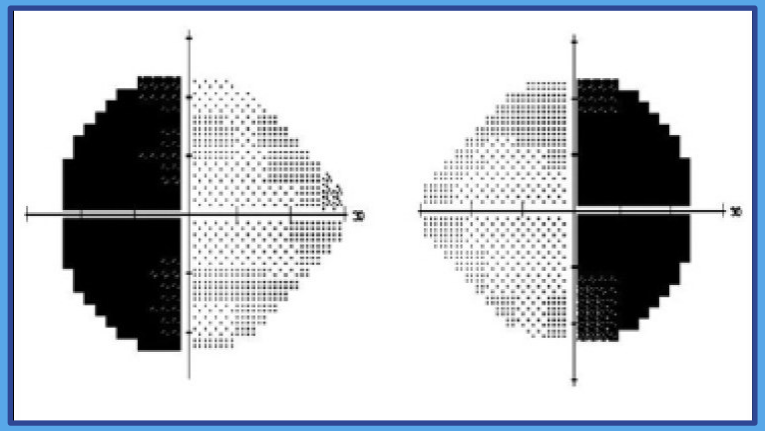


Everything You Always Wanted to Know About PITUITARY ADENOMA

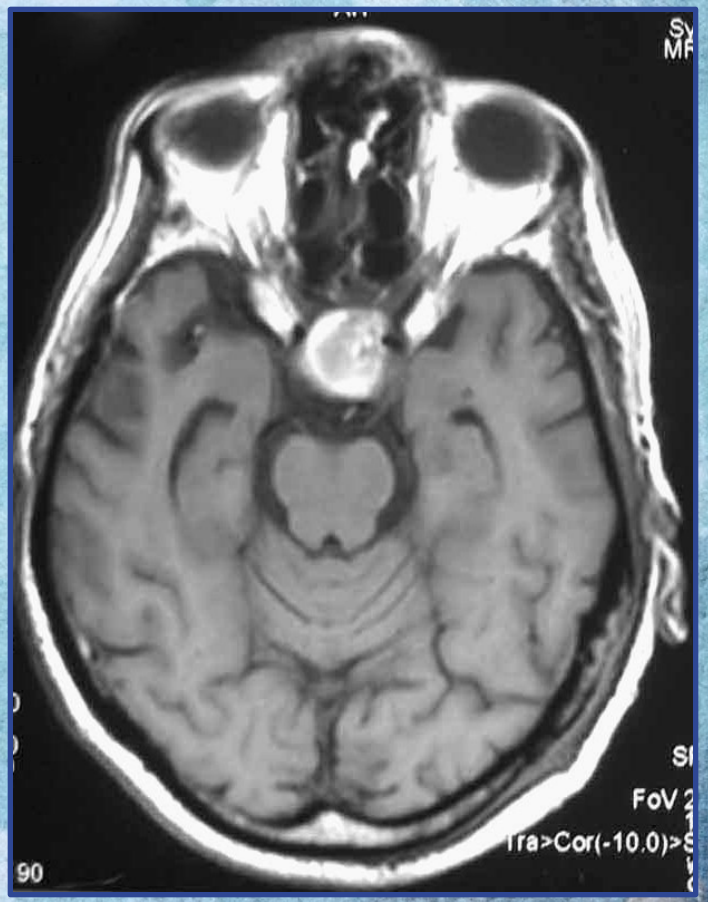
But Were Afraid to Ask!

Rick Trevino, OD, FAAO

Indiana University School of Optometry

Chiasmal Syndrome

- Online notes
  - richardtrevino.net
- Email me
  - rctrevin@iu.edu
- Disclosures
  - None



Case 1

Case 1

61yo BM presents for annual exam

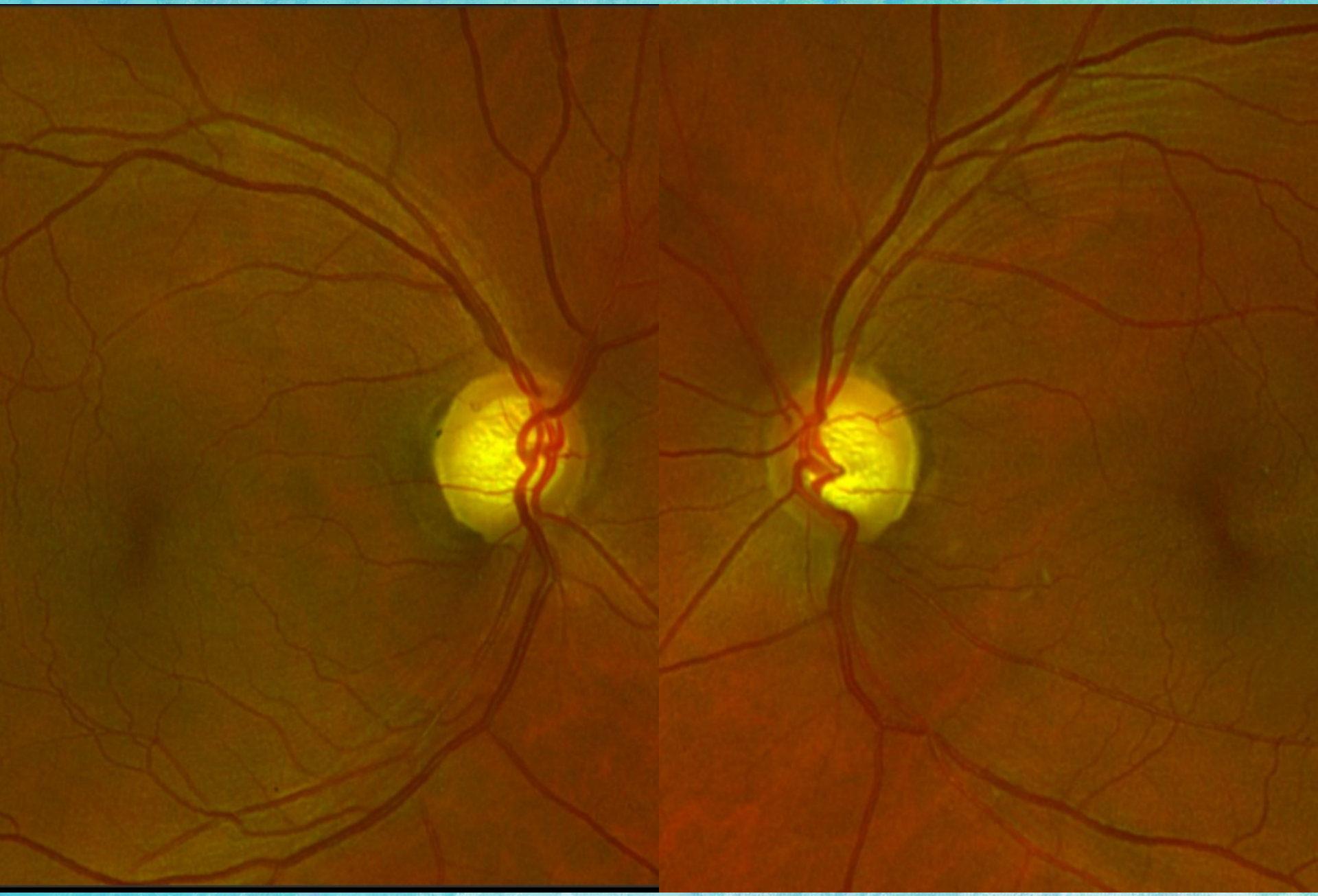
- POH: **NTG glaucoma**. Takes Alphagan S/P LASIK OU (18yrs ago)
- MH: Good health

VA: 20/20 OU

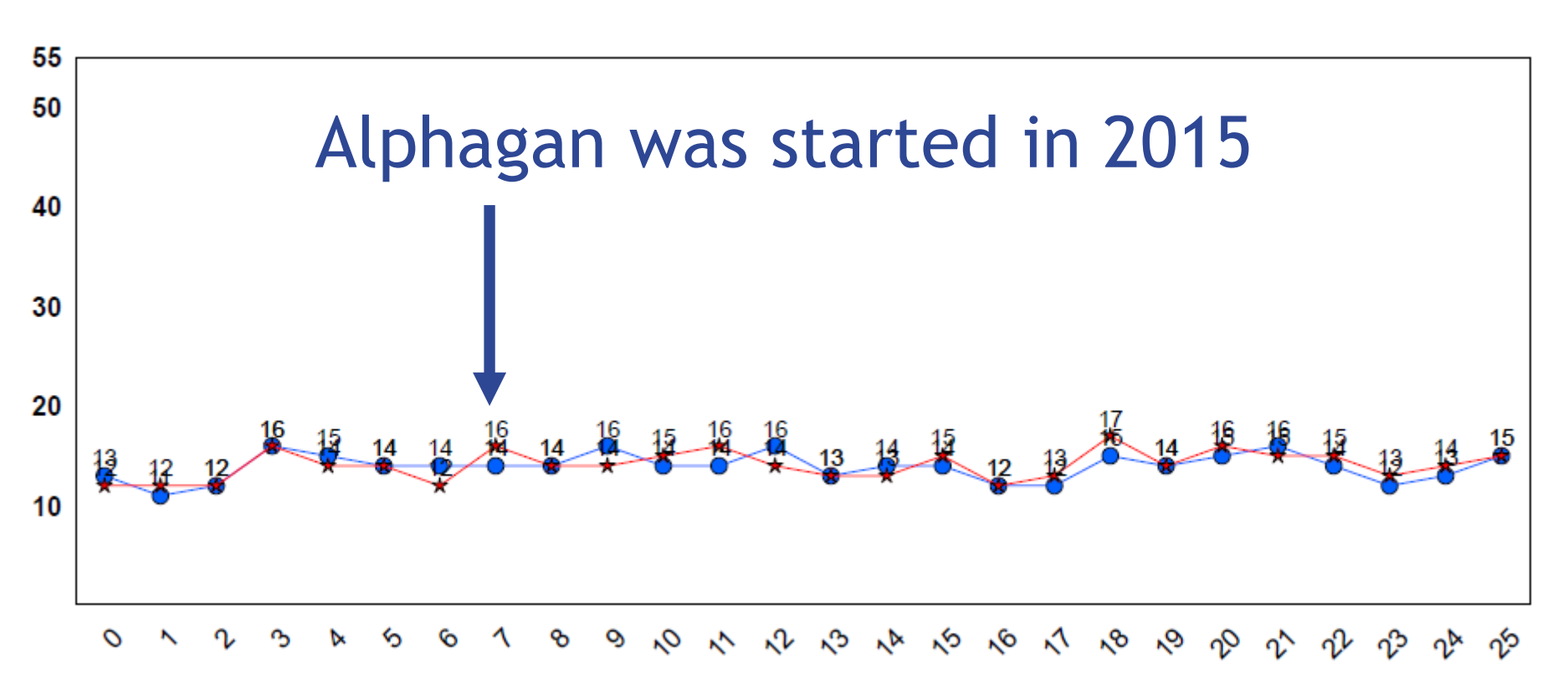
PERRL, (-)APD / FROM

Ta 14/15

SLE: WNL OU



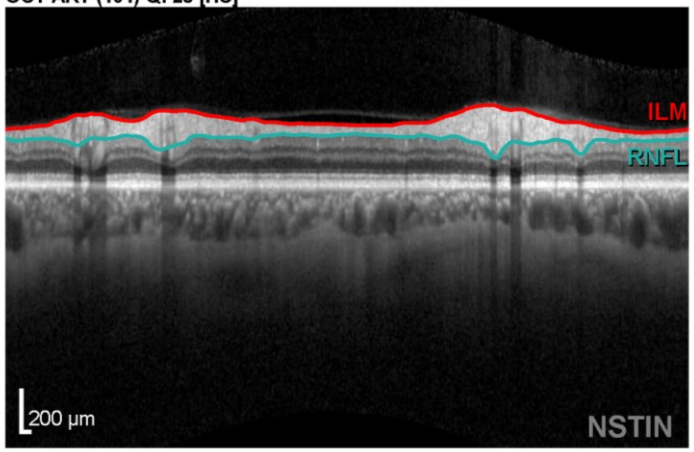
Intraocular Pressure



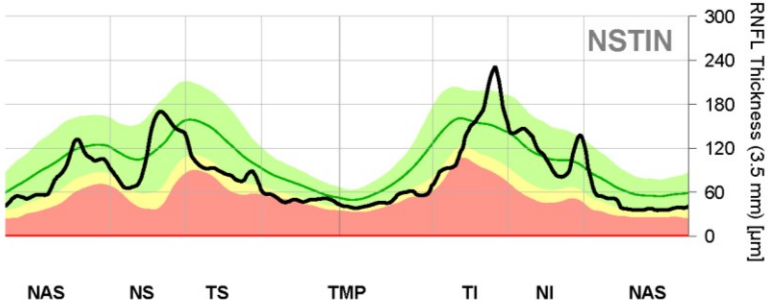
2013

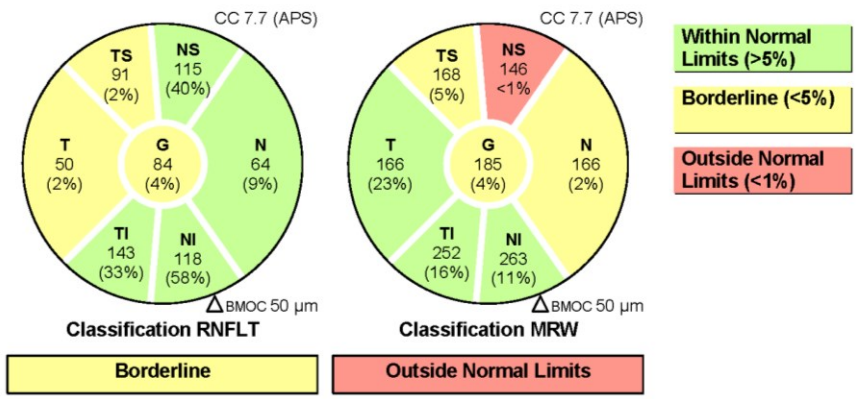
2022

OCT ART (101) Q: 28 [HS]



OD





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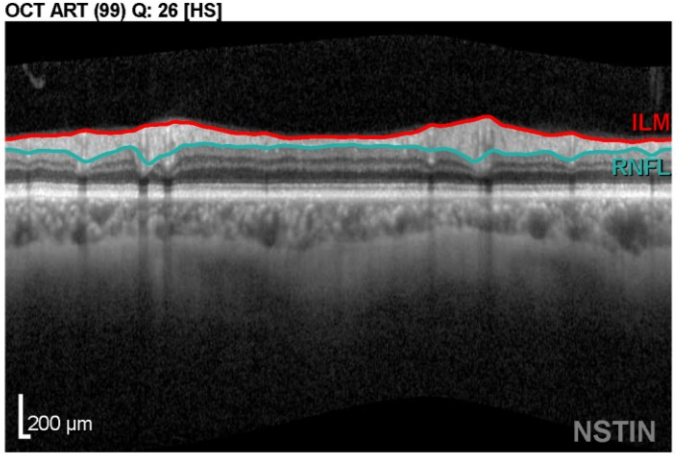
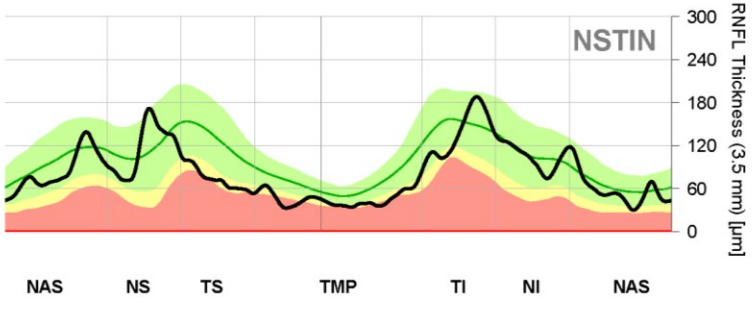
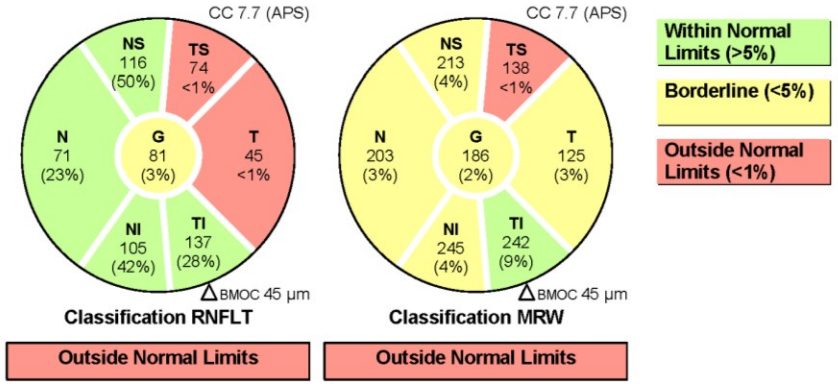


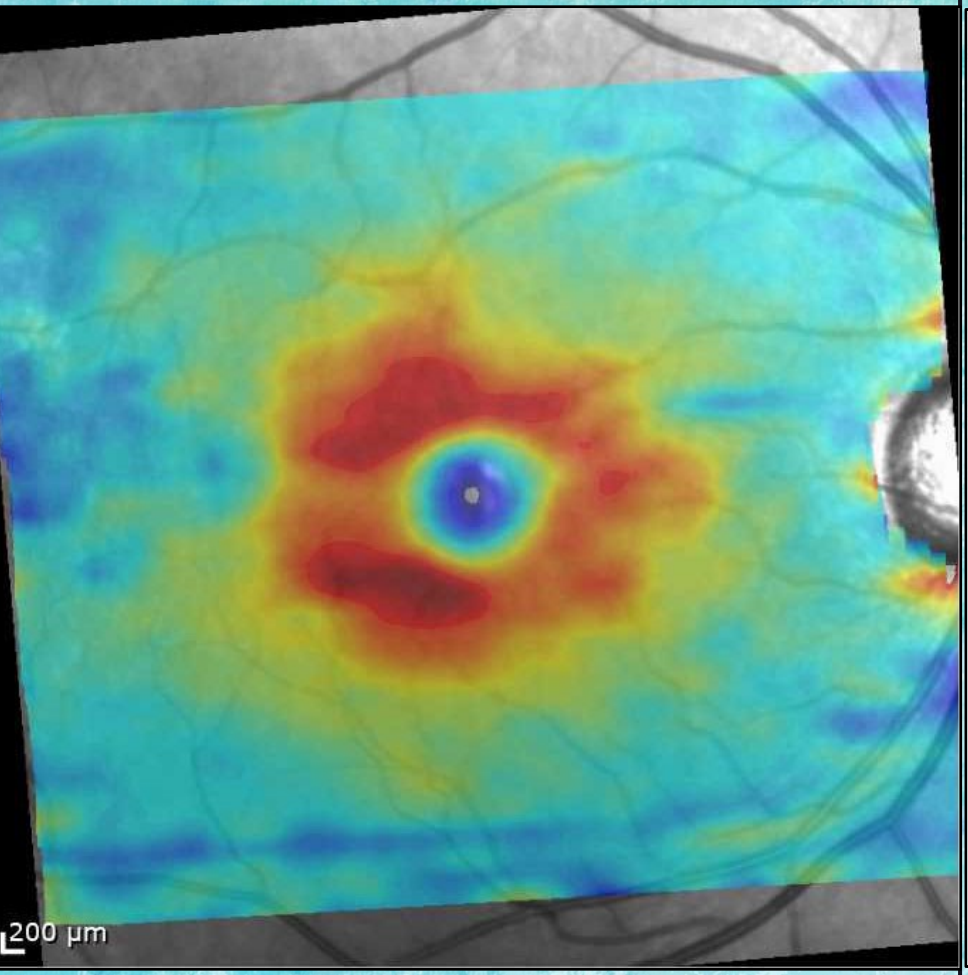
OS

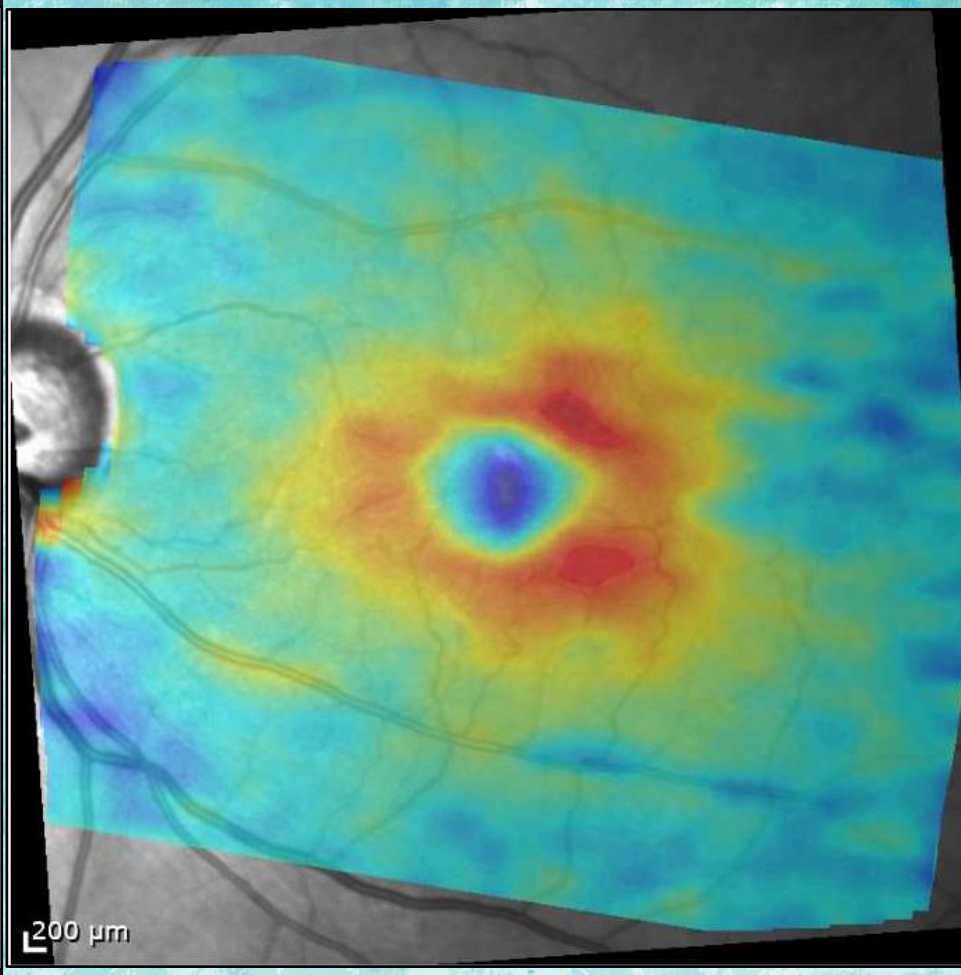


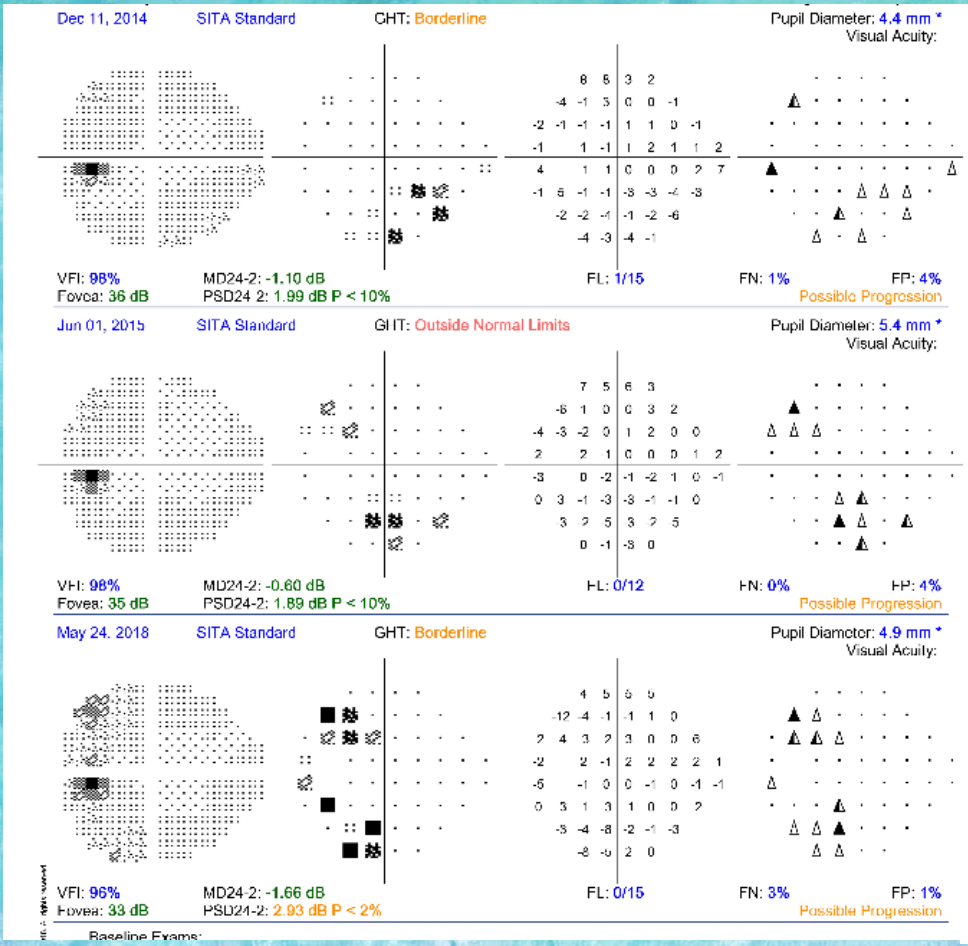


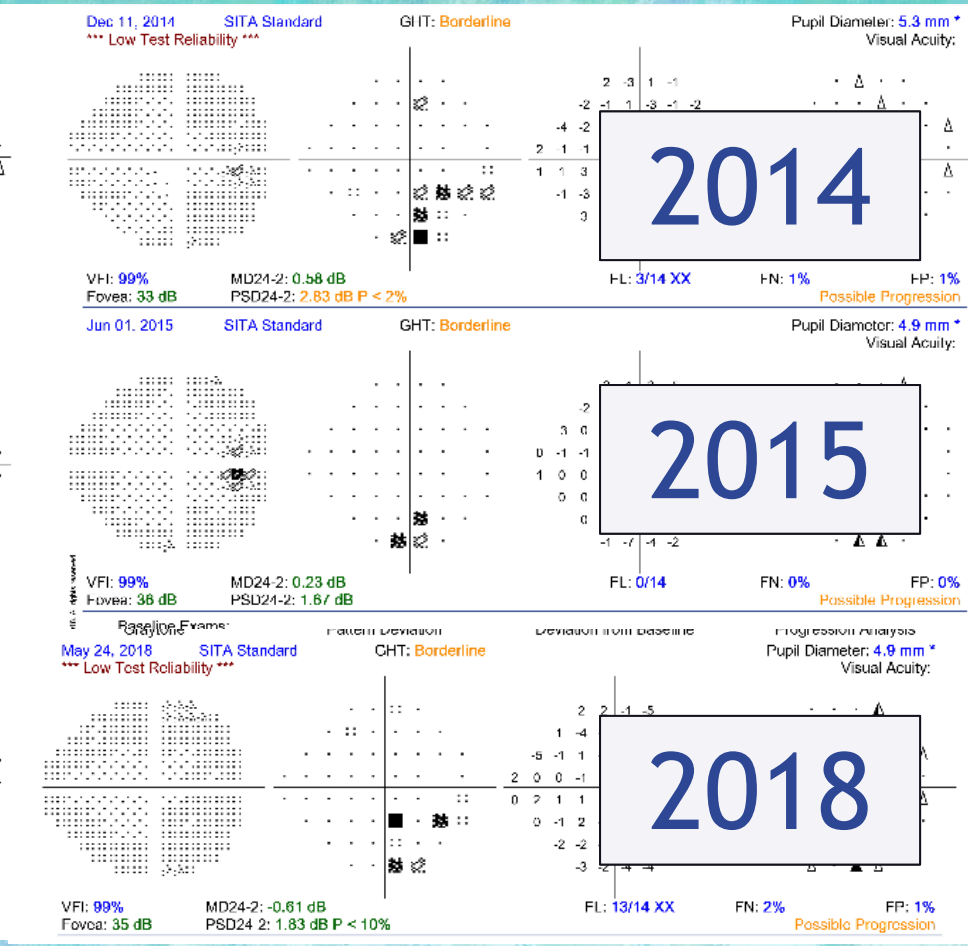
OD

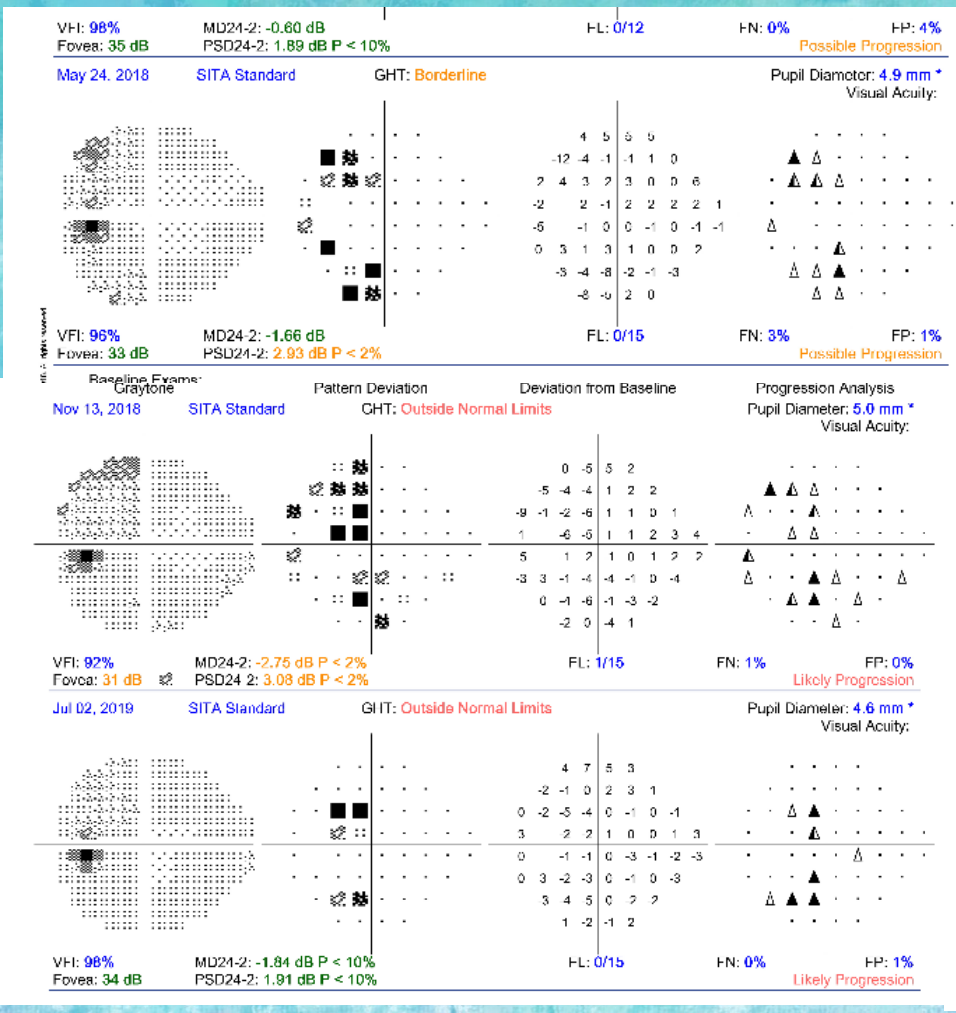
OS

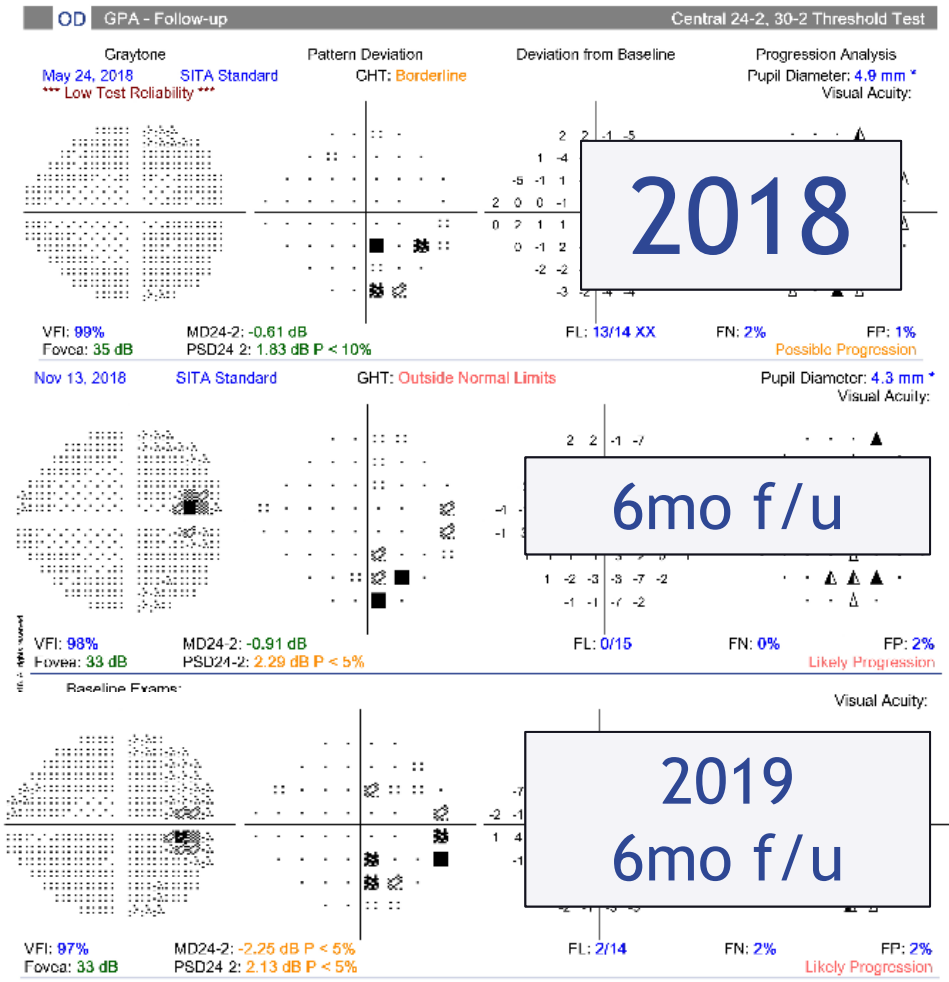





Dec 11, 2014 SITA Standard GHT: Borderline Pupil Diameter: 4.4 mm *
Visual Acuity:
VFI: 98% MD24-2: -1.10 dB FL: 1/15 FN: 1% FP: 4%
Fovea: 36 dB PSD24 2: 1.99 dB P < 10% Possible Progression
Jun 01, 2015 SITA Standard GHT: Outside Normal Limits Pupil Diameter: 5.4 mm *
Visual Acuity:
VFI: 98% MD24-2: -0.60 dB FL: 0/12 FN: 0% FP: 4%
Fovea: 35 dB PSD24-2: 1.89 dB P < 10% Possible Progression
May 24, 2018 SITA Standard GHT: Borderline Pupil Diameter: 4.9 mm *
Visual Acuity:
VFI: 96% MD24-2: -1.66 dB FL: 0/15 FN: 3% FP: 1%
Fovea: 33 dB PSD24-2: 2.93 dB P < 2% Possible Progression
Baseline Exams:


Dec 11, 2014 SITA Standard GHT: Borderline Pupil Diameter: 5.3 mm *
*** Low Test Reliability ***
Visual Acuity:
2014
VFI: 99% MD24-2: 0.58 dB FL: 3/14 XX FN: 1% FP: 1%
Fovea: 33 dB PSD24-2: 2.83 dB P < 2% Possible Progression
Jun 01, 2015 SITA Standard GHT: Borderline Pupil Diameter: 4.9 mm *
Visual Acuity:
2015
VFI: 99% MD24-2: 0.23 dB FL: 0/14 FN: 0% FP: 0%
Fovea: 38 dB PSD24-2: 1.67 dB Possible Progression
Baseline Exams:
Grayscale Pattern Deviation Deviation from Baseline Progression Analysis
May 24, 2018 SITA Standard GHT: Borderline Pupil Diameter: 4.9 mm *
*** Low Test Reliability ***
Visual Acuity:
2018
VFI: 99% MD24-2: -0.61 dB FL: 13/14 XX FN: 2% FP: 1%
Fovea: 35 dB PSD24 2: 1.83 dB P < 10% Possible Progression





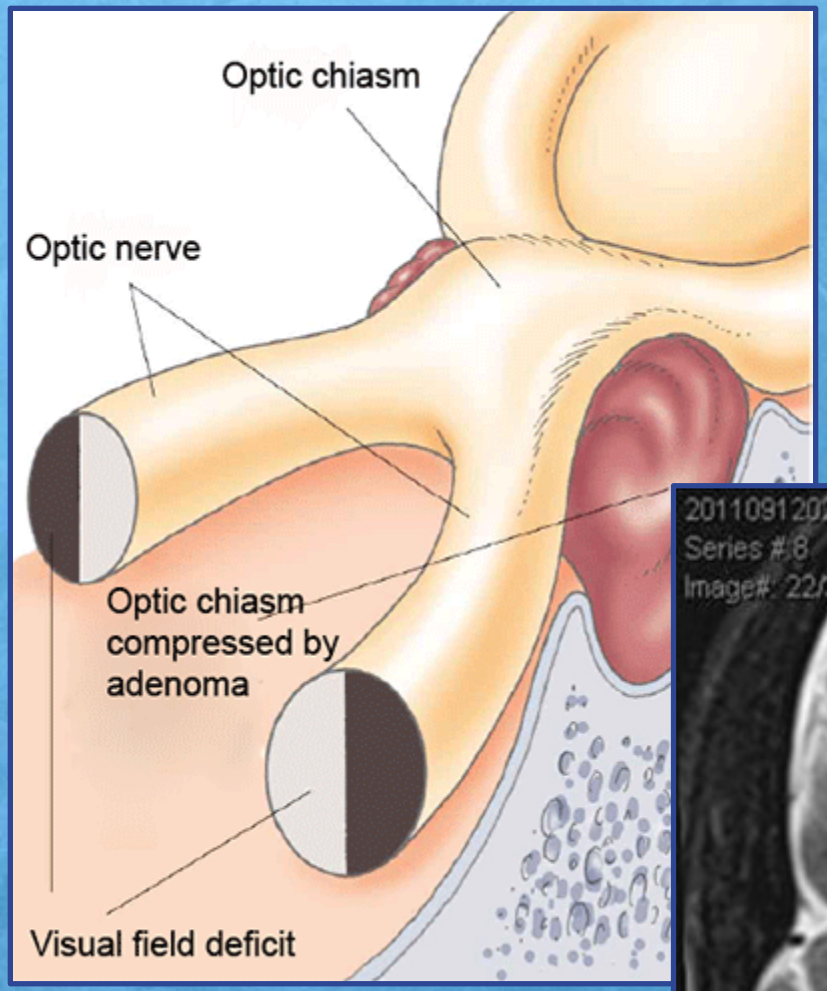
Patient was referred at 2019 exam for MRI which revealed a pituitary adenoma

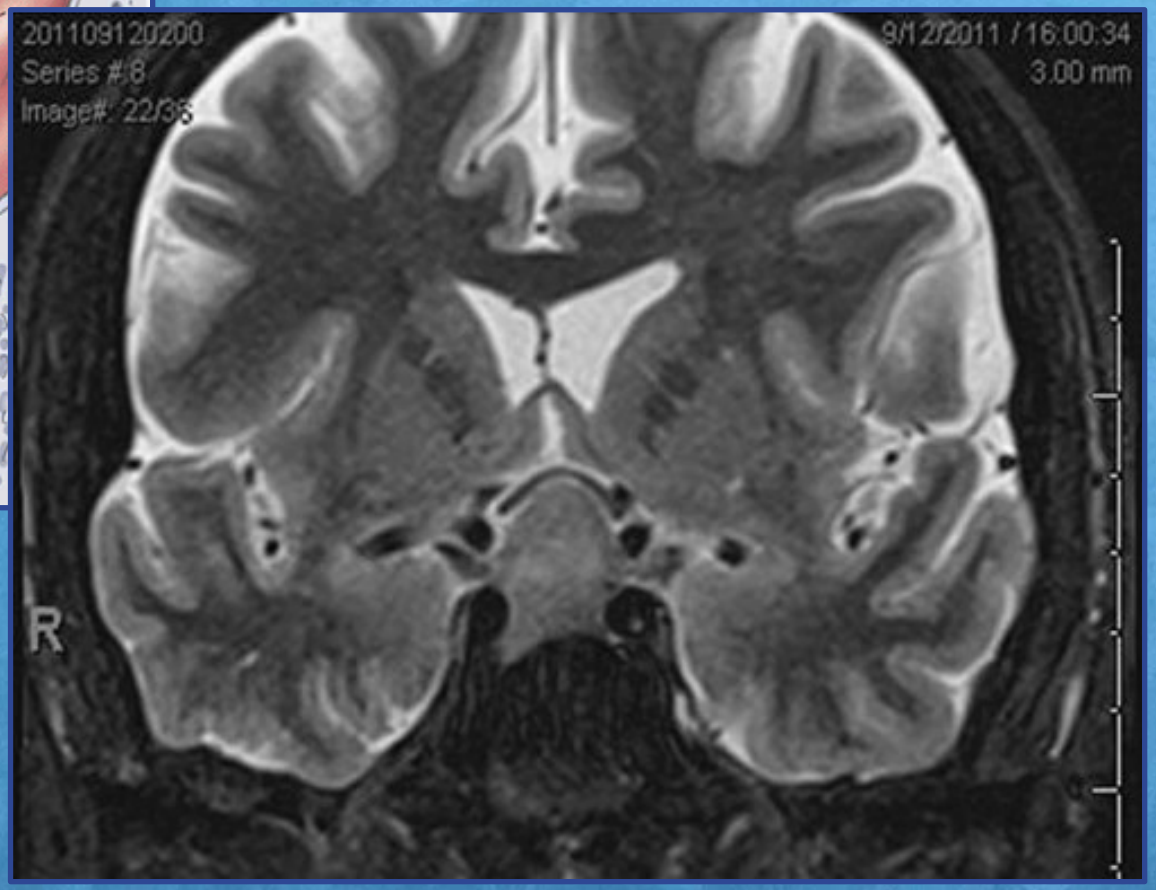

MISSED IT
FIRE
HOSE
BY THAT MUCH

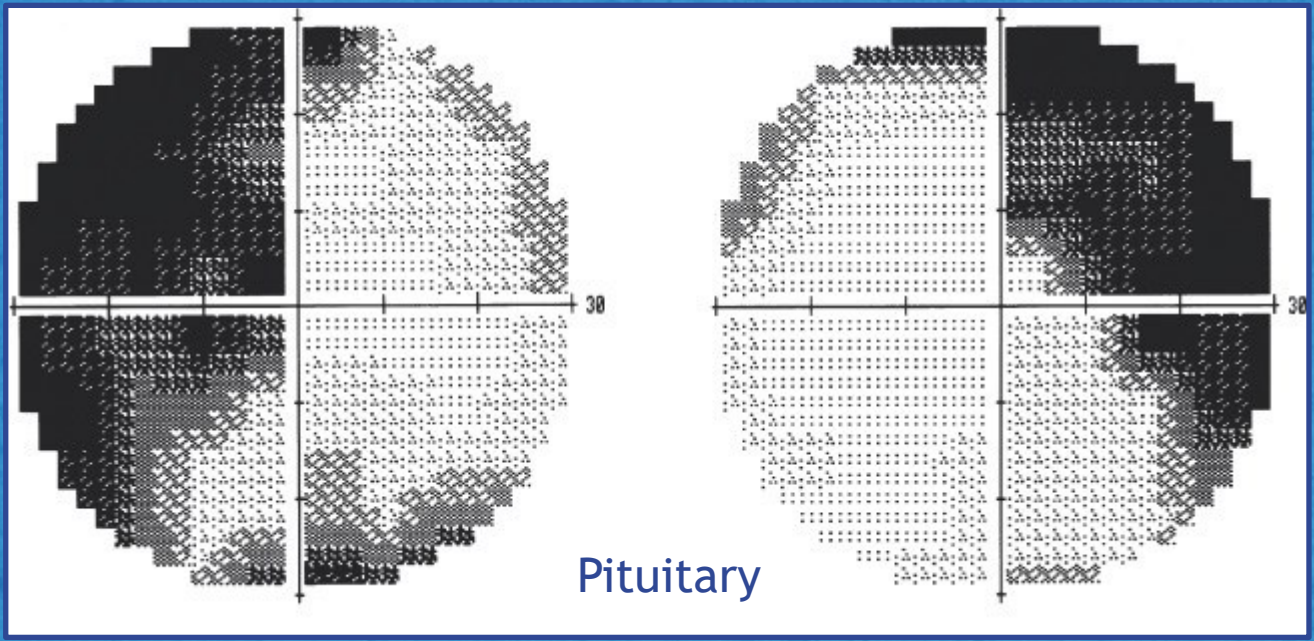
Chiasmal Syndrome

- The constellation of signs and symptoms associated with lesions of the optic chiasm
  - Pituitary adenoma is the most common cause
- **20% of all brain tumors occur in this region**
  - 50% are pituitary adenomas
  - *Visual disturbance is common*
- Headache is the most common symptom
- Causes of chiasmal syndrome include tumor, inflammation, and ischemia

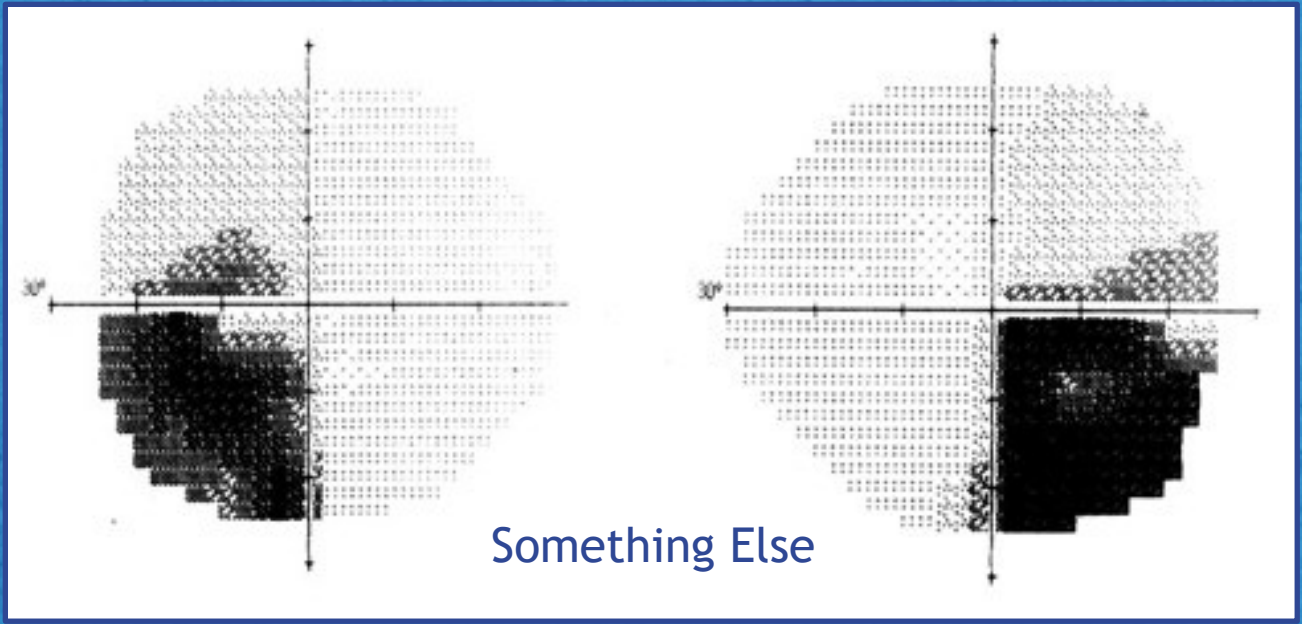
Pituitary adenoma compresses the optic chiasm from below







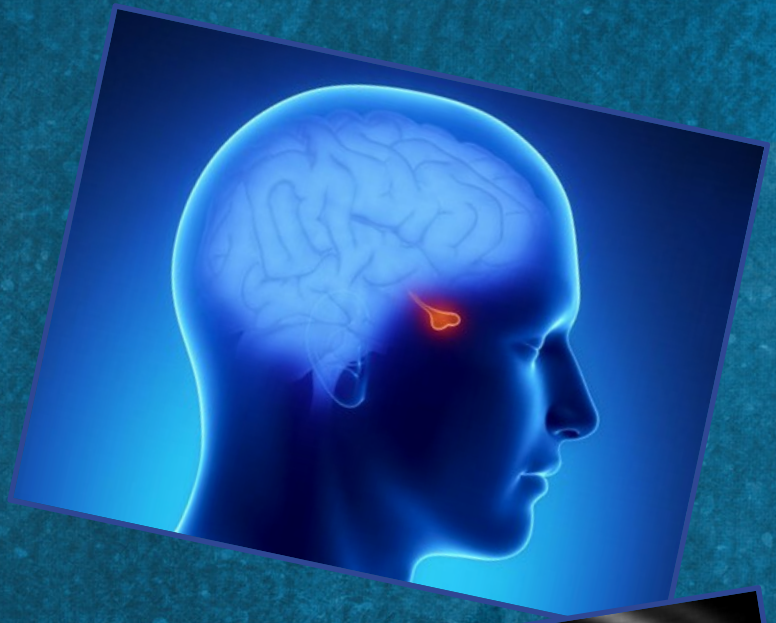
Incomplete bitemporal hemianopic defect **greater above than below** – highly suggestive of pituitary anenoma

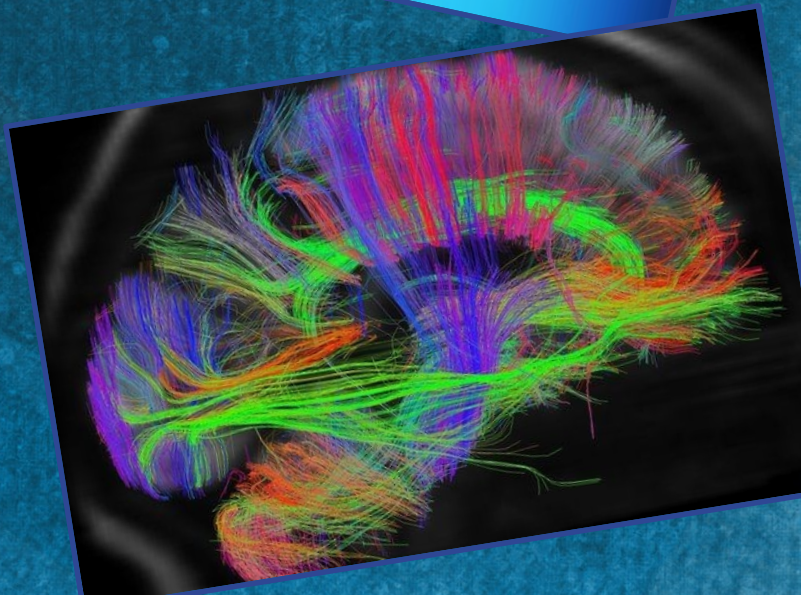


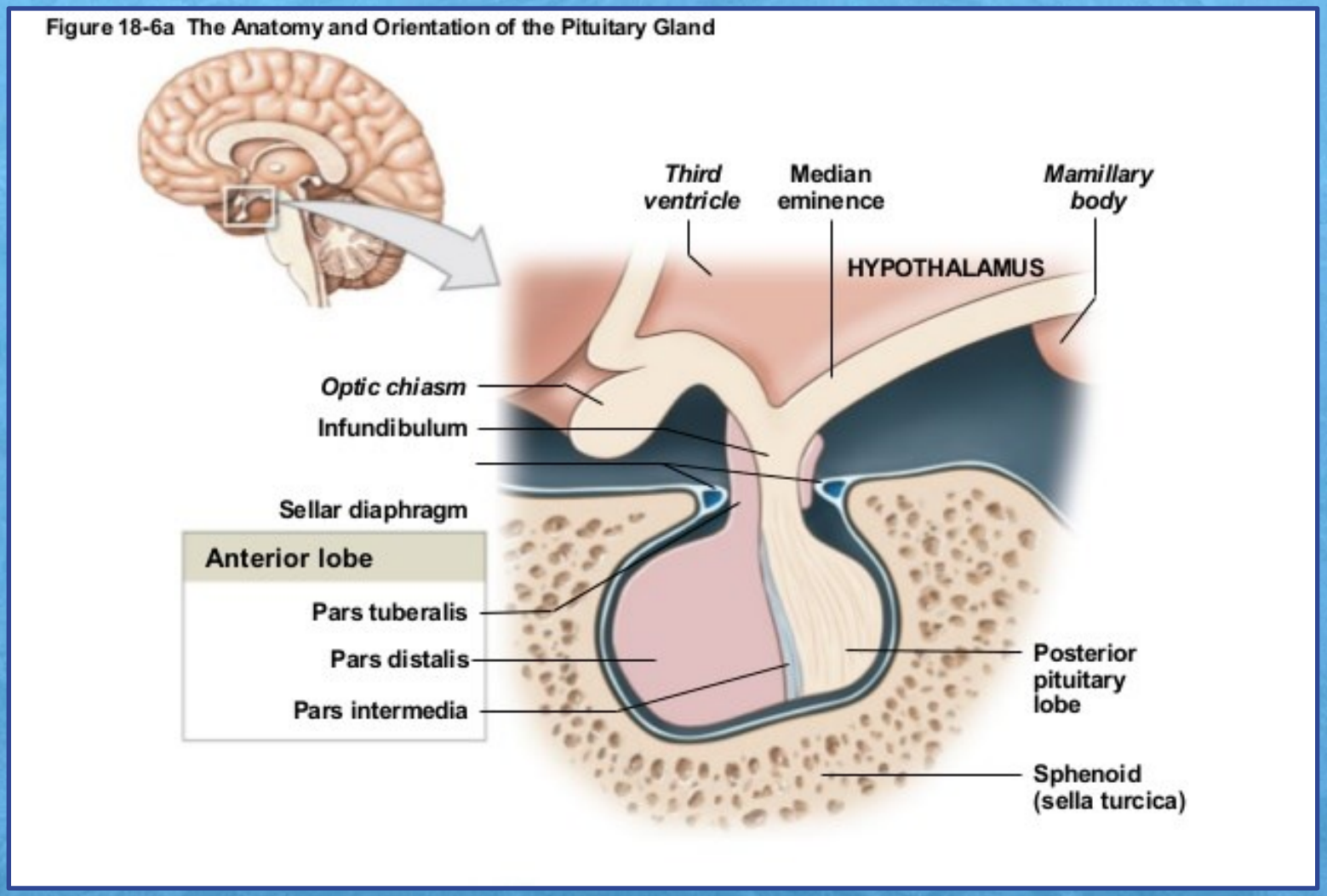
Incomplete bitemporal hemianopia **greater below than above** – highly suggestive of something other than pituitary adenoma

Chiasmal Syndrome

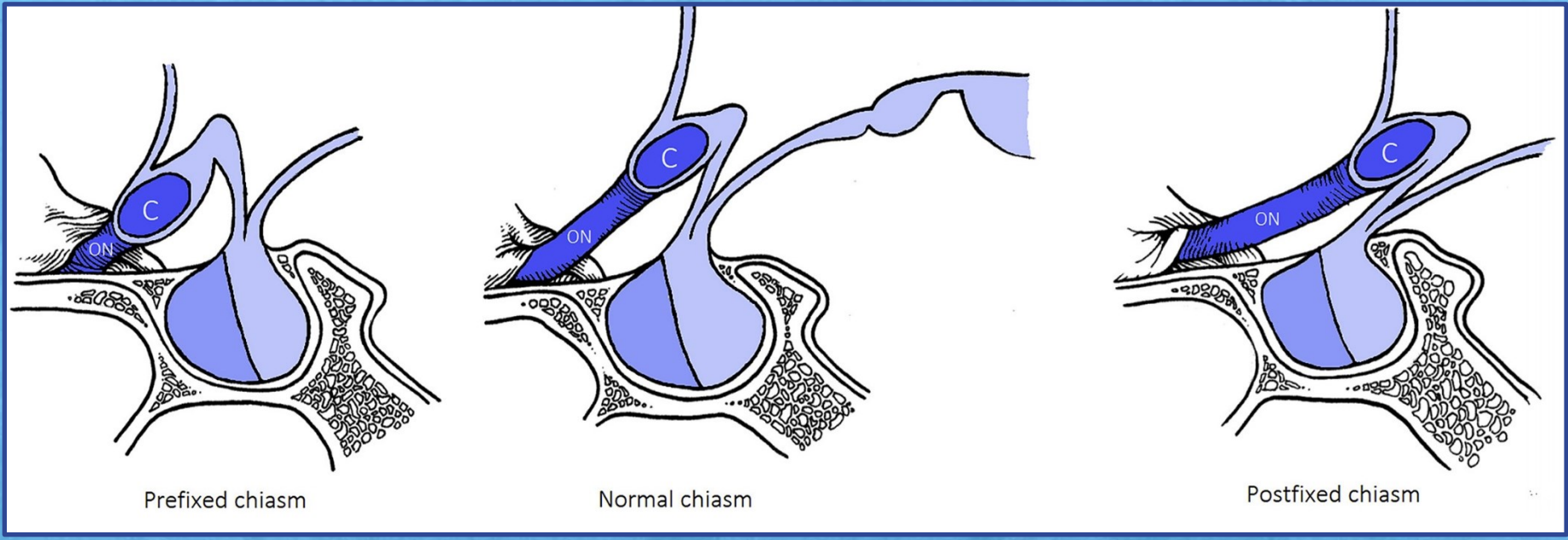
- Anatomy Review
- All About Pituitary Adenomas
- Clinical Features of Chiasmal Syndrome
- Clinical Pearls
  - Red Flag Warning Signs
  - Case Presentations

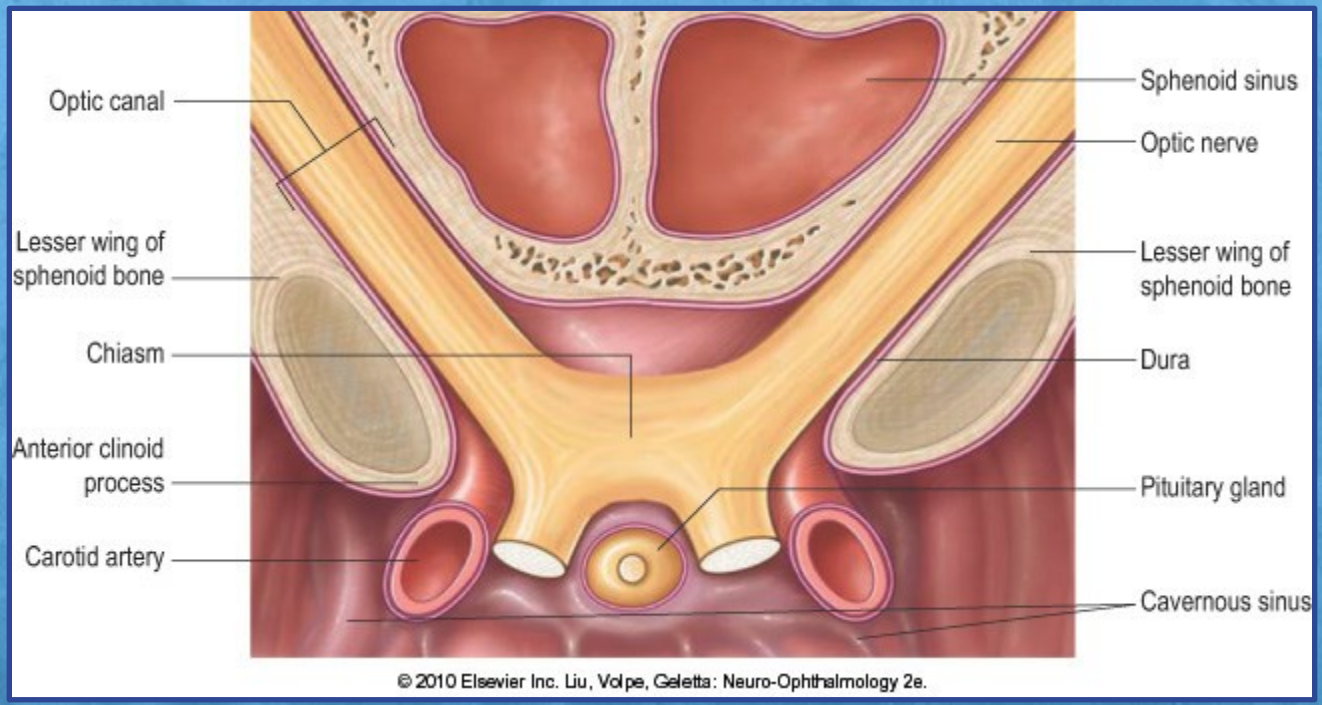






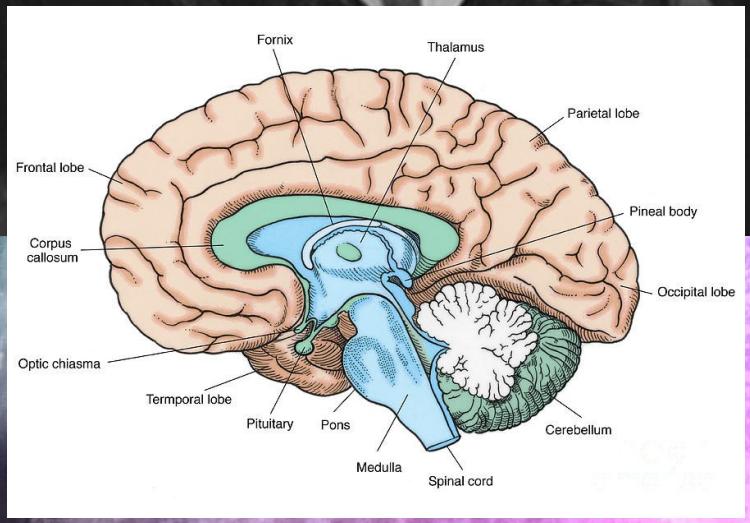
The pituitary gland is located 10mm immediately below the optic chiasm

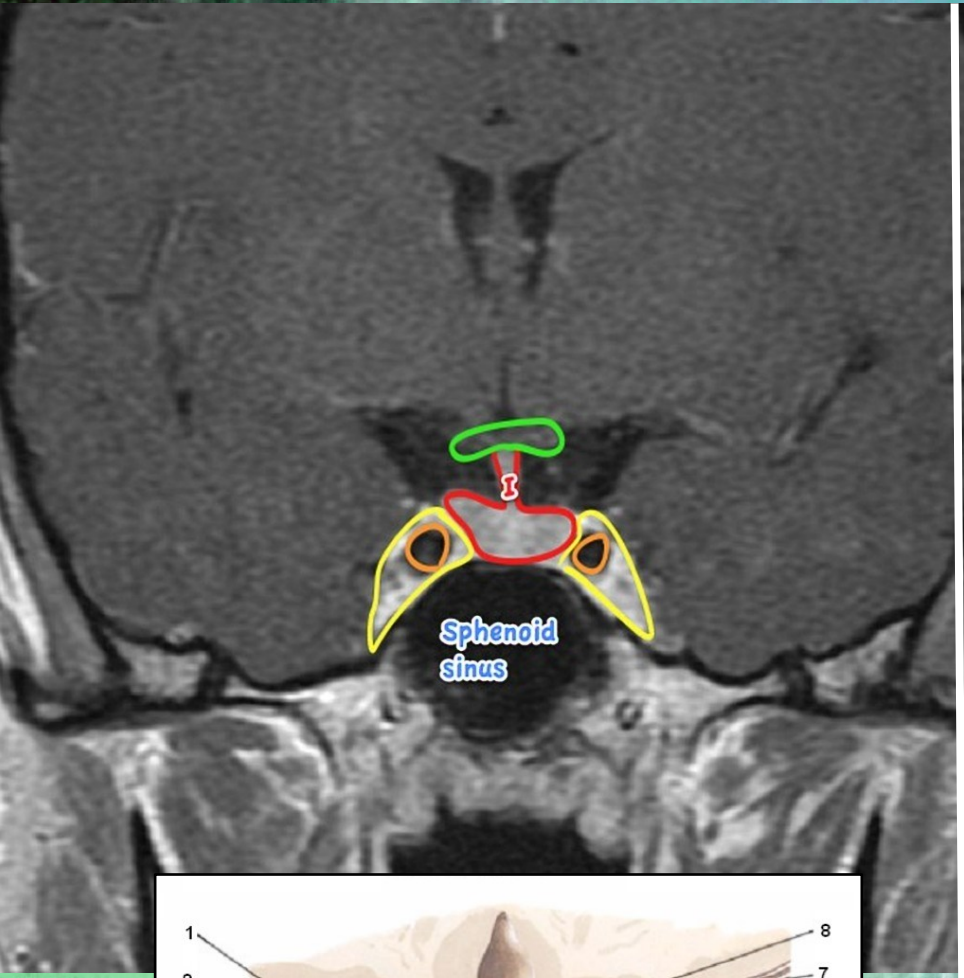

C
ON
Prefixed chiasm
C
ON
Normal chiasm
C
ON
Postfixed chiasm

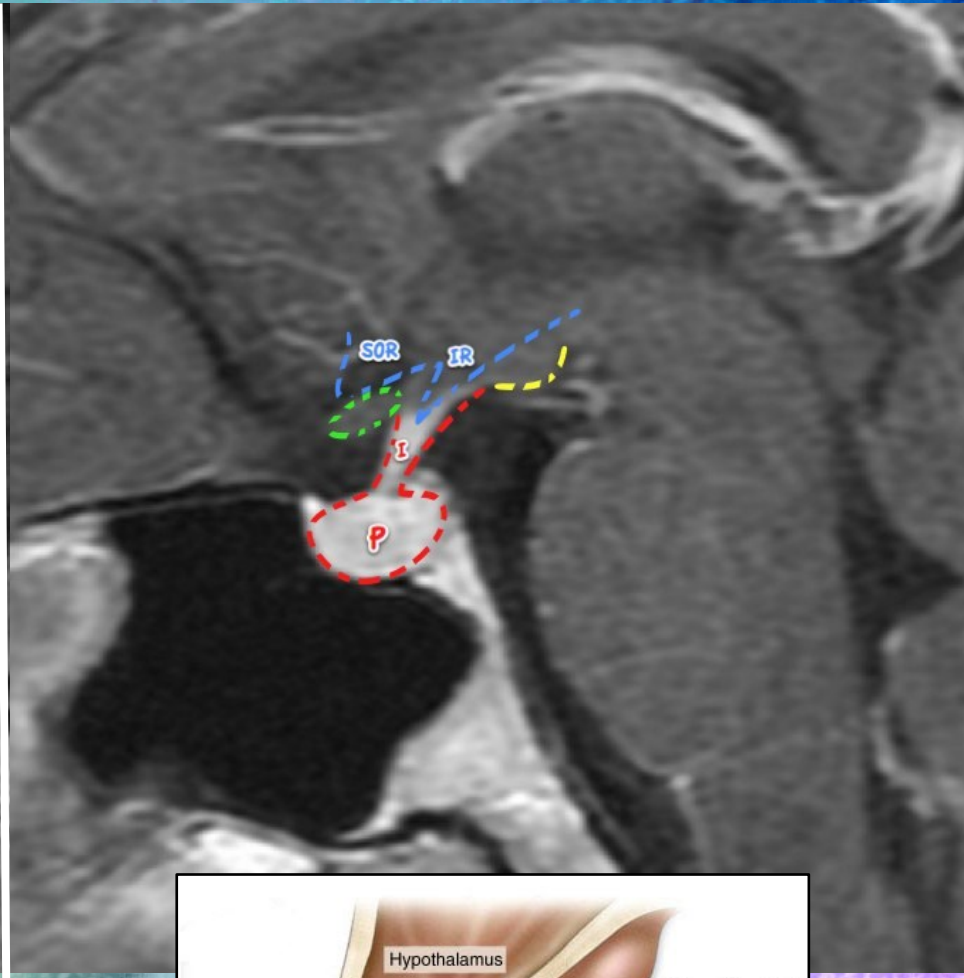

Optic canal
Lesser wing of sphenoid bone
Chiasm
Anterior clinoid process
Carotid artery
Sphenoid sinus
Optic nerve
Lesser wing of sphenoid bone
Dura
Pituitary gland
Cavernous sinus
© 2010 Elsevier Inc. Liu, Volpe, Galetta: Neuro-Ophthalmology 2e.

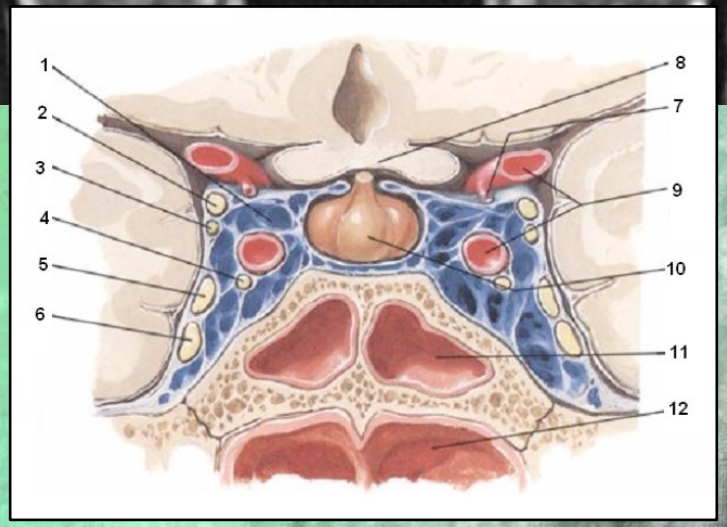
T1-weighted coronal MRI

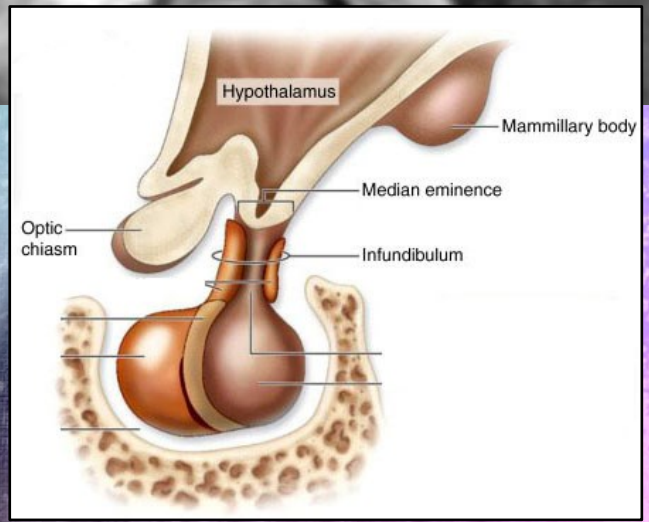
T2-weighted sagital MRI




I
Sphenoid sinus

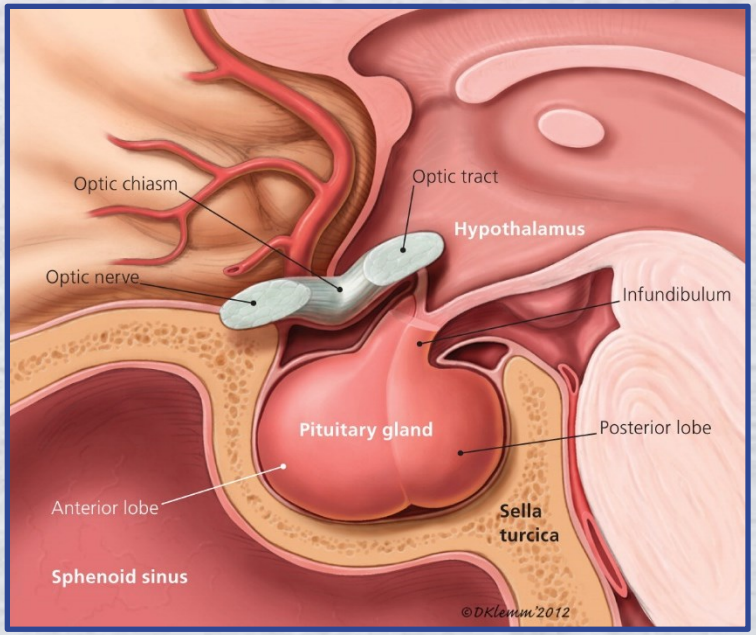

SOR
IR
I
P


1
2
3
4
5
6
7
8
9
10
11
12

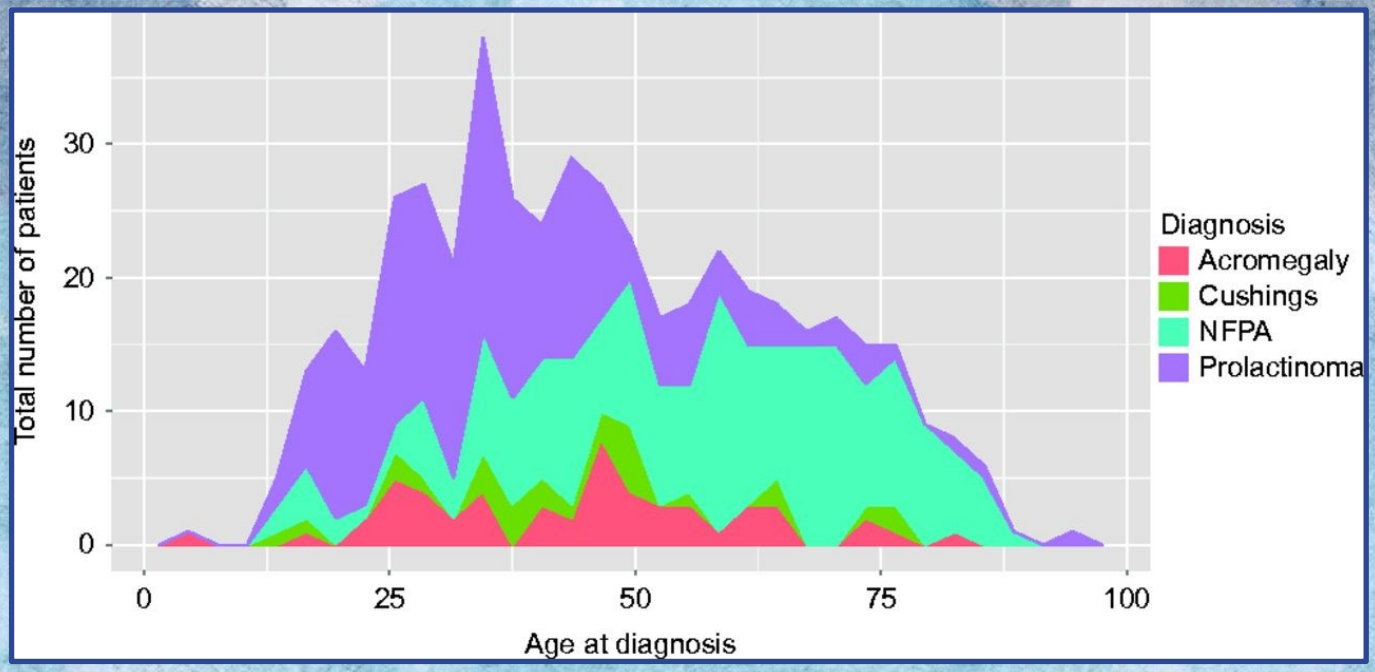

Hypothalamus
Mammillary body
Median eminence
Optic chiasm
Infundibulum

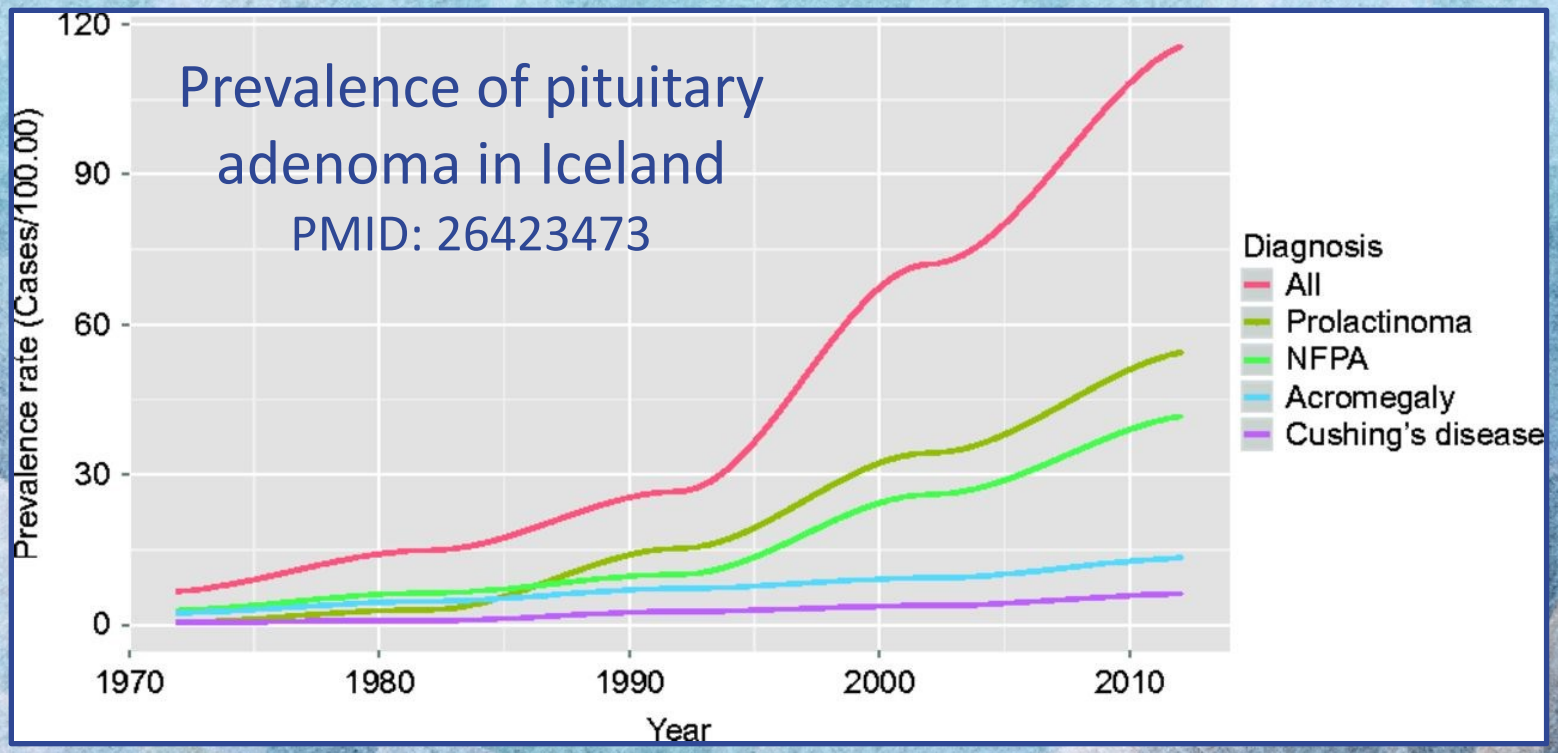
Pituitary Adenoma

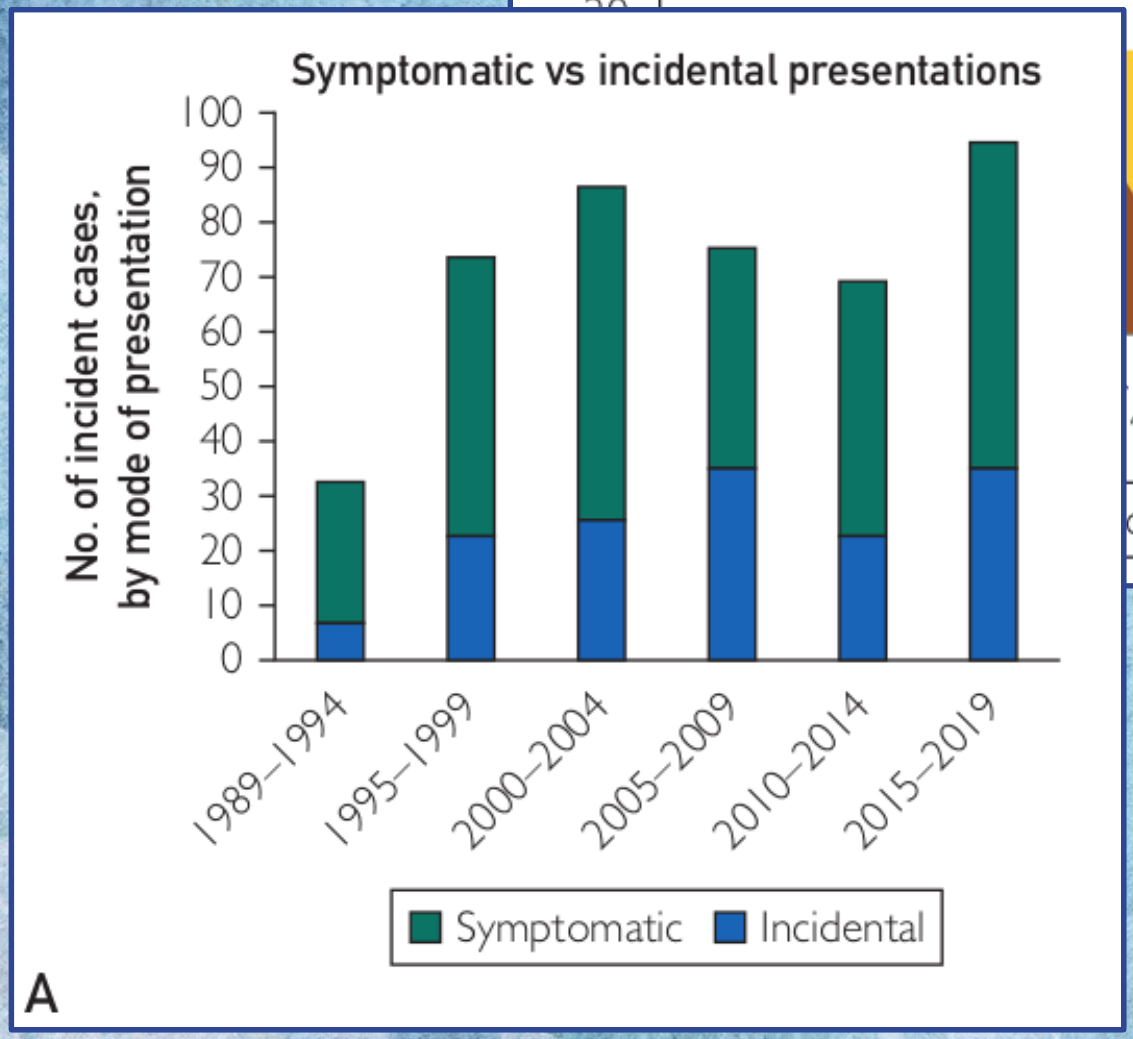
- Benign slow-growing tumor
- New terminology: Pituitary neuroendocrine tumors
- Epidemiology
  - No racial or sex difference
  - No known external risk factors
- Classification
  - Hormone production
  - Pathologic: Genetic factors
  - Radiologic: Size, shape

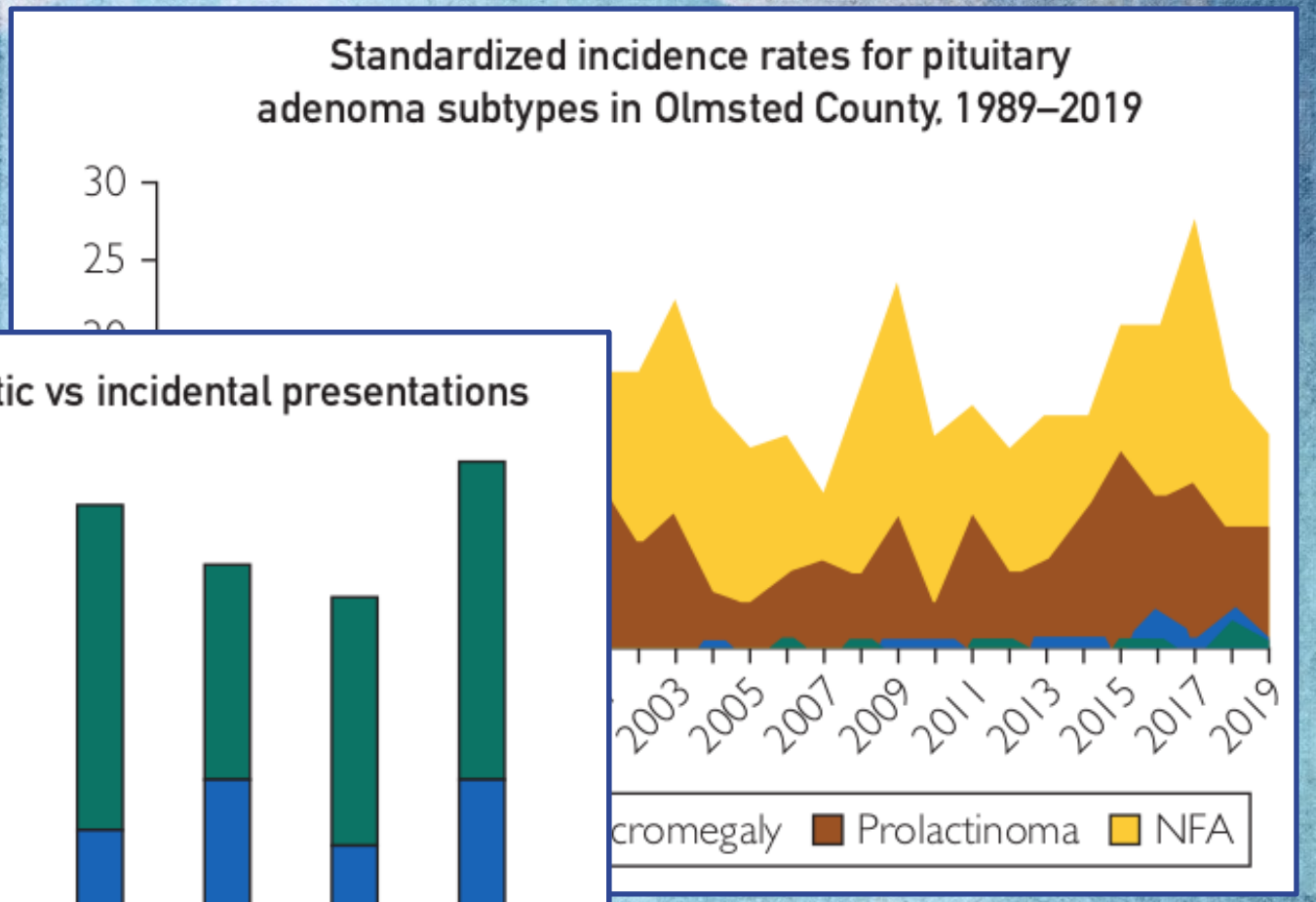


PMID: 37964483


Total number of patients
30
20
10
0
0
25
50
75
100
Age at diagnosis
Diagnosis
Acromegaly
Cushings
NFPA
Prolactinoma


Prevalence of pituitary adenoma in Iceland
PMID: 26423473
Prevalence rate (Cases/100.00)
120
90
60
30
0
1970
1980
1990
2000
2010
Year
Diagnosis
All
Prolactinoma
NFPA
Acromegaly
Cushing's disease





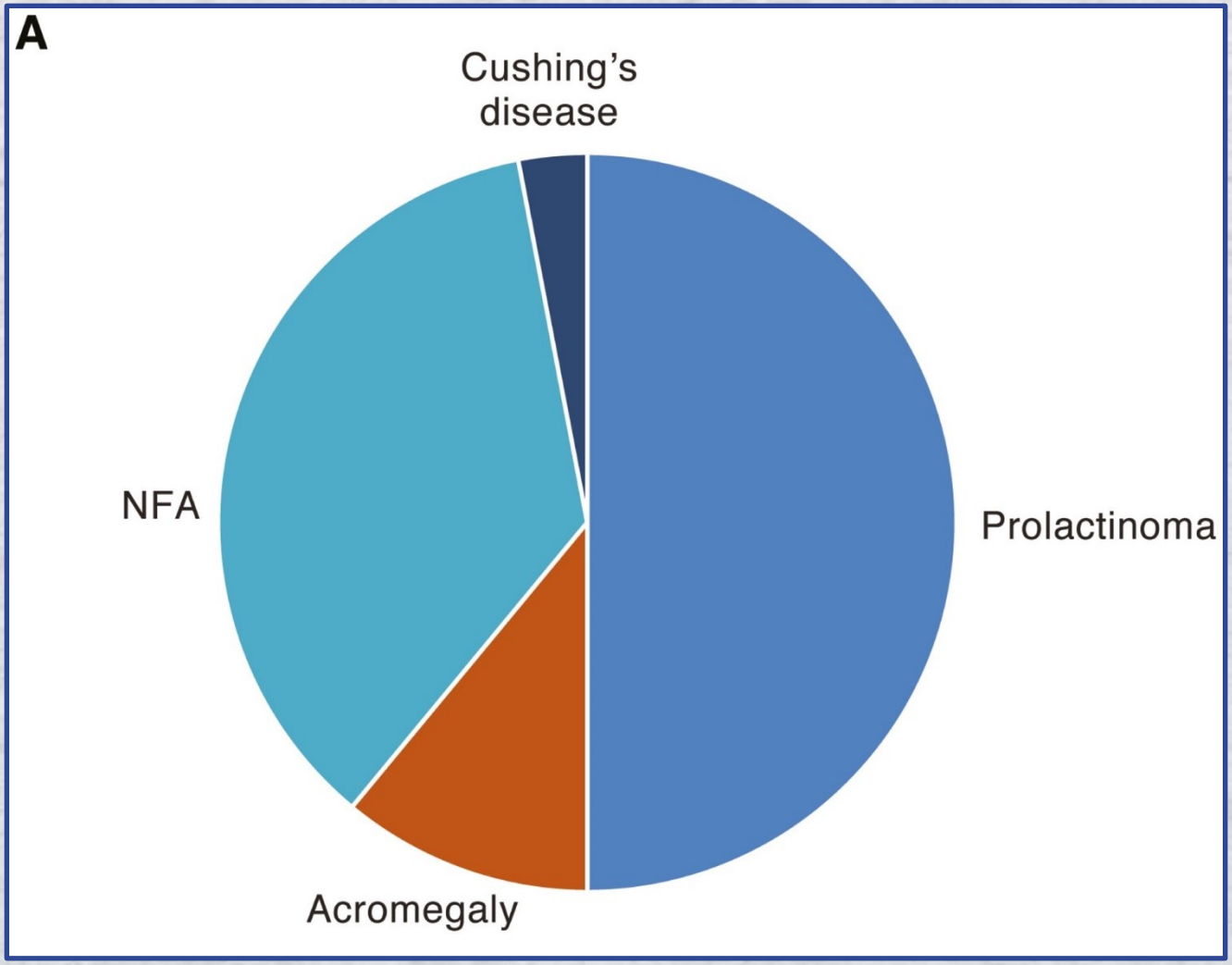
Incidence of pituitary adenoma in Minnesota

PMID: 35753823

Pituitary Adenoma

- Classification
  - Hormone production
    - Hypersecretion of hormones produces symptoms that lead to early diagnosis
    - Nonfunctioning (NFPA): No hormone secretion
  - Pathologic
    - Genetic analysis of tumor cells provides predictors of tumor aggressiveness
  - Radiologic
    - Size: Microadenoma (<1cm), Macroadenoma, Cavernous sinus involvement

Pituitary Adenoma



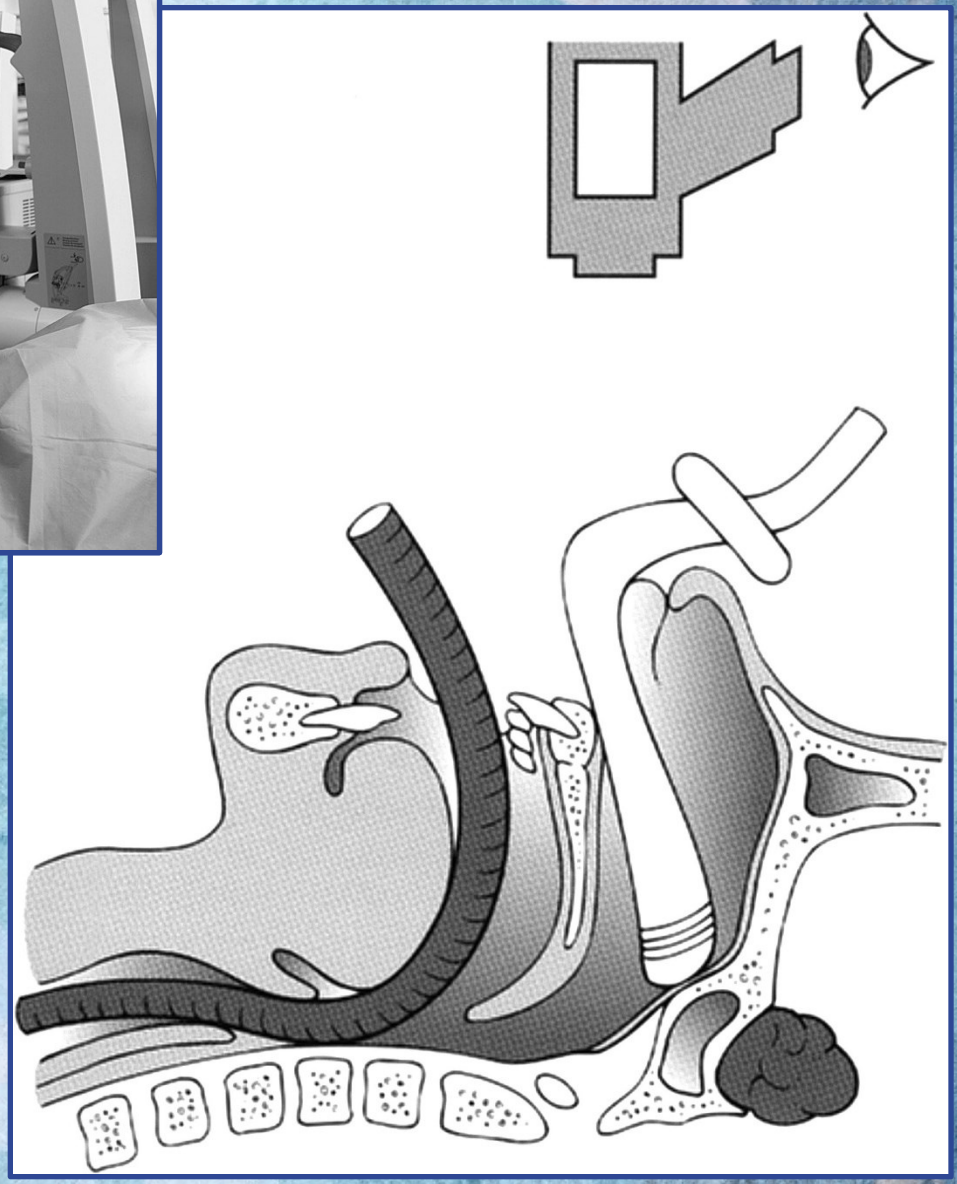
PMID: 35395078

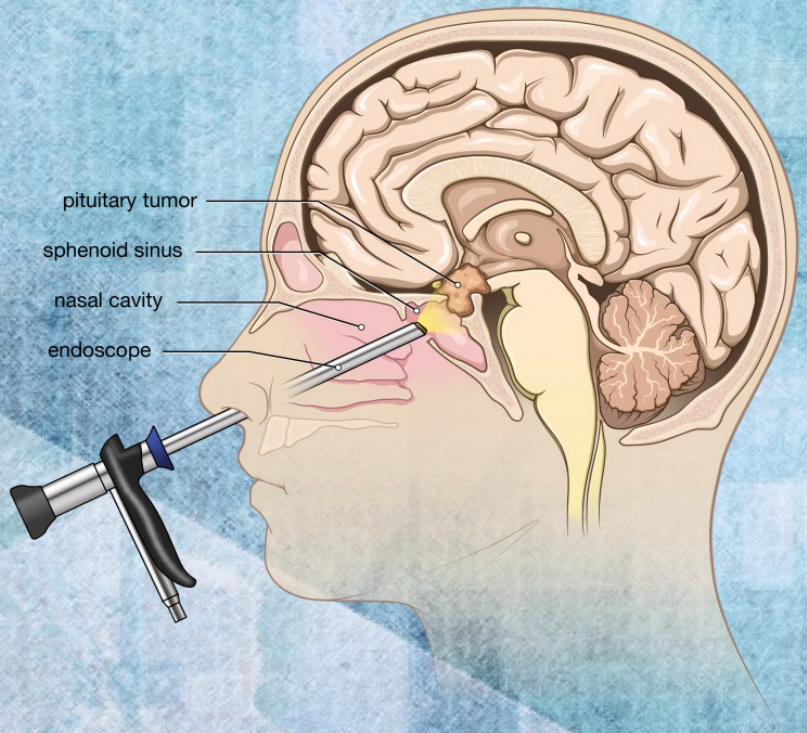
Pituitary Adenoma

- Nonfunctioning adenomas (NFPA)
  - 30% of cases
  - *Most common cause of chiasmal syndrome*
  - Only non-specific manifestations, such as **headache**, prior to onset of vision loss
  - Absence of symptoms leads to delay in diagnosis and growth of tumor
    - 70%-90% are macroadenomas at time of dx
    - Invasion of the cavernous sinus increases risk of tumor recurrence after surgery

Pituitary Adenoma

- Treatment
  - Medical
    - Treatment-of-choice for smaller (<1cm) hormone-secreting tumors
  - Surgery
    - Indicated for any symptomatic NFPA
    - Endonasal transsphenoidal endoscopic approach used in >90% of cases
    - Incomplete removal and subsequent **recurrence common** if there is invasion of the cavernous sinus




pituitary tumor
sphenoid sinus
nasal cavity
endoscope

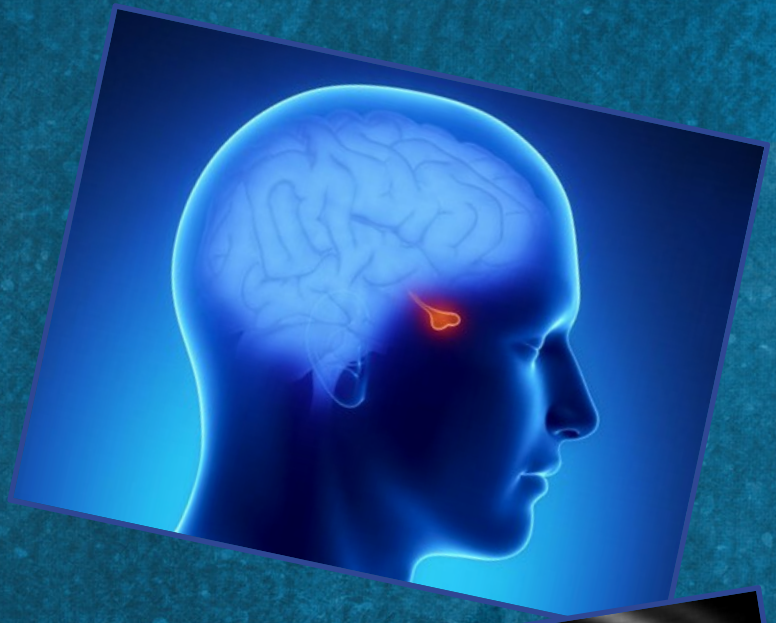
UPMC

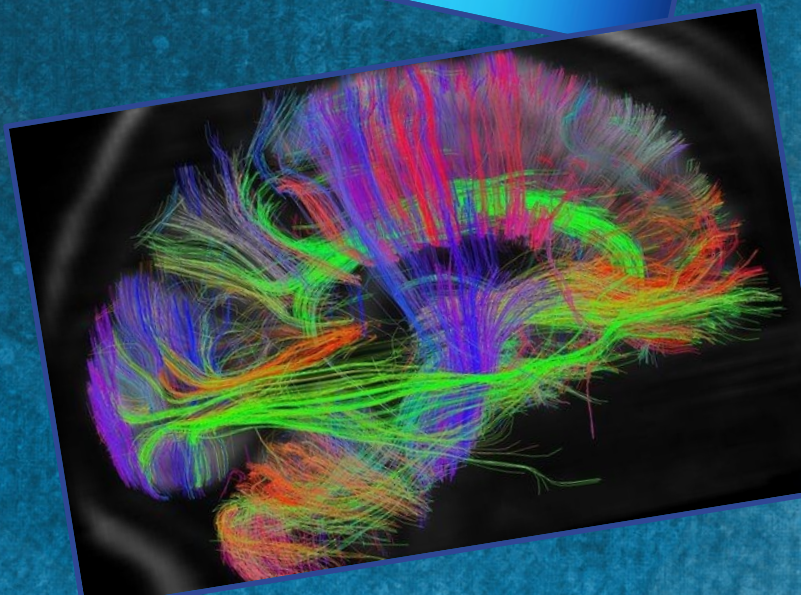
Endoscopic Endonasal Approach (EEA)

A Pioneering Surgical Approach for Skull Base Tumors and Lesions

Chiasmal Syndrome

- Anatomy Review
- All About Pituitary Adenomas
- Clinical Features of Chiasmal Syndrome
- Clinical Pearls
  - Red Flag Warning Signs
  - Case examples





Chiasmal Syndrome

SYMPTOMS

- Headache
- Visual loss
- Diplopia
- Loss of depth perception
- Endocrine dysfunction

SIGNS

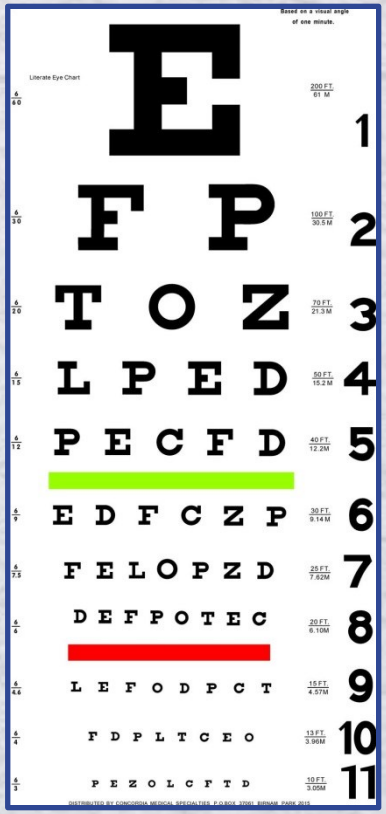
- Visual field defects
- Optic disc pallor and cupping
- OCT abnormalities
- Oculomotor paresis
- Nystagmus
- Cerebrospinal fluid rhinorrhea

Headache

- 50%-70% of patients with pituitary adenoma
- Most common symptom of NFPA
- **Often the presenting symptom**
- May be mild or severe
- HA severity not related to tumor size
  - May be related to hormonal imbalance caused by tumor

Visual Loss

- **VA is typically normal** in patients with chiasmal lesions
- Depression of central acuity is rare with bitemporal VF defects
- Anterior chiasmal lesions ("junctional scotoma") are the exception



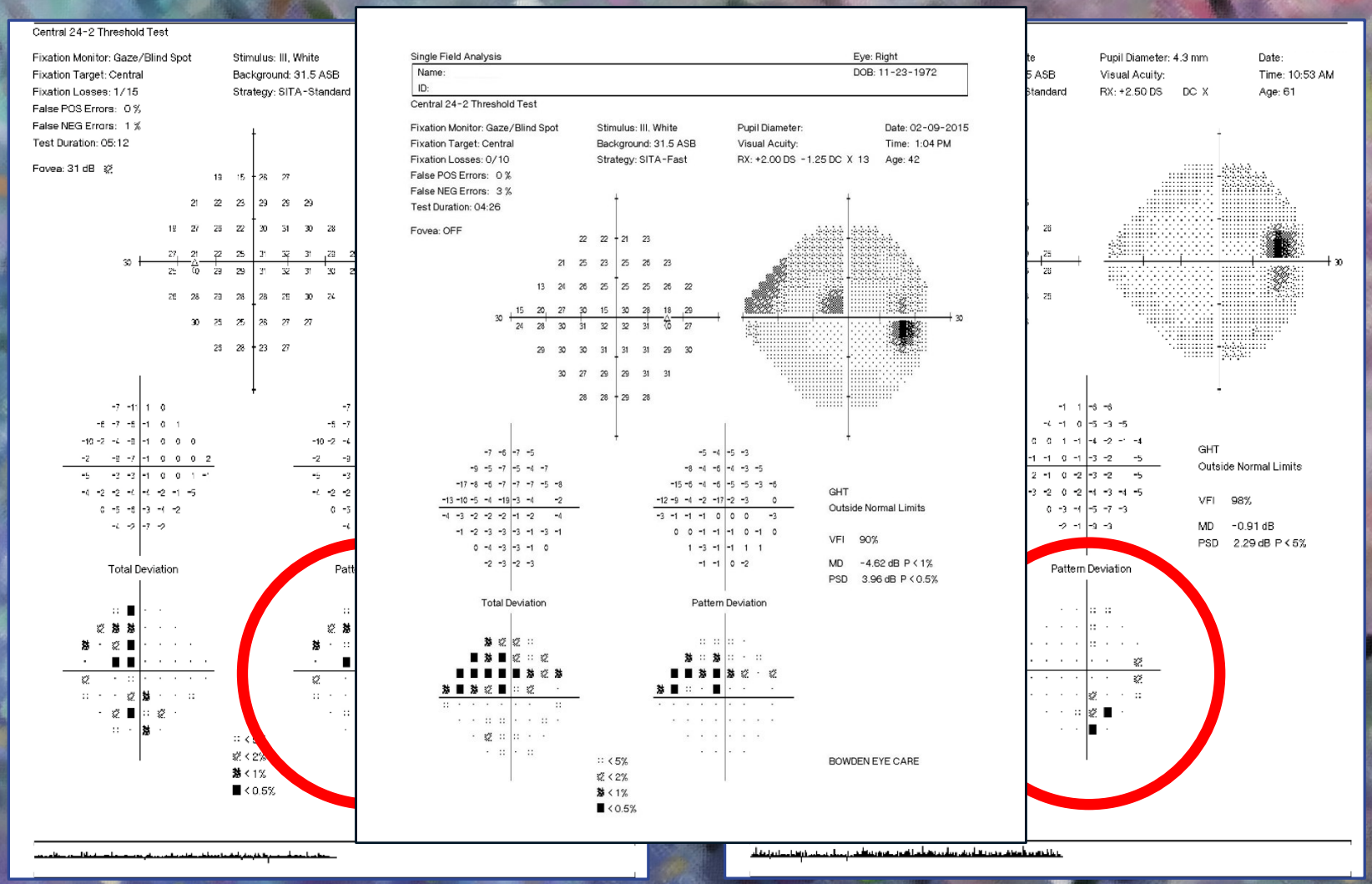
Visual Field Defects

- VF defects and ganglion cell loss may be the *only* clinical signs of a chiasmal lesion

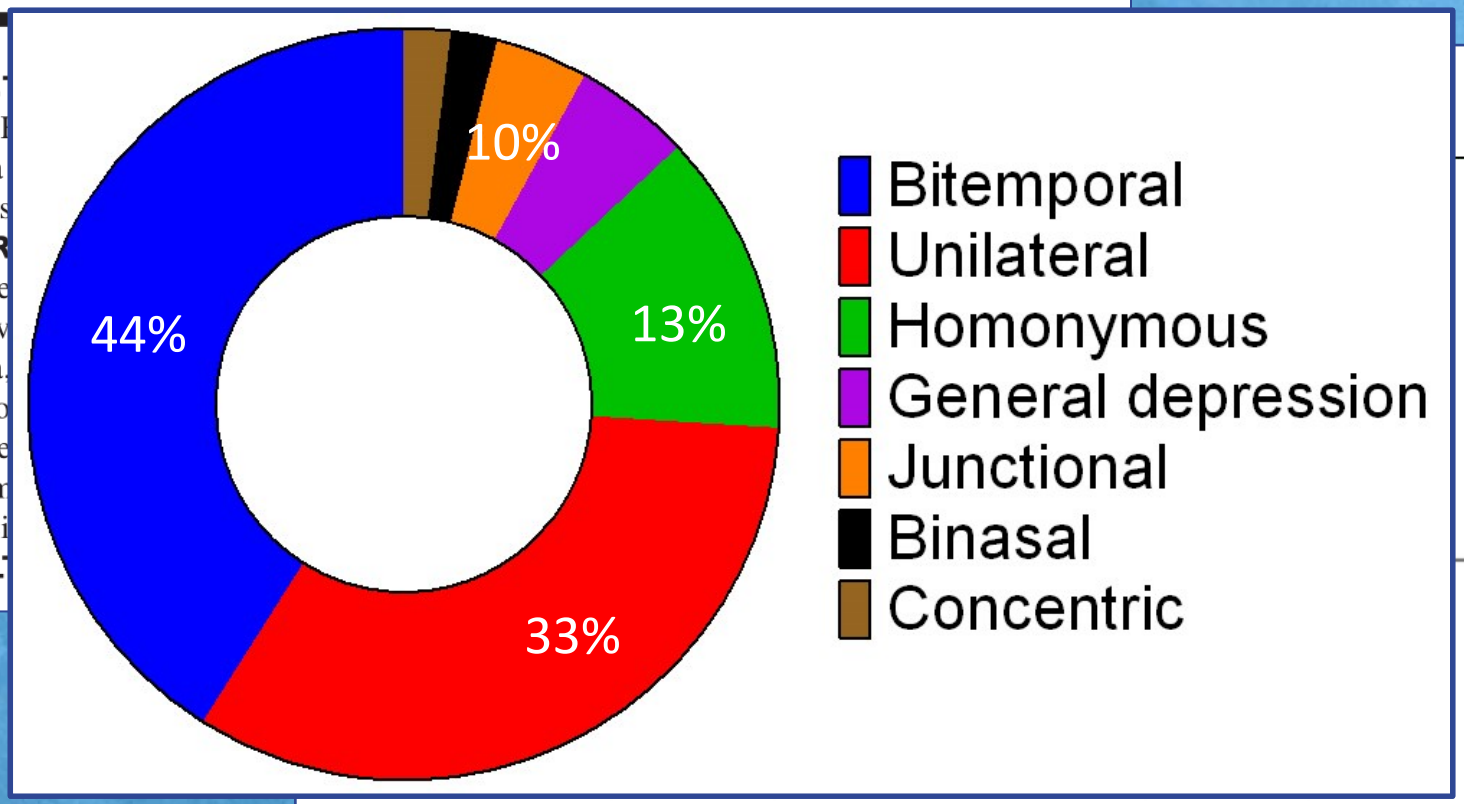
RED FLAGS

- VF defects that are **greater temporally than nasally**
- VF defects that **respect the vertical meridian**

VF defects greater temporally than nasally are NOT typical for glaucoma

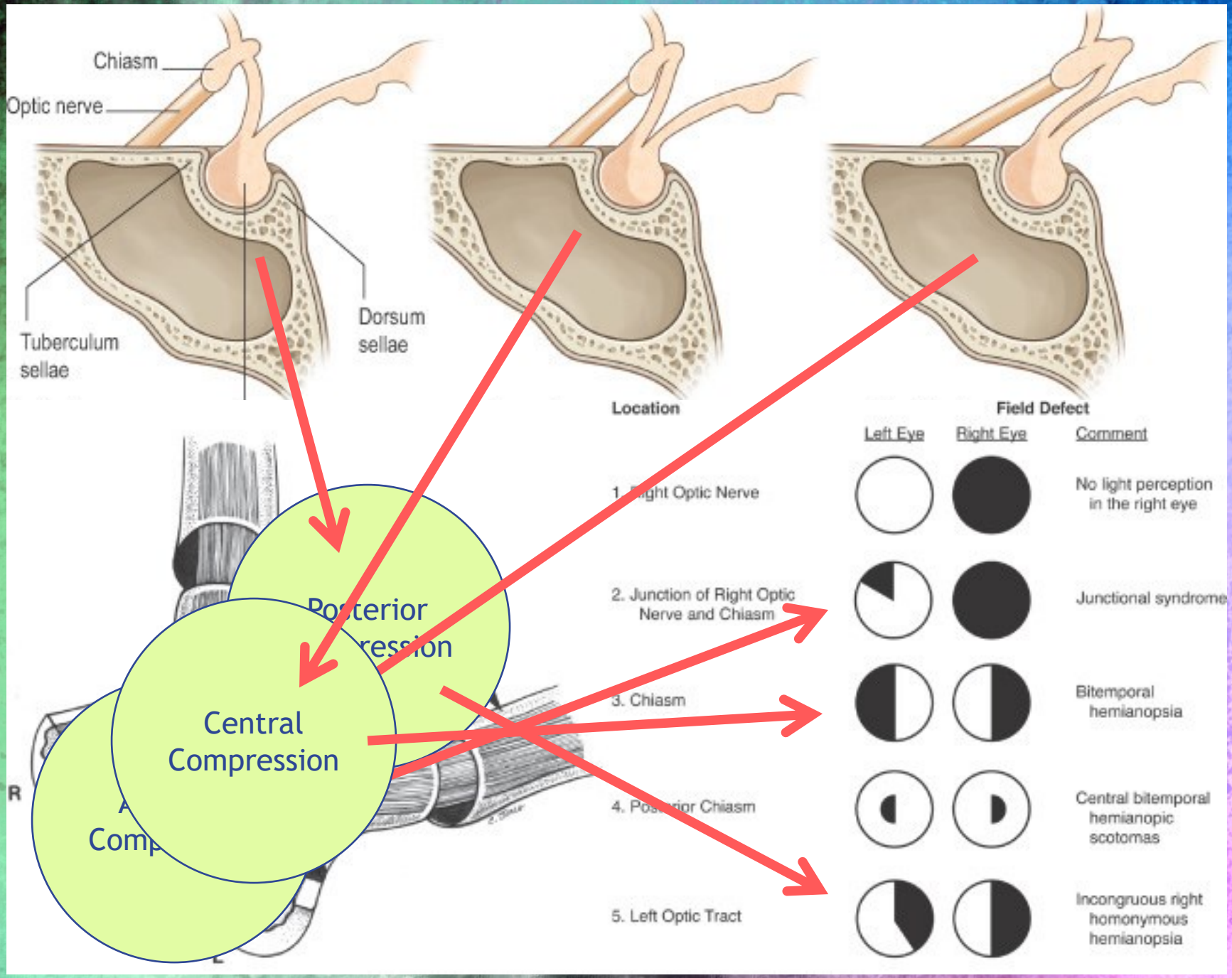


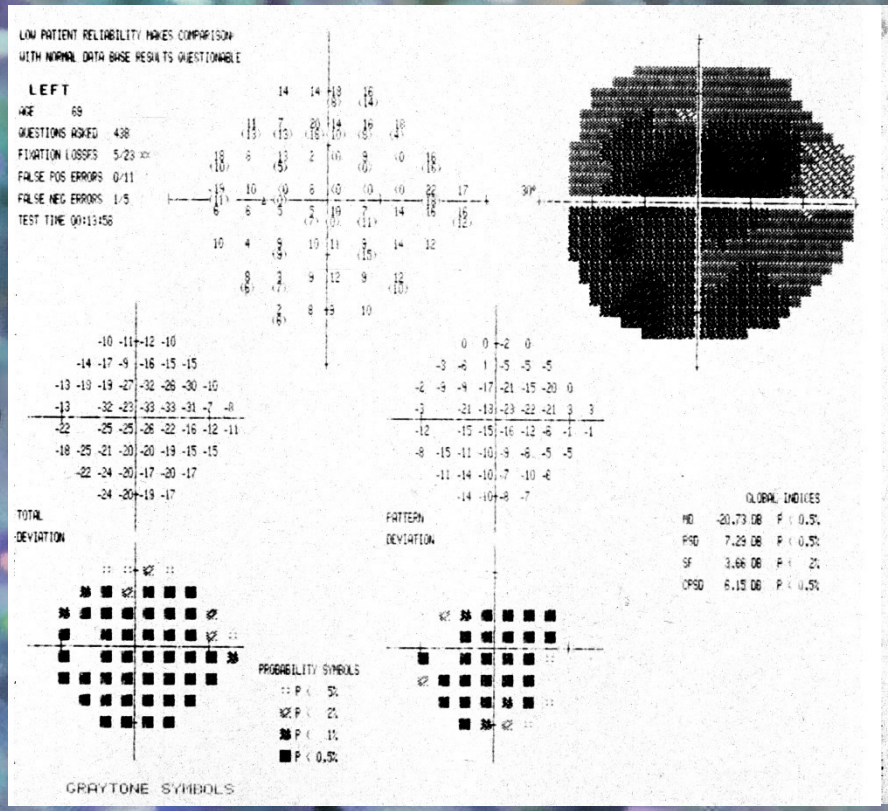
Visual Defects in Patients With Pituitary Adenomas: The Myth of Bitemporal Hemianopsia

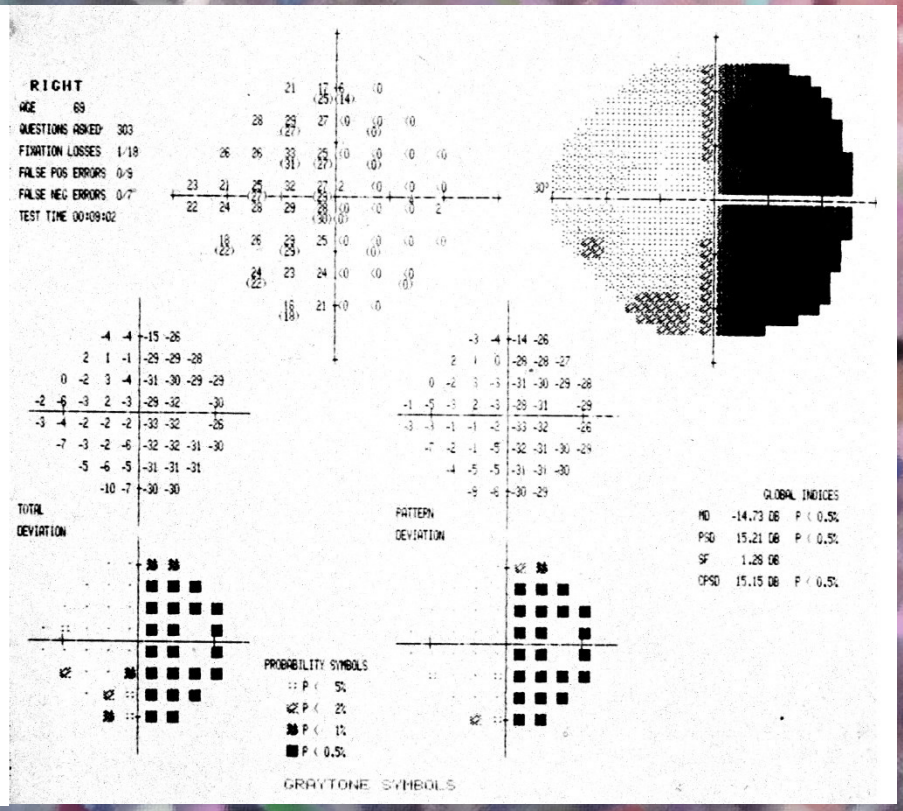


Bitemporal hemianopia accounts for ≈40% of VF defects caused by chiasmal compression

Source: PIDM 26496573; 23563861


Chiasm
Optic nerve
Tuberculum sellae
Dorsum sellae
Location
Field Defect
Left Eye
Right Eye
Comment
1. Right Optic Nerve
No light perception in the right eye
2. Junction of Right Optic Nerve and Chiasm
Junctional syndrome
3. Chiasm
Bitemporal hemianopsia
4. Posterior Chiasm
Central bitemporal hemianopic scotomas
5. Left Optic Tract
Incongruous right homonymous hemianopsia
Central Compression

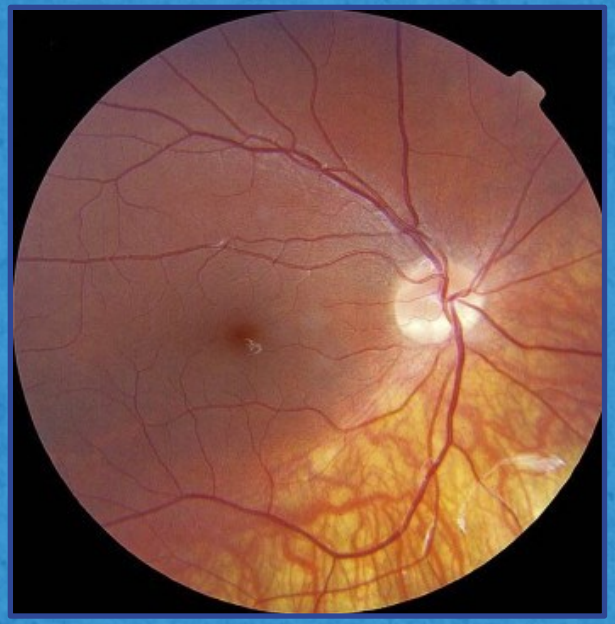


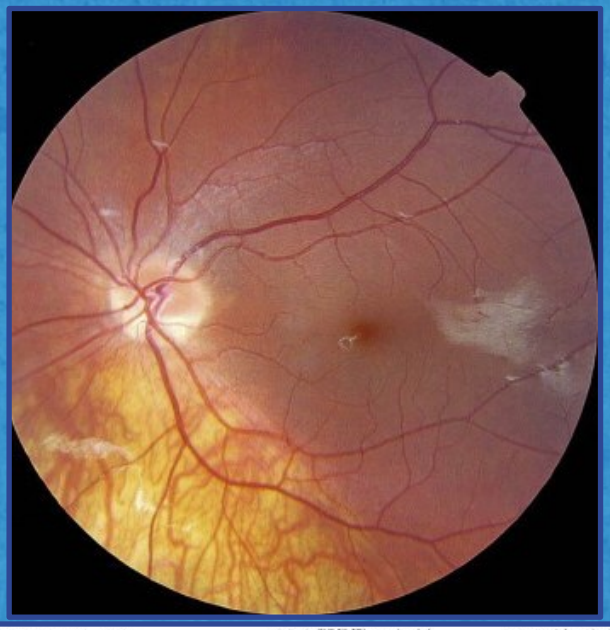


Junctional scotoma of the left eye. This 69yo man presented with c/o vision loss OS x 4 weeks. BVA was 20/25 OD and FC OS. +APD OS. CT scan revealed a pituitary adenoma.

Visual Field Defects

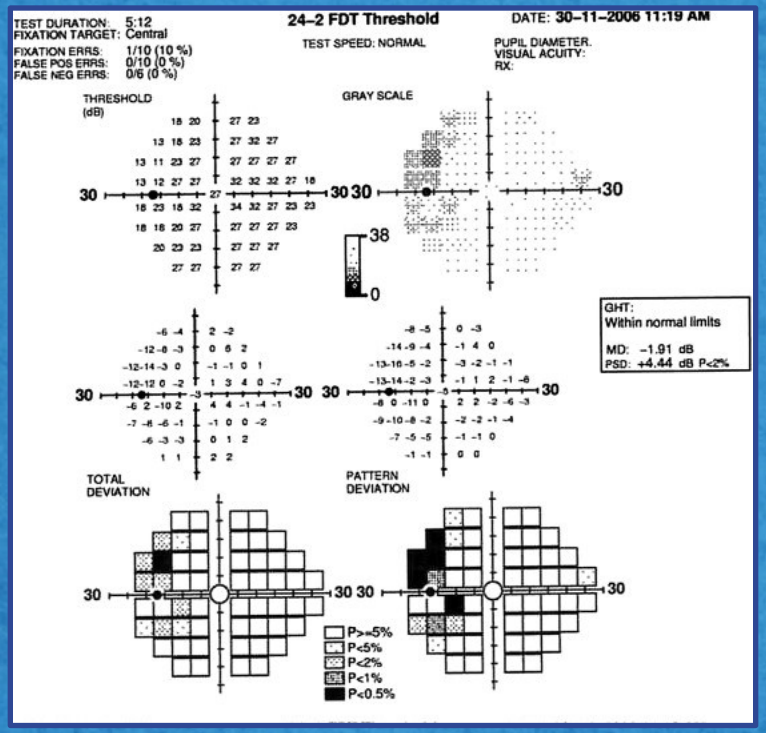
- **Bitemporal hemianopia is NOT pathognomonic for chiasmal syndrome**
- Other conditions that can give rise to bitemporal vision loss
  - *Tilted disc syndrome*
  - Overhanging redundant upper lid tissue
  - Enlarged blind spots
  - Bilateral medullation of nasal nerve fibers

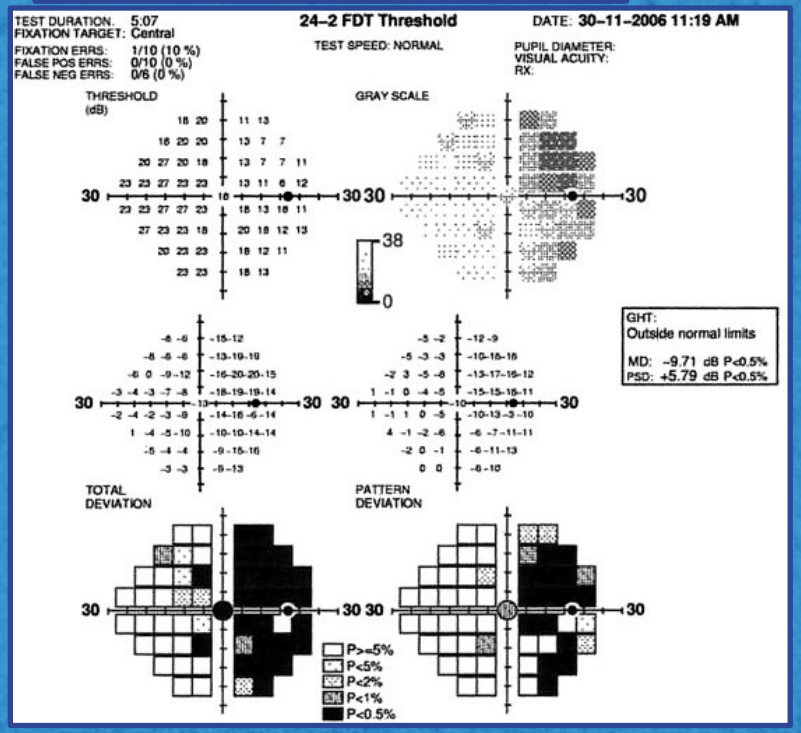




Tilted disc syndrome simulating bitemporal hemianopia

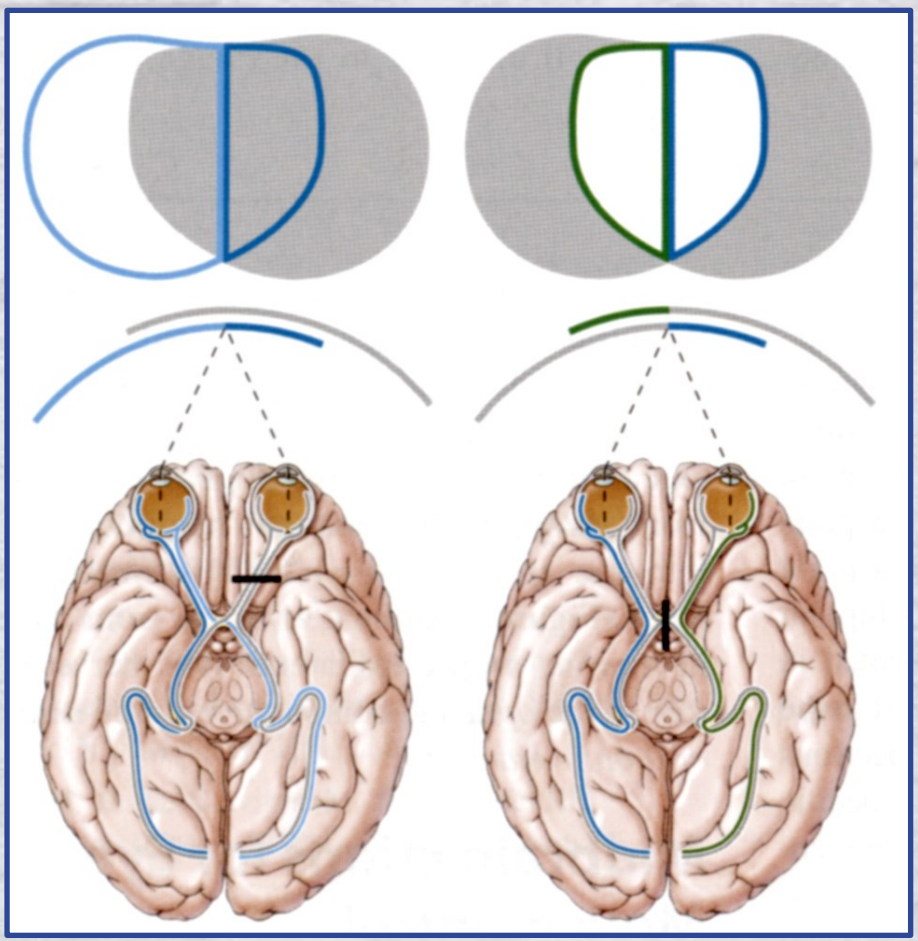
PMID: 19410228





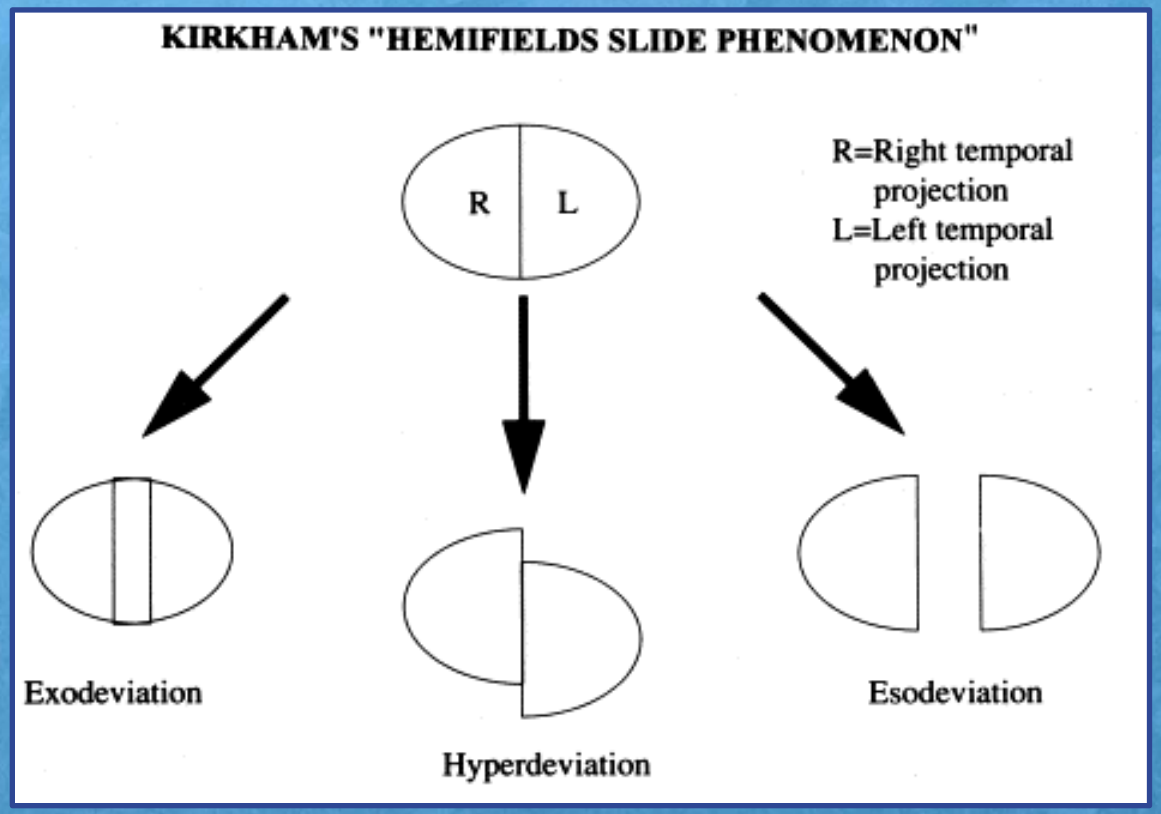
Bitemporal Hemianopia

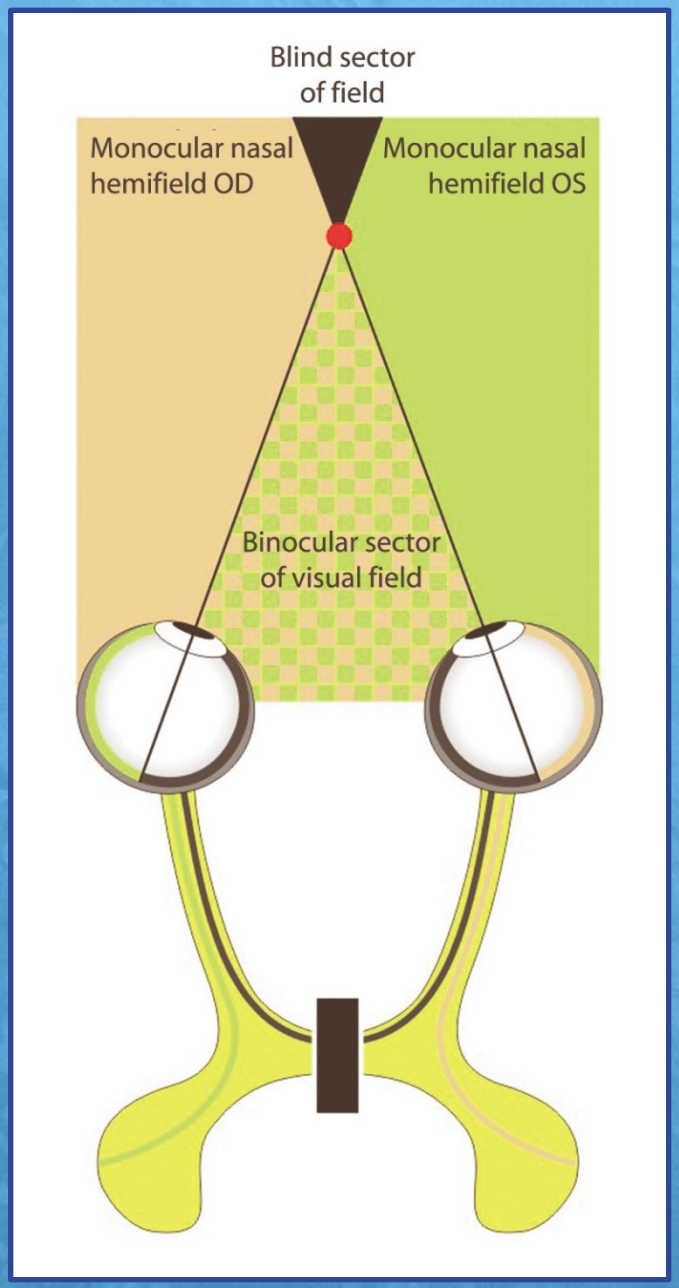
- The temporal crescents are the only part of the *binocular* VF that is lost
- A central 110–120° remains but there are **no overlapping VF elements**
- Lack of fusion lock decompensates any pre-existing phoria into a tropia



PMID: 24588535

Absence of fusion lock allows hemifields to slide.
When converged at near, there is overlap before the target and blindness behind it.





Diplopia & Stereopsis

- Intermittent diplopia occurs due to decompensating exophoria and vertical imbalance
- ***Poor depth perception is an important symptom of chiasmal syndrome***
- Loss of overlapping VF at fixation results in severe loss of stereopsis, even when VF loss is minimal and VA is preserved.
- **Stereo tests are a simple, easy, and quick screening test for chiasmal disease**

PMID: 12208719

Chiasmal Syndrome

SYMPTOMS

- Headache
- Visual loss
- Diplopia
- Loss of depth perception
- Endocrine dysfunction

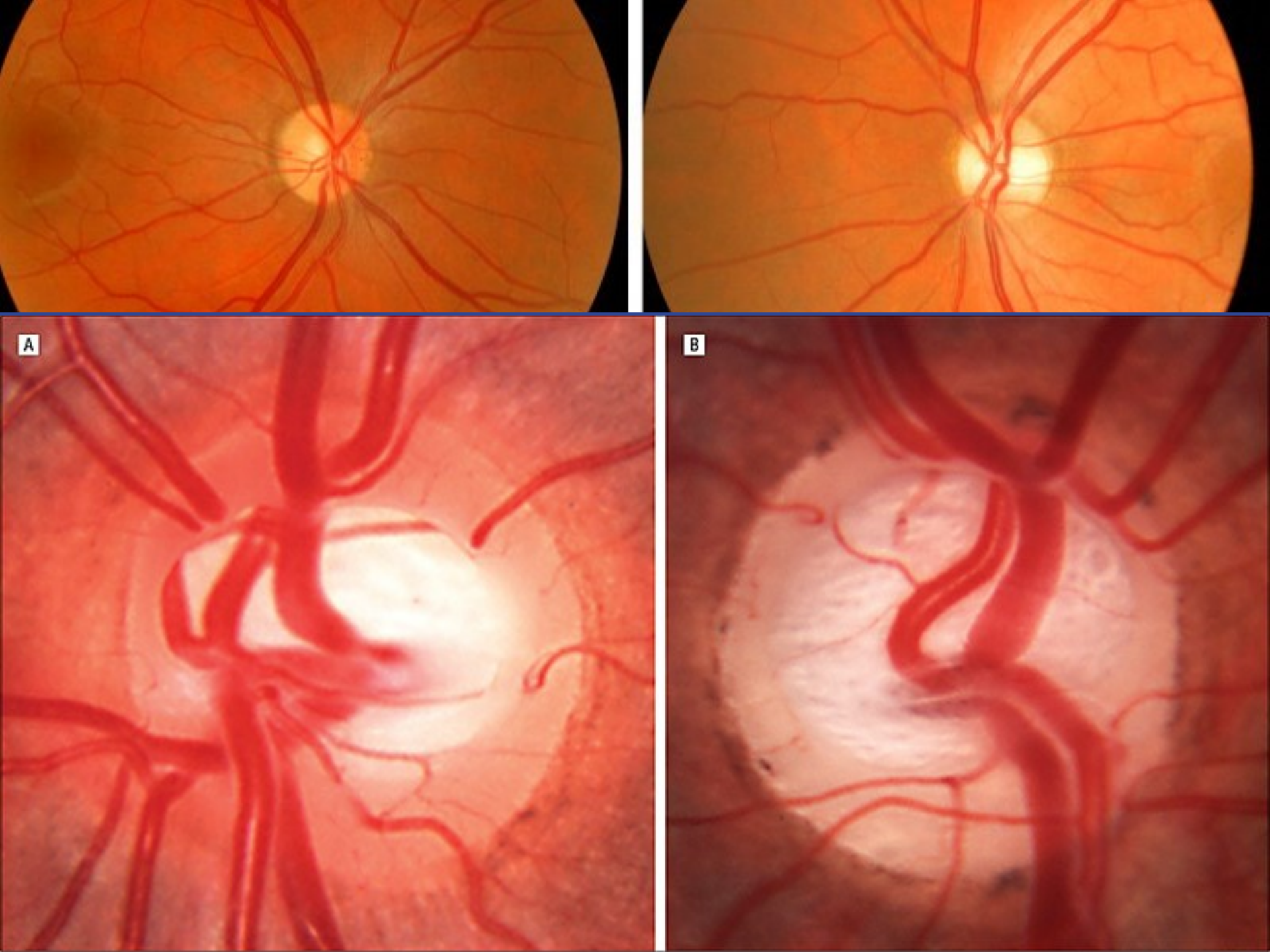
SIGNS

- Visual field defects
- Optic disc pallor and cupping
- OCT abnormalities
- Oculomotor paresis
- Nystagmus
- Cerebrospinal fluid rhinorrhea

Optic Disc

- **Pituitary adenoma is an important cause of non-glaucomatous optic disc cupping**
  - Compression of the chiasm can produce shallow enlargement of the cup (no laminar back-bowing)
- End stage chiasmal compression may produce a horizontal band of pallor ("bow-tie")
- Pituitary adenoma does not cause papilledema

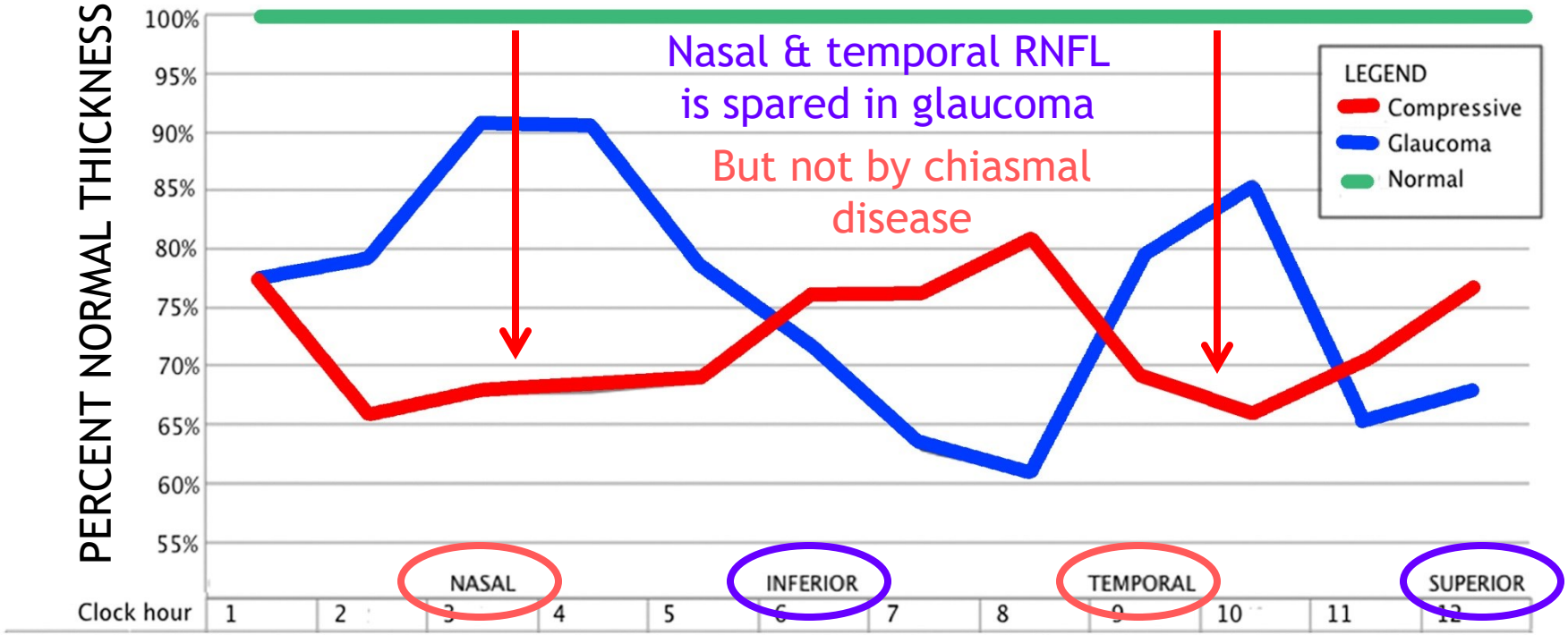
PMID: 21149793


A
B

OCT Findings

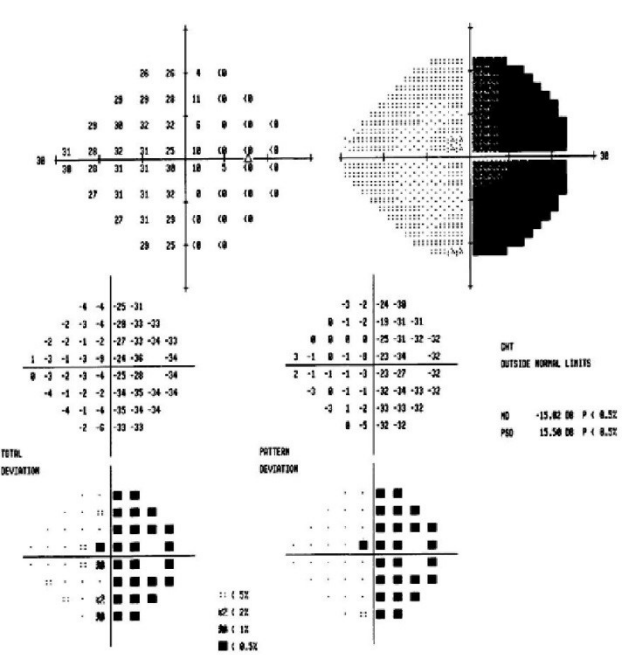
- Chiasmal compression results in RNFL and GCC thinning
  - RNFL thinning is fairly uniform in all meridians, but **greatest nasal and temporally**
  - Binasal thinning of the GCC may be detected before RNFL loss (also before VF loss)
  - *Prognostic indicator: More severe RNFL/GCC loss is associated with less VF recovery following tumor excision*

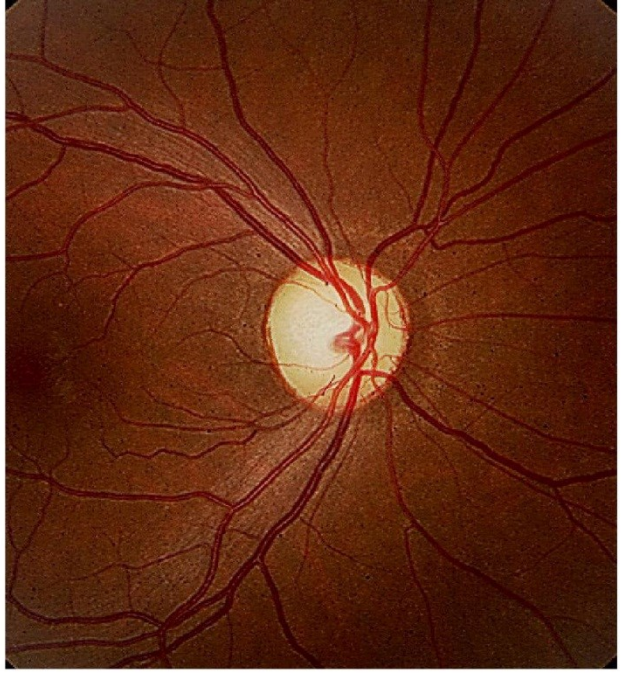
PMID: 31202890

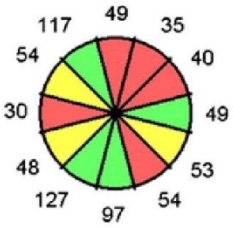


There is relative sparing of the nasal and temporal RNFL with glaucomatous optic neuropathy but **not** with chiasmal compression.

PMID: 24725827


TOTAL DEVIATION
PATTERN DEVIATION
OUTSIDE NORMAL LIMITS

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49
35
54
40
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48
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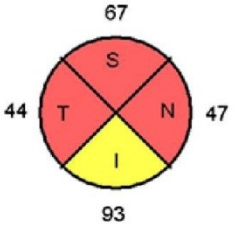
127
54
97


67
S
44
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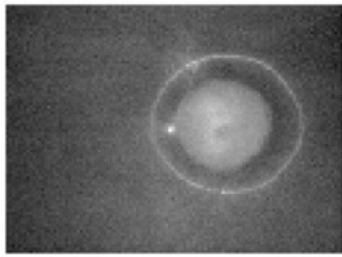
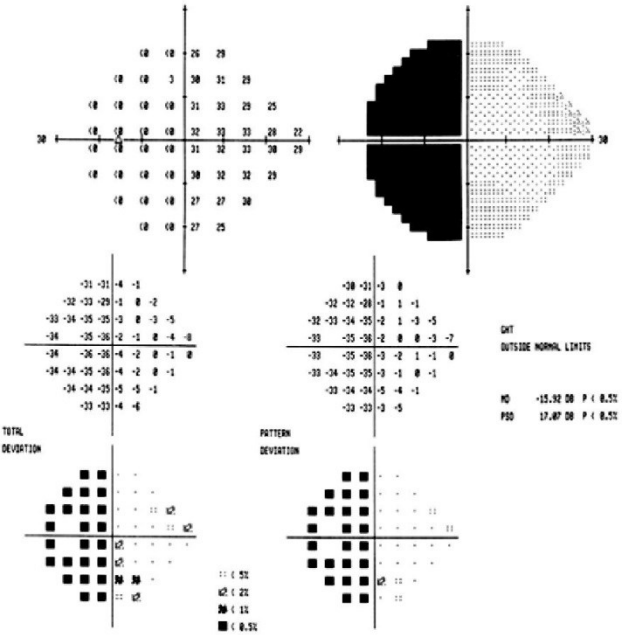
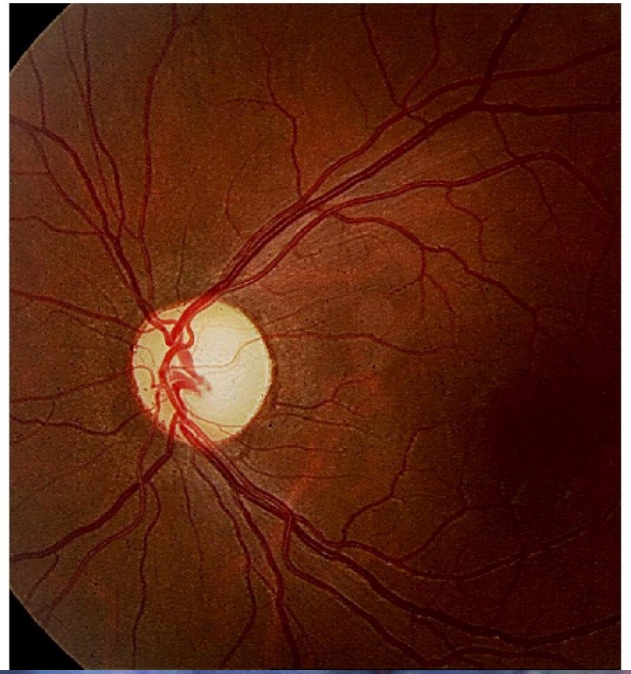
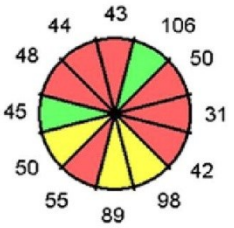
N
47
I
93




Normal distribution Percentiles
100%
95%
5%
1%
0%


TOTAL DEVIATION
PATTERN DEVIATION
OUTSIDE NORMAL LIMITS

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89
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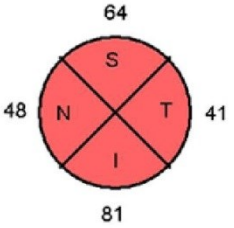
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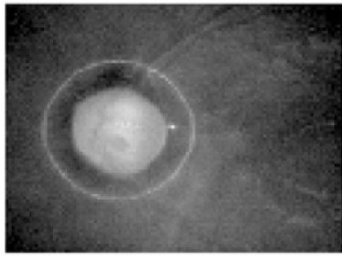
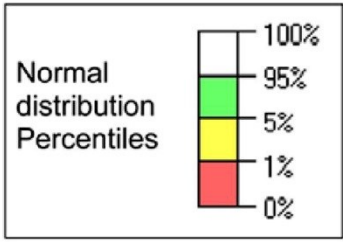
81




Normal distribution Percentiles
100%
95%
5%
1%
0%

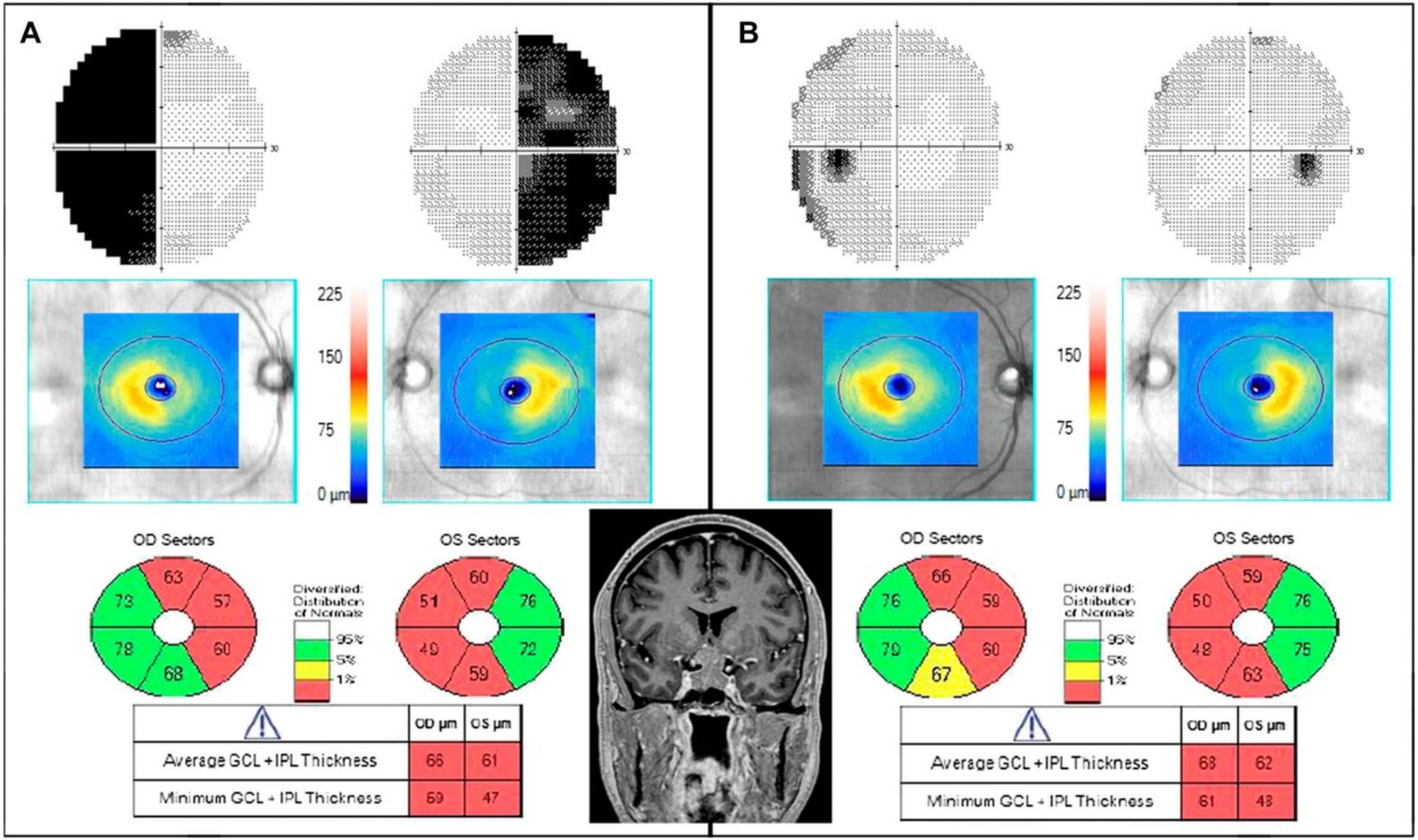
OCT Findings

- GCC thinning is **more** sensitive than perimetry in detecting chiasmal compression
- **Ganglion cell complex (GCC) thinning occurs before visual field loss**

PMID: 30097827

Pre-Op

Post-Op



Blanch RJ, et al. Pituitary 2018;21:515–23.

Prognosis

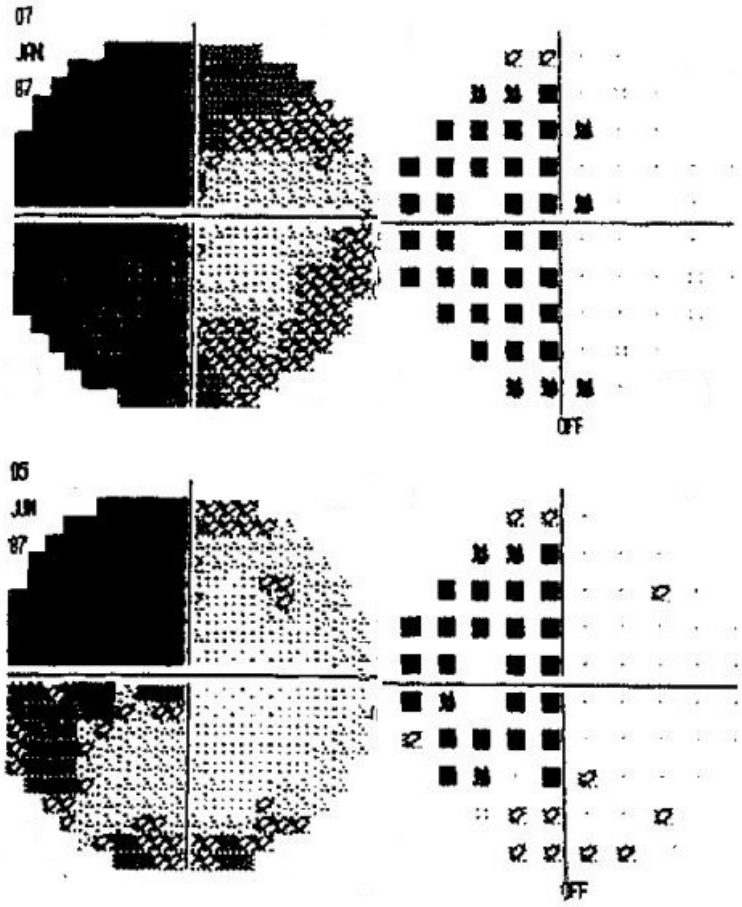
- **Most patients will experience some vision recovery**, and many will experience complete resolution of VF defects following surgery
  - Meta-analysis: 80% get some recovery; 40% experience complete recovery
  - 50% of the recovery occurs within the first 2 weeks following surgery
  - Modest gradual improvement may occur years after decompression

PMID: 31202890

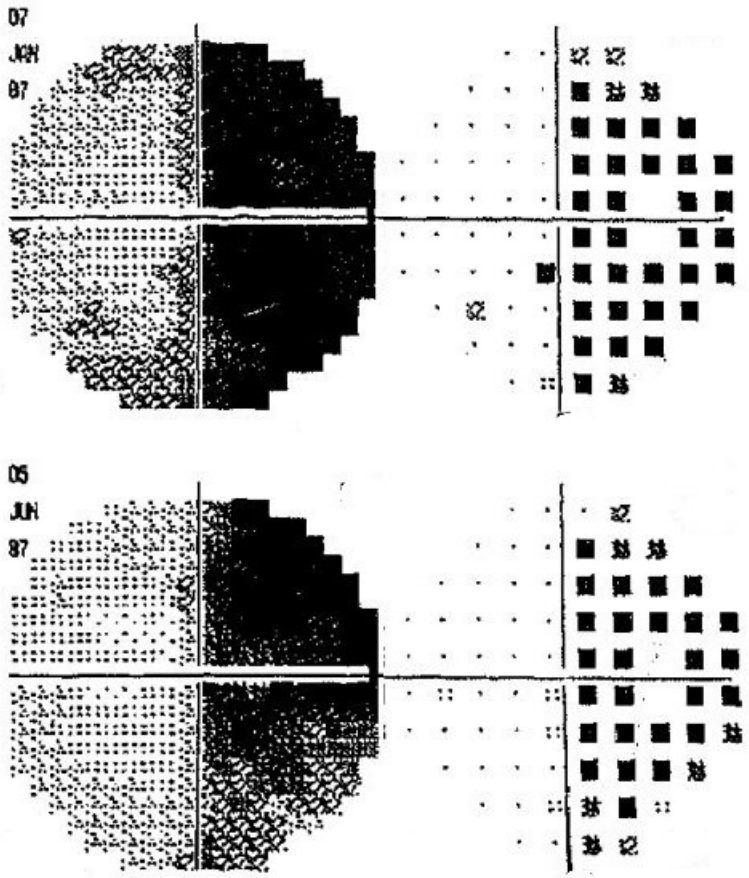
PRESENTATION

3 MOS POST-OP

OS

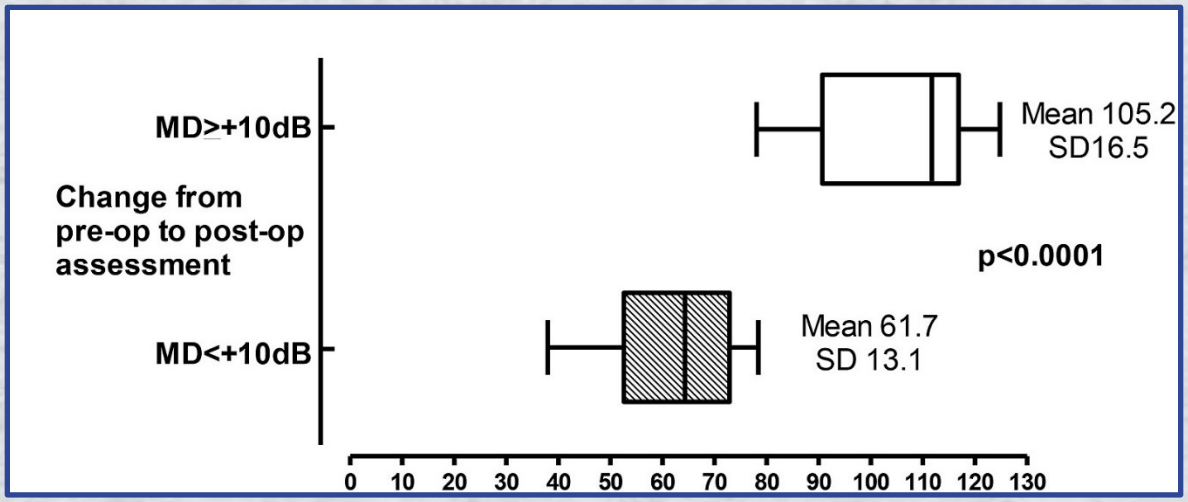


OD



Prognosis

- OCT of the RNFL and macula offer the best prognostic indicators for recovery
  - Patients with global RNFL thickness >85µm had the greatest chance for full recovery



PMID: 31202890

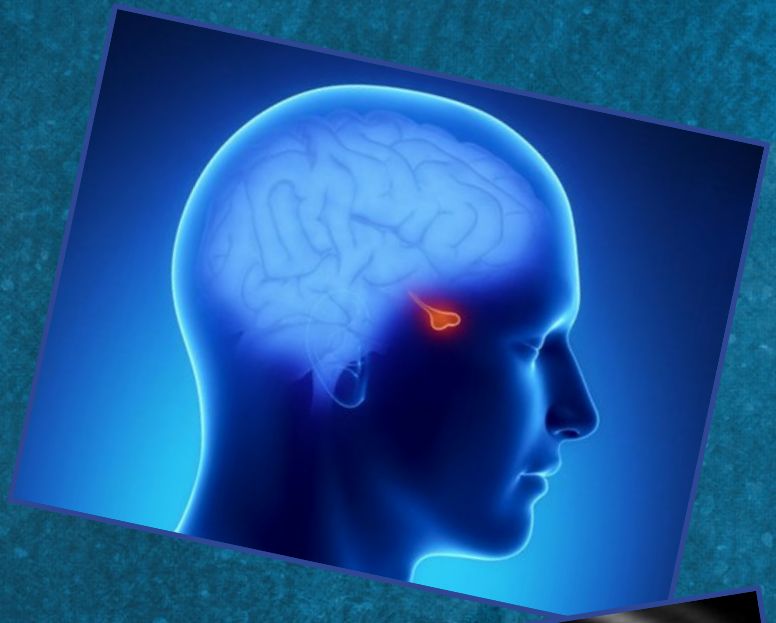
Monitoring Schedule

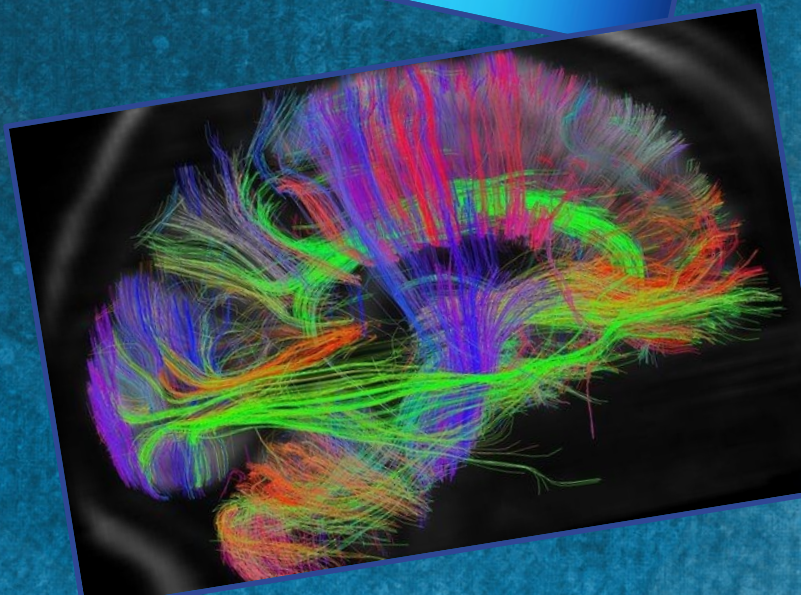
- Asymptomatic microadenoma
  - MRI monitoring only
  - <10% show any growth, <5% become macro
- Asymptomatic macroadenoma
  - MRI and VF q6mo x 3 yrs, then annually x 3yrs
  - 50% will grow, 20% become symptomatic
- Postsurgical
  - VF 3mos post-op, then q6mos until stable

PMID: 37964483, 26072284

Chiasmal Syndrome

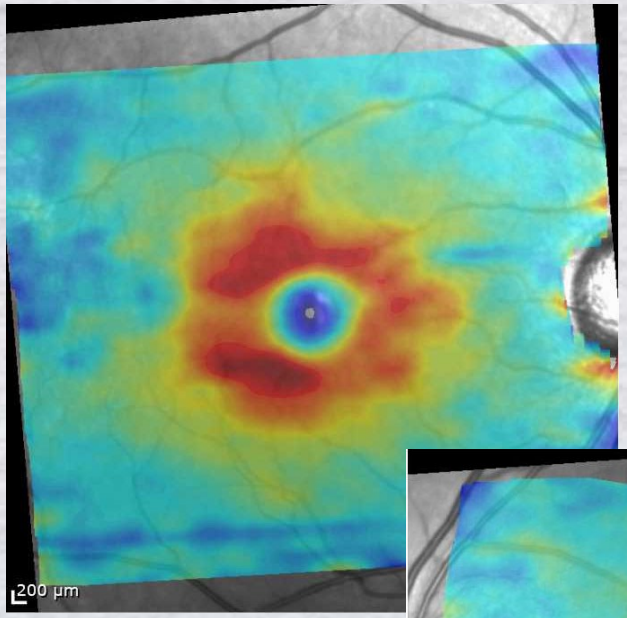
- Anatomy Review
- All About Pituitary Adenomas
- Clinical Features of Chiasmal Syndrome
- Clinical Pearls
  - Red Flag Warning Signs
  - Case examples

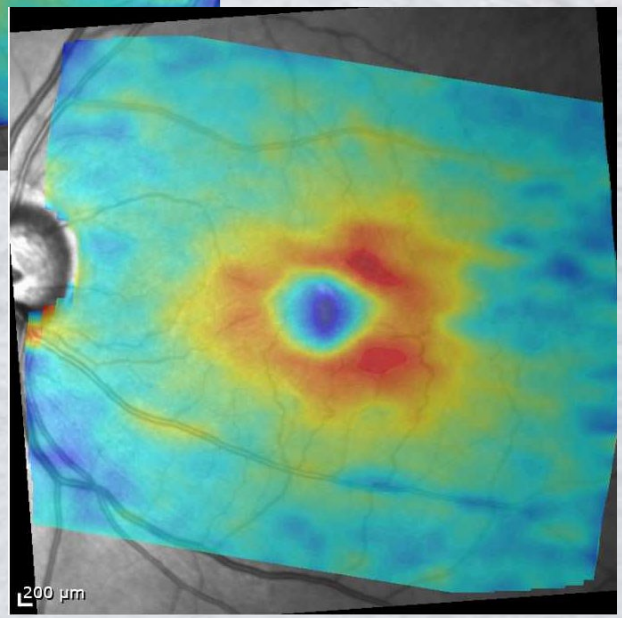




Red Flags

- **Headaches**
- **NTG suspects**
- Binasal GCC thinning
- VF loss greater temporally than nasally





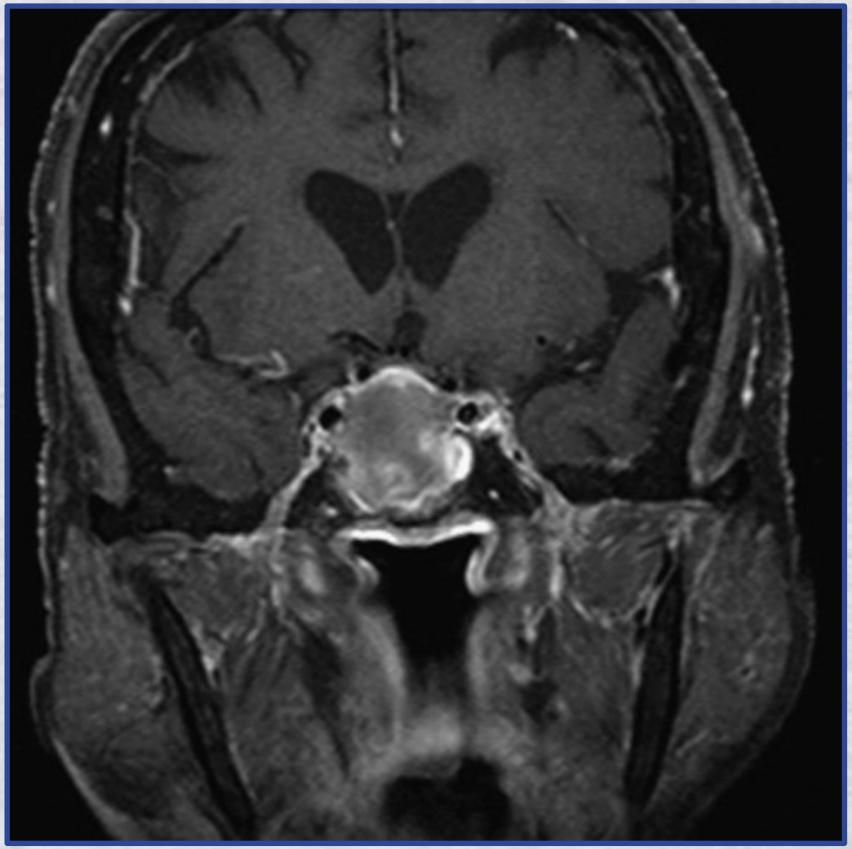
Red Flags

- When should I order an MRI for a NTG suspect?
  - Age <50 years
  - Unexplained VA loss
  - Optic nerve pallor
  - **Vertically aligned visual field defects**
  - Focal neurologic signs (eg. **headache**)

Greenfield, Ophthalmology. 1998;105:1866-74

MRI

- **Required to confirm diagnosis** and plan treatment
- *Order MRI of brain and orbits without and with contrast*



Case 2

Case 2

44yo WM presents for routine exam

- POH: LEE 7-8yrs ago
- MH: Migraines, smoker. No meds

BCVA: 20/25 OD, 20/20 OS

PERRL, (-)APD / FROM

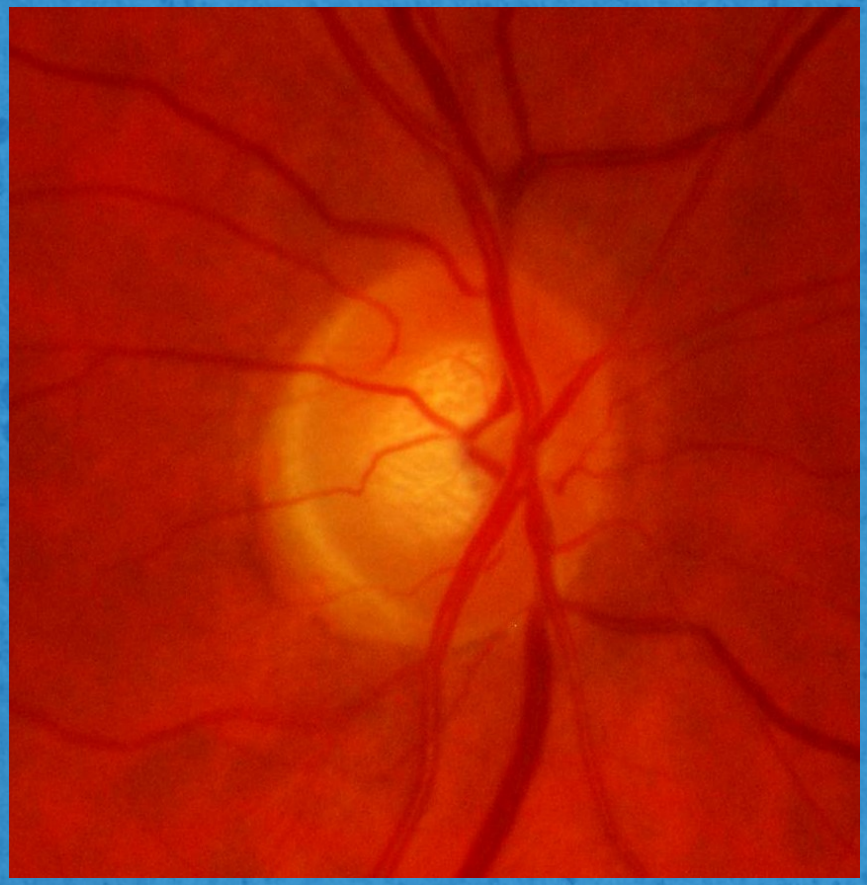
Ta 20/20 @ 3PM

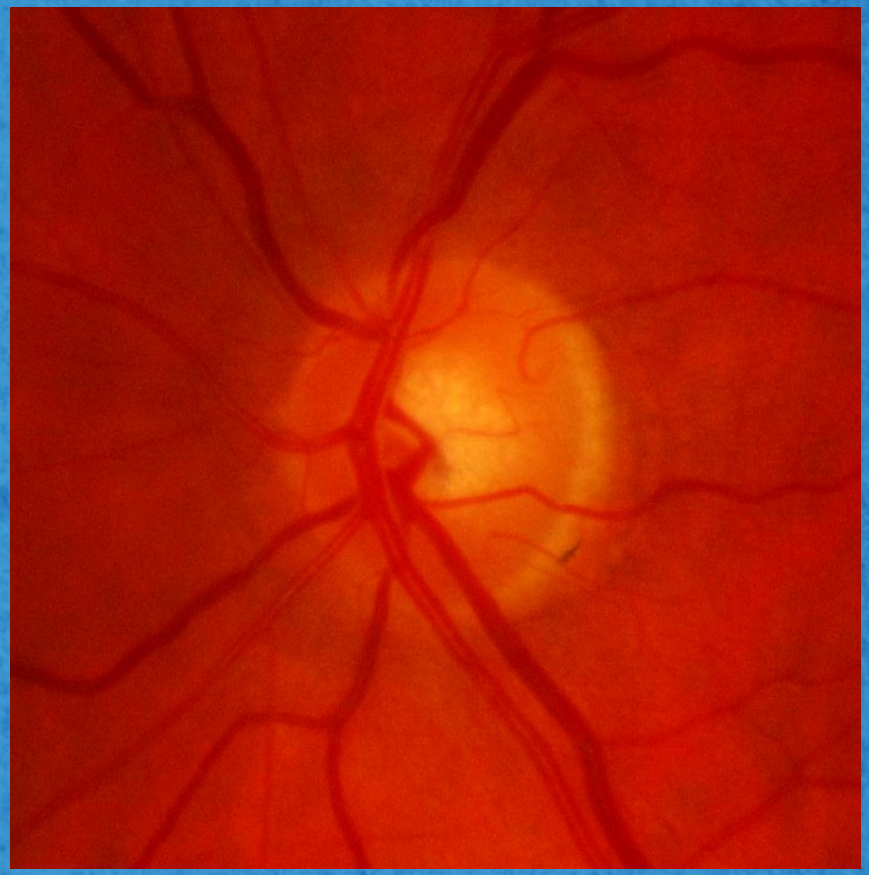
SLE: WNL OU

CDR: 0.6 OD, 0.5 OS

IMP: Borderline IOP with asym cupping

Plan: Schedule VF





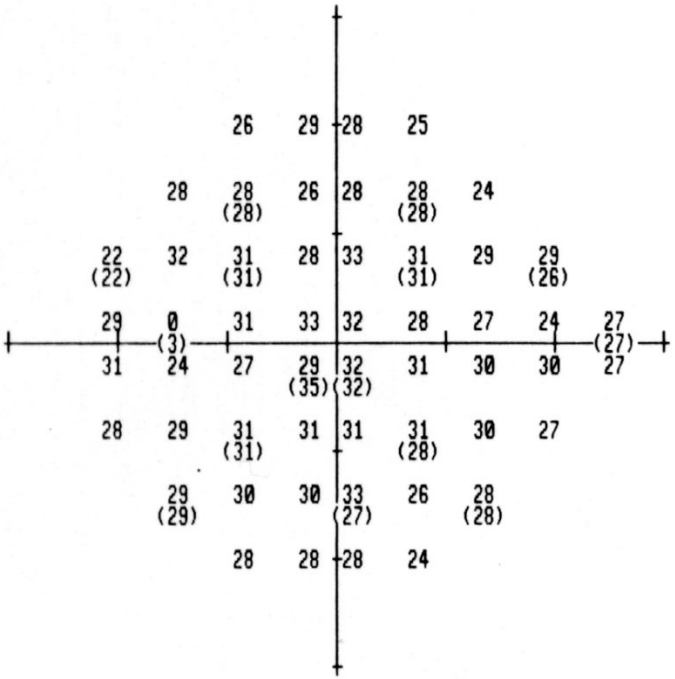
Slight asymmetry of optic cupping

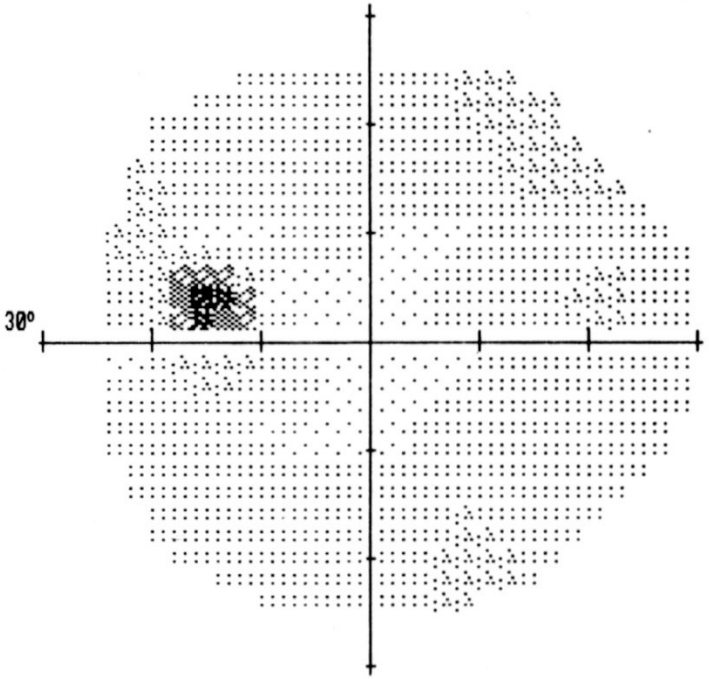
LEFT EYE

AGE 44
FIXATION LOSSES 0/12
FALSE POS ERRORS 0/9
FALSE NEG ERRORS 0/6
QUESTIONS ASKED 210
FOVEA: 37 DB
TEST TIME 05:55

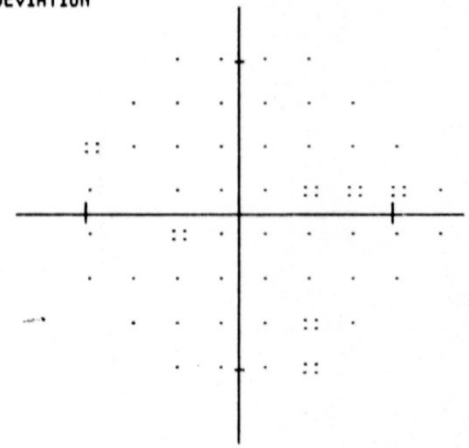
HFA S/N 607-1382

MD - 1.56 DB
PSD 1.96 DB
SF 1.60 DB
CPSD 0.96 DB





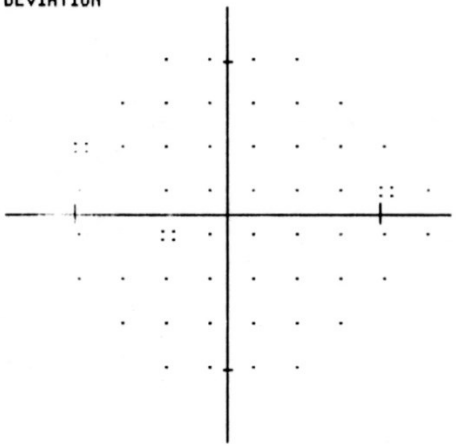
TOTAL
DEVIATION



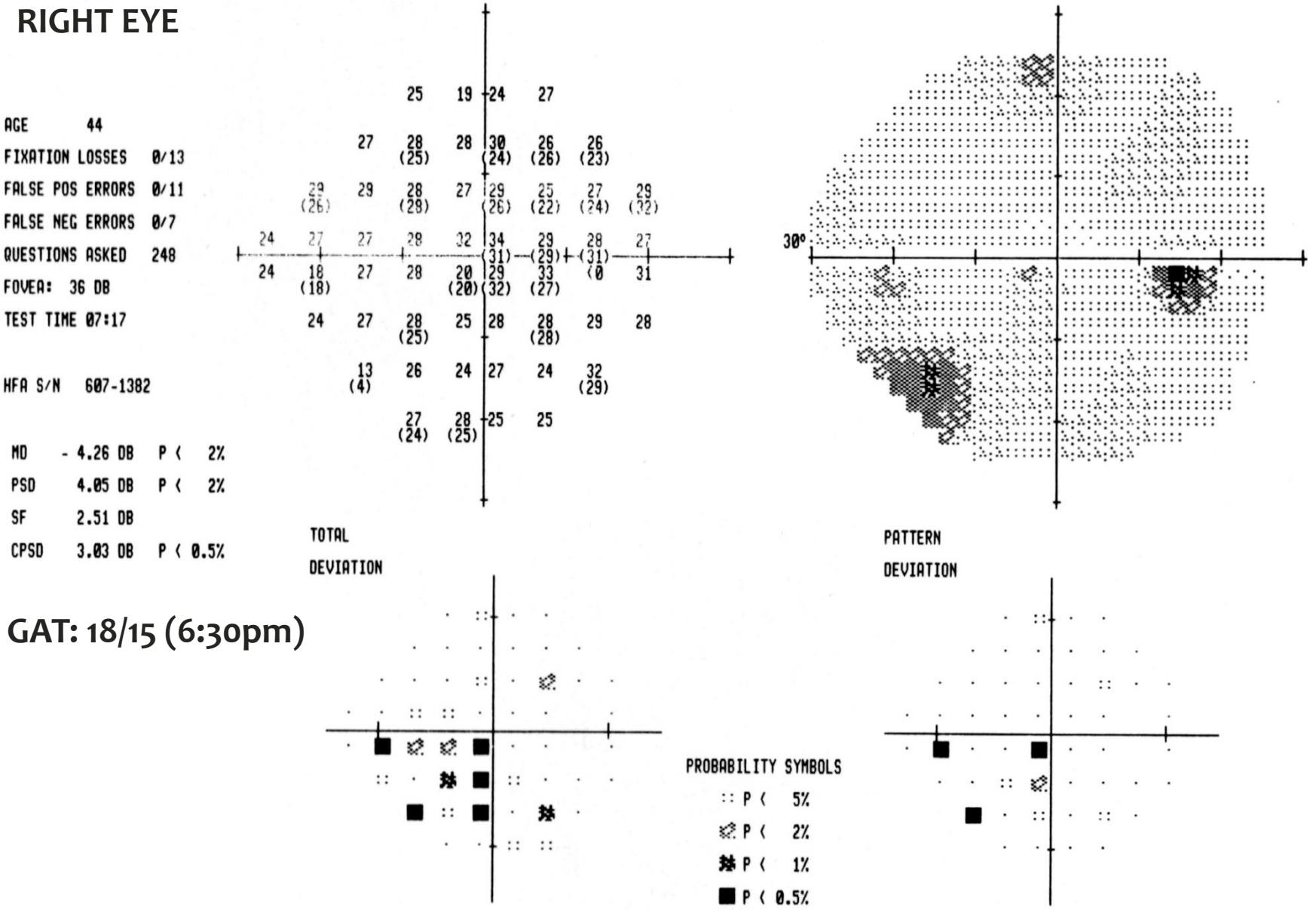
PROBABILITY SYMBOLS

:: P < 5%
P < 2%
P < 1%
■ P < 0.5%

PATTERN
DEVIATION

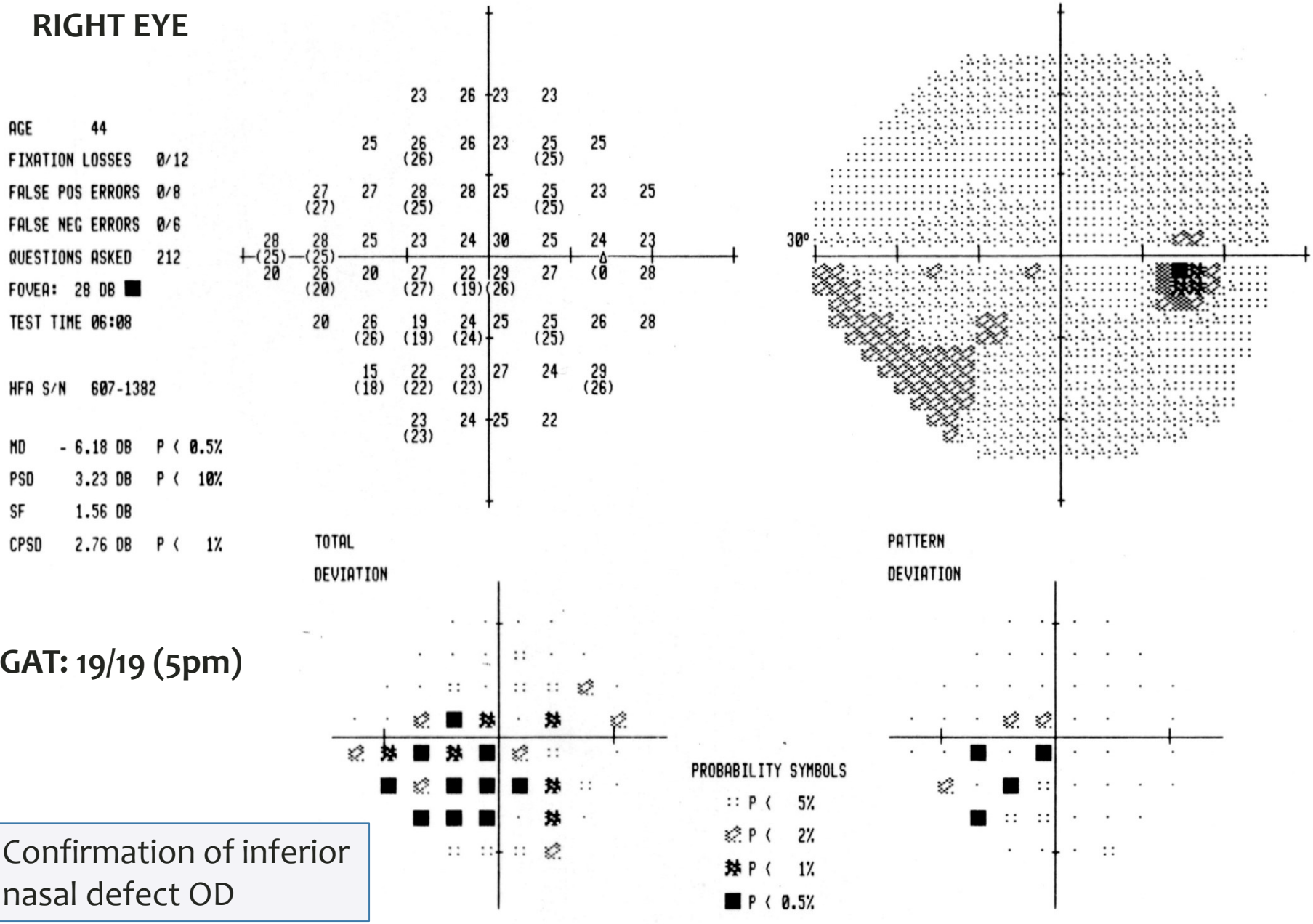


RIGHT EYE



GAT: 18/15 (6:30pm)

RIGHT EYE



GAT: 19/19 (5pm)

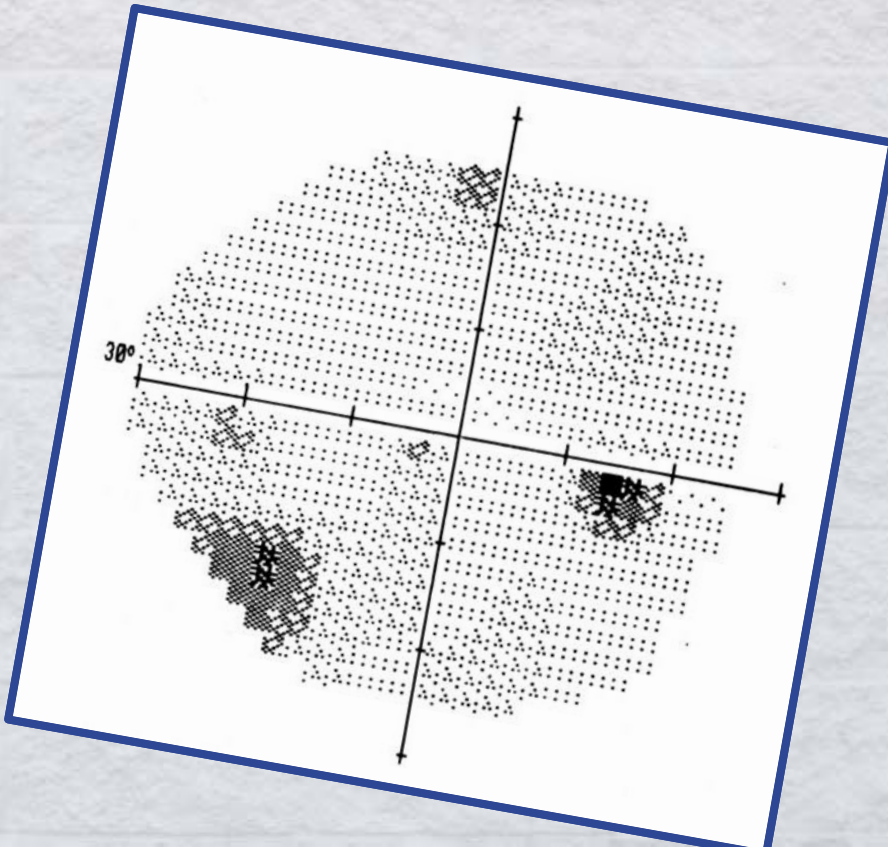
Confirmation of inferior nasal defect OD

What is going on here?

44yo WM
15-20 mmHg

Inferior nasal VF defect OD
C/D: 0.6/0.5

A. Normal tension glaucoma
B. Ischemic optic neuropathy
C. Brain tumor
D. Something else?



Case 2

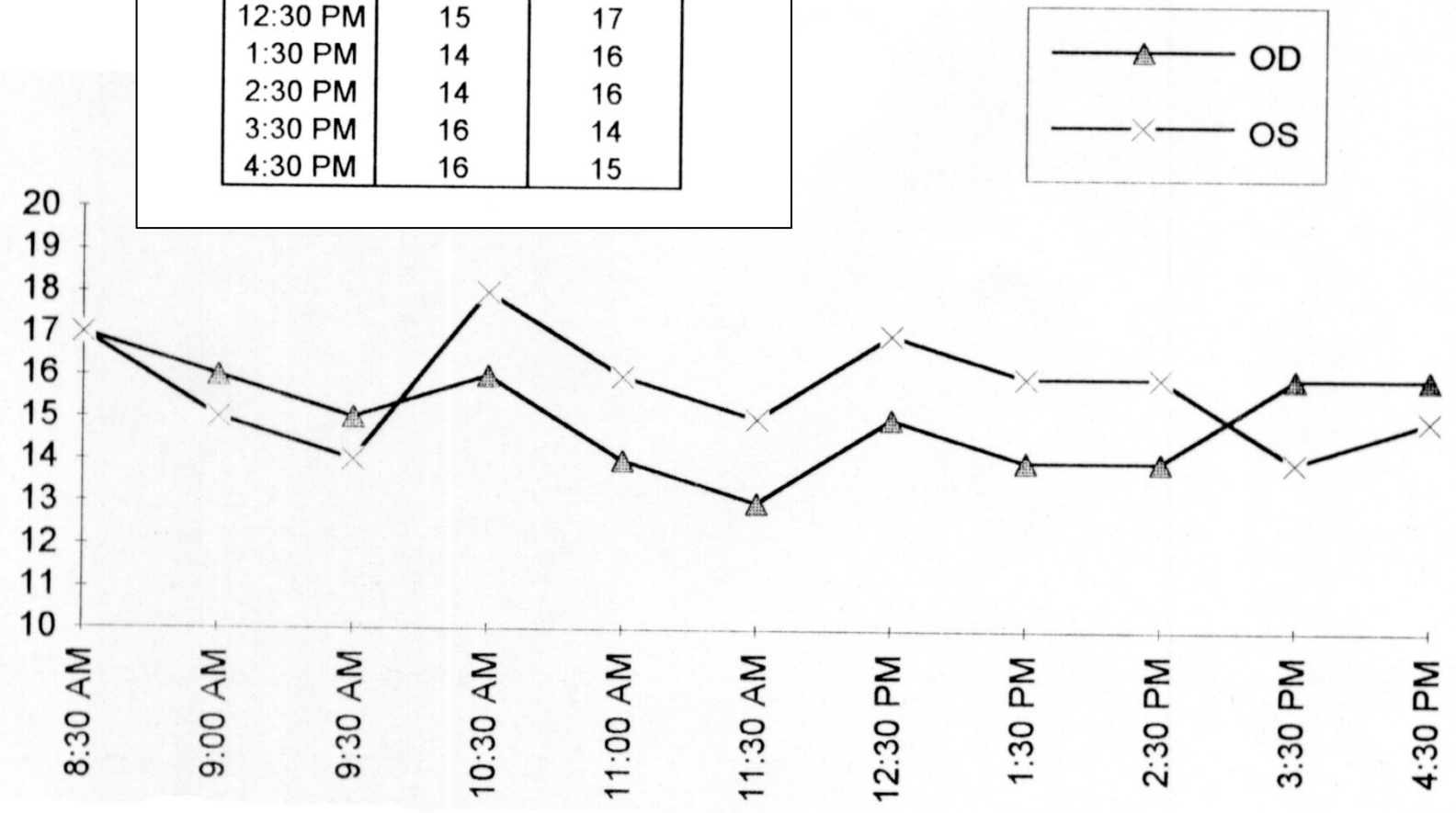
- Ophthalmology consult
  - Hx: No head/eye trauma, (+) migraine HA
  - GAT: 19/19 (3:30pm)
  - Gonio: normal OU
  - Pupils normal, Color: normal
  - DFE: normal OU, no pallor

  - **IMP**: Abnormal VF with normal IOP and ONH
  - **PLAN**: Get diurnal curve

Diurnal Curve

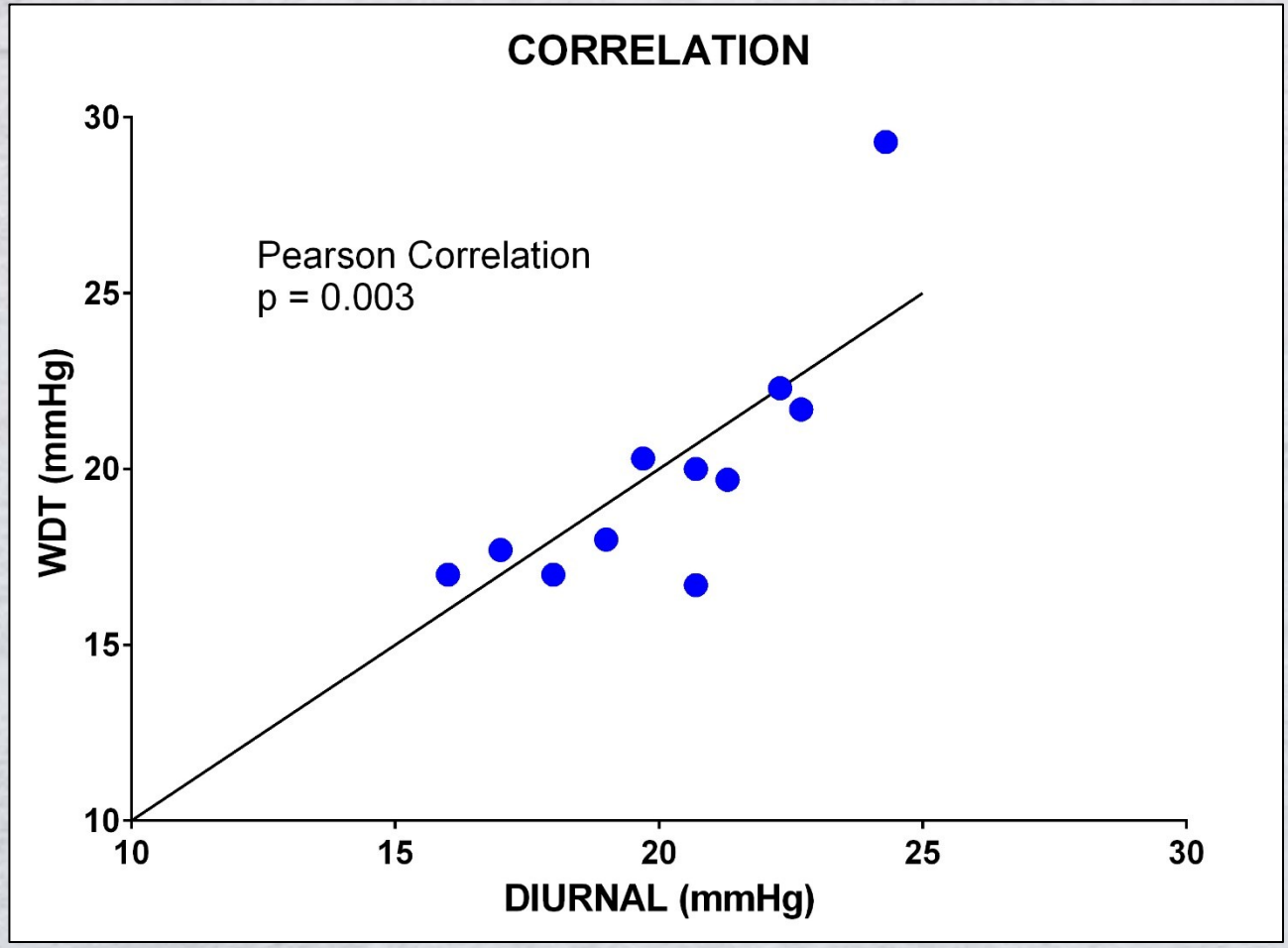
APPLANATION TONOMETRY READINGS

TIME	OD	OS
8:30 AM	17	17
9:00 AM	16	15
9:30 AM	15	14
10:30 AM	16	18
11:00 AM	14	16
11:30 AM	13	15
12:30 PM	15	17
1:30 PM	14	16
2:30 PM	14	16
3:30 PM	16	14
4:30 PM	16	15



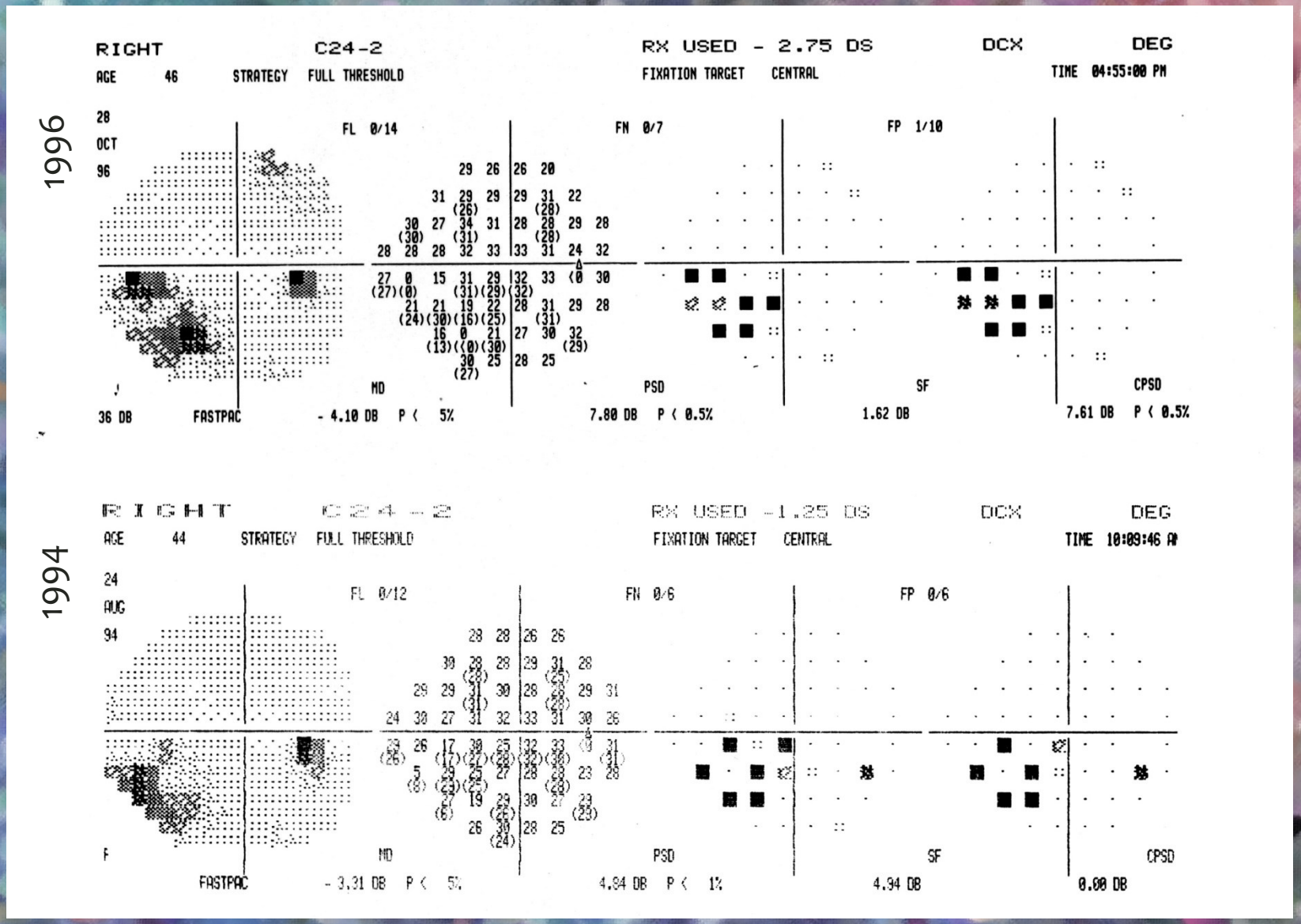
Water Drinking Test

- Estimation of diurnal peak IOP



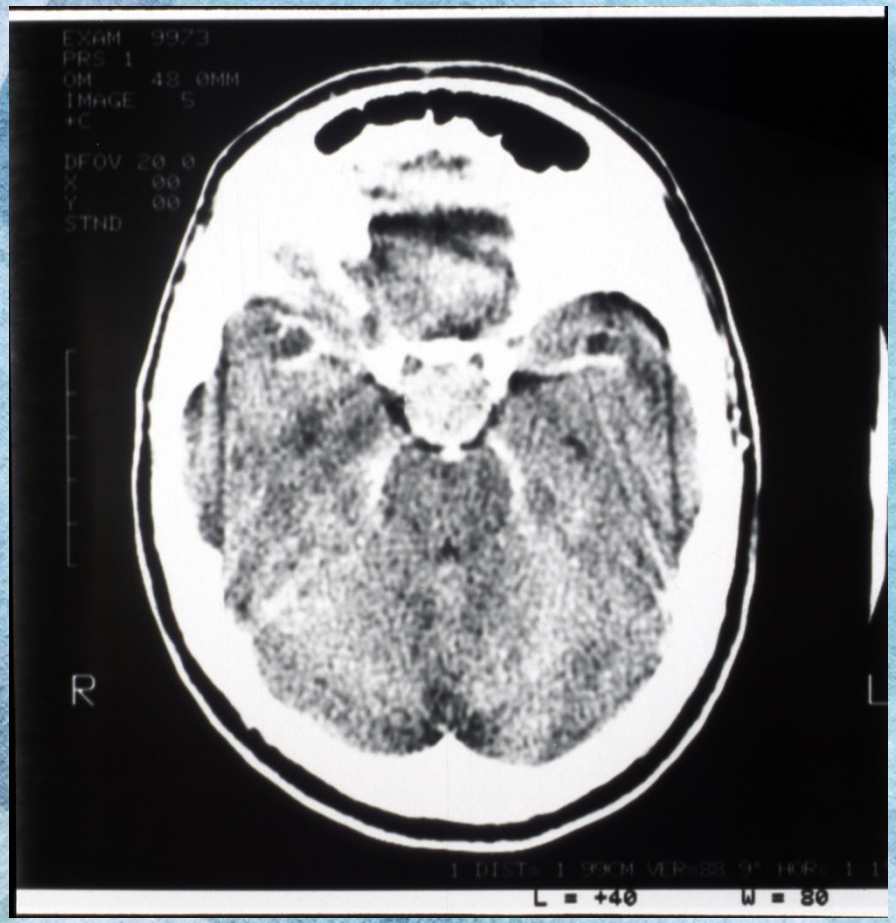
Case 2

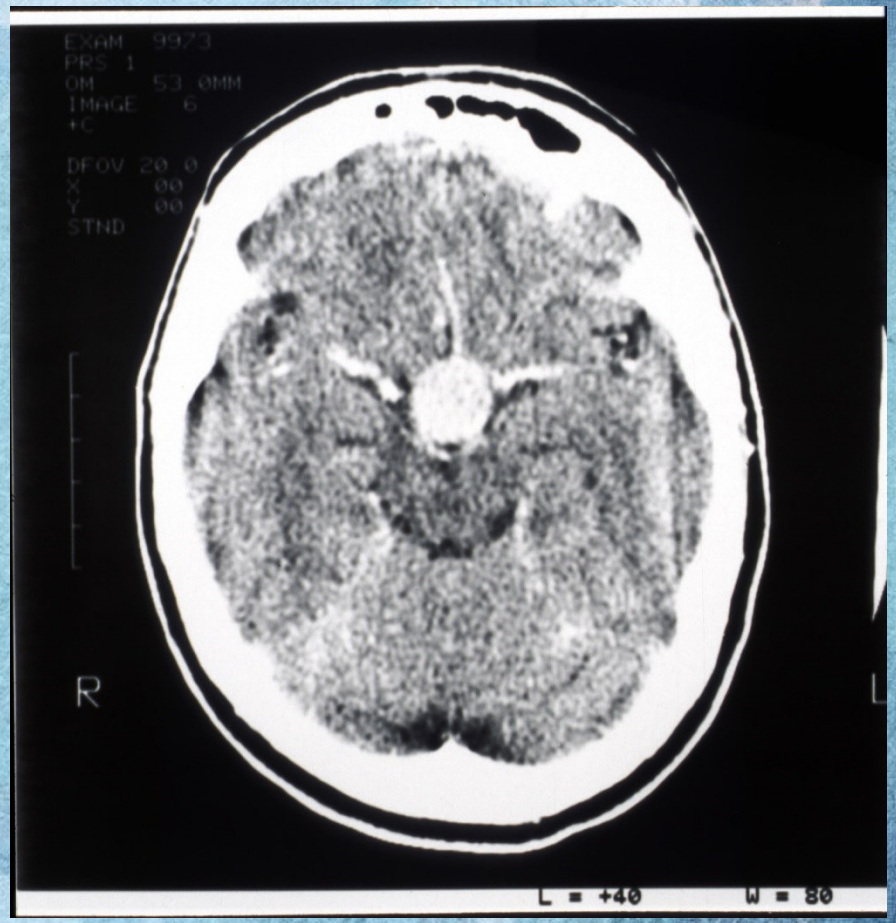
- Lost to f/u x 2 years
- Returns with c/o blurry vision
- Vcc
  -4.00-0.75x060 20/40
  -4.75 20/40
- Refraction
  -5.25-1.00x075 20/30
  -5.25-0.50x105 20/20
- GAT: 18/18 (3:30pm)
- Trace APD OD
- C/D: 0.6/0.5
- **IMP**: Optic neuropathy OD
- **PLAN**: VF, CT scan



Has progression of the defect occurred?

CT Scan





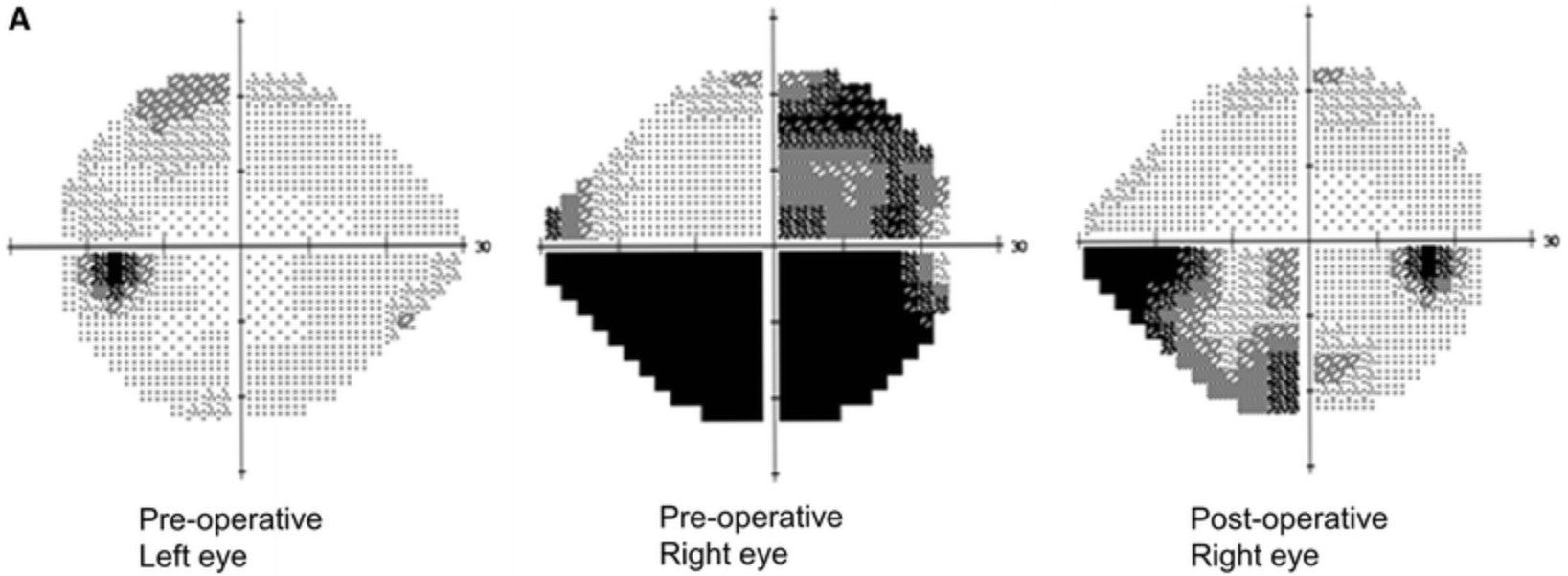
Pituitary adenoma detected on CT scan of brain

Neurol Sci (2013) 34:2057–2060
DOI 10.1007/s10072-013-1421-x

LETTER TO THE EDITOR

Unusual chiasmal visual field defects

Jae Hyoung Kim · Chae-Yong Kim · Hee Kyung Yang · Jeong-Min Hwang



"We present two patients who showed very rare visual field defects, presumably caused by compression between the mass and the anterior cerebral artery."

Key Points

- Chiasmal syndrome is a subtle, easily missed condition
- Headache and BV complaints are common
- Be suspicious of all NTG suspects
- Look for binasal OCT GCC loss
- Beware VF loss that is greater temporally than nasally

Thank you!