


# **NORMAL TENSION GLAUCOMA: TIME FOR A PARADIGM SHIFT**

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Company  
Logo



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- Normal-tension glaucoma (NTG) is an optic neuropathy of unknown etiology characterized by optic disc excavation, retinal nerve fiber layer loss, and visual field defects similar to those seen in other forms of glaucomatous optic neuropathy.
  - **CONSISTENTLY NORMAL IOP**



A distinct entity from POAG?

Or

Same disease at opposite  
end of the IOP spectrum?

# Pathogenesis

- IOP high end of normal
- Ischemia
- Autoimmune processes
- Excess Neurotoxic or insufficient Neurotrophic factors

# Role of IOP

- Statistically normal IOP on diurnal curve  $\geq 21$ mmHg
- High end of normal
- Consider non IOP dependent mechanism if Optic Neuropathy is progressive.??  
Compressive or Ischeamic
- CNTGS confirmed slowing progression with IOP reduction

# Ischemia!

- Vasospastic :Migraine,Raynaud's phenomenon,Systemic hypotension,
- Non Vasospastic: Primary Vascular disease,Nocturnal hypotension,Vascular dysregulation of ONH, Sleep Apnoea, Systemic cardiovascular disorders,Cardiac Arrhythmias-----Low Ocular perfusion pressure
- Low Cerebrospinal Fluid Pressure results into Large Trans-laminar pressure which impacts on the biomechanical integrity of Lamina cribrosa with adverse effect on ONH

# Autoimmune disorders


- Specific retinal antibodies
- Addison, Pagets, Multiple myeloma, Hypothyridism, Chronic peripheral polyneuropathy

# Epidemiology

- Estimated 20% to 35% of OAG in USA
- 80% in Korea, 90% in Japan
- Tajimi Eye Study: Reported prevalence of glaucoma 3.9%. 92% had NTG
- 56% of all OAG in Nigeria( NNS Kyari et al)

Iwase et al. Ophthalmology 2004;111:1641



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- Sex : Female > Male
  - Older Age > 60 years

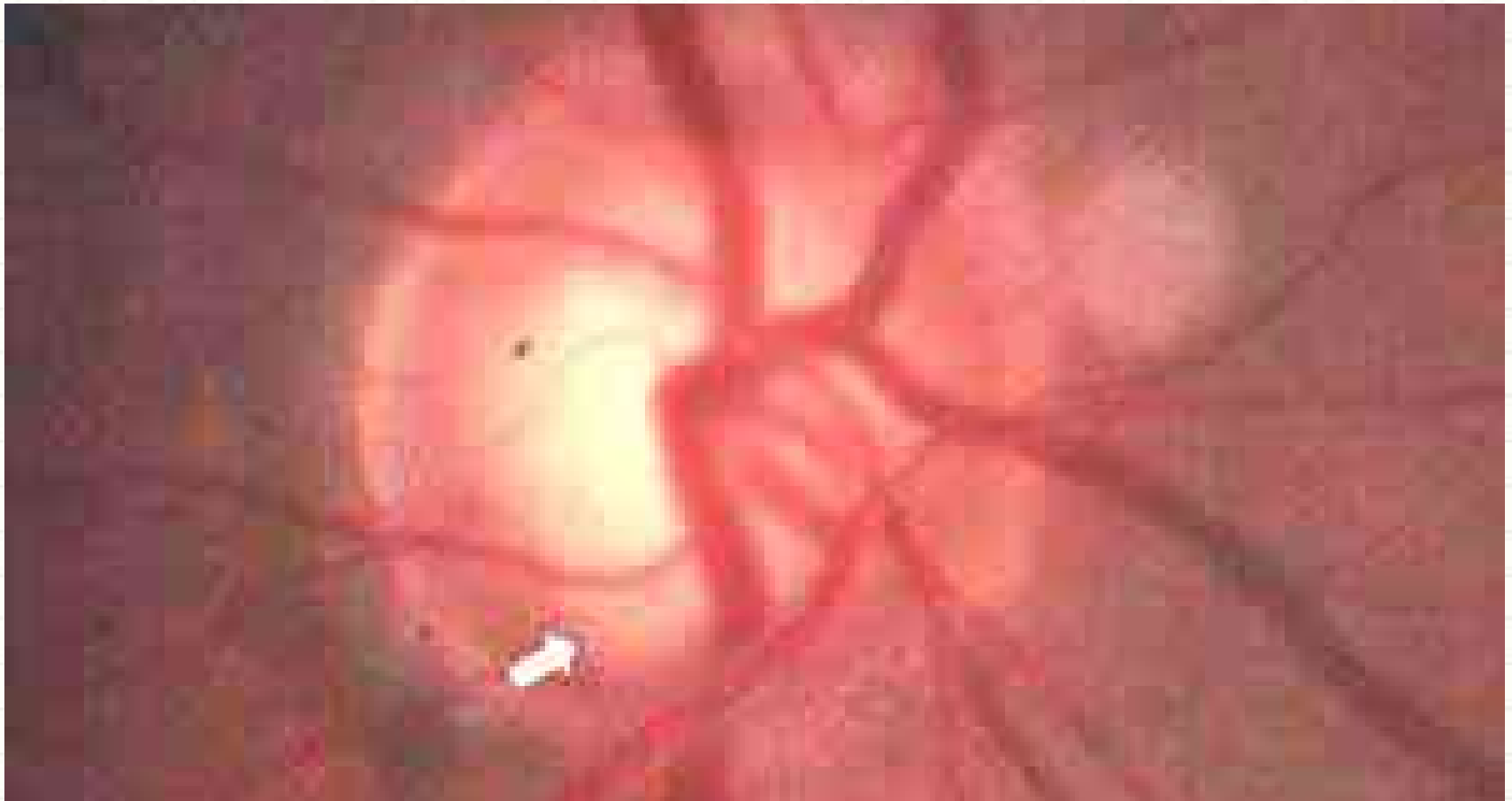
# Distinct Clinical Features!

- IOP **normal** with **large diurnal** fluctuations > 6mmHg
- High end of Normal :high teens

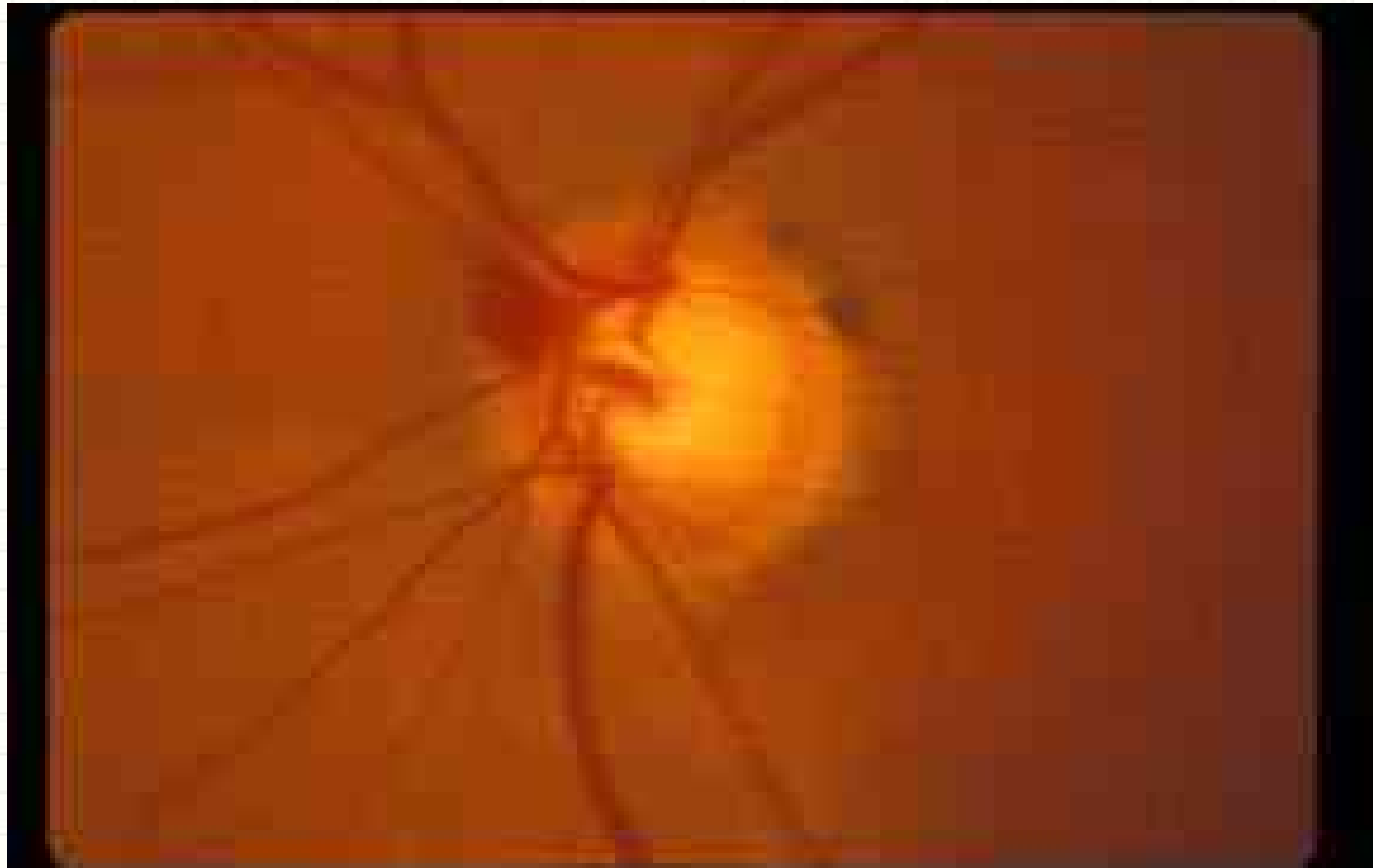
# ONH appearance

- More prominent peripapillary atrophy
- More frequent disc hemorrhages
- More prominent optic disc notching
- Optic disc larger than that typically seen in high-tension glaucoma
- Cup that is more sloped with less steep margins

# Prominent Notching

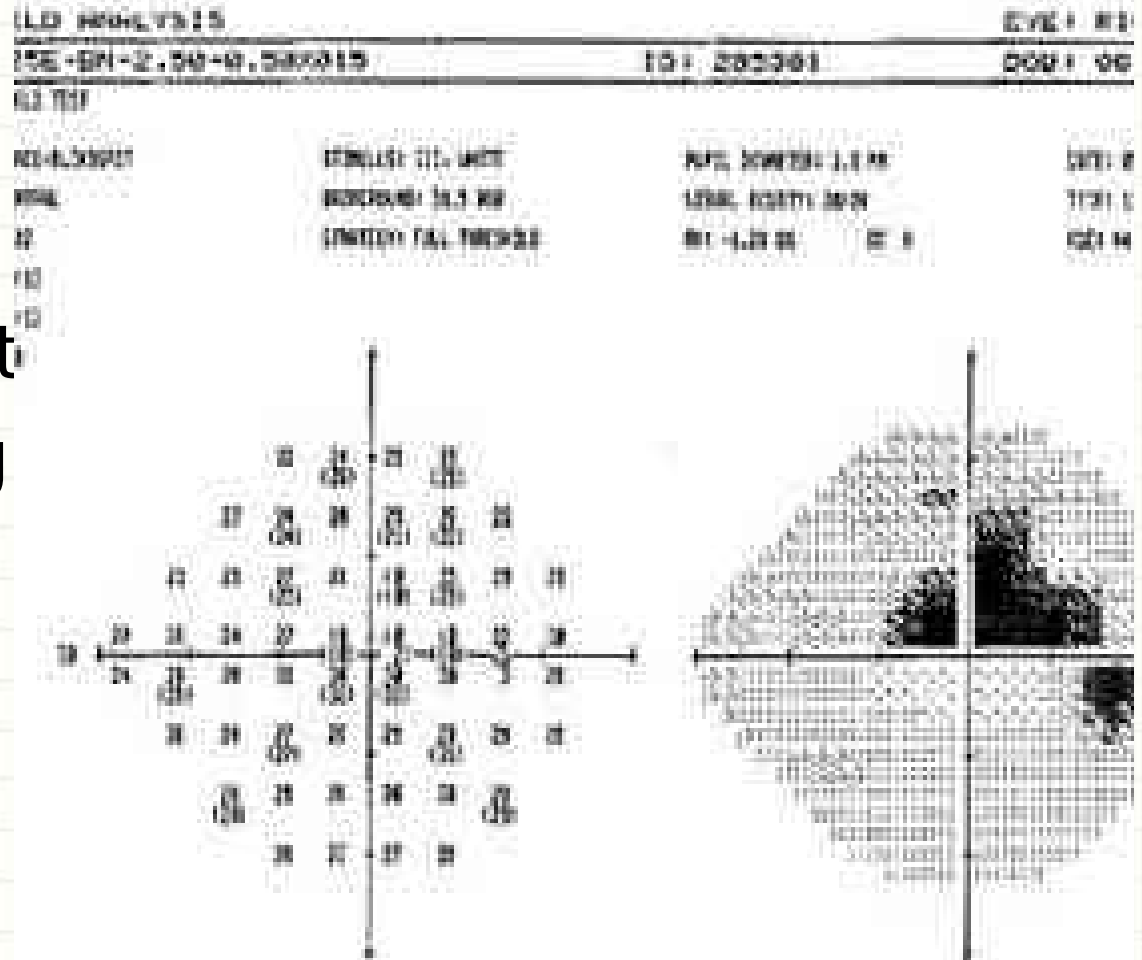



# Optic Disc Haemorrhage



# Visual Field changes

- **Scotomas**
  - ◆ Deeper;
  - ◆ Closer to fixat
  - ◆ Steeper marg




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- NTG is a diagnosis of exclusion
  - NTG appears to be a multifactorial disease. A thorough history can often provide clues to underlying systemic conditions that can predispose a patient to NTG or that play a role in its progression.

# Points to note in History

- Family history
- Arthritis/Musculoskeletal diseases/unexplained skin rashes
- Thyroid disorder
- Primary vascular disorder : Cold hands and feet; Does not fall asleep readily ; Does not thirst easily
- Migraine ;Raynauds




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- Low BP, Coronary heart disease, Cardiac arrhythmias, Carotid occlusive vascular disease
  - Orthostatic hypotension: dizziness or fading vision on standing up too quickly
  - Snores heavily ; **Sleep apnoea**
  - Hx of Anaemia or excessive blood loss in the past


# Evaluation

- Detailed Ocular examination
- IOP : **Diurnal Phasing** is a must
- Cornea Pachymetry is mandatory
- Gonioscopy mandatory
- Optic Nerve head assessment
- CVF
- OCT

# General assessment

- Detailed physical assessment for tell tale neurological signs
- Physique: Primary vascular disorder( slim) ; Sleep apnoea Obese ; thick necks
- CBC :blood dyscrasias,Anaemias
- VDRL for Syphyllis
- Serum monoclonal proteins for multiple myelomas
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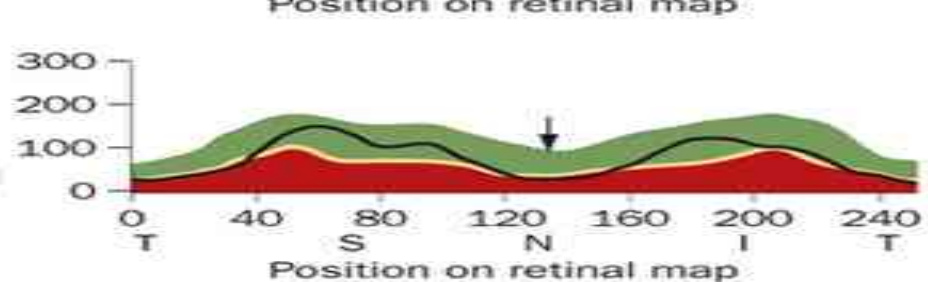
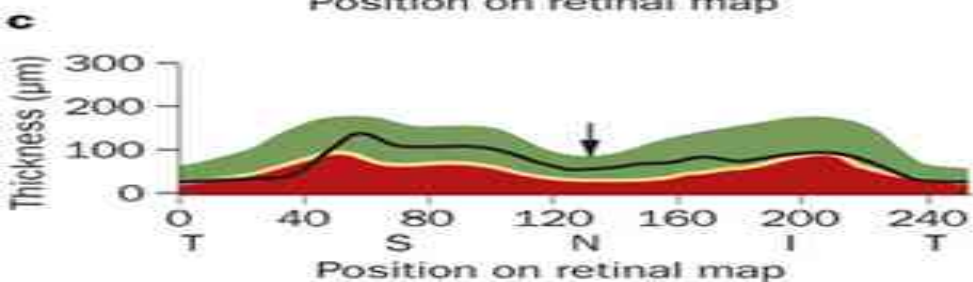
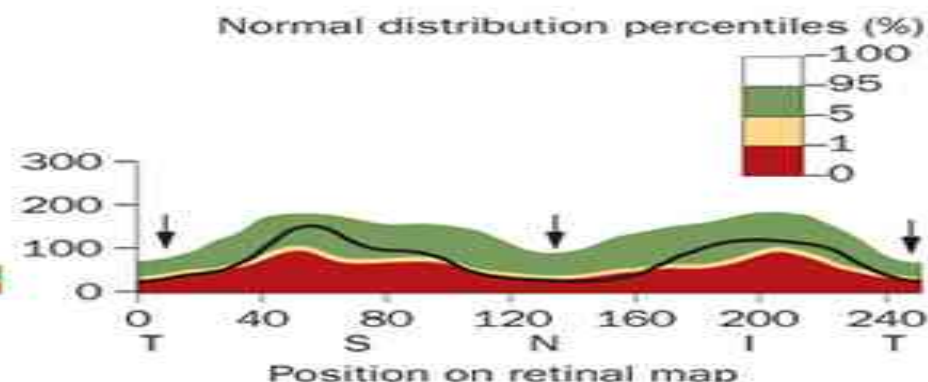
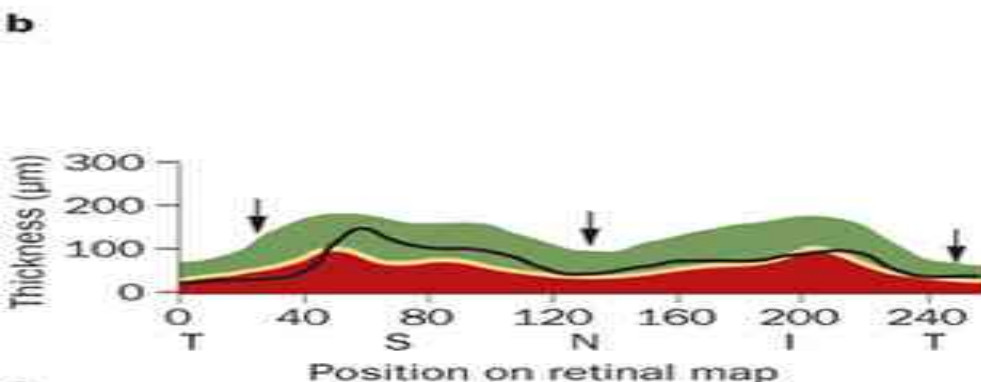
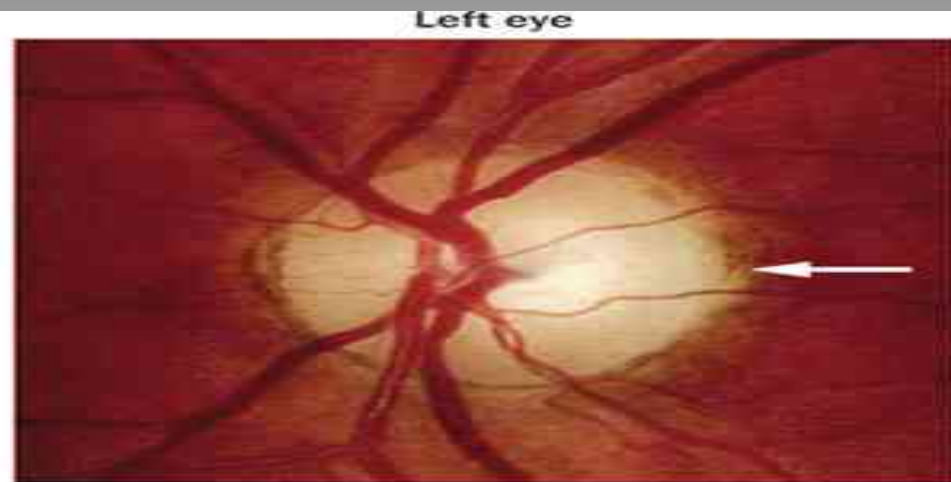
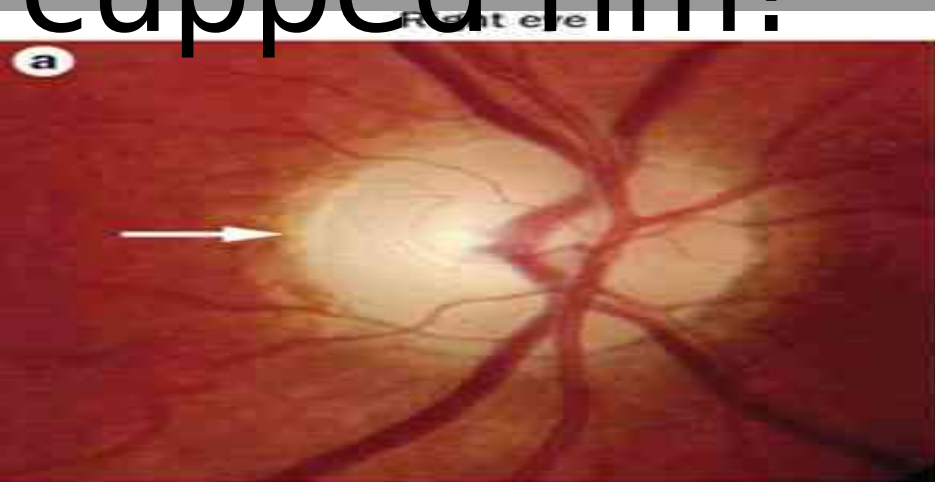
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- Genetic tests
  - Serum Cryoglobulins for Vasospastic diaseses

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- 24 hour Blood pressure monitoring to detect Nocturnal hypotension and calculate Ocular perfusion pressure
  - Carotid Doppler

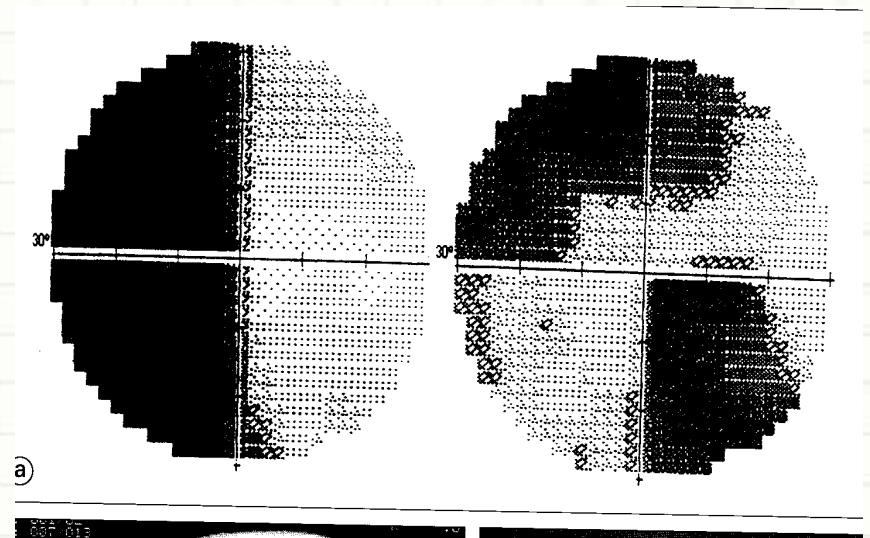
# NeuroImaging!! Who qualifies

- Younger patients
- Headaches!!!!
- Colour vision loss
- Visual acuity out of proportion to Optic disc Cupping
- RAPD with vision loss
- Non correlation of VF and ONH

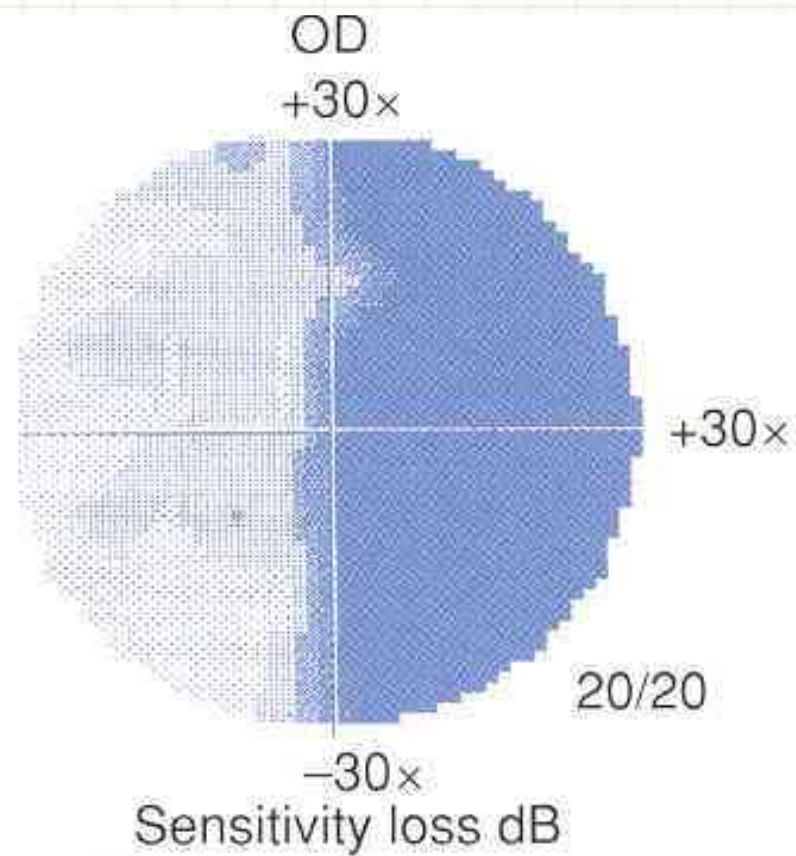
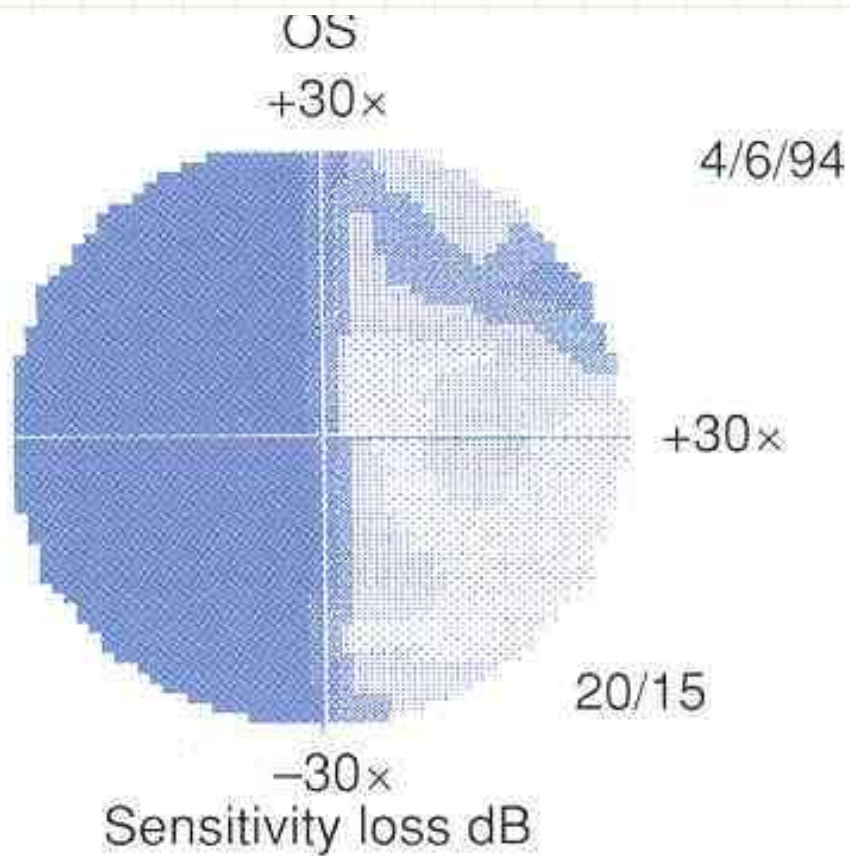
# Excessive palor of non cupped rim!



- Rapid deterioration of Vision
- Visual field obeying the vertical rule!







(a)

# Important Differential Diagnosis

- Occult high tension Glaucoma with wide diurnal fluctuation
- Low IOP with very THIN CCT
- Post Uveitic Glaucoma
- Steroid responders in whom drug is discontinued
- Intermittent Angle Closure
- Traumatic angle closure

# Differentials-----

- Previous Major blood loss
- Hypotensive crisis
- AION
- Compressive Optic Neuropathy
- Congenital optic nerve anomaly
- Toxic Optic Neuropathy

# TREATMENT

- CNTGS evidence of Non progression with treatment in 23% of patient with 30% IOP lowering
- Medical therapy: PGA , **Bblockers???**, CAI
- Laser Trabeculoplasty to reduce fluctuauations
- Trabeculectomy where there is progressive field loss
- MIGS,

# Neuroprotection/Neurorescue!

- Ultimate goal in management is preserving the Integrity of the RGC and Axons
- Antioxidants to limit Oxidative stress
- Glutamate antagonist for the Excitotoxicity

# Paradigm shift?

- Blood Pressure
- Cerebrospinal Fluid Pressure
- Episcleral Venous Pressure

# Modulates-----

- Ocular Blood Flow
- Ocular Blood Perfusion


# Vascular dysregulation

- Low MOPP <40mmHg
- Low DPP <50 mmHg
- Low SPP <101mmHg
- Nocturnal dipping/ Systemic hypotension




# Primary Vascular Disorder


- Cold hands and feet
- Reduced feeling of thirst
- Difficulty in falling asleep
- Sleep apnoea
- Migraine

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- Variant Angina
  - Vasospasm induced by Cold, Mechanical stress or Emotional stress
  - Low Body Mass Index

# Hence-----

- Need for 24 hours Ambulatory BP measurement
- 24 hours IOP profile
- Identify periods of Nocturnal hypotension and Low Ocular perfusion pressure

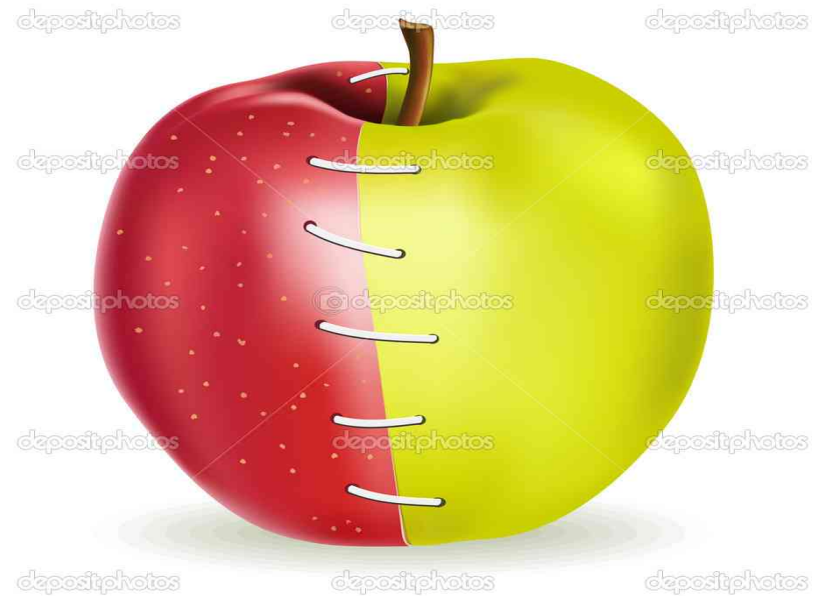
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- Co manage with Physician
  - Advise on the appropriate timing of antihypertensive, and ± use of Diuretics/*B* blockers
  - Prop up BP especially in Nocturnal Dippers
  - Reduce IOP
  - Neuroprotection

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- RHO Kinase inhibitors may help afterall!

# TAKE HOME!

- Wholistic approach
- Look beyond the eye
- Think beyond the IOP

THANK YOU ALL FOR YOUR ATTENTION.



## REFERENCES

- 5) Kyari F, Abdul MM, Bastawrous A, Gilbert CE, Faal H. Epidemiology of glaucoma in sub-saharan Africa: prevalence, incidence and risk factors. Middle East Afr. J. Ophthalmol. 2013; 20(2): 111-25.
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- 8) Tamm ER; Crowston J, Toris C, Sit A, Lim S et al. Basic Science of Intraocular pressure: In Intraocular Pressure eds Weenreb R, Brandt JD, Garway-health D, Medeiros FA. Kugler publications, 2007, PP 1-14. Amsterdam the Netherlands.





# **APPENDIX**