Managing Acute Highly Elevated IOP

The Pressure is On: Managing Acute Highly-Elevated IOP
Lorne Yudcovitch, O.D., M.S., F.A.A.O.

Disclosure Statement: Nothing to disclose

Please silence all mobile devices. Unauthorized recording of this session is prohibited.

Main Causes of Highly-Elevated Intraocular Pressure (IOP)
- Angle Closure
- Angle Recession/Trauma/Chemical
- Pigmentary Glaucoma
- Pseudoexfoliative Glaucoma
- Uveitic
- Congenital/Syndrome
- Neovascular
- Malignant Glaucoma
- Posner-Schlossman Syndrome
- Other

Urgent versus Emergent IOP
- ‘Normal’: 10-21mmHg
- Ocular hypertension: 23-29mmHg
- Urgent: 30-39mmHg
  – Management within the next few days
- Emergent: 40mmHg and above
  – Management within the next few hours

Angle Closure
- Primary
  – Narrow/closed anatomical angles
  – 2.7% from Plateau Iris Syndrome*
- Secondary
  – Iris bombe from pupillary block; aq. misdirection
  – Peripheral anterior synechiae from uveitis, ALT
  – Neovascular membrane from rubeosis iridis
  – Iridocorneal endothelial (ICE) syndromes
  – Phacomorphic (lens shape/position) changes
  – Topamax (topiramate), sulfonamides, antihistamines
  – Tumors, choroidal detachment, ocular surgeries

*Bascom Palmer Eye Institute, 2009

Anterior OCT/UBM Advantage
Helps determine narrow angle/angle closure etiology

Angle Closure Sub-Types
- Acute
  – More symptoms usually (halo, glare, nausea)
- Sub-Acute
  – May not have symptoms or mild symptoms
- Chronic
  – Usually no symptoms noted or very rare

*Fellow eye can have same or other subtype
Managing Acute Highly Elevated IOP

Angle Closure and Dilation
- Prevalence: traditionally 1:20,000
- Likely much more often than this
- Patients may not be aware it is occurring
- Most likely time of angle closure: 90 minutes post-dilation drop instillation
- Von-Harek is first identification
- Gonio/OCT/UBM confirms anatomy
- Provocative test: dilate and wait for IOP incr.

Important Point:
- For any of the prior causes of highly elevated IOP, intraocular pressure can be normal at some times, then dangerously high at other times.
- The main glaucoma examples of this are:
  1. Angle closure
  2. Pseudoexfoliation
  3. Pigmentary

Case History
- Onset/frequency/duration
- Severity/associated symptoms
- Ocular surgeries/trauma
- Systemic conditions
- Medications taken

Pupillary Response
- Sluggish response
  - Elevated IOP
  - “Boggy” iris (i.e. uveitis)
- No response
  - Highly elevated IOP
  - Mechanical restriction (i.e. posterior synechiae)
- Photophobia/consensual pain

Biomicroscopy
- Limbal injection
- Corneal edema
- Pigment dusting/iris transillumination
- Pseudoexfoliation/pupillary ruff atrophy
- Synechiae/pupillary block/corectopia
- Cells and/or flare
- Lens opacification
- Vitreous haze/hemorrhage
- Optic nerve appearance

Tonometry
- Goldmann vs NCT
- Repeated
Managing Acute Highly Elevated IOP

Gonioscopy
- Open angle/narrow angle/closed angle
- Plateau iris/iris approach
- Angle recession/anatomical anomalies
- Pigment dusting
- Pseudoexfoliation
- Anterior synechiae
- Rubeosis
- Other

With IOPs above 40mmHg:
- The iris sphincter muscle is fixed
  - Look at pupils closely – reaction to light
- Anterior segment changes may be seen
  - Limbal flush, corneal edema, conjunctivitis
- Optic nerve damage is rapid
  - Look for asymmetry of cupping between eyes
- Vision loss can occur within hours
  - Especially visual field loss
- This vision loss is usually permanent

Informed Consent
- Educate patient on seriousness and urgency of condition
- Explain prognosis and treatment including treatment risks
- Rule-out: respiratory/circulatory/endocrine/hematological contraindications
- Question patient re: med allergies (eg. sulfa)
- Evaluate blood pressure/pulse

Step 1: Initiate Oral Treatment First

• Allows systemic/ocular absorption while patient in the office
• Can monitor for any systemic reaction while patient in the office

Oral Carbonic Anhydrase Inhibitors
- acetazolmaide (Diamox)
- methazolamide (Neptazane)
  - Consider methazolamide 50mg PO as ‘safer’ option (less pH imbalances)
- dichlorphenamide (Daranide)
  - Withdrawn by Merck from US market in 2002
  - Not withdrawn for safety or efficacy reasons

acetazolamide (Diamox)
- Carbonic anhydrase inhibitor
- Indicated for acute glaucoma attacks
- Also indicated for pseudotumor cerebri
- 125, 250, and 500mg (Sequels)
- Peak effect within 2 hrs; duration over 6 hrs
Acetazolamide and Sulfa Allergies:

- "Acetazolamide...is a nonbacterial sulfonamide with a chemical structure and pharmacological activity that is different from the sulfonamide antibiotics." — Lee, A. G., et al. "Presumed 'Sulfa-allergy' in Patients with Intracranial Hypertension Treated with Acetazolamide or Furosemide: Cross-reactivity, Myth or Reality?" AJO, July 2004

- "...although there is an association between hypersensitivity after receipt of sulfonamide antibiotics and a subsequent reaction after the receipt of a sulfonamide nonantibiotic, the association appears to be due to a predisposition to allergic reactions rather than to cross-reactivity with sulfonamide drugs." — Shan, B., et al. "Absence of Cross-reactivity Between Sulfonamide Antibiotics and Sulfonamide Nonantibiotics." English Journal of Medicine, 2003; 349: 1635-1638.

- "In treating patients with acute angle closure glaucoma...We are now more comfortable with the notion of using any of the CAIs in patient giving a "soft" history of sulfa-allergy." — Ron Melton, OD, FAAO Randall Thomas, OD, MPH, FAAO "A Fresh Look at Sulfa Allergy" 2004


Hyperosmotic Agents

- Used on temporary, short-term basis to rapidly reduce body fluids
- Can be used to rapidly reduce very high IOP
- Cause hyperosmolar blood stream → causes water to be drawn from surrounding tissues into bloodstream → diuretic effect
- Creates sensation of thirst
- Efficacy lost, however, if patient is allowed to drink water

Hyperosmotic Agents

4 main drugs:
- Glycerol 50% (Osmogly) 1-1.5g/kg
- Isosorbide 45% (Ismotic) 1.5-2g/kg
- Mannitol 20% (I.V.) 2.5-10g/kg
- Urea 30% (I.V.), 50% (P.O.) 0.5-2g/kg

Biggest risks: congestive heart failure, subdural hematoma (esp. in elderly patients)

Glycerol (Osmogly, Glyrol)

- Available in 50%, 75% solutions
- "Orange" flavor
- Maximal IOP lowering at 1 hour
- This agent metabolizes into glucose – Beware using in patients with diabetes!
- Awful taste/texture – patient may vomit
- Serve over cracked ice (more palatable)
- Do not allow fluids till 2 hours later
### Hyperosmotic Agents

**Isosorbide (Ismotic, Iso-Bid)**
- 45% solution
- "Vanilla mint" flavor
- NOT metabolized into glucose
  - Safer for use in patients with diabetes
- Generally easier to keep down than glycerol
- Currently difficult to find in the U.S.

**Mannitol (Osmitrol)**
- Intravenous (I.V.) 5-25% solution
- Is NOT metabolized; electrolyte imbalance
- Causes significant fluid build-up in blood
  - Do NOT use in congestive heart failure patients or if severe kidney disease!
  - If patient doesn’t urinate within 30 min, d/c!
  - 250mL infused within 20-30 min appropriate
  - Do not run I.V. drip more than 45 minutes

**Urea**
- Intravenous (I.V.) 30% solution
- Similar contraindications to mannitol
- More severe side effects than mannitol
- Not utilized regularly
- Toxicity risk

### Anti-Emesis Drug
**prochlorperazine (Compazine)**
- A phenothiazine (neuroleptic) drug
- Potent antidopaminergic (especially in chemoreceptive trigger zone), weak antihistamine, anticholinergic
- 25mg suppository typically
- Reduces nausea within 1 hour

### Step 2: Initiate Topical Treatment Next
- Allows proper drop instillation while patient in the office
- Can monitor for any ophthalmic/systemic reaction while patient in the office

### Aqueous suppressants
- Beta-blocker
- Carbonic anhydrase inhibitor
- Alpha-2 agonist (partial mechanism)
## Managing Acute Highly Elevated IOP

### Beta-blockers

- **Noncardioselective**
  - Timolol 0.25, 0.5%
  - Carteolol 1% (Ocupress)
  - Levobunolol 0.25, 0.5%
  - Metipranolol 0.3%
- **Cardioselective**
  - Betoptic (betaxolol 0.25%) – safer, less sting (susp)
- **Mechanism** – decreases aqueous production
- **Many side effects** – ocular and systemic

### Beta-blockers

- **About 25% IOP reduction**
  - When used conventionally
- **Gel form**
  - Timoptic XE gel, generic GFS
- **Preservative free form**
  - Timoptic Ocudose 0.25%, 0.5%

### Carbonic anhydrase inhibitors

- **About 20% IOP reduction**
  - When used conventionally
- **Topical CAIs**
  - dorzolamide (Trusopt 2%, generics)
  - brinzolamide (Azopt 1% suspension)

### Topical CAIs

- **Mechanism** - decreases aqueous production
- **Careful if corneal compromise**
  - endothelial toxicity with CAIs
- **Azopt can still sting even though suspension**
- **Sulfa-based drugs**
- **No significant systemic risks** (when compared to oral CAIs)

### Alpha-2 agonists

- **About 20% IOP reduction**
  - When used conventionally
- **apraclonidine (Iopidine)**
  - 0.5% solution
- **brimonidine (Alphagan P, generics)**
  - 0.1%, 0.15%, 0.2% solutions
- **‘Dual mechanism’**: Reduced aqueous production
  - Increased aqueous outflow
- **‘Neuroprotective’ potential**

---

**References**

Combination medications

- About 20-35% IOP reduction
  - When used conventionally
- Cosopt
  - timolol 0.5% + dorzolamide 2%
  - Preservative free, generic available
- Combigan
  - timolol 0.5% + brimonidine 0.2%
- KrytanTek
  - timolol 0.5% + dorzolamide 2% + brimonidine 0.2%
  - Latin America

Simbrinza

- Alcon Pharmaceuticals
- FDA approved 4/2013
- brinzolamide 1% + brimonidine 0.2%
- igt TID dosage (conventionally)
- Two phase 3 clinical trials ~1300 pts, 3 months
  - Decreased IOP 5 to 9 mmHg from baseline
  - 3-5%: blur, eye irritation, dysgeusia (bad taste), dry mouth, eye allergy; no heart/lung ADRs
  - Safety profile comparable to single drugs

Drop instillation

- This is done every 15 minutes
  - So you need to stay another hour
- Wait at least 2-3 minutes before instilling a different drop
- Important point: make sure to PUNCTAL OCCLUDE for at least 1 min each time
  - Prevents systemic reactions; improves effectiveness
- Safest choices: Betoptic S, Azopt, Alphagan P

It’s now 5:45 PM, and your patient’s IOP is now lowered to 32 OD, 39 OS

- OK to use topical Pilo now if angle closure pt
- 1 drop of 1% or 2% pilo
  - Higher percentages run risk of pupillary block; thymoxamine 0.5% option
- Can add second drop after 15 min
- HOWEVER: Not recommended for inflammatory (i.e. uveitic) glaucoma
  - Increases blood-aqueous barrier
  - Greater pupillary block risk with ‘sticky’ iris

Cholinergic agonists

- About 15-20% IOP reduction
  - When used conventionally
- pilocarpine (Pilo, Pilostat)
  - 0.5% to 8% concentrations
  - Solution and ointment forms
- carbachol (Isopto-Carbachol)
  - 1.5% concentration

Cholinergic agonists

Several ocular side-effects:

- Miosis
- Accommodation
- Retinal tears/breaks/RD risk
- Headaches/browaches
- Pupillary block risk
- Exacerbates iris
- Irritation
PEARL: Carry-with bottle for post-surgical narrow angle patients

• Indicated for angle-closure attack treatment in-office
• Can be Rxed for emergency at-home use
  – Pt must recognize angle attack
• First refer for PI/cataract surgery/trab/etc.
  – Rx cholinergic agonist if still risk of attack

Adjunct Topical Treatment Options

Topical Hyperosmotics

• Useful for epithelial edema situations
  – angle closure
  – bullous keratopathy
  – Fuchs endothelial dystrophy
• Painful upon instillation
• May facilitate view within minutes

Adjunct Topical Treatment Options

• Topical glycerin (glycerol)
  – Ophthalgan (glycerin 50%) (Wyeth-Ayerst)
• Topical sodium chloride
  – Muro-128 2% & 5% solns, 5% ung (B &L)
  – AK-NaCl 5% ung (Akorn)
  – Adsorbonac 2% & 5% solns (Alcon)
• Topical glucose
  – Glucose-40 (glucose 40%) (Ciba)

Prostaglandin analogues?

• Question of effectiveness in acute IOP spike
• May counteract/not work with pilocarpine
  – Some question whether this is true
• Less effective with multiple doses
• Avoid in inflammatory glaucomas (i.e. uveitic)

Step 3: Initiate Repeated IOP Monitoring and Gonioscopy

• Allows continual evaluation of treatment efficacy
• Permits both diagnostic and therapeutic application

Step 3: Repeated IOP and Gonio

• IOPs
  – Monitor q15-30 min
• Gonioscopy
• 2 functions:
  – Allows view of angles
  – Used for corneal compressions
• Posner or Sussman lens
  – 30 seconds on-30 seconds off
Glaucoma Emergency Caution:
Do NOT press on the cornea (i.e. gonioscopy, corneal compressions) in cases of:
- Penetrating trauma glaucoma
  - Risk of avulsion if perforation/laceration
- Infectious glaucoma
  - i.e. herpetic-induced trabeculitis glaucoma
- Compromised cornea
  - i.e. Sjogren’s syndrome, Fuchs dystrophy, EBMD

Biomechanical Treatments
- Corneal compressions
  - Rule-out perforating injury/surgery first
- Light-induced pupillary constriction
  - Full BIO light on pupil; questionable benefit
- Prone positioning
  - Subluxed lens in AC; full dilation required
- Anterior chamber paracentesis
  - Needle aspiration or ‘burping’ surgical wound

After your oral, topical, and mechanical treatment, the IOPs are now 26 and 29 at 6:20 PM
- Rx t/g CAI and alpha-agonist for:
  - when gets home
  - before bed
  - The next morning
- If angle closure/narrow angles:
  - Refer to glaucoma specialist for PI within 24 hrs
  - Both eyes should usually have PI
  - Long-term glaucoma management afterwards

Your patient returns the next morning, and the IOPs are 12 and 14
Perform:
- Threshold visual fields
- Retinal nerve fiber analysis and/or stereo fundus photos
- Gonioscopy/pachymetry (optional)
- Anterior segment OCT/UBM (optional)
Refer:
- To glaucoma specialist

Steroid Use with Elevated IOP
Steroids are well known to increase IOP
With inflammatory-based (i.e. uveitic) glaucoma, steroids may help decrease IOP:
- Reduce trabecular meshwork inflammation, increasing outflow
- Reduce ciliary body inflammation, decreasing aqueous production
- Reduce iris inflammation, preventing posterior and anterior synechiae formation

Steroid Use with Elevated IOP
- prednisolone acetate 1% (Pred Forte)
  - strongest effect, but high IOP elevation risk
- lotoprednol 0.5% (Lotemax)
  - least likely to elevate IOP with very good anti-inflammatory effect
- difluprednate 0.05% (Durezol)
  - Equal effect to PF with only half the dosage
  - IOP elevation effect quite significant
- MUST use steroids with glaucoma meds
Managing Acute Highly Elevated IOP

Other tertiary care considerations:
- Following PI, make sure that the laser hole/blade incision remains patent
  - Retro-illuminate (not as good)
  - Evaluate with gonioscopy/OCT
- Cataract surgery may help deepen the anterior chamber in patients with narrow angle
- AC paracentesis may be needed if:
  - Unable to reduce IOP below 40
  - Highly symptomatic (nauseous) patient
  - Hyphema

Side note…what about really low pressures?
- i.e. – IOP less than 5 mmHg
- Review history (injury, surgery)
- Check for wound leak (Seidel’s sign)
- Dilated fundus exam
- Fully cycloplege
- Initiate prednisolone 1% igt q1hour
- Refer to retinal specialist for evaluation

Good Management Tips:
1. NEVER LET PATIENT LEAVE WITH HIGH IOP
2. ORAL MED TREATMENT FIRST, THEN TOPICAL
3. MONITOR IOPS EVERY 15-20 MIN. DURING Tx
4. FOLLOW DAILY TILL IOPS AT OPTIMAL LEVEL
5. BASELINE RNFL/VF AS SOON AS POSSIBLE
6. PI WITHIN 24 HRS IF NARROW ANGLE
7. WATCH FOR SECONDARY FINDINGS
8. WATCH CONTRAINDICATIONS TO Tx
9. COMMUNICATE W/ PT’S HEALTH PROVIDERS
10. EDUCATE PATIENT: CAN LOSE SIGHT IN HRS!

Primary Angle Closure Glaucoma Management

<table>
<thead>
<tr>
<th>Primary ACG suspect (new)</th>
<th>Primary ACG suspect (established)</th>
<th>Primary ACG acute attack</th>
<th>Primary ACG acute attack (following LPI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine every 3-4 months for 1 year</td>
<td>Examine every 6-12 months</td>
<td>Examine 24-48 hours after PI performed, if PI performed; after PI, 7 days, 1 month, 3 months</td>
<td>Examine every 6 months for 1 year, then annually</td>
</tr>
<tr>
<td>Tonometry each visit</td>
<td>Tonometry each visit</td>
<td>Tonometry each visit</td>
<td>Tonometry each visit</td>
</tr>
<tr>
<td>Gonioscopy each visit</td>
<td>Gonioscopy each visit</td>
<td>Gonioscopy each visit</td>
<td>Gonioscopy each visit</td>
</tr>
<tr>
<td>Slit lamp each visit</td>
<td>Slit lamp each visit</td>
<td>Slit lamp each visit</td>
<td>Slit lamp each visit</td>
</tr>
<tr>
<td>Side with stereoscopic evaluation, baseline photos and/or retinal nerve fiber layer (RNFL) analysis and OCT option</td>
<td>Side with stereoscopic evaluation every visit; repeat photos/RNFL analysis every 2-3 years; ret, OCT/UBM option</td>
<td>Side with stereoscopic evaluation every visit; repeat photos/RNFL analysis every 2-3 years; ret, OCT/UBM option</td>
<td>Side with stereoscopic evaluation every visit; repeat photos/RNFL analysis every 2-3 years; ret, OCT/UBM option</td>
</tr>
<tr>
<td>Discus signs and symptoms of attack and risks/benefits of PI</td>
<td>Review signs and symptoms of attack</td>
<td>Break attack medically; insufficient refer for PI</td>
<td>Review signs and symptoms of attack; refer if PI not patent</td>
</tr>
</tbody>
</table>