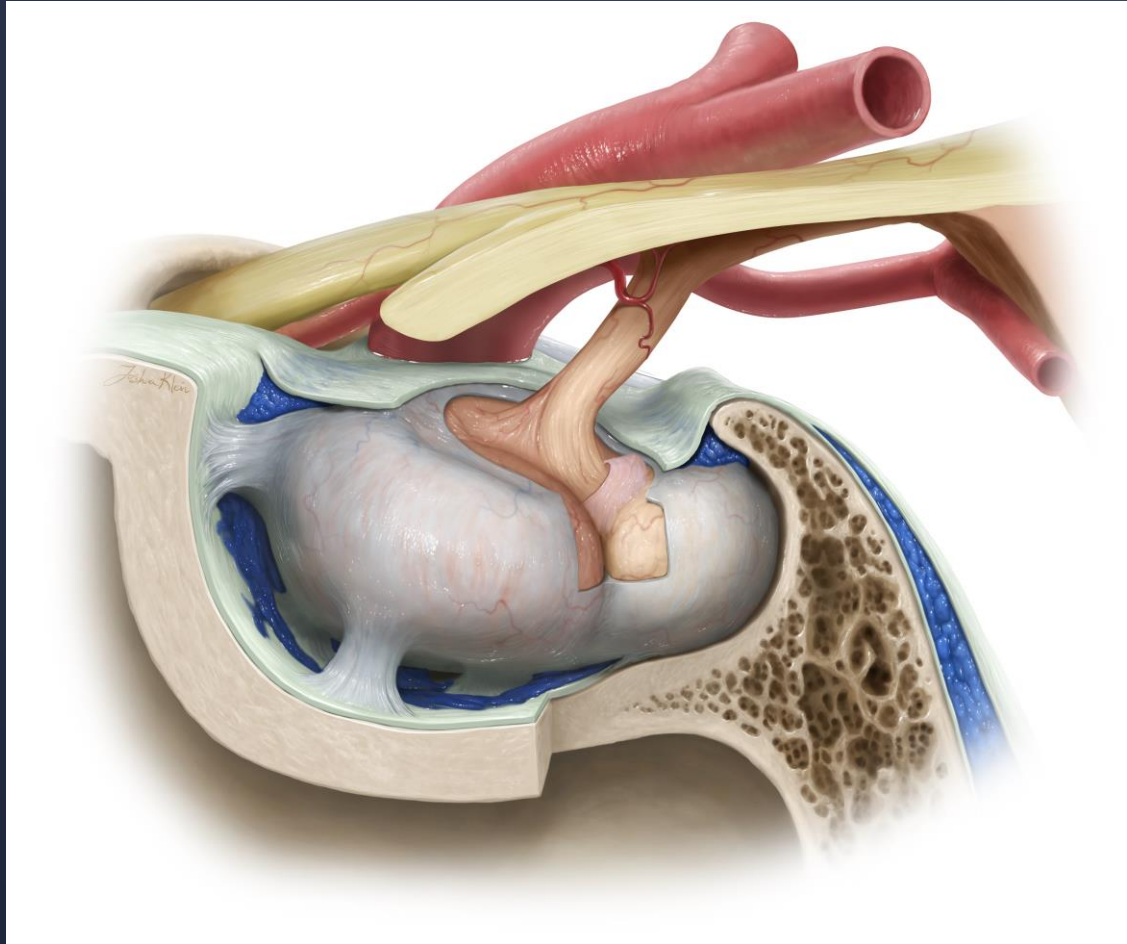
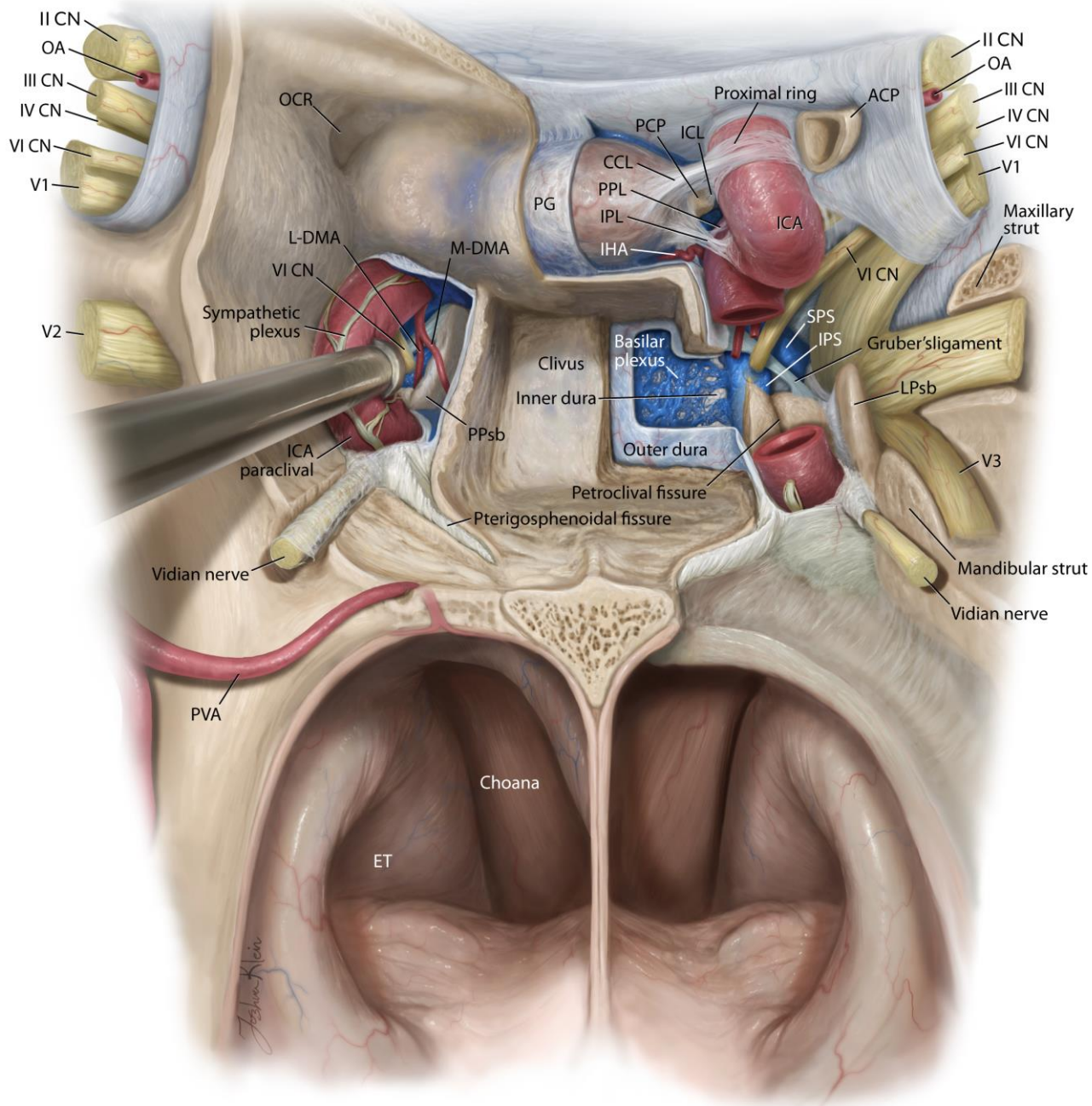
Now





The most advanced illustration and 3D media for spreading neurosurgical knowledge.







# *Neurosurgical Atlas Contents*

- 510 Chapters
- 1500 surgical videos (Highest quality ever recorded)
- 208 Grand Rounds webinars
- 9000 illustrations (unparalleled detail)
- 500 surgical images
- 1800 neuroanatomical images
- 3D VR models

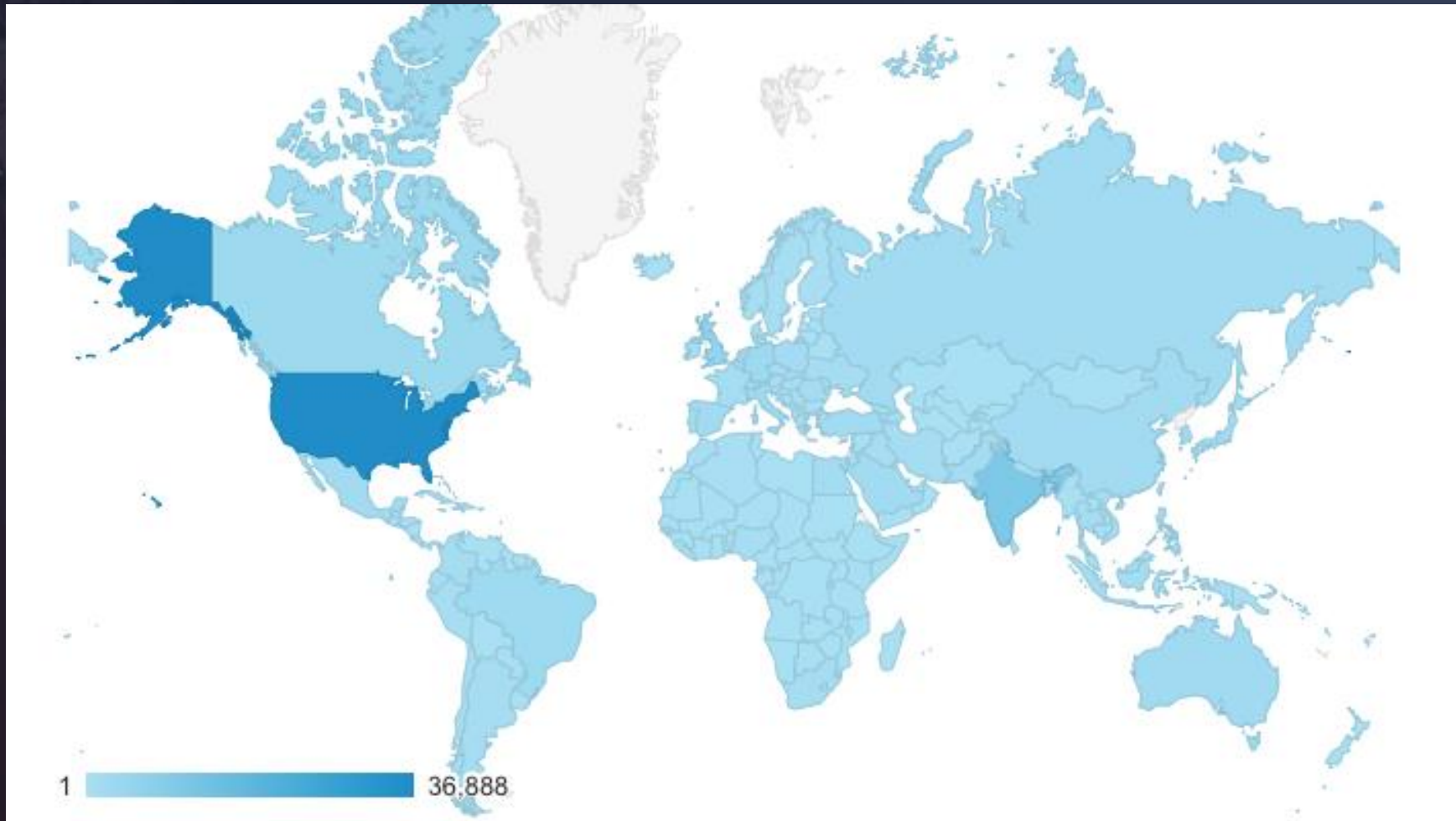
**Unspoken secrets of operative efficiency and excellence**

# LEADERSHIP IN NEUROSURGICAL EDUCATION AND RESEARCH





Geographic reach is wider than any other neurosurgical organization in the world (**AANS and CNS: 11K and 13K members; ATLAS: 66K members**)






























# Membership and Engagement (**ATLAS Community**)



- 66,000 members (Stable email list of 52,000)
  - 30% of members are neurosurgeons
  - Strong presence in US, Europe, South America, and China
- ~3600 views/day
- Twitter 20,000 followers
- Instagram 68,000 followers



The trend for  
Engagement and country  
of origin: **Global reach**  
(Please note this is for one year)

1.	 United States	264,305		33.41%
2.	 India	67,411		8.52%
3.	 United Kingdom	30,562		3.86%
4.	 China	20,404		2.58%
5.	 Canada	19,648		2.48%
6.	 Czechia	17,944		2.27%
7.	 Australia	17,216		2.18%
8.	 Brazil	17,131		2.17%
9.	 Germany	15,041		1.90%
10.	 Seychelles	14,676		1.86%
11.	 Russia	13,535		1.71%
12.	 Italy	13,403		1.69%
13.	 Turkey	11,739		1.48%
14.	 Philippines	10,744		1.36%
15.	 Netherlands	10,284		1.30%
16.	 South Korea	10,258		1.30%
17.	 Japan	9,870		1.25%

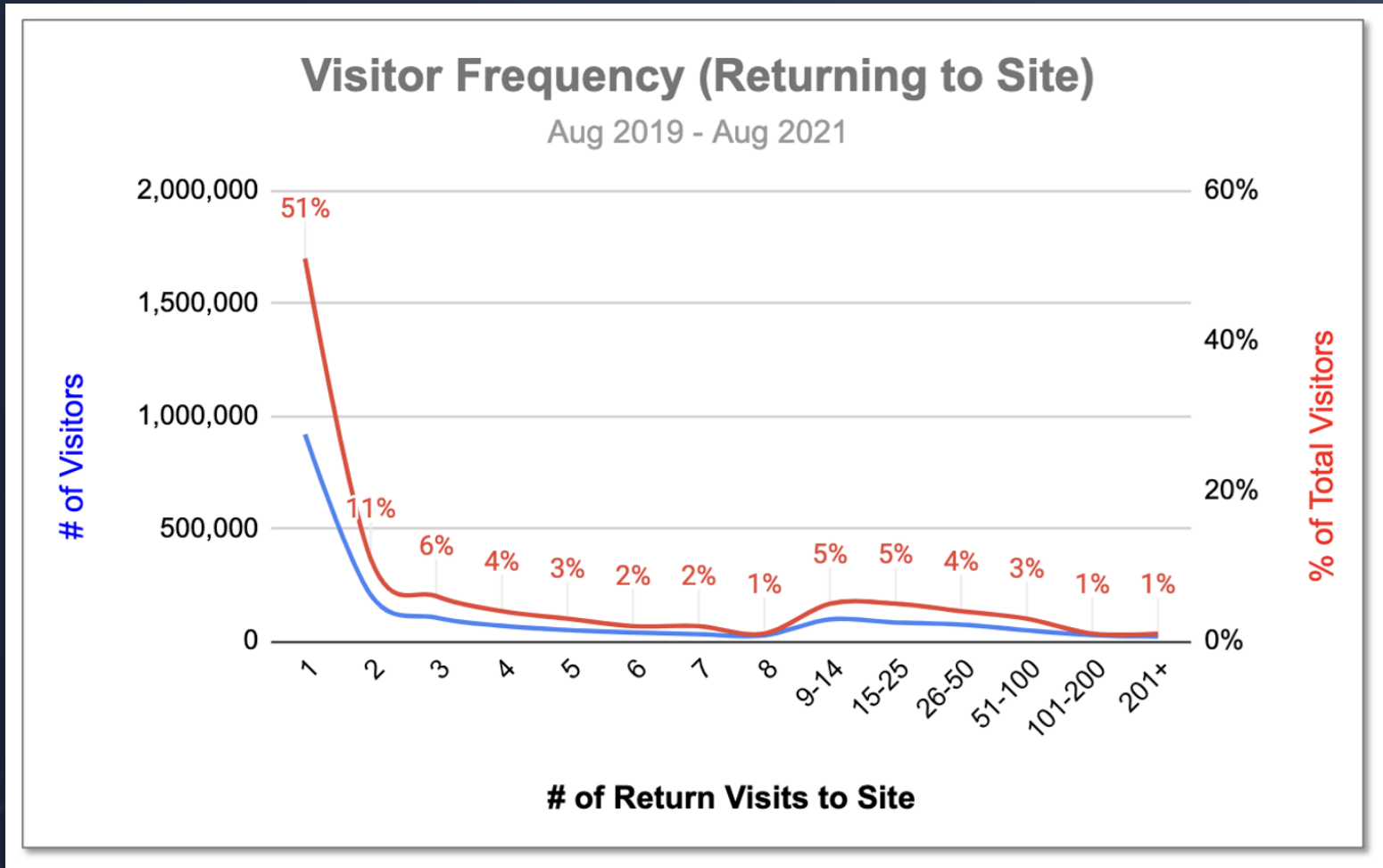


## High Visitor Return Rates

48% of new visitors return to the site

Of those that return, 29% are '*hyper consumers*' of content with 15-200+ future sessions

Average is 23.5 return visits for this high-consumption cohort



# Most Respected Resource for Complex Neurosurgery



## JNS



EDITORIAL

## Mastering the art of complex neurosurgical procedures: *The Neurosurgical Atlas and the Journal of Neurosurgery*

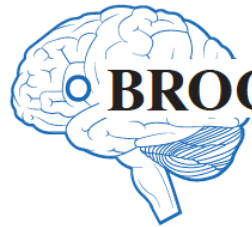
James T. Rutka, MD, PhD

Editor-in-Chief, Journal of Neurosurgery Publishing Group, Charlottesville, Virginia

**I**N 1990, I had the distinct honor of being a neurosurgery fellow in the Department of Neurosurgery at Nagoya University, Japan, under the tutelage of Dr. Kenichiro Sugita. I was the first North American to serve in Nagoya as a “Sugita Scholar” and to learn the myriad techniques mastered and espoused by Professor Sugita in microvascular neurosurgery. At that time, I was impressed with the attention that Dr. Sugita in particular, and the Japanese neurosurgery community in general, paid to capturing operative video recordings of every major case and

*umes* section, was conceived over a decade ago as a collection of text, intraoperative images, illustrations, and videos to document the most difficult moments in neurosurgical procedures. Encouraged by his residents who wanted to review his videos the night before a challenging case, Dr. Cohen-Gadol formed *The Neurosurgical Atlas* as a not-for-profit entity to advance neurosurgical education and teaching. *The Neurosurgical Atlas* reflects Dr. Cohen-Gadol’s passion for demonstrating how neurosurgical techniques represent a dynamic art (





Neurosurgical Forum

**BROCA'S AREA****The art of microneurosurgery and passion for technical excellence****Aaron A. Cohen-Gadol, MD, MSc, MBA**

Goodman Campbell Brain and Spine, Department of Neurological Surgery, Indiana University School of Medicine; and *Neurosurgical Atlas*, Indianapolis, Indiana

**T**HE technical art of neurosurgery has evolved significantly from the time the discipline was founded. Since then, we have striven to achieve technical excellence. Despite this intense drive, the definition of a technically gifted microneurosurgeon remains elusive. Is it truly an “I know it when I see it” concept? If the most extraordinary desire of our career is undefinable, how can

This phenomenon is often appreciated among professional athletes; their level of experience is inversely related to their use of analytical and conscious movements. As a resident’s level of experience advances, he or she becomes able to switch between analytical and intuitive processes more effectively.

The learning process is markedly accelerated during the time of residency, providing a reasonable medium for studying intraoperative decision-making. The process of a surgeon’s technical maturation during residency is likely to involve 3 stages. 1) Before the third year of residency, the operative procedure is interpreted as a series of actions (sequential processing). 2) The senior and chief residents assess the operative situation constantly and form a mental picture; their focus is on pattern recognition (con-



Article Spotlight



MIS lateral ACR for spinal deformity correction: technique and complication avoidance

Deformity correction using minimally invasive surgical (MIS) techniques can be challenging. Here the authors present a case in which an anterior column resection was performed using an MIS lateral approach to restore lumbar lordosis and improve sagittal balance. The authors demonstrate the technique and discuss potential complications and how they may be avoided.

[See Article >](#)

From the Neurosurgical Atlas



AVM within Eloquent Cortices: Intranidal Resection Technique

August 13, 2019

[Visit the Neurosurgical Atlas website >](#)

From the Rhoton Collection



Approaches to the Brainstem

Dr. Rhoton's Lecture on approaches to the brainstem. An overview of the anatomy related to the subtemporal, Kawase, transcranial, retrosigmoid, translabyrinthine, transcochlear, far lateral, transcondylar, transoral, telovelar, supracerebellar infratentorial, occipital, combined supra/infratentorial presigmoid, and endoscopic transclival approaches.

[Visit the Rhoton Collection website >](#)



The Neurosurgical Atlas

By Aaron Cohen-Gadol M.D.



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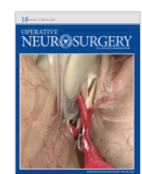
The *Atlas* content is frequently used as a reference in most respected neurosurgical journals.

OPERATIVE NEUR SURGERY  
THE SURGEON'S ARMAMENTARIUM



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Volume 18, Issue 2  
February 2020

Article Contents

- Abstract
- THE ORIGINS OF STEREOSCOPY
- FROM THE STEREOSCOPE TO THE VIEWMASTER: NEUROANATOMICAL APPLICATIONS
- THE EVOLUTION OF SS PHOTOGRAPHY IN NEUROSURGERY

Stereoscopy in Surgical Neuroanatomy: Past, Present, and Future

Roberto Rodriguez Rubio, MD, Rina Di Bonaventura, MD, Ioannis Kournoutas, BS, Dania Barakat, BA, Vera Vigo, MD, Ivan El-Sayed, MD, Adib A Abla, MD Author Notes

Operative Neurosurgery, Volume 18, Issue 2, February 2020, Pages 105-117, <https://doi.org/10.1093/ons/opz123>

Published: 19 June 2019 Article history

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Abstract

Since the dawn of antiquity, scientists, philosophers, and artists have pondered the nature of optical stereopsis—the perception of depth that arises from binocular vision. The early 19th century saw the advent of stereoscopes, devices that could replicate stereopsis by producing a 3D illusion from the superimposition of 2D photographs. This phenomenon opened up a plethora of possibilities through its usefulness as an educational tool—particularly in medicine. Before long, photographers, anatomists, and physicians were collaborating to create some of the first stereoscopic atlases available for the

The Neurosurgical Atlas  
By Aaron Cohen-Gadol M.D.



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## Pain-free survival after vagoglossopharyngeal complex sectioning with or without microvascular decompression in glossopharyngeal neuralgia

Zoe E. Teton BS, Katherine G. Holste MD, Fran A. Hardaway MD, Ki...

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DOI: <https://doi.org/10.3171/2018.8.JNS18239>

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### OBJECTIVE

Glossopharyngeal neuralgia (GN) is a rare pain condition in which patients experience paroxysmal, lancinating throbbing pain. Multiple surgical approaches have been used to treat this condition, including microvascular decompression (MVD), and sectioning of the upper rootlets of CN X, or a combination of the two. The aim of this study was to examine the long-term quality of life after MVD and sectioning of the CN X/IX complex.

### METHODS

A combined retrospective chart review and a quality-of-life telephone survey were performed to collect demographic and long-term outcome data. Quality of life was assessed by means of a questionnaire based on a combination of the Barrow Neurological Institute pain intensity scoring criteria and the Brief Pain Inventory–Facial. Kaplan-Meier analysis was performed to determine pain-free survival.

### RESULTS

**JNS**



CLINICAL ARTICLE

J Neurosurg 132:232–238, 2020

## Pain-free survival after vagoglossopharyngeal complex sectioning with or without microvascular decompression in glossopharyngeal neuralgia

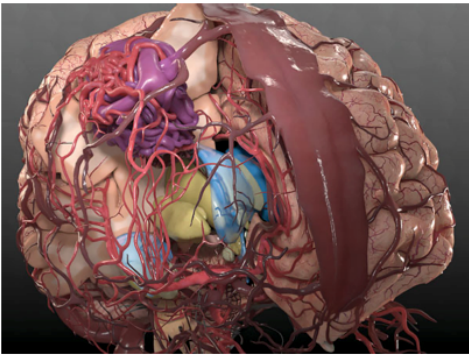
Zoe E. Teton, BS, Katherine G. Holste, MD, Fran A. Hardaway, MD, Kim J. Burchiel, MD, and Ahmed M. Raslan, MD

Department of Neurological Surgery, Oregon Health & Science University, Portland, Oregon

**OBJECTIVE** Glossopharyngeal neuralgia (GN) is a rare pain condition in which patients experience paroxysmal, lancinating throat pain. Multiple surgical approaches have been used to treat this condition, including microvascular decompression (MVD), and sectioning of cranial nerve (CN) IX and the upper rootlets of CN X, or a combination of the two. The aim of this study was to examine the long-term quality of life and pain-free survival after MVD and sectioning of the CN X/IX complex.

**METHODS** A combined retrospective chart review and a quality-of-life telephone survey were performed to collect demographic and long-term outcome data. Quality of life was assessed by means of a questionnaire based on a combination of the Barrow Neurological Institute pain intensity scoring criteria and the Brief Pain Inventory–Facial. Kaplan-Meier analysis was performed to determine pain-free survival.

**RESULTS** Of 18 patients with GN, 17 underwent sectioning of the CN IX/X complex alone or sectioning and MVD



**Benjamin K. Hendricks, MD\*§**

**Jerome Hartman\***

**Mark Seifert, PhD<sup>‡</sup>**

**Aaron A. Cohen-Gadol, MD,  
MSc, MBA\*<sup>‡</sup>**

## Introduction of a New Interactive Paradigm to Define the Next Generation of Visualization in Neurosurgical Anatomy

**T**he intricacies of cranial and cerebral anatomy have been the fascination of generations since the Middle Ages with attempts to figuratively represent these structures in increasing anatomical detail for the purposes of education, clinical application, and fascination. The initial renditions of cranial anatomy were represented by 2-dimensional (2D) schematics of the ventricular system surrounded by disorganized neural tissue.<sup>1</sup> Increasingly sophisticated and innovative 2D schematics have been developed by physicians, anatomists, and illustrators through the ages to advance anatomical and surgical understanding of the intricacies of cranial anatomy. The recent advances in graphic design and computer animation have provided a new environment that can not only be highly accurate but also be potentially revolutionary for interactive 3D anatomical representation.



NEUROSURGICAL ATLAS SERIES

The *Operative Neurosurgery* Journal has a dedicated section for the *Neurosurgical Atlas*.



The Neurosurgical Atlas

By Aaron Cohen-Gadol M.D.

**Aaron Cohen-Gadol, MD, MSc,  
MBA**  

\*Goodman Campbell Brain and Spine, Department of Neurosurgery, Indiana University, Indianapolis, Indiana; <sup>‡</sup>The Neurosurgical Atlas, Indianapolis, Indiana

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## The Orbitozygomatic Craniotomy and Its Judicious Use

The concept of maximizing bone removal along the skull base has been advocated to expand the operative space for large, firm, and encasing ventral and ventrolateral skull base tumors. However, indications for the use of such osteotomies have not been well defined. The improved maneuverability and enhanced extent of expansion of the operative corridor via the skull base approaches compared to those of standard craniotomies have been based on cadaveric studies that might not simulate the operative environment realistically. Bony removal alone is not adequate to protect neurovascular structures, and strategic use of dynamic retraction and innovative operative routes are some of the other factors that contribute to successful microsurgery. In this analysis, the more discriminate indications and modified techniques for orbitozygomatic osteotomy are discussed.

**KEY WORDS:** Craniotomy, Operative anatomy, Orbitozygomatic, OZ, Virtual reality



## Introducing *The Neurosurgical Atlas Series* as a Monthly Section of *World Neurosurgery*: Operative Pearls and Insights

We are excited to introduce a new special section of *World Neurosurgery*, *The Neurosurgical Atlas Series* (WNS-NSA). This monthly section will feature articles authored by *The Neurosurgical Atlas* team and peer reviewed by a distinguished panel of invited reviewers.

Since its inception in 2016, *The Neurosurgical Atlas* has evolved into the premier online educational resource for operative techniques. The *Atlas* is a multimedia platform featuring over 550

The WNS-NSA series is a monthly contribution. The series is a dedicated collection of safe, efficient, and comprehensive insights from the diverse



## Extradural Clinoidectomy: An Efficient Technique for Expanding the Operative Corridor Toward the Central Skull Base

Marcus A. Acioly<sup>1</sup>, Benjamin K. Hendricks<sup>1</sup>, Aaron Cohen-Gadol<sup>1,2</sup>

Extradural anterior clinoidectomy is an important tool for neurovascular and skull base surgery. This technique is cardinal for expanding access to the proximal carotid artery, optic nerve, sella, and the central skull base. The goal of anterior clinoidectomy is to reveal the more proximal ophthalmic and clinoidal segments of the internal carotid artery (ICA) while skeletonizing the proximal optic nerve. This maneuver expands the opticocarotid and carotid-oculomotor windows and therefore the operative corridor to the interpeduncular cisterns; both the carotid artery and optic nerve are partially untethered or liberated and can be more safely mobilized.

The indications and advantages of extradural clinoidectomy are as follows:

- The extradural space allows a more “aggressive” osteotomy of the medial sphenoid wing and clinoid while protecting the intradural neurovascular structures during drilling.
- This maneuver is less selective and more inclusive for some pathologies.
- It is more beneficial for resection of medial sphenoid wing meningiomas because it enables devascularization of the tumor and decompression of the optic nerve early in the surgery. The tumor-infiltrated clinoid can be removed. With early decompression of the nerve, further tumor manipulation might not

The *WORLD NEUROSURGERY* Journal has a dedicated section for the *Neurosurgical Atlas*.

# Virtual OR with 400 viewers/session is held every other Monday



Most popular webinar for neurosurgeons worldwide

This block contains a large endoscopic view of a surgical site, showing pinkish, moist tissue and a network of blood vessels. In the top right corner of the video frame, there is a small logo of a brain with the word "Atlas" underneath. At the bottom of the video frame, there is a video player interface with a play button, a progress bar, and a timestamp of "20:18". A small inset video in the bottom right corner shows a man's face, likely the speaker or a participant.

