



AGING & VISION

Abstract

A summary of age associated vision changes and their functional implications, common conditions affecting vision in older adults, recommendations for primary care providers and rehabilitation options.

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Aging and Vision

Learning objectives

1. Describe age associated biological changes in eyes and their functional implications
2. List common eye disorders in older adults
3. Propose an approach to assessment , and rehabilitation of older adults with low vision /vision loss
4. Identify neurologic causes of acute and chronic vision loss in older adult

Biological changes in Eyes with Aging and Functional Implications

- Presbyopia: lens stiffens, making it difficult to focus on nearby objects
- Lens becomes denser causing less light to pass through to retina; makes it difficult to see in dim light
- Pupil dilates/contracts more slowly to light changes, making it difficult to adjust to dark/light environments
- Lens yellows, altering the way colors are perceived (colors look less bright and contrasts may be more difficult to see)
- Number of nerve cells that transmit visual signals from eyes to brain decreases, impairing depth perception and fine details (differences in shades and tones)
- Mucous cells that produce fluids to lubricate the eyes decrease, making them feel dry (tear production also decreases)
- Floaters (bits of normal fluid in eye that have solidified) increase in number, resulting in more tiny black specks moving across field of vision (usually not cause for concern)

Effects of Aging on Vision

- Visual acuity (sharpness) and field decline with age
- Age-related miosis (pupil gets smaller)
- Increased glare and intraocular light scatter
- Presbyopia: lens of eye becomes less flexible/capable of thickening, thus less able to focus on nearby objects (need for bifocals)
- Refractive (astigmatic axis) changes
- Color vision changes

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Impact of Vision Loss on Quality of Life

- Difficulty adapting to vision loss
 - Public transportation
 - Changing daily routines, living quarters
 - Financial implications, limited income
- Depression
 - Anxiety regarding further loss
- Altered mental status (worsening delirium or dementia)
 - Due to sensory deprivation
- ADLs
 - Self-care: shopping/cooking, dressing/hygiene, housekeeping, preparing/taking medications
- Social roles in family, community (isolation)
- Poor vision greatly increases risk of falls in older adults (predisposing to fractures and further morbidity/mortality)

LEGAL BLINDNESS

Legal blindness is a level of blindness that has been defined by **law** to limit some activities for **safety reason**, such as driving, or to **determine eligibility** for disability-related government programs and benefits.

Someone is considered to be legally blind when:

- Visual acuity is 20/200 (or 6/60) or less in both eyes after correction, and/or
- A visual field of 20 degrees or narrower.

Keller et al. 1999

Examined the effects of vision and hearing on function in community-dwelling, frail, older individuals

- Impaired vision (20/70 or worse) associated with statistically and clinically significant difference in function (IADL and ADL scores)
- The effect of vision impairment was independent of other factors (e.g. cognition, illness burden)
- Dual sensory loss is associated with a greater decrease in function than that seen with a single sensory loss
- Individuals with corrected sensory loss are less likely to suffer impairment of mood, functional status, and social relationships than are those uncorrected

Swenor et al. 2015

- Visual impairments (i.e. distance visual acuity worse than 20/40, contrast sensitivity less than 1.55 log Contrast, and stereoacuity > 85 arcsec) lead to

Common Eye Disorders: The “Big Four”

- Age Related Macular Degeneration (ARMD)
- Diabetic retinopathy (DR)
- Primary Open Angle Glaucoma (POAG)
- Cataracts

Age-related Macular Degeneration (ARMD)

- Most common cause of new blindness >65
 - 57% of blindness in the Beaver Dam Study (leading cause of permanent visual loss in the older adults in the US)
 - Symptoms: painless progressive loss of central vision
 - Patients complain about distortion of vision
 - Screen with Amsler grid to test central vision
 - Maintain peripheral vision
 - Two major forms: dry vs. wet
 1. Dry: Most common form
 - Atrophy of retinal pigment epithelium
 - Predisposing factors: age, blue eyes (UV), family history, smoking/CVD
 - Vitamins containing antioxidants have been shown to slow rate of AMD progression
 - No cure or surgical intervention available
 2. Wet: more devastating
 - leakage of exudate/blood into macula
- Marra et al. 2016*
- Distortion and decrease in central vision are common symptoms of AMD
 - Drusen often causes metamorphopsia (wavy vision) and decrease in central vision acuity

Diabetic Retinopathy

- 7% of legal blindness >65 y/o
- Type II diabetes most prevalent
- Proliferative (neovascularization – vasoproliferative growth factors) vs. non-proliferative types of DR (dot/blot hemorrhages, retinal infarcts, hard exudates – lipid)

Glaucoma

Types of glaucoma:

Open angle glaucoma (POAG)

More common, no symptoms

Angle = where the aqueous fluid drains out of the eye.

When the “drain” outflow is reduced, intraocular pressure (IOP) goes up due to under-filtration and damages the optic nerve

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Aging and Vision

Glaucoma damages peripheral vision first and moves centrally (which is why **patients usually report no symptoms**)

Signs: High IOP, red eye, hazy cornea, fixed pupil, firm globe

Less likely; requires immediate referral due to increased severity

Older patients are more at risk

Angle closure glaucoma

Drain gets blocked acutely

Symptoms: brow ache, acute loss of central vision, abdominal pain, nausea/vomiting

Final common pathway: optic nerve damage manifested as “cupping”

Cataract

- Most common cause of vision loss in general US population (present in 50% patients over 65 yo)
- Curable blindness – painless, slow progressive loss of vision and glare
- Etiology: Advancing age, genetic predisposition, UV light exposure, trauma (including prior ocular surgery), toxins (tobacco), medications (steroids), disease (diabetes)

Marra et al. 2016

- Decrease visual clarity and sharpness. Typically, individuals experience glare, halos, reduced acuity, night driving difficulty, polyopia, and difficulty reading text

Lai et al. 2014

- Good clinical outcomes of cataract surgery are attainable despite high prevalence of systemic (e.g. HTN, T2D, MI) and ocular (AMRD, glaucoma) comorbidities in very older adults
- 79.2% of 207 participants aged 90 and over achieved visual improvement after cataract surgery; those with AMRD and vitreous loss less likely to improve

Dry Eye/Blepharitis

- Dry eyes are extremely common in older adults
- Caused by any condition that decreases tear production or increases tear evaporation, resulting in loss of water from tear film and increased osmolarity
- Increases epithelial cell desquamation, decreases conjunctival goblet cell density (mucus-producing cells providing natural lubrication for the eye), resulting in secondary inflammatory response
- Decrease in tear lysozyme and lactoferrin → bacterial overgrowth on eyelids
- Hypotonic artificial tear formulations result in progressive normalization of tear film osmolarity; antibacterial lid hygiene product reduces bacterial overgrowth
- High dietary omega-3 fatty acid consumption associated with reduced risk of dry eye; warm compresses (105F) thicken tear film lipid layer, increase blood flow

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Neurological Vision Impairment

- Loss of vision resulting from acquired brain injury or impaired eye coordination, and difficulties with visual perception
- Eyes deliver information to brain via nerves that detect light; occipital cortex processes information and interprets distance, shape, movement, and color
- Causes include: ischemia (e.g., stroke involving occipital lobe), hypoxia (e.g., myocardial infarction), brain tumor, multiple sclerosis, head injury (e.g., car accident or fall), and infections of the CNS (e.g., meningitis, cytomegalovirus)

Screening Recommendations

- All persons >40 y/o should have screening evaluation for glaucoma every 2-5 yrs
- Should have a dilated exam every 1-2 years
- Especially if Hx of retinal detachment, diabetes mellitus, hypertension, FHx of glaucoma, African-American, or age > 65 yrs
- US Preventive Services Task Force: inconclusive evidence for routine screening for vision loss among older adults by primary care providers re: improved visual outcomes, functional status, or QOL

Marra et al. 2016

- The ability of primary care physicians (PCPs) to identify early signs of cataracts and AMD in individuals at risk of vision loss is critical to early diagnosis and management
- Cataracts can be safely treated and vision restored, but AMD is leading cause of irreversible vision loss in the developed world; early detection is most effective method of reducing vision loss
- PCPs are essential for recognizing visual and functional manifestations of these diseases, making appropriately timed referrals to optometrists or comprehensive ophthalmologists, ensuring rehabilitation services are accessible, and encouraging the use of community services
- PCPs also play a role in preserving vision through education and behavioral modification. Changes in diet, smoking habits, and self-testing have been shown to slow progression of disease and limit risk of permanent vision loss
- Timing of visual changes in an effective ophthalmic screening is a critical determinant of referral urgency
- Individuals with unexplained chronic progressive vision loss over longer than 1 month should make a non-urgent appointment with an ophthalmologist
- Individuals with sudden (monocular or binocular) vision loss over the course of 1 day-week should receive urgent referral (within 48hrs)

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- Vision assessment should be done for older adults with **recent cognitive decline, functional impairment, or falls**

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Aids and Rehabilitation for Patients with Low Vision

Hand-held magnifiers – most basic vision aid

Stand magnifiers – magnifying lenses mounted on a stand, typically sits on a desk top

High-powered spectacles – inexpensive eyeglasses with high-magnification lenses

Spectacle-mounted magnifiers – small protruding lenses that are mounted on eyeglass frames

Electronic magnification units – use video cameras to view objects and project magnified image of the object on a computer monitor

Home ergonomics review – making home safer, better lighting, etc.

One does not need to be legally blind to access services from the CNIB Foundation, Vision Loss Rehabilitation Canada or other CNIB organizations. As soon as ones eyesight begins to affect their daily life, they are eligible.

<https://cnib.ca/en/sight-loss-info/living-with-blindness/rehabilitation-services?region=on>

Table 1: Advantages and Disadvantages of Various Low Vision Aids

Device	Advantages	Disadvantages
Hand-held magnifiers	Inexpensive; can be illuminated	Must hold at precise focal length from reading material; slow reading; difficult with tremor
Stand magnifiers	Inexpensive; can be illuminated; no hands necessary	Must set device at precise focal length from reading material; not easily portable
High-powered spectacles	Inexpensive; no hands necessary	Objects must be close to eye, which interferes with illumination
Spectacle-mounted magnifiers	Have both “microscope” and “telescope” lenses, so can be used for both near and far vision; no hands necessary	Expensive; objects must be held close to the eyes in microscope mode; narrow field of vision; training required
Electronic magnification units (closed-circuit TV)	Permit high-resolution images at a customized high-magnification level; both portable and desktop methods	Expensive

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References

1. Besdine RW. Changes in the body with aging [Internet]. New Jersey, USA: Merck & Co., Inc.; 2017 [cited 2017 May 29]. Available from: <http://www.merckmanuals.com/en-ca/home/older-people%E2%80%99s-health-issues/the-aging-body/changes-in-the-body-with-aging#v8967858>
2. Andrew Lee. Vision Impairment in the Elderly [Internet]. POGOe - Portal of Geriatrics Online Education; 2009 [cited 2017 May 29]. Available from: <https://www.pogoe.org/productid/18456> Medicine and Gerontology. 6th Edition. New York: McGraw Hill; 2009. p. 883-95.
3. Keller BK, Morton JL, Thomas VS, Potter JF. The effect of visual and hearing impairments on functional status. *J Am Geriatr Soc.* 1999 Nov;47(11):1319-25.
4. Swenor BK, Simonsick EM, Ferrucci L, Newman AB, Rubin S, Wilson V. Visual impairment and incident mobility limitations: The Health, Aging, and Body Composition Study. *J Am Geriatr Soc.* 2014 Dec 23;63(1):46-54.
5. Marra KV, Wagley S, Kuperwaser MC, Campo R, Arroyo JG. Care of older adults: Role of primary care physicians in the treatment of cataracts and macular degeneration. *J Am Geriatr Soc.* 2016 Feb;64(2):369-77.
6. Lai FH, Lok JY, Chow PP, Young AL. Clinical outcomes of cataract surgery in very elderly adults. *J Am Geriatr Soc.* 2014 Jan; 62(1):165-70.
7. Chou R, Dana T, Bougatsos C, Grusing S, Blazina I. Screening for Impaired Visual Acuity in Older Adults: A Systematic Review to Update the 2009 U.S. Preventive Services Task Force Recommendation. Maryland, USA: Agency for Healthcare Research and Quality; 2016. Evidence Synthesis No. 127. AHRQ Publication No. 14-05209-EF-1.
8. Gilbard JP. Dry eye and blepharitis: Approaching the patient with chronic eye irritation. *Geriatrics.* 2009 Jun;64(6):22-6.
9. Rosenberg EA, Sperazza LC. The visually impaired patient. *Am Fam Physician.* 2008 May;77(10):1431-6.
10. Vision loss – neurological [Internet]. Better Health Channel; 2017 [cited 2017 July 3]. Available from: <https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/vision-loss-neurological><https://www.cnib.ca/en/sight-loss-info/blindness/what-blindness?region=on?viewAsPdf=true>
11. Yvonne M. Buys. US recommendation on vision screening in older adults. *CMAJ* Sep 2018, 190 (38) E1144; DOI: 10.1503/cmaj.70063

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