

## Steroid Induced Glaucoma

**Authors:** •*Subham Sinha Roy, MBBS* •*Richa Jain, MS*, •*Snigdha Sen, MS*  
Upgraded Department of Ophthalmology, Sarojini Naidu Medical College, Agra

Steroid-induced glaucoma is a form of open-angle glaucoma occurring as an adverse effect of corticosteroid therapy. However, an even higher percentage of normal individuals develop substantially increased IOPs if the glucocorticoid is administered in greater frequency, at higher doses or for a longer period. It is usually associated with topical steroid use, but it may develop with oral, intravenous, inhaled and periocular steroid administrations by causing decrease in aqueous outflow facility. A number of drugs have been implicated in corticosteroid-induced glaucoma like dexamethasone, prednisolone, betamethasone, fluoromethalone, hydrocortisone, cortisone etc.

Apart from glaucoma, corticosteroid administration is associated with posterior subcapsular cataract development.

### INCIDENCE

Steroid induced intraocular pressure (IOP) elevations can occur in all age groups. No gender and racial predilection exists for steroid induced glaucoma.

Incidence of steroid induced IOP elevations in patients on systemic corticosteroids is unknown. These patients may be discovered during routine eye check or else seeking medical care to an ophthalmologist due to some other reason

However, 5% of the general population is considered to be 'steroid responders', i.e., may develop steroid induced glaucoma when steroid is administered. Approximately one-third of individuals experience moderate increase in IOP after topical steroid use. Following 4-6 weeks of topical corticosteroids, in about 5% of patients

IOP will rise by more than 16 mmHg and 30%, by 6-15 mmHg.<sup>1,2</sup> Classic studies by Armaly and Becker indicate that 56% of normal develop marked IOP rises after 46 weeks of topical dexamethasone or betamethasone administration.

TABLE 1: IOP response to topical corticosteroids

	Armaly <sup>3</sup>	Becker <sup>4</sup>
Frequency	QID	TDS
Duration	6 weeks	4 weeks
Parameter	Final IOP	IOP change
Type of Responder	IOP(mmHg)	IOP(mmHg)
Low	<20 (58%)	<6 (66%)
Intermediate	20-31 (36%)	6-15 (29%)
High	>31 (6%)	>15 (5%)

### RISK FACTORS

#### 1. PATIENT'S SUSCEPTIBILITY

Patients who are steroid responders are likely to develop Primary open angle glaucoma (POAG) following steroid administration and those with pre-existing POAG. 92% of POAG patients are high steroid responders; among their children, 19%.

A higher than average risk is found in patients with:

1. Patients with pre-existing POAG
2. A first degree relative with POAG
3. A history of previous steroid induced IOP elevation
4. Type 1 Diabetes Mellitus
5. Connective tissue diseases
6. Penetrating Keratoplasty, especially in eyes with Fuchs Endothelial dystrophy or keratoconus.
7. High Myopia



**2. ROUTES OF ADMINISTRATION:**

Steroid induced glaucoma is mostly caused by exogenous steroids. In rare cases, glaucoma is produced by endogenous glucocorticoids associated with adrenal hyperplasia or adenoma. It is mostly seen with topical steroids, however, it is

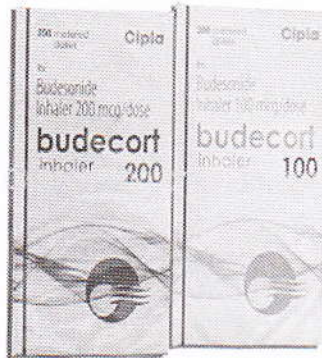


TABLE 2: Route of administration

**EXOGENOUS CORTICOSTEROIDS**

**OCULAR**

- Eye-drops
- Ocular ointment

**PERIOcular/INTRAVITREAL INJECTIONS**

**SYSTEMIC**

- Oral
- Injection
- Topical to skin

**ENDOGENOUS CORTICOSTEROIDS**

- Adrenal hyperplasia
- Adrenal adenoma or carcinoma
- Ectopic ACTH production



possible with other local (dermal or inhalational), depot (sub-conjunctival, sub-Tenon's, intravitreal), or systemic steroids. Intravitreal triamcinolone can increase IOP for months. A 20mg dose increased IOP above 21mmHg in 40% of people for up to 9 months: 1% required trabeculectomy. In some patients, the IOP rise persists and may require topical medication, laser trabeculectomy or even trabeculectomy to lower the pressure and prevent optic nerve damage or progression of optic nerve damage.

Systemic corticosteroids are least likely to induce glaucoma. IOP elevations may occur weeks to years after treatment. There have been several case reports of increased IOP following use of a corticosteroid inhaler for asthma. Even new inhalational agent with safety profile like Fluticasone propionate has been reported to cause a significant rise in IOP especially in patients predisposed to POAG.

**3. STEROID PREPARATIONS:**

More potent the steroid more is its pressure inducing effect i.e, directly proportional. Potent steroids like dexamethasone, betamethasone and prednisolone have a higher tendency for IOP rise compared to lesser potent steroids like fluoromethalone and medrysone. Even more the concentration of steroids, more is the likelihood of IOP rise.

**4. DURATION OF STEROID-THERAPY:**

It takes from weeks, months to years to develop rise in IOP following steroid administration. It



depends upon various factors like steroid formulations, mode of administrations etc. However, topical steroids can cause rise in IOP following 4-6 weeks of therapy whereas systemic steroids takes a longer time for IOP rise. Longer the duration of steroid therapy, higher is the propensity to develop IOP rise and glaucoma.

### **PATHOPHYSIOLOGY:**

Glucocorticoids raise IOP by lowering outflow facility through an unknown mechanism. The most common explanation for this phenomenon has been that glucocorticoids cause an accumulation of glycosaminoglycans in the trabecular meshwork, perhaps by stabilizing lysosomal membranes and inhibiting the release of catabolic enzymes. Thus, they reduce trabecular outflow facility.

Other explanations for corticosteroid glaucoma include an inhibition of the phagocytosis of foreign matter by trabecular endothelial cells and decreased synthesis of prostaglandins that regulate aqueous humor outflow.

Southren and co-workers and Weinstein and co-workers found abnormal glucocorticoid metabolism in trabecular tissue from patients with POAG. This finding may explain the increased susceptibility of patients with POAG to the ocular hypertensive effects of glucocorticoids.

### **CLINICAL FEATURES:**

As stated, corticosteroid glaucoma usually resembles POAG. History of systemic or ocular disease which could require chronic corticosteroid use (asthma, uveitis, collagen vascular disease, asthma, dermatitis) should be elicited in patients having open angle glaucoma. However, the clinical picture may be altered by the age of the patient. Infants treated with corticosteroids may develop a condition that resembles congenital glaucoma. In contrast; elderly patients who received corticosteroid treatment in the past may have normal tension

glaucoma.

Clinical evaluation reveals an elevated IOP, open and normal appearing angles on gonioscopy, white painless eye, optic disc cupping and visual field defects.

There have been several reports of moderate to severe IOP elevation in patients treated with corticosteroid eye-drops following laser-assisted in-situ keratomileusis (LASIK). These cases can be particularly challenging because of the difficulty in obtaining an accurate measurement of the true IOP in the postoperative period (or, in fact, anytime after LASIK because of the subsequent very thin cornea).

### **DIFFERENTIAL DIAGNOSIS:**

1. POAG
2. Uveitic glaucoma
3. Glaucomatocyclitic crisis
4. Normal tension glaucoma
5. Congenital glaucoma

### **MANAGEMENT:**

The first step in managing corticosteroid glaucoma is to discontinue the drug. In most cases, IOP returns to normal over a few days to several weeks. During this period, anti-glaucoma medications may be used to control IOP.<sup>23</sup>

If glucocorticoid treatment is necessary for the patient's life or well-being, therapy should be altered to the weakest possible drug at the lowest possible dose. The residual glaucoma is then treated in the same fashion as is POAG. In the cases that require topical ocular corticosteroid therapy, the patient should be treated if possible with drugs such as medrysone or fluorometholone because these drugs have less of a tendency to raise IOP. Topical NSAIDs are other alternatives with no IOP rising potential but lacks enough anti-inflammatory property compared to steroids.

If medication is unsuccessful in controlling IOP



and the optic nerve is threatened, laser-trabeculoplasty or filtering surgery should be considered. However, if both medical and laser therapy fails, trabeculectomy with or without antimetabolites is the primary procedure. In cases of eyes with active neovascularization or inflammation, a glaucoma drainage device may be used as the primary procedure.

In rare cases, IOP remains elevated months to years after the corticosteroid has been discontinued. In these situations, it may be impossible to determine whether this is a residual effect of glucocorticoid treatment or whether the patient has had underlying open-angle glaucoma unmasked by the treatment. In either case, the patient is treated in similar fashion.

### CONCLUSION:

All patients under corticosteroid therapy especially those with a family history of glaucoma should be routinely examined to rule out glaucoma. Inadvertent use of steroids and self-medication should be discouraged. Long term use of steroid should be avoided or substituted by other alternatives without compromising treatment standard to the best possible way.

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*You've had your peepers since you were born, so you may think you know them pretty well, but here are some fun facts you may not know about eyes:*

- *The average blink lasts for about 1/10th of a second.*
- *While it takes some time for most parts of your body to warm up to their full potential, your eyes are on their "A game" 24/7.*
- *Eyes heal quickly. With proper care, it only takes about 48 hours for the eye to repair a corneal scratch.*
- *Seeing is such a big part of everyday life that it requires about half of the brain to get involved.*
- *Newborns don't produce tears. They make crying sounds, but the tears don't start flowing until they are about 4-13 weeks old.*
- *Around the world, about 39 million people are blind and roughly 6 times that many have some kind of vision impairment.*
- *Doctors have yet to find a way to transplant an eyeball. The optic nerve that connects the eye to the brain is too sensitive to reconstruct successfully.*
- *The cells in your eye come in different shapes. Rod-shaped cells allow you to see shapes, and cone-shaped cells allow you to see color.*
- *You blink about 12 times every minute.*
- *Your eyes are about 1 inch across and weigh about 0.25 ounce.*
- *Some people are born with two differently colored eyes. This condition is heterochromia.*
- *Even if no one in the past few generations of your family had blue or green eyes, these recessive traits can still appear in later generations.*
- *Each of your eyes has a small blind spot in the back of the retina where the optic nerve attaches. You don't notice the hole in your vision because your eyes work together to fill in each other's blind spot.*
- *Out of all the muscles in your body, the muscles that control your eyes are the most active.*
- *80% of vision problems worldwide are avoidable or even curable.*