



## TO INVESTIGATE ASSOCIATION BETWEEN INTRAOCULAR PRESSURE AND INHALED CORTICOSTEROIDS

**Sindu Sulekha Chigiri**

Professor, Department of Ophthalmology, Chalmeda Anand Rao Institute of Medical Sciences, India

**Porandla Laxmi Prasanna**

Assistant Professor, Department of Ophthalmology, Chalmeda Anand Rao Institute of Medical Sciences, India

**Nakka Shiva Kumar Yadav\***

P.G. Resident, Department of Ophthalmology, Chalmeda Anand Rao Institute of Medical Sciences, India \*Corresponding Author

### ABSTRACT

**Background and Objective:** It is well known that oral steroids cause several ocular side effects, most commonly cataract and glaucoma[1]; however, the ocular side effects of inhalational steroids are less well understood. The present study was taken up to study the association between the use of inhalational corticosteroids and intra ocular pressure. **Materials and Methods:** The present prospective study was conducted at the Department of Ophthalmology, Chalmeda Anand Rao Institute of Medical Sciences from Jan 2021- July 2022. 100 patients satisfying inclusion and exclusion criteria were included, out of which 50 patients each were taken as cases and controls. Cases with age >18 years and use of ICS of  $\geq 800$  mcg equivalent of budesonide for at least 6 months were included in the study. Controls did not have any respiratory disease and had never used corticosteroids in any form—topical, inhaled, or oral. Age- and sex-matched cases and controls were recruited from among the patients of the ophthalmology department. Written informed consent was provided, and in those consenting, a detailed history was taken, including demographics, ocular disease, past medical illness, drug history, and personal history. Total study population was divided into two groups: Group A: 50 patients using 800 mcg of budesonide or its equivalent dose of ICS for at least 6 months. Group B: 50 healthy controls not using any form of steroids. Ocular examination including visual acuity using Snellen's chart, slit lamp examination, and fundus examination using 90D and indirect ophthalmoscopy was done. IOP was measured by Goldmann applanation tonometry, with an average of 3 recordings. If corrected, IOP was  $\geq 21$  mmHg or disc changes (cup-to-disc ratio of  $\geq 0.5$  or cup-disc asymmetry of  $\geq 0.2$ ) then gonioscopy and visual fields testing were performed. **Results:** Of the total 50 cases, 47 (94%) had normal Intra Ocular Pressure and optic nerves (cup-to-disc ratio of  $< 0.5$ ). Only 3 (6%) cases had raised intra ocular pressure. None of the controls had raised IOP. There was a statistically significant difference between the means of IOP among the cases and controls with P value of  $< 0.0001$ . **Conclusion:** Use of ICS causes significant rise in IOP

**KEYWORDS :** Inhaled Corticosteroids, Intra Ocular Pressure, Glaucoma

### INTRODUCTION

In 2019, the Global Initiative for Asthma (GINA) introduced what is described as the most radical change to the asthma treatment paradigm of the last 30 years.[1] Previously, for patients with mild intermittent asthma, short-acting beta-agonists (SABA) alone were used as first-line therapy. The addition of inhaled corticosteroids (ICS) was reserved for more severely symptomatic cases.[1] The new report from GINA recommended using SABA + ICS combination for both maintenance and relief therapy in patients of 12 years of age or older,[2] affecting the patients with mild intermittent asthma who are not currently adherent to regular ICS treatment, thus increasing the population's exposure to corticosteroids. These recommendations influence clinical decision-making and treatment guidelines throughout the world and these changes continue to be reflected in the 2020 and 2021 GINA reports.[3,4]

It is well known that oral steroids cause several ocular side effects, most commonly Cataract and Glaucoma[5]; however, the ocular side effects of inhalational steroids are less well understood. Intraocular pressure (IOP) is the most common risk factor for progressive optic neuropathy in glaucoma and is affected by both topical and oral corticosteroids.

The exact mechanism of steroid-induced IOP increase is still unknown, although many theories have been postulated. The most commonly accepted hypothesis, proposed by Clark,[6] is that steroid receptors are activated that alter the trabecular meshwork genes myocilin and optineurin, which in turn cause changes in the extracellular matrix.

Steroids can also reduce the phagocytic action of the trabecular meshwork endothelial cells.[5]

Garbe et al[7] was first to study the association between inhalational steroids and ocular hypertension. Mitchell et al[8] also showed a positive correlation between risk of glaucoma and use of inhaled steroids in patients with a family history of glaucoma.

The present study was taken up to study the association between the use of inhalational corticosteroids and intra ocular pressure.

### AIM:

To study the association between the use of inhalational corticosteroids and intra ocular pressure.

### MATERIALS AND METHODS:

The present prospective study was conducted at the Department of Ophthalmology, Chalmeda Anand Rao Institute of Medical Sciences from Jan 2021- July 2022. 100 patients satisfying inclusion and exclusion criteria were included, out of which 50 patients each were taken as cases and controls.

### Inclusion Criteria:

- Cases with age >18 years and use of ICS of  $\geq 800$  mcg equivalent of budesonide for at least 6 months.
- Controls did not have any respiratory disease and had never used corticosteroids in any form—topical, inhaled, or oral.

This change increases the resistance to aqueous outflow.[5]

### Exclusion Criteria:

- Patients who had preexisting glaucoma, family history of glaucoma, or who were taking any form of topical steroids were excluded.
- Patients with any cause of diminution of vision other than cataract, including retinal pathology, corneal pathology (including previous refractive surgeries), and uveitis, were also excluded, as were those who had received oral/parenteral corticosteroids for >2 weeks within the last 3 months.
- Patients with diabetes mellitus and hypertension were also excluded to avoid confounding bias.

**Procedure:**

Age and sex-matched cases and controls were recruited from among the patients of the ophthalmology department. Written informed consent was provided, and in those consenting, a detailed history was taken, including demographics, ocular disease, past medical illness, drug history, and personal history. Total study population was divided into two groups.

**Group A:**

50 patients using 800 mcg of budesonide or its equivalent dose of ICS for atleast 6 months.

**Group B:** 50 healthy controls not using any form of steroids.

Ocular examination including visual acuity using Snellen's chart, slit lamp examination, and fundus examination using 90D and indirect ophthalmoscopy Was done. IOP was measured by Goldman applanation tonometry, with an average of 3 recordings. If corrected, IOP was  $\geq 21$  mmHg or disc changes (cup-to-disc ratio of  $\geq 0.5$  or cup-disc asymmetry of  $\geq 0.2$ ) then gonioscopy and visual fields testing were performed.

Data entry was done by using Microsoft Excel 2010 version. Data analysis was done by Epi Info 7.2.14 version and also Microsoft Excel. SPSS 19<sup>th</sup> version was also used. Descriptive Statistics like Mean, Median were used for continuous variables and frequencies were used for categorical variables.

Inferential Statistics like Chi square test for categorical variables and T test was used for continuous variables. The p value <0.05 is considered to be statistically significant.

**OBSERVATIONS AND RESULTS:**

The patients in both the groups were matched for age and sex. The age range of participants was 19–79 years of age. The mean ( $\pm$  SD) age of cases was  $51.23 \pm 10.45$  years; of controls,  $51.65 \pm 9.68$  years ( $P > 0.05$ ). There were 29 males and 21 females in each group.

The following table shows the demographic details of cases and controls:

Parameter	Cases	Controls	P value
Age	51.23 $\pm$ 10.45 years	51.65 $\pm$ 9.68 years	>0.05
Gender (M/F)	29/21	29/21	0.99

Of the total 50 cases, 47 (94%) had normal Intra Ocular Pressure and optic nerves (cup-to-disc ratio of <0.5). Only 3 (6%) cases had raised intra ocular pressure. None of the controls had raised IOP. There was a statistically significant difference between the means of IOP among the cases and controls with P value of <0.0001.

The following table shows the intra ocular pressure among cases and controls:

Study group	Mean	Standard deviation	P value
Controls	12.25	1.95	<0.0001
Cases	16.23	4.01	

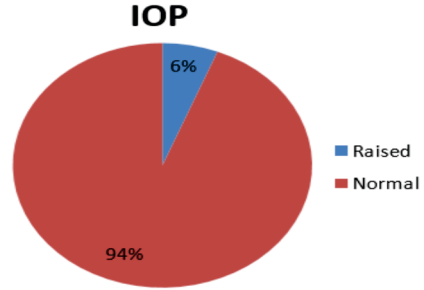


Figure showing the IOP among cases:

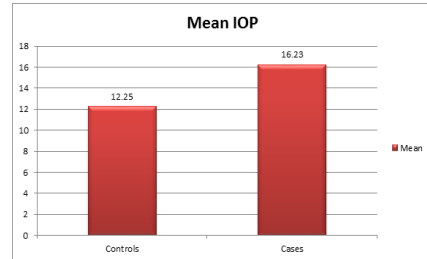


Figure showing the mean IOP among cases and controls:

**DISCUSSION:**

In the present study, of the total 50 cases, 47 (94%) had normal Intra Ocular Pressure and optic nerves (cup-to-disc ratio of <0.5). Only 3 (6%) cases had raised intra ocular pressure – Ocular Hypertension. None of the controls had raised IOP. There was a statistically significant difference between the means of IOP among the cases and controls with P value of <0.0001.

The findings of the present study are in line with the following studies:

In a study done by Shroff S et al[9], the mean IOP of cases was  $15.31 \pm 3.27$  mm Hg, statistically significantly higher than the mean of  $13.39$  mm Hg  $\pm 1.95$  in controls ( $P < 0.001$ ). Among the cases, 11 (5.5%) had ocular hypertension and 2 (1%) had open-angle glaucoma.

On the contrary, the following studies did not show any association between use of ICS and IOP:

In an study done by Moss EB et al[10], there was no significant change in IOP from baseline to 6 weeks ( $14.3 \pm 3.6$  mmHg vs  $14.5 \pm 4.0$  mmHg,  $p = 0.34$ ). There was no IOP elevation  $\geq 20\%$  from baseline at any study visit.

In an another study done by Vinokurtseva A et al[11], use of ICS or INS does not significantly increase the incidence of glaucoma or OHT. However, ICS and INS patients had significantly higher IOPs compared to untreated patients.

**CONCLUSION:**

With the above results it can be concluded that use of ICS can cause significant rise in IOP

**Conflicts Of Interest:** None

**Financial Support And Sponsorship:** None

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