

AgingEye Times

[Home](#) > Drug Treatment for Glaucoma

[Medical Dictionary](#)

[Using Eyedrops](#)

High eye pressure not only increases the risk of developing glaucoma, but also causes progression of glaucoma and visual field defects. The mainstay of glaucoma treatment is to lower the eye pressure, either with eyedrops or surgery. Progression of visual field defects can be practically halted if the eye pressure is lowered below 12 mm Hg. Even in patients with a type of glaucoma in which visual field defects occur and progress despite the eye pressure being in the normal range (normal-tension glaucoma), reducing the eye pressure by 30% is associated with less visual field loss.

Other eye pressure-independent strategies for glaucoma management are being currently investigated. These include increasing blood supply to the optic nerve and providing some forms of neuroprotection. Perhaps in the future, we will have ways other than eye pressure reduction to manage glaucoma. Until then, lowering the eye pressure is the only method for reducing the risk of glaucoma visual field loss and remains the primary goal of therapy.

Several eyedrops are available to reduce the eye pressure. The choice of the initial agent is guided by the patient characteristics and associated medical conditions. In general Timoptic has been a traditional favorite. Recently the shift has been to consider Xalatan as the initial drug to lower the eye pressure. The guiding principal is to avoid known side effect issues while maintaining the convenience of once a day administration to maximize compliance. Because the effect on eye pressure of glaucoma drugs from different groups is additive, they can be used in conjunction and interchangeably. We discuss below the key points in considering the drug treatment. We have used brand-names because of general familiarity with the names, although several drugs are available in equally effective and cost effective generic forms.

Clicking on the individual drug will allow you to view detailed information regarding that drug. The top row shows drugs that are prescribed more often. The bottom row has newer drugs as well as older drugs with unique characteristics.



Beta blockers (Timoptic, Timoptic (XE/GFS), or Ocudose), Betoptic, Optipranolol, Ocupress)

Over twenty years later, beta-blockers are still the most popular anti-glaucoma agents, and they far surpass any other medication as the first therapy of choice in open-angle glaucoma. Although beta blockers have proven to be very effective and safe when used as eyedrops, there are several long-term side effects that one needs to be aware of. In general side effects are more associated with non-selective beta blockers (Timoptic) than with selective beta blockers (Betoptic). However, Timoptic pressure lowering affect is more efficacious than Betoptic. The non-selective beta-blocker Timoptic lowers the Eye pressure by 4-6 mm Hg (20-35%), and Betoptic lowers eye pressure by 3-4 mm Hg (15-25%). One mechanism of Betoptic of considerable investigative interest is the calcium channel antagonistic effect providing **neuroprotection**. Despite lesser lowering of eye pressure than Timoptic, Betoptic has been reported to have a better effect on preservation of visual fields than Timoptic. This argues for possible neuroprotection with Betoptic, however most physicians concede that although this effect may occur at high doses of Betoptic, it would be probably be difficult to achieve neuroprotection at the low dose that is used in the eyedrops. All beta-blockers are less effective in eyes with dark colored iris (*Surv Ophthalmol* 47 (Suppl 1):S2-S5, 2002).

Beta blockers can cause bronchospasm and thus can exacerbate asthma and chronic obstructive pulmonary disease (COPD). It may be worthwhile to avoid beta blockers in patients who smoke and in patients with a history of bronchospastic disorders (selective beta blocker, Betoptic may still be used). Beta blockers should be used with caution in diabetics because they may mask the symptoms of hypoglycemia. Bradycardia (reduced heart rate) is another potential side effect. Since myocardial contractility is reduced, these agents can exacerbate congestive heart failure. These agents should be used with caution in any patient with heart disease. Recently reports suggest that beta-blocking agents are associated with nocturnal hypotension, which may be a risk factor in progression of glaucomatous optic nerve damage. After prolonged use, depression, mood alterations, memory loss, hallucinations, decreased libido, and impotence can all occur. **An easy and effective way to reduce systemic side effects of timoptic is to perform nasolacrimal occlusion after topical application.** Nasolacrimal occlusion reduces plasma levels of timoptic by up to 70%. **Betimol** also has Timolol (like in Timoptic).

Prostaglandin analogues (Xalatan, Rescula, Travatan, Lumigan)

These prostaglandin-like drugs lower intraocular pressure by increasing the uveoscleral outflow of aqueous humor. They are very effective in reducing the eye pressure and have the advantage of requiring only once a day administration. The prostaglandin analogs (Xalatan) lower IOP by up to 50% and 6-8 mm Hg on average. Current trend clearly shows Xalatan to be emerging as the favored first-line eye pressure reducing drug. Rescula is not quite as effective and is only able to lower the eye pressure by 3-4 mm Hg. The prostaglandin analogs seem to be more effective in eyes with dark colored iris. Unopened bottles of Xalatan require refrigeration but after opening it one can keep the opened bottle at room temperature if the bottle is going to be used up within a month. The Use of Xalatan has been reported to be associated with exacerbation of uveitis and cystoid macular edema. Of some concern is the ability of these agents to cause permanent iris color changes. Blue/green iris color may become brownish. These agents should also be avoided in pregnant women because of the potential of prostaglandins to induce labor.

Alpha-Adrenergic Agonists (Alphagan, Iopidine, Propine)

These drugs work by both increasing uveoscleral outflow and by decreasing aqueous formation. They require twice-daily administration to be effective. Alphagan can reduce eye pressure by approximately 20-27%. Alphagan has also **neuroprotective** properties. Though the evidence is far from being definitive, experimental studies show that alphagan prevents degeneration of retinal nerve cells (*Surv Ophthalmol* 47(Suppl 1) :S116-S124, 2002). Allergy rate of 30% has been observed with Alphagan. A new formulation, Alphagan-P has Purite as the preservative and this formulation may decrease the incidence and severity of allergic reactions. Othe side effects include conjunctival hyperemia (the eye appears red) along with conjunctival follicle formation. Severe hypotension and other cardiovascular side effects have been reported in infants and toddlers. Alphagan is contraindicated in infants because of serious systemic side-effects and should be avoided in children under 5 years of age.

Carbonic anhydrase inhibitors (Trusopt, Azopt)

These drugs decrease intraocular pressure by reducing aqueous formation. Although slightly less effective than the beta-blockers, these agents are usually well tolerated. If used as monotherapy, they may require three-times daily dosing, but twice-daily dosing is usually effective when they are used as adjunctive treatment. These are sulfa-drugs so patients allergic to sulfonamides should not use them. Serious side effects are rare, but kidney stones, corneal decompensation, hypotony, and choroidal detachment have been reported in patients using topical carbonic anhydrase inhibitors. A metallic or distorted taste, particularly with carbonated beverages, may be experienced. Oral carbonic anhydrase inhibitors are also available ([Diamox](#), [Neptazane](#)).

Combination eyedrops (Cosopt)

Currently combination of Timoptic and Trusopt (Cosopt) is available and is very effective in twice a day dosing. Combinations of Xalatan and Timoptic as well as Alphagan and Timoptic are being studied and may become available soon. Combination eyedrops may improve compliance if more than one drug is needed to control the eye pressure as it is more convenient to deal with just one bottle.

Pregnancy and Glaucoma treatment

The following are good principles to remember in consideration of treating pregnant women with glaucoma. All available glaucoma medications cross the placenta as well as are secreted into the milk during lactation therefore there will always be a potential for side effects to the fetus. The safest option is to avoid all glaucoma eyedrops altogether and opt for alternative methods of reducing the IOP such as laser surgery (ALT). Incisional surgery should be considered for patients who cannot achieve an adequate intraocular pressure with no or judicious use of topical medication.

If eyedrops are opted for, then use drug doses with the lowest systemic levels in the mother, employ punctal occlusion, and refer to the FDA categories in choosing medical therapy during gestation and lactation. The minimum amount of medical treatment possible for glaucoma should be prescribed. Timolol and Trusopt are approved by the American Academy of Pediatrics for use during lactation and should be used with punctal occlusion. Timolol gel forming solution appears to be a good choice. Alphagan should not be used in infants and is best avoided during pregnancy and lactation. Xalatan has the potential of causing premature labor, therefore may not be a first choice agent.

(References: Stamper. *Surv Ophthalmol* 2002;47:63-67, Johnson. *Surv Ophthalmol* 2001;45:449-54)

Exercise and Eye Pressure

Isokinetic exercises cause considerable reduction in intraocular pressure and may be helpful in glaucoma (*Ophthalmologica* 1999;213:290-4). Aerobic exercise also lowers intraocular pressure (IOP) and short-term studies show it may improve blood flow to the retina and optic nerve as well. Eye pressure can be lowered by exercise that raises the pulse just 20-25% --that could be a brisk walk -- for 20 minutes, a minimum of four times a week or Aerobics (Quigley H, in *Glaucoma.org* 2002, vol.19 newsletter).

In normal eyes of sedentary subjects who engage in moderate to heavy exercise for 3 months, a consistent decrease in IOP occurs (on the order of 1–2 mm Hg). The effect is diminished in physically fit subjects. If one stops exercising, the effect wears off in 3 weeks. Exercise may not be effective in lowering IOP in everyone. In one study IOP was lowered by at least 2 mm Hg by exercise in 34%. However, 57% had no change in IOP, while 9% had an IOP elevation (*Survey of Ophthalmology* 2001;46:43-55).

What is Isokinetic exercise and Aerobics?

In Isokinetic Exercises movements take place at a controlled rate of speed. For example, an isokinetic stationary bicycle set at 90 revolutions per minute means that despite how hard and fast the exerciser works, the isokinetic properties of the bicycle will allow the exerciser to pedal only as fast as 90 revolutions per minute. Cybex® and Biodex® machines provide this kind of workout, but these machines are generally used by physical therapists and not readily available to most people.

Aerobics refers to using the same large muscle group, rhythmically, for a period of 15 to 20 minutes or longer while maintaining 60-80% of your maximum heart rate. Aerobic activities include: walking, biking, jogging, swimming, aerobic classes and cross-country skiing. Think of aerobic exercises as being long in duration yet low in intensity. You should be able to carry on a short conversation while doing aerobic exercise.

Read or print the JAMA patient page on [why you should exercise](#) as well as the [benefits of](#)

regular physical activity.

Often people get confused by the terminology used to describe different exercise types. There are two other exercise types. **1). Isometric exercises:** The term "isometric exercise" means tensing a muscle and holding it in a stationary position while maintaining the tension. Isometric exercises are especially helpful to people recovering from injuries that limit range of motion. An example of isometric exercise is pushing against a brick wall -- even though there is a build up of tension in the muscles, there is no actual movement. If you suffer from heart disease or raised blood pressure, you should not do isometric training. During the muscular contractions in this form of exercise, blood pressure can rise quite dramatically. **2). Isotonic exercises:** These exercises are popular muscle-strengthening exercises, for example free-dumbbells, weight lifting etc. The muscles contract and go through a range of movement against a fixed load. Isotonic exercises are the most common form of exercise in rehabilitation.

Coffee, caffeine and Glaucoma

Most physicians will advise glaucoma patients to avoid caffeine beverages. AgingEye Times reviewed the published studies to address this issue.

A recent study investigated the effect of caffeine on eye pressure (*Ann Pharmacother.* 2002;36:992-5). The consumption of regular (180 mg caffeine in 200 mL beverage) and decaffeinated coffee (3.6 mg caffeine in 200 mL beverage) was compared. Regular coffee resulted in about 3 mm Hg eye pressure increase in 1 hour. This magnitude of eye pressure increase is likely to be clinically important. Another study in the past had shown much lower eye pressure rise with caffeine (about 1 mm Hg pressure rise - likely not to be clinically important) (*Ophthalmology.* 1989;96:624-6).

It is important to note that the eye pressure rise will depend on how much caffeine you consume. Different beverages have differing amounts of caffeine. Given what we know, high amount of caffeine consumption is certainly not good for glaucoma. Whether lower amounts should also be avoided is debatable. Current evidence does not suggest a strict avoidance of caffeine, but rather a lowering of the intake. Beverages containing about 50 mg caffeine may be fine. Certainly as the study showed, glaucoma patients should not consume a 180 mg caffeine beverage. Tea (black or green - made of leaves) contains lesser caffeine and has the additional advantage of being rich in flavonoids (antioxidants good for the heart and the eye too), therefore tea may be a good alternative beverage for glaucoma patients.

Marijuana and Glaucoma

Studies in the early 1970s showed that marijuana, when smoked, lowers intraocular pressure in people with normal pressure and those with glaucoma. In an effort to determine whether marijuana, or drugs derived from marijuana, might be effective as a glaucoma treatment, the National Eye Institute supported research studies from 1978 to 1984. These studies demonstrated that some derivatives of marijuana lowered intraocular pressure when administered orally, intravenously, or by smoking, but not when topically applied to the eye. However, none of these studies demonstrated that marijuana -- or any of its components -- could safely and effectively lower intraocular pressure any more than a variety of drugs then on the market.

As research with other potential glaucoma drugs has shown, simply lowering intraocular pressure does not necessarily control the disease. In addition, some potentially serious side effects were noted, including an increased heart rate and a decrease in blood pressure in studies using smoked marijuana.

A wide variety of therapies are currently used to treat glaucoma, including FDA-approved drugs and laser and conventional surgery. Several of these medications have just recently been approved by the FDA. Research to date has not investigated whether marijuana use offers any advantages over currently available glaucoma treatments or if it is useful when used in combination with standard therapies.

For more information on Marijuana, read the [Workshop on the Medical Utility of Marijuana](#) -- Report to the Director, NIH, by the Ad Hoc Group of Experts.

Acupuncture

Two separate case series with glaucoma have found that most patients report a subjective improvement of central visual acuity after acupuncture but there was no change in eye pressure or visual field (Survey of Ophthalmology 2001:46:43-55).

What is Acupuncture?

Acupuncture is based on the belief that health is determined by a balanced flow of vital life energy (called qi or chi) present in all living organisms. This energy circulates in the body along 12 major energy pathways called meridians. Each meridian contains over 1000 acupoints that can be stimulated to alter the flow of qi. With the use of special needles inserted just under the skin at these acupoints, an acupuncturist attempts to correct or rebalance the flow of energy to treat disease.

To date, there is no clear evidence that Stress or Relaxation (Meditation) can affect eye pressure or glaucoma. There has been no convincing study showing a beneficial effect of Therapeutic Touch or Chiropractic Medicine on glaucoma.

 [Print](#)  [copy of this page](#)

© 2003. Read copyright notice.

[Back](#)