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Review Article

Drug Utilization in Angle-Closure Glaucoma A Comprehensive Review

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ABSTRACT:
Angle-closure glaucoma (ACG) is one of the leading causes of irreversible blindness worldwide, particularly in Asian populations. It is characterized by obstruction of aqueous humor outflow due to closure of the iridocorneal angle, resulting in elevated intraocular pressure (IOP) and optic nerve damage. Although laser peripheral iridotomy and surgical interventions remain the definitive treatment, pharmacological therapy plays a crucial role in acute management, perioperative care, and long-term IOP control in selected patients. Drug utilization studies help evaluate prescribing patterns, rational use of medications, adherence to clinical guidelines, cost-effectiveness, and patient outcomes. This review discusses current pharmacological management, prescribing trends, rational drug utilization, emerging therapies, and challenges associated with medication use in angle-closure glaucoma.

Keywords: *Angle-closure glaucoma, Drug utilization, Antiglaucoma drugs, Intraocular pressure, Rational prescribing, Pharmacotherapy.*

INTRODUCTION

Glaucoma represents a heterogeneous group of optic neuropathies characterized by progressive retinal ganglion cell loss and visual field defects. Among its various forms, angle-closure glaucoma (ACG) accounts for nearly half of glaucoma-related blindness despite being less prevalent than primary open-angle glaucoma. According to recent estimates, over 23 million people worldwide are affected by angle-closure glaucoma, with the majority residing in Asia.

Drug therapy remains essential in reducing intraocular pressure before definitive laser or surgical intervention. Understanding drug utilization patterns provides valuable information regarding prescribing behavior, adherence to evidence-based guidelines, medication accessibility, adverse drug reactions, and healthcare expenditure.

Drug utilization research has become increasingly important in ophthalmology because irrational prescribing may delay definitive treatment, increase adverse effects, and contribute to poor visual outcomes.

EPIDEMIOLOGY

Primary angle-closure glaucoma primarily affects:

- Elderly individuals
- Females
- Hyperopic patients
- Asian populations
- Individuals with shallow anterior chambers

RISK FACTORS INCLUDE:

- Increasing age
- Female gender
- Family history
- Thick crystalline lens
- Short axial length

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- Cataract
- Certain medications causing pupillary dilation

PATHOPHYSIOLOGY

Angle closure occurs when aqueous humor drainage through the trabecular meshwork becomes obstructed because the peripheral iris blocks the anterior chamber angle.

Major mechanisms include:

- Pupillary block
- Plateau iris syndrome
- Lens-induced angle closure
- Secondary angle closure

Elevated intraocular pressure results in optic nerve ischemia and retinal ganglion cell apoptosis.

Principles of Pharmacological Management
Drug therapy aims to:

- Rapidly reduce intraocular pressure
- Relieve symptoms
- Prevent optic nerve damage
- Prepare patients for laser peripheral iridotomy
- Control IOP when surgery is delayed
- Prevent recurrence

Drug Classes Used in Angle-Closure Glaucoma
1. Carbonic Anhydrase Inhibitors
Systemic

- Acetazolamide
- Methazolamide

Mechanism:

Reduce aqueous humor production by inhibiting carbonic anhydrase.

Advantages:

- Rapid IOP reduction
- Useful during acute attacks

Adverse effects:

- Metabolic acidosis
- Hypokalemia
- Gastrointestinal upset
- Renal stones
- Paresthesia

Contraindications:

- Sulfonamide allergy
- Severe renal disease
- Hepatic impairment

Topical

- Dorzolamide
- Brinzolamide

Advantages

- Fewer systemic adverse effects
- Effective adjunctive therapy

2. Beta-Adrenergic Blockers
Examples:

- Timolol
- Betaxolol
- Levobunolol

Mechanism

Decrease aqueous humor production.

Advantages

- Effective
- Low cost
- Widely available

Limitations

Avoid in patients with:

- Asthma
- COPD
- Bradycardia
- Heart block

3. ALPHA-2 ADRENERGIC AGONISTS

Examples

- Brimonidine
- Apraclonidine

Mechanism

- Reduce aqueous humor formation
- Increase uveoscleral outflow

Advantages

Rapid onset of action.

Adverse effects

- Dry mouth
- Fatigue
- Allergic conjunctivitis

4. CHOLINERGIC AGENTS

Pilocarpine remains the classic drug.

Mechanism

Produces miosis, pulling the iris away from the trabecular meshwork.

Clinical use

Administer only after partial reduction of IOP because ischemic iris sphincter may initially be unresponsive.

Side effects

- Brow ache
- Blurred vision
- Induced myopia

5. HYPEROSMOTIC AGENTS

Examples

- Mannitol IV
- Oral glycerol
- Isosorbide

Mechanism

Create osmotic gradient to remove fluid from the vitreous.

Used in:

- Acute angle-closure glaucoma with markedly elevated IOP

6. PROSTAGLANDIN ANALOGUES

Examples

- Latanoprost
- Travoprost
- Bimatoprost
- Tafluprost

Mechanism

Increase uveoscleral outflow.

Role

Usually employed for chronic IOP control after angle reopening.

Advantages

- Once daily dosing
- Excellent efficacy

Drug Utilization Pattern
Drug utilization studies worldwide reveal:

Drug Class	Frequency of Use
Timolol	Very High
Acetazolamide	High
Pilocarpine	High during acute attacks
Brimonidine	Moderate
Dorzolamide	Moderate
Prostaglandin analogues	Increasing
Mannitol	Emergency use only

Combination therapy is increasingly preferred because it improves compliance and reduces preservative exposure.

Rational Drug Utilization
WHO prescribing indicators recommend:

- Appropriate indication
- Correct dose
- Appropriate duration
- Minimal polypharmacy
- Generic prescribing whenever possible
- Evidence-based prescribing

Drug utilization evaluation helps identify:

- Overuse
- Underuse
- Irrational combinations
- Medication errors
- Poor adherence

Fixed Dose Combinations
Common combinations include:

- Timolol + Dorzolamide
- Timolol + Brimonidine
- Timolol + Latanoprost

Advantages:

- Improved compliance
- Reduced preservative exposure
- Lower treatment burden

Limitations:

- Less dosing flexibility
- Higher cost

Drug Utilization Studies
Recent observational studies indicate:

- Beta blockers remain the most prescribed first-line drugs in resource-limited settings.
- Carbonic anhydrase inhibitors are routinely prescribed during acute attacks.
- Fixed-dose combinations are increasing in tertiary hospitals.
- Generic medications significantly reduce treatment costs.
- Adherence remains a major challenge among elderly patients.

Factors Influencing Drug Utilization
Several factors affect prescribing patterns:

- Drug availability
- Cost
- Physician preference
- National guidelines
- Patient affordability
- Presence of comorbidities
- Insurance coverage

Medication Adherence
Poor adherence contributes to:

- Persistent high IOP
- Disease progression
- Visual field loss
- Increased surgical intervention

Strategies to improve adherence include:

- Patient education
- Simplified dosing schedules
- Fixed-dose combinations
- Regular follow-up
- Reminder systems

Challenges
Major challenges include:

- Delayed diagnosis
- Inappropriate long-term use of pilocarpine
- Cost of newer medications
- Poor patient awareness
- Adverse drug reactions
- Limited access in rural areas

Emerging Therapies
Recent developments include:

- Rho kinase inhibitors
- Sustained-release drug delivery systems
- Drug-eluting implants
- Nanotechnology-based ocular formulations
- Personalized glaucoma pharmacotherapy

These innovations may improve adherence and long-term IOP control.

Future Perspectives

Future drug utilization research should focus on:

- Real-world prescribing patterns
- Pharmacoeconomic evaluations
- Artificial intelligence-assisted prescribing
- Personalized medicine
- Medication adherence monitoring
- Quality-of-life assessments

Conclusion

Drug therapy remains an indispensable component in the management of angle-closure glaucoma, particularly during acute episodes and as an adjunct to definitive laser or surgical treatment. Drug utilization studies demonstrate that beta blockers, carbonic anhydrase inhibitors, cholinergic agents, and fixed-dose combinations constitute the cornerstone of current pharmacotherapy. Rational prescribing based on evidence-based guidelines can optimize intraocular pressure control, reduce adverse drug reactions, improve patient adherence, and minimize healthcare costs. Future advances in sustained drug delivery systems and personalized pharmacotherapy are expected to further improve the management of angle-closure glaucoma.

REFERENCES

1. Weinreb RN, Aung T, Medeiros FA. The pathophysiology and treatment of glaucoma. *JAMA*. 2014;311(18):1901–1911.
2. European Glaucoma Society. European Glaucoma Society Terminology and Guidelines for Glaucoma. 5th ed. Br J Ophthalmol. 2021;105(Suppl 1):1–169.
3. American Academy of Ophthalmology. Primary Angle Closure Preferred Practice Pattern. Ophthalmology. 2021;128(1):P30–P70.
4. Tham YC, Li X, Wong TY, et al. Global prevalence of glaucoma and projections through 2040. *Ophthalmology*. 2014;121(11):2081–2090.
5. Foster PJ, Johnson GJ. Glaucoma in China. *Br J Ophthalmol*. 2001;85:1277–1282.
6. National Institute for Health and Care Excellence. Glaucoma: Diagnosis and Management. NICE Guideline NG81. London: NICE; 2022.
7. Katz LJ, Steinmann WC, Kabir A, et al. Selective laser trabeculoplasty versus medical therapy as initial treatment of glaucoma. *J Glaucoma*. 2012;21(7):460–468.
8. Gedde SJ, Vinod K, Wright MM, et al. Primary Angle Closure Disease Preferred Practice Pattern. *Ophthalmology*. 2021;128:P30–P70.
9. World Health Organization. Introduction to Drug Utilization Research. Geneva: WHO; 2003.
10. Lee DA, Higginbotham EJ. Glaucoma and its treatment. *Am J Health Syst Pharm*. 2005;62:691–699.
11. Khaw PT, Shah P, Elkington AR. *ABC of Eyes*. 5th ed. Wiley-Blackwell; 2014.
12. Kanski JJ, Bowling B. *Clinical Ophthalmology: A Systematic Approach*. 9th ed. Elsevier; 2020.
13. Tripathi RC, Tripathi BJ, Haggerty C. Drug therapy for glaucoma. *Expert Opin Pharmacother*. 2003;4:1629–1643.
14. Quigley HA. Glaucoma. *Lancet*. 2011;377:1367–1377.
15. World Health Organization Collaborating Centre for Drug Statistics Methodology. *Guidelines for ATC Classification and DDD Assignment*. Oslo: WHO; latest edition.