

Glaucoma Associated with Some Blood Pressure Medications

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Key Findings:

- Hypertensive patients on ACE inhibitors, calcium channel blockers, and angiotensin II receptor blockers are more likely to develop glaucoma than hypertensive patients not on these medications.

Glaucoma is a condition that can result in nerve damage and blindness, often caused by increased pressure within the eyes.¹ Hypertension is a known risk factor for developing glaucoma.¹ However, how hypertension treatment affects this risk is less clear. Previous studies on whether certain classes of hypertensive medications are associated with glaucoma risk have shown mixed results.^{2,3,4}

To understand the risk of glaucoma diagnosis for various blood pressure treatments, we studied 3,760,091 patients with hypertension during 2022. We included patients prescribed common antihypertensive medication classes for at least the six months between January 1 and June 30, 2022. We then assessed new diagnoses of open-angle glaucoma between July 1 and December 31, 2022. We adjusted for race, ethnicity, type 2 diabetes, social vulnerability, age, sex, median blood pressure (BP) quintile while on the BP medication, and whether a patient was on multiple classes of BP medications.

We found that hypertensive patients on ACE inhibitors had 35% greater odds of developing glaucoma than those not on ACE inhibitors. Similarly, patients on calcium channel blockers had 31% greater odds of developing glaucoma than those not on calcium channel blockers. Patients on angiotensin II receptor blockers had 29% greater odds of being diagnosed with glaucoma than those not on angiotensin II receptor blockers. Alpha-2 receptor agonists, diuretics, vasodilators, beta blockers, and combination alpha and beta blockers showed no significant impact on the likelihood of being diagnosed with glaucoma.

Glaucoma Diagnosis Odds by BP Medication Class

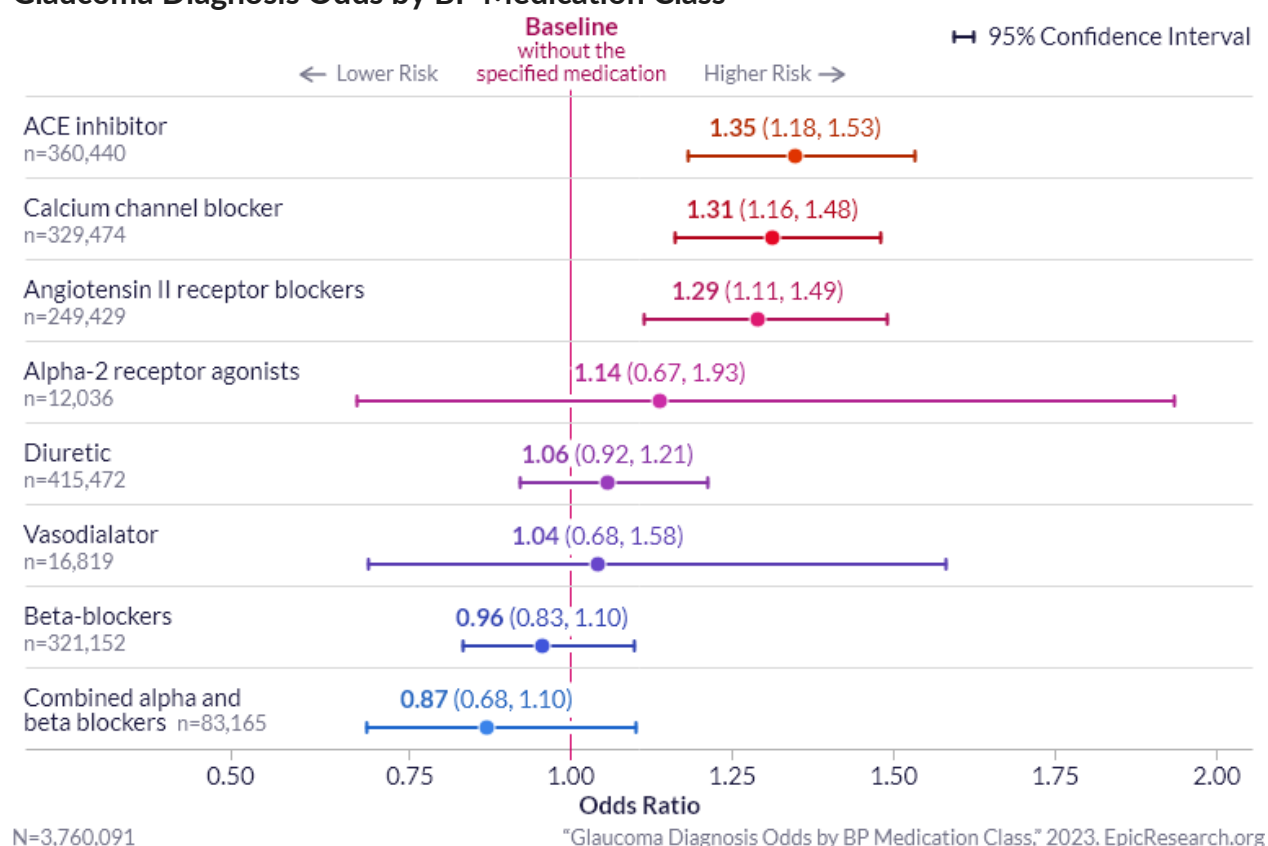


Figure 1. The odd ratios of a hypertensive patient to develop glaucoma following BP medication use. An odds ratio of 2 indicates patients are twice as likely to have a glaucoma diagnosis and an odds ratio of 0.5 means patients are half as likely to have a glaucoma diagnosis than patients not on that medication.

While the results of this study suggest that some BP medications are more correlated with glaucoma, further evaluation is needed because our study did not account for a patient's BP medication history prior to our study period, which might affect the outcome.

These data come from Cosmos, a HIPAA-defined Limited Data Set of more than 220 million patients from 222 Epic organizations including 1,276 hospitals and more than 27,200 clinics, serving patients in all 50 states and Lebanon. This study was completed by two teams that worked independently, each composed of a clinician and research scientists. The two teams came to similar conclusions. Graphics by Brian Olson.

References

1. Glaucoma. Mayo Clinic. Published September 30, 2022. Accessed November 20, 2023. <https://www.mayoclinic.org/diseases-conditions/glaucoma/symptoms-causes/syc-20372839>
2. Kastner A, Stuart KV, Montesano G, et al. Calcium channel blocker use and associated glaucoma and related traits among UK Biobank participants. *JAMA Ophthalmol.* 2023;141(10):956. doi:10.1001/jamaophthalmol.2023.3877
3. Vergroesen JE, Schuster AK, Stuart KV, et al. Association of Systemic Medication Use with Glaucoma and Intraocular Pressure: The European Eye Epidemiology Consortium. *Ophthalmology.* 2023;130(9):893-906. doi:10.1016/j.ophtha.2023.05.001
4. Horwitz A, Klemp M, Jeppesen J, Tsai JC, Torp-Pedersen C, Kolko M. Antihypertensive medication postpones the onset of glaucoma: Evidence from a nationwide study. *Hypertension.* 2017;69(2):202-210. doi:10.1161/hypertensionaha.116.08068

Data Definitions

Term	Definition
Study period	1/1/2022 - 12/31/2022
Study population	Patients ages 50 to 100 with hypertension diagnosed before 1/1/2022 with no changes in oral BP medications from 1/1/2022 to 6/30/2022, at least one BP reading between 1/1/2022 and 6/30/2022, an associated social vulnerability index (SVI) measure for their most recent residence, no pre-existing glaucoma diagnosis, and no non-oral BP medications during the study period.
Hypertension	A diagnosis with ICD-10-CM code I1*.
Glaucoma	We excluded patients with a pre-existing diagnosis with ICD-10-CM code H40.1* or H40.2*. A diagnosis with ICD-10-CM code H40.1* in the six months of analysis was our outcome measurement.
Type 2 diabetes	A diagnosis with ICD-10-CM code E11*.
BP medications (categories – simple generic medication names)	An oral-route prescription or patient-reported use of: Calcium channel blockers – amlodipine besylate, nifedipine, or diltiazem HCl. ACE Inhibitors – lisinopril or lisinopril/hydrochlorothiazide. Angiotensin II receptor blockers – losartan potassium, losartan/hydrochlorothiazide, or valsartan. Diuretics – hydrochlorothiazide, lisinopril/hydrochlorothiazide, losartan/hydrochlorothiazide, furosemide, spironolactone, triamterene/hydrochlorothiazide, or chlorthalidone. Beta-blockers – metoprolol succinate, metoprolol tartrate, or atenolol. Vasodilators – hydralazine HCl Combined alpha and beta-blockers – carvedilol or labetalol HCl. Alpha-2 receptor agonists – clonidine HCl

Table 1: Glaucoma Diagnosis Odds by BP Medication Class

Variable	Odds Ratio	Lower CI	Upper CI
Age	1.05	1.05	1.06
Is Female	0.82	0.77	0.88
Is Black	2.54	2.15	3.00
Is Asian	1.41	1.11	1.77
Is White	0.77	0.65	0.90
Is Hispanic	1.71	1.47	1.98
SVI Qtl 4	1.08	0.97	1.19
SVI Qtl 2	1.03	0.94	1.14
SVI Qtl 3	0.94	0.85	1.04
Has DM	1.29	1.20	1.39
BP Qtl 1	1.03	0.92	1.15
BP Qtl 2	1.02	0.92	1.14
BP Qtl 4	0.96	0.86	1.08

BP Qtl 5	0.91	0.81	1.01
ACE inhibitor	1.35	1.18	1.53
CCB	1.31	1.16	1.48
ARB	1.29	1.11	1.49
Alpha-2 agonist	1.14	0.67	1.93
Diuretic	1.06	0.92	1.21
Vasodilator	1.04	0.68	1.58
Beta blocker	0.96	0.83	1.10
Alpha/beta blocker	0.87	0.68	1.10
>1 med class	0.85	0.71	1.03