Work-up of the Cataract Patient

2009 Ophthalmology Symposium
July 18, 2009

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Course Objectives

- Describe the normal anatomy and physiology of the crystalline lens
- Distinguish types of congenital and acquired cataracts
- Identify appropriate patient screening and testing methods to assist the surgeon in obtaining optimal cataract surgery results
- Describe the proper techniques necessary to ensure the most accurate visual acuity and functional vision testing for patients considering cataract surgery

Epidemiology

- By 2020, 800 million people will be age 60 or over
- Age-related cataract is responsible for 48% of world blindness (18 million people according to WHO)
- In some developing countries, cataracts are still the leading cause of blindness and low vision
- In US, cataracts are 3rd leading cause of legal blindness
  - 42% ages 62-64, 60% ages 65-74, and 91% over age 75
- Cataract surgery is the most frequently performed operation in US among persons age 65 or older
- Approximately 10 million CEIs are performed each year in the world, with rates varying from 100-6000 operations per million population
Cataract Risk Factors

- Age
- Genetics
- Diseases such as diabetes, atopic/allergic conditions
- Trauma
- Personal behavior like smoking/heavy alcohol use
- Environmental- sunlight and other types of radiation exposure
- Preventative measures
  - UV protecting sunglasses and wide brimmed hats
  - Stop smoking
  - Good nutrition
    - Green leafy vegetables
    - Fruit
    - Antioxidants (vitamins A, C, E)
    - Lutein, zeaxanthin, bilberry
  - Research
    - Statins, acetylecarnosine gts.

Review of Ocular Anatomy

Ocular Anatomy Review

The Posterior Segment

The Anterior Segment

- Iris
- Ciliary body
- Choroid
- Retina
- Optic nerve
Normal Crystalline Lens Anatomy

- Transparent, biconvex structure
- Functions:
  - Maintain its own clarity
  - Refract light (15-20 D)
  - Permit accommodation
- No blood supply or innervation after fetal development
- Depends on aqueous humor to meet its metabolic requirements/remove wastes
- Suspended by zonules of Zinn
- Composed of:
  - Capsule
  - Lens epithelium
  - Cortex
  - Nucleus
- Divided into anterior and posterior poles

Lens Anatomy, cont.

Types of Cataracts

- No standard definition
- Immature, mature, hypermature
- Traditionally categorized by location (anterior/posterior)
  - Nuclear (NS) (myopic shift)
  - Brunescence
  - Cortical (glare from car headlight, monocular diplopia)
  - Subcapsular (PSC) (glare, poor near VA under bright lights)
- Graded from trace to 4+
- After cataract posterior capsular opacification (PCO)

- Congenital and Infantile
  - Polar
  - Sutural
  - Coronary
  - Cerulean
  - Nuclear
  - Capsular
  - Lamellar
  - Complete
  - Membranous
  - Rubella
Causes of Cataracts (Etiology)

- Age-related (nuclear, cortical, posterior subcapsular)
- Congenital and infantile (occur in ~1/2000 live births, uni- or bi-lateral)
- Traumatic (blunt injury, perforating injury, chemical injuries, intralenticular foreign bodies, electrical shock, dislocation or subluxation)
- Metabolic (diabetes mellitus, galactosemia, hypocalcemia, Wilson disease, sarcoidosis)
- Diabetic (with or without diabetes mellitus, hypocalcemia, sarcoidosis)
- Drug-induced (corticosteroids, phenothiazines, miotics, amiodarone)
- Radiation (ionizing, infrared, UV)
- Secondary to ocular disorders (glaucoma, detached retina, vitreous hemorrhage)
- Alcoholic

Evaluation of the Cataract Patient

- Does the lens opacity correspond with the degree of visual impairment?
- Does the patient's reduced ability to function warrant surgery?
- Is the eye sufficiently healthy to expect improved visual function if surgery is performed without complications?
- Is the lens opacity secondary to systemic or ocular condition?
- Is the patient or some other responsible person capable of participating in post-operative care?

Ophthalmic and Medical History

- Chief complaint
- History of present illness
- Ocular history (present to past)
- Medical history (present to past)
- Allergies
- Family ocular and medical history
Chief Complaint

- Driving ability (20/40)
- Read fine print
- Perform job
- Enjoy recreational activities
  - Television
  - Play golf/cards
- Recommended by MD to evaluate retina for AMD, DR

Chief Complaint: Signs and Symptoms

- Decreased visual acuity
- Glare
- Color desaturation
- Contrast sensitivity
- Myopic shift
- Monocular diplopia
- Loss of stereopsis
- Diminished peripheral vision
- Symptomatic anisometropia

Ocular History, cont.

- History of present illness
  - Status, onset, presence, progression, severity, treatment
- Glasses/contact lens hx
- Trauma
- Inflammation
- Amblyopia
- Glaucoma
- Optic nerve abnormalities
- Retinal disease

- Past records
  - VA prior to cataract
  - Cataract surgery in fellow eye
  - Operative/post-operative complications: elevated IOP, vitreous loss, CME, endophthalmitis, hemorrhage
  - Refractive surgery
Medical History
- Ophthalmic surgeon works closely with PCP-optimal management of all conditions
  - Diabetes mellitus
  - Ischemic heart disease
  - COPD
  - Bleeding disorders
  - Musculoskeletal disorders that prevent hyperextension of neck
  - Anticoagulants/immunosuppressants
  - Medication allergies/latex sensitivities/iodine hypersensitivity
- Social History
  - Important for documenting pts. subjective visual disability
  - Occupation
  - Lifestyle
  - Possible chemical dependencies
- Planning Postoperative care
  - Ability to administer eyedrops
  - Good ocular and general hygiene
  - Assess ability to function monocularly
  - Family or other support system

Family Ocular and Medical History
- Common familial ocular disorders
  - Myopia
  - Strabismus
  - Glaucoma
  - Macular degeneration
  - Color blindness
  - Retinitis pigmentosa
  - Keratoconus
- Common familial medical disorders
  - Diabetes
  - Cardiovascular disease
  - Sickle cell anemia
  - Migraine
  - Marfan’s syndrome

Non-Surgical/Medical Management
- Careful refraction
- Increased lighting/increased spectacle add
- Low-vision aids
- Absorptive lenses
- Pupillary dilation
- Under investigation:
  - Sorbitol-lowering agents
  - Aspirin
  - Antioxidant vitamins C, E
Indications for Cataract Surgery

- Reduced visual function interferes substantially with desired activities
- Medical indications:
  - Phacolytic glaucoma
  - Dislocated lens
  - Dense cataract that obscures view of fundus impedes dx of ocular diseases: DR, glaucoma

Surgical Options

- Intracapsular cataract extraction (ICCE)
- Extracapsular cataract extraction with nuclear expression
- Phacoemulsification
- Pars plana lensectomy
- IOL options
  - Monofocal (spheric/toric)
  - Multifocal (ReStor, ReZoom)
  - Accommodating (Crystalens)

Cataract Surgery after LASIK

- Post-LASIK dry eye
- Quality vision
  - Irregular astigmatism
  - Decentered ablation
  - Contrast sensitivity loss
- IOL power calculation
- Special considerations
  - Post-LASIK ectasia
  - Retinal detachment
  - Flap healing
  - Lens selection
  - LASIK enhancement after cataract surgery
Visual Function Assessment

- Visual Acuity
  - Distance acuity
  - Pinhole acuity
  - Near acuity
  - Careful refraction-manifest and cycloplegic
- Brightness Acuity/Glare Test
- Contrast Sensitivity
- Potential Acuity Estimation
- Visual Field Testing

Visual Acuity Assessment

- 20/40 (legal driving)
- More than how well patient sees in daylight
  - Artificial lighting
  - Night vision
  - Fluctuating throughout day/day-to-day
- Distance and Near
- Uncorrected
- Current correction
  - Manifest refraction
  - Cycloplegic refraction
- Ocular Dominance

Refractometry

- Measurement of refractive error
  - Experienced technician or O.D.
  - Manifest (dry)- no drops
  - Cycloplegic (wet)- after drops instilled, wait 20-30 min.
- Careful refraction should be performed on both eyes
  - S/P anisometropia
Potential Acuity Estimation

- Super pinhole
- Potential Acuity Meter (PAM)
- Retinal Acuity Meter (RAM)
- Laser Interferometer

Contrast Sensitivity Testing

- C/O decreased vision despite 20/20 on Snellen chart
- Pre-operative values should be taken for comparison
- Higher corrections will result in greater reduction in contrast

Brightness Acuity/Glare Testing

- Preoperative values should be established for comparison post-operatively
- Some occupations may require glare testing to insure night driving isn’t a problem
- Don’t rely on patient’s subjective analysis
- Functional Vision Analyzer (FVA)
- Brightness Acuity Meter (BAT)
  - Light is shone into the eye while vision is assessed
  - BAT has 3 levels of brightness, should measure VA at all 3
Visual Field Testing

- Confrontational visual fields
- Document loss in patients with history of glaucoma, optic nerve disease or retinal abnormality with Goldmann or Humphrey visual fields

Assessment of primary actions of extraocular muscles and cardinal fields of gaze

Assessment of the pupil

- Size: 3-5mm in ordinary room light (varies with age, iris color, refractive error)
- Shape: round (irregularities may result from congenital abnormalities, inflammation of the iris, trauma, surgical intervention)
- Equality of size (anisocoria may be harmless, but it’s never physiologic)
- Reaction to light (direct and consensual response to a bright light)
- Reaction to accommodation (when eyes converge to focus on near object, pupils should constrict)
Keratometry/Corneal Topography
- Keratometry - corneal curvature (+4 points)
- Topography
  - Placido ring principle
  - Concentric rings reflected off tear film on corneal surface (1000’s of points)
  - Cornea is convex mirror
    - Steeper = smaller objects appear
  - Computer knows actual size, video camera captures image of reflected rings, measures distance between rings

Corneal Thickness
- Pachometry (pachy comes from Greek for thick)
- Distance between corneal epithelium and endothelium. Thinner in center, increases towards periphery.
- Micron (μ): 1000 microns = 1 mm
- Average: 520-555 μm centrally, up to 1 mm in far periphery (varies by race and other conditions)
- Nominal avg. CCT of 550 microns
  - Each micron = 0.08 D
  - 12 microns of cornea = 1 D
- Verify <500 μm or >600 μm (edema)
- Perform prior to tonometry
- Keratoconus - thin at apex
- Keratoglobus - thin in periphery

Specular Microscopy
- Corneal endothelial cell count
  - Normal >2400 cells/mm²
  - Abnormal <1000 cells/mm²
- Endothelial cell morphology
  - Enlargement - polymegathism
  - Irregularity - pleomorphism
Intraocular Pressure Measurement

- Tonometry
  - Goldmann tonometer
  - MacKay-Marg tonometer
  - Perkins
  - Tono-Pen
  - Pneumotonometer
- Steroid responders
- Increased IOP
  - Glaucoma, optic neuropathy
  - Hypertensive retinopathy

IOL Pre-op Examination

- Modern cataract surgery is not simply removal of clouded lens, it’s refractive surgery
- Axial length (AL)
- Keratometry
- Anterior chamber depth (ACD)
- White to white
- IOL Master
  - Axial length
  - Autokeratometry
  - White-to-white
  - Optical Anterior Chamber Depth
  - IOL Calculations

Pre-op Testing /IOL Master Pearls

- Stable cornea (discontinue CLs to return to stable readings)
- Adequate tear film (have pt. blink, instill artificial tears)
- Don’t touch cornea (applanation, gonioscopy, etc.)
- Proper, comfortable positioning (coarse focus)
- IOL Master
  - Check calibration daily (calibration eye)
  - Ask patients to focus steadily on orange/red fixation point
  - AL-use larger light spot, NS-slightly off center vertically
  - AL in eyes >6D, measure through spectacles
  - If measuring marks are obstructed, hold eyelid
External Examination
- Body
  - Obesity
  - Bull neck
  - Head tremor
- Ocular
  - Enophthalmos/prominent brow
  - Entropion/ectropian eyelid closure
  - Blepharitis
  - Tear film

Biomicroscopy (Slit lamp exam)
- Help identify problems that patient may be having and/or require treatment prior to surgery:
  - Lids and Lashes (L & L)
  - Conjunctiva (C)
  - Sclera (S)
  - Cornea (K) and tear film
  - Anterior chamber (AC)
  - Iris (I)
  - Lens (L)
  - Anterior vitreous

Slit Lamp Exam, cont.
- Herpes simplex
- Corneal dystrophies
  - Fuchs’
  - Fingerprint
  - Reis-Buckler
- Corneal ulcers
- Keratoconjunctivitis sicca/blepharitis
- Marginal degenerations
- Iritis
Eyelids and Conjunctiva
- Stye
- Chalazion
- Blepharitis (lid hygiene)
- Ptosis
- Ectropian
- Entropian
  - Trichiasis
- Lagophthalmos
- Basal cell carcinoma
- Conjunctivitis ("pink eye")
  - Bacterial
  - Viral
  - Allergic (vernal)
  - Ophthalmia neonatorum
- Subconjunctival hemorrhage
- Pinguecula
- Pterygium

Keratoconjunctivitis sicca/Dry eyes
- Schirmer Tear Test
- Tear Break-up Time

Gonioscopy

Gonioscopy grading:
- Grade 0
- Grade 1
- Grade 2
- Grade 3
- Grade 4
Ophthalmoscopy
- Dilated fundus exam
- Posterior segment evaluation
- Rule-out retinal pathology and optic nerve disease:
  - Retinal holes, tears, detachments, BRVO, etc.
  - Diabetic retinopathy
  - Cardiovascular disease
  - Glaucoma

Conclusion
- Hopefully, I’ve succeeded in providing you with a better appreciation for the important functions that ophthalmic medical personnel perform in the work-up of the cataract surgery patient. Upon completion of this course, you should be able to:
  - Identify appropriate patient screening and testing methods to assist the surgeon in determining which refractive surgery patients are most likely to achieve optimal results
  - Describe the proper techniques necessary to ensure the most accurate visual acuity and functional vision testing for patients considering cataract surgery

Thank you!