Chapter 49

Drugs for Eye and Ear Disorders

Eye Anatomy

- Anterior cavity filled with aqueous humor
- Anterior contains anterior and posterior chamber
- Aqueous humor originates from ciliary body in posterior chamber
  - Flows through pupil into anterior chamber

Eye Anatomy

- Trabecular network—connected to canal of Schlemm
- Aqueous humor drains from anterior chamber into canal of Schlemm

Figure 49.1 Internal structures of the eye. Source: Pearson Education/PH College.

Glaucoma

- Occurs when there is increased intraocular pressure
  - Leads to optic nerve damage and visual-field loss
- Leading cause of preventable blindness

Etiology of Glaucoma

- Often primary condition without identifiable cause
- Most frequent in those over 60 years of age
- Associated with genetic factors
Etiology of Glaucoma (continued)

- Can be secondary to certain conditions
  - Eye trauma, diabetes, inflammation
  - Hemorrhage, tumor, cataracts

Risk Factors for Glaucoma

- Long-term use of some medications
  - Glucocorticoids, antihypertensives
  - Antihistamines, antidepressants
- Hypertension
- Migraine headaches
- Severe nearsightedness or farsightedness
- Normal aging

Two Types of Glaucoma

- Closed-angle
- Open-angle
- Both result from buildup of aqueous humor
  - Excessive production or
  - Blockage of outflow

Two Types of Glaucoma (continued)

- Difference between types
  - How quickly it occurs
  - If there is narrowing of anterior angle
- Diagnosed with tonometry
  - Measures intraocular pressure (IOP)

Closed-Angle Glaucoma

- Also called acute or narrow-angle glaucoma
- Accounts for 5% of all glaucoma
- Usually unilateral; caused by
  - Stress, impact injury, or medications
- Iris pushed over drainage area; causes angle to narrow and close
- Causes sudden increase in IOP

Symptoms of Closed-Angle Glaucoma

- Dull to severe eye pain, headache
- Bloodshot eyes, foggy vision with halos, bulging iris
- Medical emergency requiring surgery
Open-Angle Glaucoma

- Accounts for 90% of cases
- Usually bilateral
- IOP develops slowly over years
- Asymptomatic
- Iris does not cover opening
- Treated with medications

Glucoma Pharmacotherapy

- Goal is to prevent damage to optic nerve by lowering IOP
- Treatment begins
  - When IOP is between 21 and 30 mm/Hg or
  - When signs of optic nerve damage or visual-field changes are present regardless of IOP
- Combination therapy may be necessary to achieve goal

Mechanisms of Action

- Drugs used for glaucoma
  - Decrease IOP by increasing outflow of aqueous humor, or
  - Decrease formation of aqueous humor
  - Many antiglaucoma drugs affect autonomic nervous system

Role of the Nurse

- Monitor client's condition
- Provide client education
- Obtain medical, surgical, drug history
- Assess lifestyle and dietary habits
- Obtain description of symptomology and current therapies

Figure 49.2: Forms of primary adult glaucoma: (a) in chronic open-angle glaucoma, the anterior chamber angle remains open, but drainage of aqueous humor through the canal of Schlemm is impaired; (b) in acute closed-angle glaucoma, the angle of the iris and anterior chamber narrows, obstructing the outflow of aqueous humor.
Drug Therapy for Glaucoma

• Determine history of certain conditions
  – Heart block, bradycardia, heart failure
  – Chronic obstructive pulmonary disease (COPD)
• Establish baseline blood pressure and pulse

Drug Therapy for Glaucoma (continued)

• With use of beta-blockers, teach client how to check pulse and blood pressure
• Review normal heart rate and blood pressure parameters
• Determine factors that could decrease compliance
  – Insufficient financial resources

Drug Therapy with Otic Preparations

• Assess
  – Baseline hearing and auditory status
  – Symptoms; any current medical conditions
• Obtain information regarding hypersensitivity
  – Hydrocortisone, neomycin sulfate, polymyxin B

Drug Therapy with Otic Preparations (continued)

• Many otic medications contraindicated in presence of perforated eardrum
• With hypersensitivity, eardrum perforation, chloramphenicol contraindicated
  – Side effects: burning, redness, rash, swelling

Drug Therapy with Otic Preparations (continued)

• When instilling otic preparations
  – Cleanse ear thoroughly
  – Remove cerumen through irrigation
  – Warm to body temperature (but not higher) before instillation
Pharmacotherapy of Glaucoma

- Prostaglandins
  - Dilate trabecular meshwork
  - Increase aqueous humor outflow

(continued)

- Beta-adrenergic blockers
  - Decrease production of aqueous humor
  - Adverse effects: bronchoconstriction, dysrhythmias, hypotension
- Alpha2-adrenergic agonists
  - Decrease production of aqueous humor

Drugs for Glaucoma—Prostaglandins

- Prototype drug: latanoprost (Xalatan)
- Mechanism of action: believed to reduce IOP by increasing outflow of aqueous humor
- Primary use: to treat open-angle glaucoma

(continued)

- Adverse effects: conjunctival edema, tearing
  - Dryness, burning, pain, irritation
  - Itching, sensation of foreign body in eye
  - Photophobia and/or visual disturbances
  - Eyelashes on treated eye may grow thicker and/or darker.
  - Changes in pigmentation of iris of treated eye and periocular skin

Drugs for Glaucoma—Beta-Adrenergic Blocker

- Prototype drug: timolol (Timoptic, Timoptic XE)
- Mechanism of action: reduces formation of aqueous humor
- Primary use: to reduce elevated intraocular pressure in chronic open-angle glaucoma
- Adverse effects: local burning and stinging upon instillation

(continued)

- Carbonic anhydrase inhibitors: decrease production of aqueous humor
- Nonselective sympathomimetics (mydriatics): dilate pupil to increase outflow
  - May also cause increased IOP, increased BP and HR
  - Rarely used for glaucoma
**Pharmacotherapy of Glaucoma (continued)**

- Cholinergic agonists (miotics): constrict pupil to allow more room for outflow
- Osmotic diuretics: reduce formation of aqueous humor

**Drugs Used in Eye Examinations**

- Mydriatics
  - Dilate pupil to allow better visualization
  - Cause photophobia, can increase IOP, can cause CNS effects
- Cycloplegics
  - Cause both dilation and relaxation of ciliary muscle
  - Cause severe blurred vision, loss of near vision, angle-closure glaucoma attacks

**Drugs for Irritation and Dryness**

- Vasoconstrictors
- Cycloplegics
- Mydriatics
- Lubricant drugs

**Actions of Drugs for Irritation and Dryness**

- Lubricate eye’s surface
- Penetrate specific area of eye

**The Ear**

- Two major sensory functions
  - Hearing
  - Equilibrium and balance

**Structure of Ear**

- Three important structural areas
  - Outer ear
  - Middle ear
  - Inner ear
Otitis—Inflammation of Ear

- **External otitis**
  - Associated with water (swimmer’s ear)

- **Otitis media**
  - Associated with upper respiratory infections, allergies, auditory tube irritation

Inner Ear Infections

- **Mastoiditis**: inflammation of mastoid sinus
- Can result in hearing loss if untreated

Pharmacotherapy for Ear Disorders

- **Antibiotics** used to treat infections
  - Topical (eardrops) for external ear
  - Systemic for middle and inner ear infections; also for extensive outer ear infections

Pharmacotherapy for Ear Disorders (continued)

- **Glucocorticoids** used when inflammation present
- **Cerumen (earwax)** softeners used to remove accumulated earwax buildup

Clients Receiving Ophthalmic Solutions for Glaucoma

- **Assessment**
- Obtain complete health history
- Obtain complete physical examination
  - Focus on visual acuity, visual-field assessments
- Assess for presence or history of ocular pain
Clients Receiving Ophthalmic Solutions for Glaucoma

• Nursing Diagnoses
  – Risk for injury, related to visual-acuity deficits
  – Deficient self-care, related to impaired vision
  – Pain, related to disease process

• Planning—client will
  – Exhibit no progression of visual impairment
  – Demonstrate understanding of disease process
  – Demonstrate understanding of drug’s action
  – Safely function within own environment without injury
  – Report absence of pain

• Implementation
  – Monitor visual acuity, blurred vision, pupillary reactions
  – Monitor extraocular movements and ocular pain
  – Monitor client for specific contraindications for prescribed drug
  – Remove contact lenses before administration of ophthalmic solutions

– Administer ophthalmic solutions using proper technique
– Monitor for ocular reaction to drug: conjunctivitis and lid reactions
– Assess IOP readings

– Monitor color of iris and periorbital tissue of treated eye
– Monitor for systemic absorption of ophthalmic preparations by taking pulse, blood pressure, heart rate
– Encourage compliance with treatment regimen
– Monitor and adjust environmental lighting for client’s comfort

• Evaluation—client
  – Exhibits no progression of visual impairment
  – Verbalizes understanding of disease process
  – Accurately states drug’s action and side effects
  – Safely functions within own environment without injury
  – Is free of pain
### Table 49.1 Selected Drugs for Glaucoma

<table>
<thead>
<tr>
<th>Drug</th>
<th>Effect</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetazolamide</td>
<td>Reduces intraocular pressure</td>
<td>250-1000 mg/day</td>
</tr>
<tr>
<td>Betaxolol</td>
<td>Reduces intraocular pressure</td>
<td>0.25-0.5 mg/day</td>
</tr>
<tr>
<td>Brimonidine</td>
<td>Reduces intraocular pressure</td>
<td>0.1-0.2 mg/day</td>
</tr>
</tbody>
</table>

### Table 49.1b Selected Drugs for Glaucoma

<table>
<thead>
<tr>
<th>Drug</th>
<th>Effect</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined Timolol and Timolol Maleate</td>
<td>Reduces intraocular pressure</td>
<td>5 mg/1 mg/day</td>
</tr>
<tr>
<td>Combined Timolol and Timolol Maleate</td>
<td>Reduces intraocular pressure</td>
<td>2 mg/1 mg/day</td>
</tr>
</tbody>
</table>

### Table 49.1c Selected Drugs for Glaucoma

<table>
<thead>
<tr>
<th>Drug</th>
<th>Effect</th>
<th>Dosage</th>
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</thead>
<tbody>
<tr>
<td>Combined Timolol and Timolol Maleate</td>
<td>Reduces intraocular pressure</td>
<td>1 mg/1 mg/day</td>
</tr>
<tr>
<td>Combined Timolol and Timolol Maleate</td>
<td>Reduces intraocular pressure</td>
<td>0.5 mg/1 mg/day</td>
</tr>
</tbody>
</table>

### Table 49.2 Drugs for Mydriasis, Cycloplegia, and Lubrication of the Eye

<table>
<thead>
<tr>
<th>Drug</th>
<th>Effect</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atropine</td>
<td>Mydriasis and cycloplegia</td>
<td>0.01-0.5 mg/day</td>
</tr>
<tr>
<td>Cyclopentolate</td>
<td>Mydriasis and cycloplegia</td>
<td>0.5-1.0 mg/day</td>
</tr>
<tr>
<td>Methylcellulose</td>
<td>Lubrication</td>
<td>As needed</td>
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### Table 49.3 Otic Preparations

<table>
<thead>
<tr>
<th>Drug</th>
<th>Effect</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gentamicin</td>
<td>Ototoxic effect</td>
<td>0.5-2.0 mg/mL</td>
</tr>
<tr>
<td>Hydrocortisone</td>
<td>Anti-inflammatory effect</td>
<td>1-2% ointment</td>
</tr>
<tr>
<td>Polysporin</td>
<td>Antimicrobial effect</td>
<td>1-2% ointment</td>
</tr>
</tbody>
</table>