Ophthalmologic Examination

Last updated: June 3, 2019

**OBJECTIVE EXAMINATION**

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**Complaints:**

1. decreased (blurry) vision - vision acuity; ask about:
   - near or far
   - night blindness (nyctalopia)
   - glare in bright light
2. visual field loss, scotomas
   - how patient noticed it? missing stars of inferior visual field has been lost, noticing portions of words missing when reading, difficulty with driving
3. distortion of vision
4. crossed eyes, double vision – diplopia; ask:
   - near or far
   - one or two eyes
   - vertical or horizontal
5. photophobia (→ dim light to make patient feel more comfortable!)
6. itching, burning, foreign body sensation
7. pain
   - pain on eye movement – optic neuritis (vision loss), scleritis (no vision loss, red eye)
   - redness, discharge
   - excessive tearing / dryness
   - eyelid crusting / swelling / drooping / twitching / inability to close
8. visual hallucinations, light flashes, floaters, halos around lights
9. headache

**HPI:**

1. glasses / contact lenses
2. last eye examination, last glaucoma screening
3. known eye diseases, trauma & operations: myopia, glaucoma, cataracts.
4. systemic diseases (esp. diabetes, hypertension, migraine)

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**Pediatric Aspects**

- **neck:** examination is enhanced by providingipple or soothe and by placing head on one side;
  - physician gently strokes patient to maintain arousal, while examining closest eye
  - newborns keep lids tightly closed; attempts at separating lids increase contraction of orbicularis oculi
  - examine in subdued light (bright light causes infant to blink).
- older child should be placed in parent's lap and should be distracted by bright objects or toys.

**CORNEA, CONJUNCTIVA & SCLERA**

**Sclera & conjunctiva**

**Lower lid:** ask patient to look up as you depress both lower lids with your thumbs.

**Upper lid**

1. Ask patient to look down as you keep both upper lids lifted with your thumbs.
2. Perform lid eversion
   1. patient looks down with relaxed eyes.
   2. raise upper eyelid slightly (so that upper eyelashes protrude), grasp eyelashes and pull them gently down and forward.
   3. place small stick (e.g. applicator) at least 1 cm above lid margin.
   4. push down on upper eyelid (do not press on eyeball itself!), thus everting it.
   5. secure upper lashes against eyebrow with your fingers, perform inspection.
   6. grasp eyelashes and pull them gently forward; ask patient to look up – eyelid will return to its normal position.

Conjunctivitis – check for preauricular LAD (viral etiology?)
Fluorescein staining should be inspected closely.
- if pain / photophobia make it difficult to open eye, instill 1 drop of proparacaine 0.5% or tetraacaine 0.5% before examination.

Fluorescein staining:
- sterile, individually packaged fluorescein strip is mounted on 1 drop of sterile saline and, with eye turned upward, is touched momentarily to inside of lower lid.
- patient is asked to blink several times (to spread dye into tear film) → eye is examined under good magnification (slit-lamp) & cobalt blue illumination.
- areas where corneal / conjunctival epithelium is absent (abrasions, ulcers) will stain green.

Blue sclerae of osteogenesis imperfecta:

**Pediatric aspects**
- corneal blink reflex must be present at birth.
- small subconjunctival, scleral, and retinal hemorrhages are common in newborns.
- newborns may suffer from chemical conjunctivitis (swollen eyelids) due to silver nitrate instillation; may extend to dacyrocystitis and nasolacrimal duct obstruction.

N. Opticus
Patient's dress & cleanliness are clue to visual function!

**Visual acuity, vs. Vision**
- test of central vision, first step in ocular evaluation (analogous to vital signs during general physical examination)!!!

from neurologic (vs. ophthalmologic) standpoint, best possible vision must be determined → good ambient lighting, patient is wearing his own glasses (except reading glasses);
- if glasses are not available (or visual acuity still suboptimal even with glasses) → place pinhole directly in front of patient's glasses;
- pinhole can correct most refractive errors! (pinhole only corrects = 3-4 diopters (D) of refractive error).

N.B. organic causes (vs. refractive errors) of diminished vision are not corrected with pinhole!

**Snellen chart**:
- viewed at distance of 20 ft (6. m).
- cover one eye with card (so patient will not peep between fingers), some advice at first to test both eyes simultaneously and only then each eye separately.
- ask to read aloud smallest line; if unsuccessful → determine smallest line from which patient is able to identify > 50% letters.
- results are expressed as fraction.

Snellen chart

\[ \text{numerator is 20; or 6; } \]
\[ \text{denominator is greatest distance from chart at which normal individual can read smallest line tested individual can read.} \]
\[ \text{normal visual acuity is 20/20; or 6/6; } \]
\[ 20/15 \text{ visual acuity is better than normal; } \]
\[ 20/100 \text{ visual acuity is subnormal.} \]

vision when wearing glasses is recorded as “corrected” (e.g. “20/40 corrected”).

- height of letters in smallest line (that normal individual can read at 20 ft) subtends visual angle of 5 minutes; each of lines in letters are separated by 1 minute of arc (i.e. minimum separable in normal individual is visual angle of 1 minute).
- Snellen chart lines are from 20/400 to 20/10.
- if patient is unable to read largest Snellen letters (vision is worse than 20/400):
  1) position patient closer to chart until he can read largest letters (note distance accordingly; e.g. 10/400 – can see top letter at 10 feet).
  2) check ability to count fingers (CF) (and at what distance; usually at 3 feet; e.g. “counts fingers at 3 feet”).
- detect hand motions (HMM) (wave hand before patient’s eye)
- have light perception (LP).
- Blind eye has no light perception (NLP)!

LogMar Chart

LogMar 1.0 = Snellen 20/200
LogMar 0.0 = Snellen 20/20 (normal vision)

Geriatric aspects
Visual acuity remains fairly constant until age 50, then diminishes gradually until 70, more rapidly after that (nevertheless, most elderly retain good vision – 20/20 to 20/70).

Pediatric aspects

- pinhole: - optical blink (dazzle) reflex - blink and head dorsiflexion in response to bright light (it is one of infantile automatisms / primitive reflexes - disappears after 1st year); reflex blink to visual threat.
- 28 wk premature infant blank when bright light is directed to eyes.
- 32 wk premature maintains eye closure until light source is removed.
- 37 wk premature turns head and eyes to soft light.

- term newborn: visual fixation and ability to follow brilliant target are present (optokinetic nystagmus can be demonstrated;)

**RTANS** - assessment of fixing and following in most instances is sufficient.
- when more accurate visual acuities are required → preferential looking tests (Teller's acuities)
  - based upon principle that child would rather look at objects with pattern stimulus (alternating black and white lines of specific width) than at homogeneous field; smallest pattern that child seems to prefer is best visual acuity.

Objective visual acuity screening must begin at age 3 years, children unable to cooperate → repeat attempt 4-6 months later (if still unsuccessful → refer to ophthalmologist).
- in children > 3 years, Snellen E chart already can be used (child can indicate in which direction E is pointing – either orally or by positioning of fingers).
- optokinetic testing is most accurate method in early childhood!
  - N.B. in early childhood (before age 4-6 years), bilateral acuity must be tested – to detect amblyopia! (child usually accepts covering amblyopic eye, but resists covering normal eye during test)
- central vision progresses from birth (only light perception) to 6 years (adult vision levels).

**VISUAL ACUITY**

| at 1-5 days | ± 20/670 |
| at 1 year | ± 20/200 |
| at 3 years | ± 20/400 |
| at 4-5 years | ± 20/30 |
| at 6-7 years | ± 20/20 |

- objective screening is recommended at ages 5, 10, and 12 years.

- visual acuity should be 20/40 or better by 3-5 years and 20/20 by 6 years; failure to do that (or two-line difference between eyes) → full ophthalmologic evaluation

**NEAR VISION**

- assessed with HAND-HOLD CARD; acuity with near card is recorded using standard Jaeger notation (J1, J3, etc); patient wears his own reading glasses. see Near Vision testing card...

near vision starts to blur noticeably in 40s.

**VISUAL FIELD**

- **PERIMETRIC VISUAL PERIMETRY**
  - confrontational testing (crude method):
    - position yourself at 1 m. distance from patient, eyes at the same level.
    - patient covers one eye, other eye fixates to your nose tip;
    - patient's head should be tilted away from any obstructing facial feature (e.g. heavy eyebrows, large nose);
    - doctor does the same.
    - cotton ball (or wiggling finger) is approached from periphery – patient responds when notices object in his visual field; some authors prefer testing in quadrants instead of +;
    - cotton ball always at the same distance from you and patient – allows control by comparing to your visual perimeter * (except for temporal field [norma - 90°] – place test object behind plane of patient eye);
    - by convention, record defects from perspective of patient rather than examiner.
      - to position patient to better advantage, hand is held up slightly closer to examiner - this provides wider field for patient: if examiner can see target, patient can see it unless he / she has field deficit.

Names of visual field defects → see: Eyes41

- Homonymous defects
  - both your and patient's eyes open.
  - approach with target in each of four outer quadrants of patient's visual field - superotemporal, superonasal, inferotemporal, inferonasal - ask patient to point to target; slowly bring target into centre of visual field until patient detects it.

- Sensory inattention (hemineglect) - test both left and right fields at the same time.

Crude test (for largely uncooperative patients) - reflex blink; to visual threat.

- Most precise test - quantitative instrumental perimetry.

**CENTRAL MACULAR VISION:** AMBERG grid (can detect small central or paracentral scotomas, metamorphopsias):
- cover one eye; hold grid 12 inches in front of eye; patient is asked if he can see red object in grid center (dot) – central scotoma; if can see dot, he is asked to fixate on dot and then to note if all four corners of diagram are visible and if any of boxes are missing, if grid areas appear desaturated, if any grid areas have missing lines, or if lines do not appear straight.

- patient is asked to outline any missing or distorted areas on the grid with a pencil.

- normal central vision extends ≥ 30° in all directions of central fixation.
- blind spot is located ≥ 15-20° temporal to fixation point.

**Pediatric aspects:**
• child sits on parent’s lap; parent fixates child’s head in midline; approach toy from behind infant into child’s vision field – child’s eye will deviate toward toy when it is seen (visual recognition response).

General rule: 
ACUITY is impaired by lesions of *globe structures, optic nerves; VISUAL FIELD defects are due to lesions of optic nerves + intracranial pathways.

COLOR VISION
- pseudoisochromatic *ISHIHARA or HARDY-RAND-RITTNER plates.

Red desaturation (impaired ability to identify red objects) is early indicator of optic nerve pathology.

Ishihara plates
First plate is test plate (if number is not seen, it indicates poor visual acuity or functional visual loss):

![First plate image]

Second plate (if number is not seen, it indicates red-green deficiencies):

![Second plate image]

CONTRAST SENSITIVITY
- PELL&ROBSON chart

HIGHER VISUAL CORTEX

Unilateral visual neglect
1) wiggle fingers simultaneously in both upper temporal quadrants, then in lowers.
2) letter cancellation - patient is asked to find specific letter within random array (patients with left visual neglect may find specified letter only when it appears on right page side).

Agnosias
• bedside tests - using common objects such as pen, cup, or book.
• inability to recognize faces (PROSOPAGNOSIA) or interpret complex scenes (ASIMULTAGNOSIA) - can be tested with magazine / newspaper photos and advertisements.

N. OCULOMOTORIUS, N. TROCHLEARIUS, N. ABDUCENS
Review patient's old photographs - to determine chronicity of lid, pupil, dysmotility, and orbital problems.

EYELID POSITION
• determined by measuring distance between central corneal light reflex* and upper and lower lid margins - margin-reflex distance (MRD): MRD: for upper lid, MRD: for lower lid.

*light reflex is produced by shining focused light source on eyes; light reflex does not change with variation in eye position!

• compare for symmetry between eyes.
• test adequacy of lid closure in:
  1) exophthalmos
  2) CN7 palsy
  3) unconsciousness

PUPILS
N.B. if muscle relaxants have been administered to patient, only aspect of neurologic examination that may be evaluated is pupillary examination!

1) SHAPE: size in mm (both in dark [Le scotopic] and Illuminated environment; patient fixates at distant object).
• anisocoria (minor anisocoria is normal!!?), is anisocoria greater in dark or in light?
• transient fluctuation in pupillary diameter (hippia) are normal.

2) direct & indirect (consensual) REACTION TO LIGHT - dim room light, patient fixes on distant object (to avoid accommodation), shine strong light (e.g. from ophthalmoscope) obliquely* into one eye, normally – symmetric miosis.

*alternatively – hold light at temple and shine tangentially on one eye so as to cast shadow over other eye!!

N.B. if different pupils, both pupils are equal in size at all times! (unilateral optic nerve lesions cause afferent pupillary defect even with apparently normal vision, whereas with macular lesions this is late finding); in ollert defects – there is anisocoria (unless defect is bilateral).
• look for crescentic shadow on iris side away from light – indicates narrow-angle (risk for narrow-angle glaucoma); normally no shadow – eye is open although lens continues to grow over life, pushing iris forward.

3) REACTION TO CONVERGENCE / ACOMMODATION – patient first looks at distant object and then at reading card (or other nonbright object) held few inches away; normally – miosis.

ESSENTIAL ANISOCORIA – common normal variant - one pupil is bigger than other, but otherwise they behave normally.

PSYCHIC PUPILLARY ABNORMALITIES

• pupil is difficult to examine in premature (palely pigmented iris and resistance to lid opening).
• inspect irides for transient pupillary reactivity to light (quickly reactive to light if at all; glide visually to accommodate (watch & wait carefully – eventually constricts more than normal pupil).
• N.B. there is a common normal variant in bilateral preterm infants – bilaterally dilated pupil (risk for poor visual development).
• bilateral sluggishness (myotic pupillary defect) - decreased direct pupillary light reflex - during swinging-flashlight test, abnormal pupil dilates when exposed to light.

HOMOLOGUE (myotic) pupil (slow idopathic degeneration of ciliary ganglion) – unilateral (80%) moderately dilated pupil and poor reactive to light. (If at all; graded visually to accommodate).

ABNORMAL PUPILLARY REACTIVITY TO LIGHT – pupil reacts to accommodation.

HETEROIDIC pupil (rapidly rising unilateral ICP with transtentorial herniation – CN3 compression) – pupil on lesion side first constricts; then widely dilates; other pupil then goes through same sequence.

WERNERNE sign (hemianopic pupillary reactivity) – loss of pupillary constriction when light is directed to blind side of retina; pupillary constriction is maintained when light stimulates normal side.

– bilaterally constricted pupils (pupilpin) – drug (takalpid, opium), pons lesion.
– bilaterally widely dilated pupils – drugs (atropine, barbiturate, cocaine), anoxia, lesion in brainstem; fixed & dilated – usually irreversible injury (but if due to systemic hypoxia, pupils may recover reactivity when oxygenation is restored).

PENDULAR NYSTAGMUS

• if patient is asked to look forward (maintaining primary position), and then to look in all secondary and tertiary positions – Lissajous zigzags (see g) (suggested by m. obliquus superior).
• if patient is asked to look to one side (including blind side), and then to look in all directions (i.e. in field of full binocular vision; if > 45° away, patient may go through sequence but fails to look back to midline).
• patient may exhibit a pendular discharge of varying degrees of intensity.

EXTRAOCULAR MOVEMENTS (EOM)

If voluntary eye movements cannot be assessed – oculocephalic & oculocephalovestibular testing

1. MONOCULAR ZIGGLOGIC PARALYSES

Extrakokulinių raumenų testavimo kryptys

N.B. tai ne raumenų veikimo kryptys, bet būdas izoliuotai testuoti kiekvieną raumenį.

1) ištestuojamos vertikalių kryptių kryptys (it is already tested during pupillary reaction to light).
2) ištestuojamos horizontalių kryptių kryptys; check downgaze positions twice:
   a) without lifting lids (lid lag – lid inferior gaze synkinesis?); normally, upper lid always slightly overlaps iris.
   b) with lids lifted (lids do not obscure eye).
3) puo to po priūtų priešais diudėlį (lid raise – patient is眯着眼看东西).
4) gale testuojama konvergencija (it is already tested during pupillary reaction to accommodation!!).
5) daug kiek dėmesio skiriama visiems (puo to po priūtų priešais diudėlį); patient’s reaction.
6) dvyminiais didžiuosius žvilkus paženkti pakieklos zigloginius paieškos kryptį: CN4 - vidų ir žemyn, CN3 - fiksacijos kryptį;
7) pakenkta akinių mažoms sukčiams yra periferinęs ir mažiausias rūšis; t.y. upšupų "pakenu" akis, išskirti lasterienos vaizdą.

2. HETEROTROPIA (DIPLOPIA), HETEROPHORIA – testuojama jei aptinkama monokulinis zigloginius paralyzinius at pačių pasiektinumų dėmpos.
1) central corneal light reflex – look for symmetry (good test if patient has epicanthal folds causing pseudotetraismos).
2) colored glass over one eye – ask patient where colored image is relative to white one as he views point light source.
3) cover right eye – ask patient which image disappears (if right – esotropia; if left – exotropia).
4) uncover-cover test (also detects heterophoria) – unblocking, PO to atidengiant vieną akį, atidengiant vieną akį.

3. NYSTAGMUS – Lissajous zigzag in gydytojo pištuoja laikoma > 1 m atstumu, pradžiai tiesiogiai, per to pirštus užvedamas 3 ir 9 val. kryptimi ne daugiau 30° (i.e. in field of full binocular vision, if > 45°; if patient is blind binarily, go to 12 or 6:5 kryptimi ne daugiau 15°.

kiekviename poskyryje laikoma > 5 sekundės (postižočius neįprastus < 3 beveikinias)

• details of examination – see p. Eye 64–66.
B inside orbital rim (watch for Lacrimal drainage system side.
Lacrimal gland

N.B. in Exophthalmos (s. Proptosis)

SACCADES, SMOOTH PURSUIT

PEDIATRIC ASPECTS

complete oculomotor movement may be demonstrated as early as 25 wk of gestation utilizing doll’s eye maneuver.
check corneal light reflex and cover test at age > 3 months.
red glass test - to assess extraocular muscles: red glass is placed over one eye, and patient is requested to follow white light in all fields of direction - child sees only one red/white light in normal muscle direction but notes separation of red and white images that is greatest in plane of action of affected muscle;

N.B. in supranuclear gaze palsies, child sees only one red/white light in normal muscle direction but remains fixed (staring in one direction) as head is slowly moved throughout full range of motion (doll’s eye test).

fixation on objects develops at 2-4 weeks.
conjugate eye movements develop soon after birth, but definitive pursuit movements are not seen for 3-6 weeks.
during first 10 days of life, eyes do not move but remain fixed (staring in one direction) as head is slowly moved throughout full range of motion (doll’s eye test).

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N.B. in supranuclear gaze palsies, all eye movements are intact during “doll’s eye” test.

SACCADES, SMOOTH PURSUIT

about testing — see p. Eyed4 >>

in normal elderly impairment of upward gaze is possible.

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LACRIMAL APPARATUS

Checking plant – elevate temporal aspect of upper lid and ask patient to look down to opposite side.
Lacrimal drainage system – check for obstruction by pressing medial aspect of lower eyelid just inside orbital rim (watch for fluid/regurgitation out of lacrimal puncta); palpate area for tenderness.

BIBLIOGRAPHY

for ch. “Diagnostics” — follow this LINK >>