Gonioscopy: Covering All Angles

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Why Perform Gonioscopy?

• Diagnosis
  ♦ Glaucoma type
  ♦ Peripheral tumors
  ♦ Cysts
  ♦ Foreign bodies
  ♦ Inflammatory conditions

• Drug treatment decisions
Kresge Eye Institute

• The most underutilized test by ophthalmology residents was gonioscopy

Poster, AAO, Las Vegas, November 2006
Any Alternatives?

1. Chamber depth with slit lamp
2. Fancy and much more expensive new instruments
   - Perhaps some day, when we can bill for it, instruments like the Visante OCT or Pentacam will be screening tests done on everyone
   - If suspicious, gonioscopy can then be performed
• Glaucoma Imaging and Evaluation
  – Differential diagnosis open versus narrow angle
  – Narrow angle differential diagnosis
  – Filtering bleb / trabeculectomy patency assessment
  – Drainage device imaging
History of Gonioscopy
Gonioscopy Timeline

1899: Trantas performs 1st gonioscopic exam
1907: Trantas’ 1st publication of gonioscopic observations
1918: Trantas coins term “gonioscopy”
1919: Koeppel lens developed
1925: Troncoso self-illuminating gonioscope
1927: Thorburn is 1st to photograph angle
1938: Goldmann mirrored contact lens
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1947: Troncoso’s classic book on gonioscopy published
1954: Gonioprism invented

1899 1910 1920 1930 1940 2003
1905 1915 1925 1935 1950
Gonioscopy
Pioneers

• Alexio Trantas (1867-1961)
• Maximilian Saltzmann (1862-1954)
• Koeppe
• Manuel Uribe Troncoso (1868-1969)
• Thorburn
• Otto Barkan (1887-1958)
• Goldmann
Gonioscopy
Pioneers

- Alexio Trantas, Greek ophthalmologist (1867-1961)
- Coined the term “gonioscopy”
- Reported his observations of the angle using direct ophthalmoscope with and without indentation of the sclera with his finger (1899-1907)
- Published detailed drawings of the angle (1918)
Gonioscopy

Pioneers

- Maximilian Saltzmann, Viennese ophthalmologist (1862-1954)
- Recognized that total internal reflection prevented observation of the normal angle
- First to observe the angle through a contact lens (1915)
- Hand-painted his own illustrations for scientific papers describing normal and abnormal angles
Gonioscopy Pioneers

- Leonard Koepppe (1884-1969)
- Evaluated the nasal and temporal segments of the angle with a Zeiss slit lamp while patient was seated (1919)
- Calculated best characteristics for a contact lens mathematically
  - Thicker and more convex than Salzmann lenses
Gonioscopy Pioneers

• Manuel Uribe Troncoso, Mexican ophthalmologist (1868-1969)
• Invented self-illuminating monocular gonioscope to observe all parts of the angle (1925)
• Wrote first comprehensive book on gonioscopy (1947)
Gonioscopy Pioneers

- T. Thorburn, Swedish ophthalmologist
- First to photograph the angle (1927)
- First to observe that most glaucoma patients had open angles
Gonioscopy Pioneers

- Otto Barkan, American ophthalmologist, (1887-1958)
- Coined the term “open-angle glaucoma”
- Suspended slitlamp from ceiling to examine angle with hand-held illuminator and Koeppe lens
  - Achieved 40X magnification
- Extensive anatomical analyses of eyes supplied by surgeons at Folsom and San Quentin prisons to identify and correlate surgical, histological, and gonioscopic landmarks
- Invented surgical procedures and instrumentation
Gonioscopy Pioneers

• Hans Goldmann, Swiss ophthalmologist (1899-1991)

• Prolific inventor:
  – Applanation tonometer
  – Perimeter
  – Contact lens
  – 3-mirror gonioscopy lens
Gonioscopy Pioneers

• Carl Zeiss (1816-1888)
  – 1846: started manufacture of lenses, microscopes, and field glasses in Jena, Germany

• Posner invented a 4 mirror goniolens for indentation gonioscopy
  – Gorin G, Posner A. 1957 Slit Lamp Gonioscopy

• Sussman invented a 4 mirror goniolens for indentation gonioscopy
Gonioscopy Pioneers

- **Gonioscopy and the Glaucomas**

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Fundamentals of Gonioscopy
Anatomy of Aqueous Production/ Drainage
Total Internal Reflection

- Angle cannot be viewed with external light source alone because of total internal reflection
  - Curvature of cornea
  - Index of refraction for air is different than for optical tissue
- Contact lens needed to eliminate the air to cornea interface
Anatomic Structures Visible Using Gonioscopy

- Schwalbe’s Line
- Trabecular meshwork
  - Pigmented
  - Non-pigmented
- Scleral spur
- Ciliary body band
- Peripheral iris
- Pupil border
- Blood vessels
Gonioscopic Lenses
Gonioscopic Lenses
Koepppe Lens (Direct Method)
Gonioscopic Lenses: Goldmann Lens (Indirect Method)
Gonioscopic Lenses
Zeiss Lens (Indirect Method)
Gonioscopic Lenses: Posner (Indirect Method)
Gonioscopic Lenses
Sussman (Indirect Method)
Gonioscopic Technique
Gonioscopic Technique
If Unable to Perform Gonioscopy

• Flashlight test
  – Shine a narrow-beam light across the eye, parallel to plane of iris at the limbus
If Unable to Perform Gonioscopy

– Estimation of angle using slit-lamp
  • Van Herick method
Gonioscopic Technique
Goldmann Lens

- Anesthesia
- Coupling agent (methylcellulose gel) with same refractive index as cornea needed because curvature of lens is steeper than that of cornea
• Lens rotation: start at 12 o’clock to view inferior angle; move mirror clockwise

• Eye gaze direction – toward viewing mirror to see deeper into angle
Gonioscopic Technique
Goldmann Lens

- **Pros**
  - Magnification 16X to 20X depending on power of microscope used
  - Easier visualization of angle in narrow-angled eyes than with Zeiss lens
  - Easier to control for beginning clinician

- **Cons**
  - Unable to perform indentation gonioscopy
  - Slower to perform
  - Gel causes blurry vision therefore perimetry, ophthalmoscopy, disc photography can’t be performed after gonioscopy
Gonioscopic Technique
Zeiss/Posner/Sussman Lens

• Anesthesia
• No coupling agent
• Lens stays stationary
• Move slit lamp to view all areas
• Eye gaze direction - toward viewing mirror to see deeper into angle
Gonioscopic Technique
Zeiss/Posner/Sussman Lens

• Pros
  – Done with topical proparacaine following T applanation
  – Handle makes placement easier
  – Magnification 16X to 20X depending on power of microscope used
  – Can perform indentation gonioscopy

• Cons
  – Possible to push lens too hard against cornea
  – May artificially deepen angle
  – Folds in descemet’s
Gonioscopic Technique
Koepppe Lens

- Anesthesia
- Coupling agent: saline
- Move around patient to view all areas
Gonioscopic Technique
Koeppe Lens

• Pros
  – Adequate to diagnose angle closure when used with Barkan illuminator
  – Magnification 24X depending on power of microscope used
  – Useful to diagnose possible occlusion of angle
  – Enables simultaneous comparison of all parts of angle

• Cons
  – Difficult to learn
  – Not used often in United States
  – Lens may need to be held by an assistant to avoid bubbles
  – Patient must lie supine
  – Angles tend to look wider than they really are
  – Patients nose may interfere with visualization of upper temporal angle
Angle Classification Systems
Angle Classification Systems

- Scheie
  - Based on extent of angle structures visualized
  - Wide open (Grade I) to occluded (Grade 4) [reverse of current grading systems]

- Shaffer
  - Based on angular width of recess
  - Grade 0 (partly/totally closed) to grade 4 (30-45°)

- Spaeth
  - Based on angular approach to recess, configuration of peripheral iris, insertion of iris root
  - A (anterior to Schwalbe’s line) through E (extremely deep); grades A & B are always pathological
Recording Your Findings

- Grading system IV, III, II, I, slit, closed
- Grid drawing
- Label each quadrant numerically or with description of structures seen (ie CBB, or 2+ PTM)
Gonioscopy Guidelines

• Baseline gonioscopic exam for every
  – New glaucoma suspect
  – Already diagnosed glaucoma patient
  – Pt with family history of glaucoma
  – Pt with shallow chambers
  – Pt with history of transient pain, blurred vision
• Repeat if neovascularization or sudden change in pressure
• Repeat yearly:
  – Post-iridotomy
  – If angle is narrow
• Repeat yearly:
  – Open angle (COAG) patients
  – Hyperopes older than 40 years
Billing

- Code 92020
- Use a 92 or 99 code (E/M) exam code along with separate gonio charge
- Reimbursed in the $32 to $40 range
Gonioscopy: Just Do It!

• Your insurance policy that you will never dilate a dangerous angle
• Gain confidence by doing it on one patient a day!
Case in Point

• 62 yo WM with history of “borderline IOP”
• Seen by OD for first time, noted “shallow chambers” and IOP 21/21
• Patient noted one episode of severe pain a year ago, and second episode 1 week prior to seeing OD
• Our exam: IOP 22/22
• VA 20/25 with early SMD, cats
• VF normal
• Discs as shown
Question:

• This patient most likely has:
  1. Low tension glaucoma
  2. Acute narrow angle glaucoma
  3. Sub-acute narrow angle attacks
  4. Chronic narrow angle glaucoma
  5. Unexplained eye pain
Question:

• Given the clinical picture now, your most likely treatment of choice *initially* would be:
  1. Alphagan
  2. Xalatan
  3. Refer for laser PI’s
  4. Refer for trabeculectomy
Case 2

• Diagnosis: SubAcute Angle Closure
• Tipoff: pain, but most importantly the view of the angles with gonioscopy
• Treatment: bilateral PI’s, IOP now 14 with open angles
Related Case:

- 65 WM
- Sent to Omni for PI’s due to narrow angles
- +1.50 hyperope
- IOP 14
- No complaints
Pearl:

• Do gonioscopy!
• Saves the patient time and money and worry
• Increases your confidence AND the bottom line!
Pigment Dispersion Syndrome

- 20 to 45 yo; M>F
- Deep anterior chambers
- Mid-peripheral TI defects
- Krukenberg spindle
- 50% risk of associated glaucoma
Exfoliation Syndrome

- Prevalence increases with age
- Accounts for 20-25% of OAG worldwide
- Scandinavian descent
- Often presents unilaterally then becomes bilateral
- 20 to 60% risk of associated glaucoma
- Glaucoma tends to be refractory to medical therapy
Narrow (or Crowded) Angle

- Hyperopia or rarely myopia
- Family history of angle closure episodes
- Can progress with age as lens thickens
- Need for peripheral iridectomy (PI) sooner rather than later
- Can be done with Argon or YAG
Chronic Angle Closure (Indentation Gonioscopy)

- Shallow anterior chamber
- Convex iris
- Progressive synechiae formation
- IOP rise is proportional to amount of angle obstruction (Goldmann equation)
Plateau Iris

- Anterior chamber is usually deeper centrally than those in narrow angle
- Anteriorly displaced ciliary processes place the iris base close to the angle
- Initial treatment is to rule out narrow angles with a PI
- Relatively rare
Angle Recession

- Typically post trauma and associated with >50% of traumatic hyphema
- Risk of glaucoma is proportional to the extent of angle involvement
- Bimodal distribution of glaucoma prevalence
- Tear between the circular and longitudinal muscles of the ciliary body
- Widened ciliary body band
Rubeosis

- Conditions causing retinal ischemia release angiogenic factors
- Fibrovascular membrane impairs trabecular outflow
- PAS eventually develop as the membrane contracts
- Treatment is usually surgical
Iris Melanoma
Synechiae
Iris Processes
Iris Cysts
Iris Cysts
Ciliary Body Cyst
Gonioscopy

- A valuable tool that we should be doing on many of our patients every day!