INTRAOCULAR PRESSURE

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RECENT MODALITIES IN TONOMETRY

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Table 1-1 Risk factors for primary open-angle glaucoma

Factor	Quality of evidence	Remarks
Ocular risk factors		
Intraocular pressure	Excellent	Most important
Thinner central corneal thickness	Excellent	Related to IOP and to optic nerve?
Myopia	Excellent	Related to IOP and to optic nerve?
Disc hemorrhage	Good	Prognostically important
Increased cup/disc ratio	Equivocal	May represent early POAG
Asymmetric cupping	Equivocal	May represent early POAG
Non-ocular risk factors		
Age	Excellent	Causal mechanisms unknown
Race (e.g. African or Hispanic descent)	Excellent	Causal mechanisms unknown
Family history	Excellent	Multifactorial genetic factors
Adult onset diabetes	Equivocal	Elevated IOPs, but 'protective' of ganglion cells?
Diastolic perfusion pressure	Excellent	Biologically plausible
Migraine and peripheral vasospasm	Equivocal	More relevant in 'low-tension' disease?
Gender	Inadequate	Contradictory reports
Alcohol consumption	Inadequate	Requires confirmation
Cigarette smoking	Inadequate	Requires confirmation

RELATIONSHIP BETWEEN IOP & VF LOSS

The Australian Blue Mountain study found the odds ratio of developing glaucoma was 4.7 times higher in patients with a screening IOP of greater than 21 mmHg than in patients with lower IOP.

Ref: Surveys of Ophthalmology 2003; 48 (Suppl 1): 53-57

RELATIONSHIP BETWEEN IOP & VF LOSS

According to the **AGIS** study, reducing IOP in glaucoma patients limits disease progression and slows visual field loss.

According to the **EMGT** study, for every 1 mm drop in IOP, a 10% reduction in risk of glaucomatous progression was observed.

IOP??

- Majority of cases with OH do not develop glaucoma (OHTT)
- Some cases with glaucoma never progress without Rx (EMGT)
- Some cases with glaucoma develop VF loss despite adequate control of IOP (AGIS)

NORMAL IOP

In children:

6-8 mmHg at birth increase by 1 mmHg /2years till 12 ys

Healthy adult:

10 - 21 mmH (16+/- 2.5) increase with age above 40 ys (1mmHg per decade)

Goldmann tonometry for reproducibility

Recommendation

GAT tonometer is the most reproducible, it is recommended for IOP measurement in patients with **healthy corneas**

Canadian Ophthalmological Society evidence-based clinical practice guidelines for the management of glaucoma in the adult eye.

Precision figures reported for GAT

Under ideal circumstances for measurement,

Intraobserver variability: 2.5 mmHg

two readings by the same observer will be within this figure for 95% of subjects.

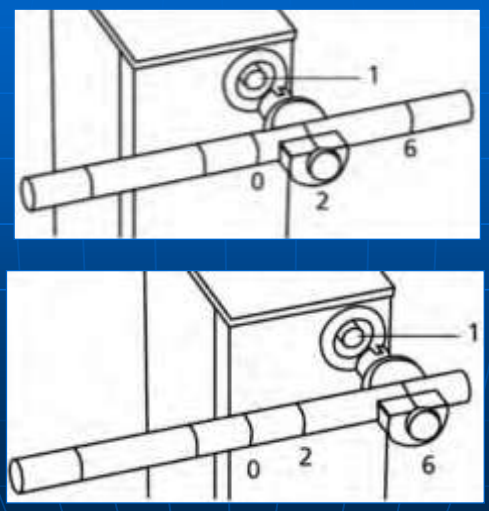
Interobserver variability: ± 4 mmHg (95% confidence limits either side of mean difference between observers)

Prevalence of Calibration Errors in GAT

- Approximately 90% and 30% of tonometers were outside the tolerance ranges of ±0.5 and ±2.5 mmHg,respectively.
- For achieving more accurate IOP measurement regular checking of GAT tonometers for calibration

Tonometer Calibration Errors; *Amini et al*

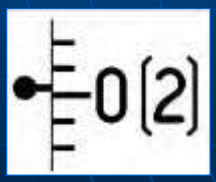
How to test calibration of a GAT

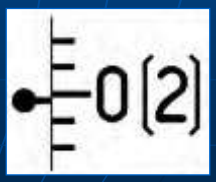


How to test calibration of a GAT

Periodic calibration check recommended: at least twice yearly

1. **Set the tonometer in position on the slit-lamp stand, with the biprism head in place and the tension on the circular dial on the right side set at 5 mm Hg. The head should lean slightly forwards (away from the examiner).**
2. **Slowly twirl the circular dial counter-clockwise until the head rocks back towards you. The tension should read 0 to 2 mm Hg below zero .**





1. Garway-Heath DF. In: *World Glaucoma Association: Intraocular Pressure. Consensus series 4.* The Hague: Kugler Publications

Tonometry — role for finger tonometry for special circumstances

Consideration can be given to finger tonometry to estimate IOP as very low, normal, or very high

in certain situations (e.g., eyes with flat anterior chambers, eyes with keratoprosthesis)

To check IOP after LA

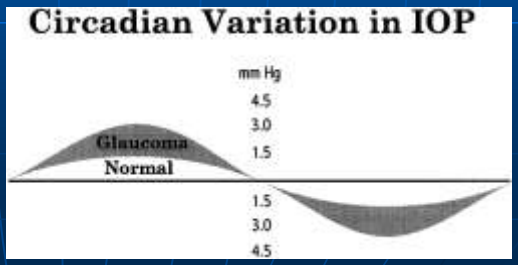
Circadian Cycle

Diurnal variation 3-5 mmHg more in untreated glaucoma

Maximum IOP between 8-11am

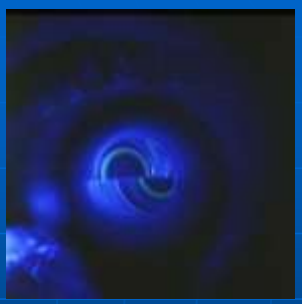
Minimum between midnight & 2am

This is dependent on sleep cycle than daylight cycle



IOP

- The semicircles should be clear with distinct margins.
- Wider, blurred semicircles result in false-high readings as does vertical misalignment.
- Measurements without the use of fluorescein underestimate the true IOP



IOP & Cataract Surgery

IOP was lower after speculum placement.

IOP :decrease by 3mmHg after surgery & is Maintained over years

Viscoelastics

Steroids

Transient increase in IOP

- IOP increases temporarily because of wearing tight neckties, caffeine intake, yoga positions and isometric exercises.
- Valsalva maneuvers, or breath holding by the patient, must be avoided.
- The unanswered **question** is whether these intermittent bursts of elevated IOP lead to pathological problems?

Neurol Res. 1999;21:243-6

Corneal Edema

- Large amounts of corneal edema produce an underestimation of IOP when measured by applanation tonometry.
- Small amounts of corneal edema (as induced by CL wear) probably cause an overestimation of IOP.
- Remove CL 2 hrs before tonometry

Natural History of Intraocular Pressure During Pregnancy.

- **Metabolic and physiologic changes during pregnancy cause a mild decrease in IOP.**

1-The episcleral venous pressure decreases.

2- A metabolic acidosis occurs, which affects aqueous production and - IOP.

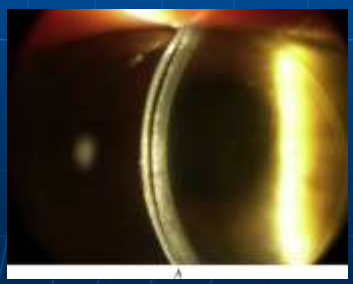
- **IOP show an average decrease of 1.5mmHg during pregnancy.**

Natural History of Intraocular Pressure During Pregnancy.

- In one study, the majority of eyes required treatment with glaucoma medications and maintained stable visual fields.the course of glaucoma was variable, with 18% developing visual field loss and another 18% developing increased IOP without visual field loss.

INTERFACE FLUID SYNDROME

- **Post-LASIK :**
  stromal edema or interface fluid on slit lamp exam, increase in pachymetry measurements, steepening of corneal topography, or inappropriately low IOP measurements



INTERFACE FLUID SYNDROME

Pathophysiology:

- **High intraocular pressure ➔diffusion of aqueous humor across the corneal endothelium into the stromal interface created by the flap➔ pocket of fluid accumulates at the lamellar interface[3,12]**

Why Target IOP

Physiological variations
Measurement errors
Corneal thickness , Hysteresis
Individual suscebility
State & rate of progression

THE TARGET IOP CONCEPT

The goal of the clinician while treating patients with glaucoma should be to lower the IOP to a level that is **"safe"** for that particular eye.

Ref: Surveys of Ophthalmology 2003; 48 (suppl 1): 53-57

THE TARGET IOP CONCEPT

A"target" pressure should be set as a goal of long term therapy: it should be chosen on an individual basis, weighing potential benefits and risks of treatment for each patient.

Ref: Surveys of Ophthalmology 2003; 48 (suppl 1): 53-57

SETTING TARGET IOP
FACTORS TO BE CONSIDERED

- IOP level at which optic nerve damage occurred
- Extent and rate of progression of glaucomatous damage,
- Presence of other risk factors
- Patient's age
- Expected life span & Medical history

Ref: Surveys of Ophthalmology 2003; 48 (suppl 1); 53-57

AAO GUIDELINES: TARGET IOP

- **Ocular hypertension**
  → Reduction of 20% from baseline
- **Glaucoma patients with mild damage (optic disc cupping but no visual field loss)**
  → Reduction of 20-30% from baseline
- **Glaucoma patients with advance damage**
  → Reduction of 40% or more from baseline
- **Normal pressure glaucoma**
  → Reduction of 30% from baseline

HOW TO CALCULATE TARGET IOP

Target IOP = "Maximum IOP – Maximum IOP% - Z"

Z is an optic nerve damage severity factor.

0 →Normal disc and Normal VF

1 →Abnormal Disc and Normal VF

2 →VF loss not threatening fixation

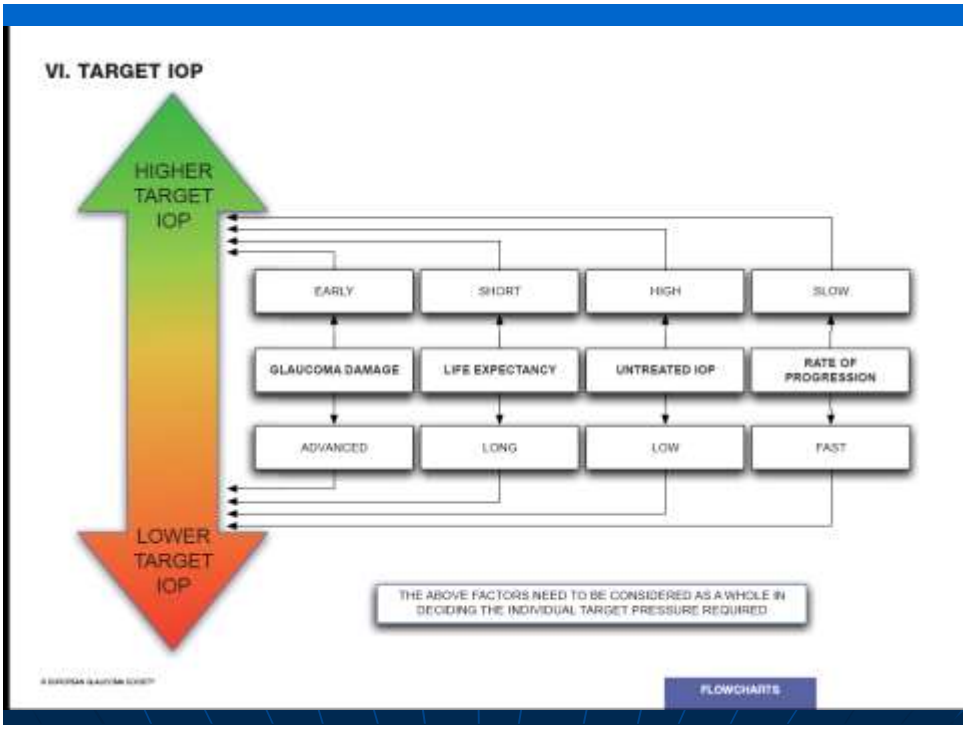
3 →VF loss threatening or involving fixation

Ref: Bull Soc. Belge Ophthalmol 274, 61-65, 1999

HOW TO CALCULATE TARGET IOP

An eye with a maximum IOP of 30 mmHg, optic nerve damage and visual field loss not threatening fixation would have a target set at 19 mmHg (30-30%-2)

Bull. Soc. Belge Ophthalmol 274, 61-65, 1999



THANK YOU
FOR YOUR TIME