

## A Study on the Effect of Intranasal Steroids on Intra Ocular Pressure in Allergic Rhinitis Patients Attending a Tertiary Teaching Hospital

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### Abstract

**Background:** Allergic Rhinitis is a worldwide burden of disease and in India the prevalence is 25 to 30% of the population. Oral and Intranasal steroids are used as a mode of treatment in 10% of these patients. The effect of intranasal steroids on intra-ocular pressure was reported in the literature and in this study an attempt was made to review its incidence and effects on the vision over a period of 16 months.

**Aim of the Study:** To study the effects of intra nasal steroids used in Allergic Rhinitis patients on the intraocular pressure and vision.

**Materials:** 109 patients aged between 15 and 65 years who were using Intra nasal steroids belonging to both genders were included. The Allergic Rhinitis response score was used and graded as Allergic Rhinitis score: Good- 45 to 60, Moderate- 30 to 45, Average- 20 to 30 and Poor- Less than 20. Parameters used were decrease in rhinorrhea, nasal obstruction, sneezing, time taken for relief and improved quality of life. All the subjects were assessed with visual acuity and intraocular pressure using Goldmann applanation tonometry. The Goldmann tonometer was calibrated

**Results:** The mean age was 32.35±4.15 years in males and 28.45±2.15 years in females. There were 69/109 (63.30%) male patients and 40/109 (36.69%) female patients. Pearson coefficient correlations showed significant statistical significance between tonometry results and steroid usage in both the eyes (p value was 0.021; p significant at less than 0.05).

**Conclusions:** This cross-sectional study showed that Intra nasal steroids were safer in patients with Allergic Rhinitis without any Intra ocular pressure changes. The study showed a statistical significant data in favour of INS. However the Ophthalmologists should be aware of INS causing IOP in patients using INS. The ENT surgeons should cautious of occurrence of IOP in Allergic Rhinitis patients treated with INS. Such awareness remains significant in patients with glaucoma risk. Large sample cohort study would be welcome to evaluate the long-term results.

**Keywords:** Allergic Rhinitis, Intra ocular pressure, steroids, oral and intra nasal.

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## Introduction

Intra nasal steroids (topical steroids) used for a long period, have a definite role in the management of Allergic Rhinitis by reducing the symptoms like itching, rhinorrhea and excessive sneezing, hence extensively used either alone in combination of locally acting anti histamines [1]. But its long-term usage has few adverse effects on various systems including the eyes [2]. Steroids used orally or on intranasal route are known to produce changes in the lens of the eyes [3]. Prolonged use of these drugs can cause some adverse effects on eyes especially subcapsular cataracts and raised intraocular pressure [4,5]. Normally the intraocular pressure changes as a circadian rhythm and is directly proportional to the cortisol levels of the blood [6]. Intraocular pressure also varies with the age, local and systemic factors and use of medications [7]. Intraocular pressure changes are noted with the use of oral steroids, ocular steroids and injectable steroids [8]. There are studies on the effect of intra nasal steroids on intraocular pressure changes, but the mechanism of the change was not clear [9]. Intranasal steroids are used to reduce nasal obstruction (airway edema), minimize secretion of mucus, which would help in restoring the normal airway, and reduce the airway inflammation [10]. The common intranasal steroids used are Beclomethasone dipropionate, Flunisolide, budesonide, Mometasone furoate, and triamcinolone acetonide [11]. Intranasal steroids are useful in treating both the seasonal and perennial allergic rhinitis [12]. The pharmacological actions of intranasal steroids are basically acting as an anti-inflammatory agent through multiple pathways [12]. They cause inhibition of inflammatory cells by inhibiting the chemical mediators like leukotrienes and prostaglandins, which are involved in the entire allergic process [13]. They also cause increased synthesis of lipocortin-1, which in turn inhibits

phospholipase A2 and prevents the production of lipid mediators of inflammation. They also directly inhibit other mediators like histamine, kinins, platelet-activating factor, and substance P [14]. There was not much scientific evidence that intranasal steroids cause suppression of the hypothalamic-pituitary-adrenal axis [15]. Prospective studies on clinical basis have not shown to produce any effect on the growth of children except Beclomethasone dipropionate [16]. The first-generation intranasal steroids are known to have higher first-pass hepatic metabolism and higher oral bioavailability [17]. However intranasal steroids should be used cautiously to avoid raised intraocular pressure especially in Glaucoma patients [18]. Sudden increase in intraocular pressure may lead to ischemic effects on the retinal nerve fiber layer (RNFL). Chronic elevation of IOP has been suggestive of primary open-angle glaucoma. It may also lead to chronic vision loss [20]. The aim of this study was to investigate Intra ocular pressure changes in patients with Allergic Rhinitis using intranasal steroids for more than 06 months duration and followed up to 16 months.

**Type of Study:** A cross sectional and analytical study

**Period of Study:** January 2021 to June 2022

**Institution of Study:** Government Medical College and Government General Hospital, Suryapet, Telangana State.

**Materials:** 109 patients with proven Allergic Rhinitis attending the ENT OPD and using intra nasal steroids were included in the study. An ethics committee clearance was obtained from the Institute authorities. A consent form approved by the ethics committee was used.

**Inclusion Criteria:** Patients diagnosed as Allergic Rhinitis and using intra nasal steroids were included. Patients aged above

15 years and below 65 years were included. Patients of both the genders were included. Patients who are on intranasal steroids for more than 03 months before the commencement of the study were included. The patients diagnosis confirmed by skin prick tests was included.

**Exclusion Criteria:** Patients without confirmed Allergic Rhinitis were excluded. Patients aged below 15 years and above 65 years were excluded. Patients on oral corticosteroids were excluded. Patients with earlier diagnosis of raised intraocular pressure were excluded. Patients with history of ocular trauma, glaucoma and ocular surgeries were excluded. Patients with co-morbid diseases like diabetes, Hypertension and renal diseases were excluded. Patients who were on steroids and other drugs which increase intra ocular pressure were excluded.

**Study method:** A proforma with questions related to demography (Age, gender, socio-economic group, BMI, smoking and areas of living), methods of usage of steroids (Name of the intranasal steroid, number of puffs used per day, the number of weeks the subjects used) and Rhinitis control Assessment tests were included. The common intranasal steroids used by the patients were Beclomethasone dipropionate, Flunisolide, budesonide, Mometasone furoate, and triamcinolone acetonide. The Allergic Rhinitis response score was used and graded as Allergic Rhinitis score: Good- 45 to 60, Moderate- 30 to 45, Average- 20 to 30 and Poor- Less than 20. Parameters used were decrease in rhinorrhea, nasal obstruction, sneezing, time taken for relief and improved quality of life. All the subjects were assessed with visual acuity and intraocular pressure using Goldmann applanation tonometry. The Goldmann tonometer was calibrated using the guidelines of Steven *et al.* (13) Mean IOP measurements were used in the analysis.

The number of puffs of INCS used along with the frequency of usage was also determined.

**Statistical Analysis:** The variables studied were Race, gender, smoking status. Descriptive statistics used were frequencies and percentages. The mean, median, mode, standard deviation, variance, and range for all other variables were calculated. Pearson correlations was undertaken for Goldmann applanation tonometry and groups of patients by number of puffs of Intra Nasal cortico-steroids used, number of times per day of use, and number of weeks of use. Significance of differences within and between groups was analyzed statistically.

## Results

The present study was a cross sectional study which included the 109 patients undergoing treatment with intra nasal steroids for Allergic Rhinitis (AR). There were 07/109 (06.42%) patients in the age group of 15 to 24 years, 11/109 (10.09%) patients in the age group of 25 to 34 years, 36/109 (33.02%) patients in the age group of 35 to 44 years, 38/109 (34.86%) patients in the age group of 45 to 54 years, 17/109 (15.59%) patients in the age group of 55 to 64 years. (**Table 1**) The mean age was  $32.35 \pm 4.15$  years in males and  $28.45 \pm 2.15$  years in females. There were 69/109 (63.30%) male patients and 40/109 (36.69%) female patients. There were 45/109 (41.28%) patients in the low socio-economic group, 38/109 (34.86%) patients in the middle socio-economic group, 27/109 (24.77%) patients in the High socio-economic group. BMI was between 20 and 25 Kg/m<sup>2</sup> in 41/109 (37.61%) patients, between 25 and 30 Kg/m<sup>2</sup> in 26/109 (23.85%) patients, above 35 in 36/109 (33.02%) patients. (**Table 1**) History of smoking was present in 29/109 (26.60%) patients and no smoking in 80/109 (73.39%) patients. The successful treatment also

depended upon the number of puffs taken by them during the treatment period. 84 (77.06%) patients were taking two puffs in each nostril daily, 14 (12.84%) patients one puff in each nostril daily and 11 (10.09%) patients one puff in each nostril daily.

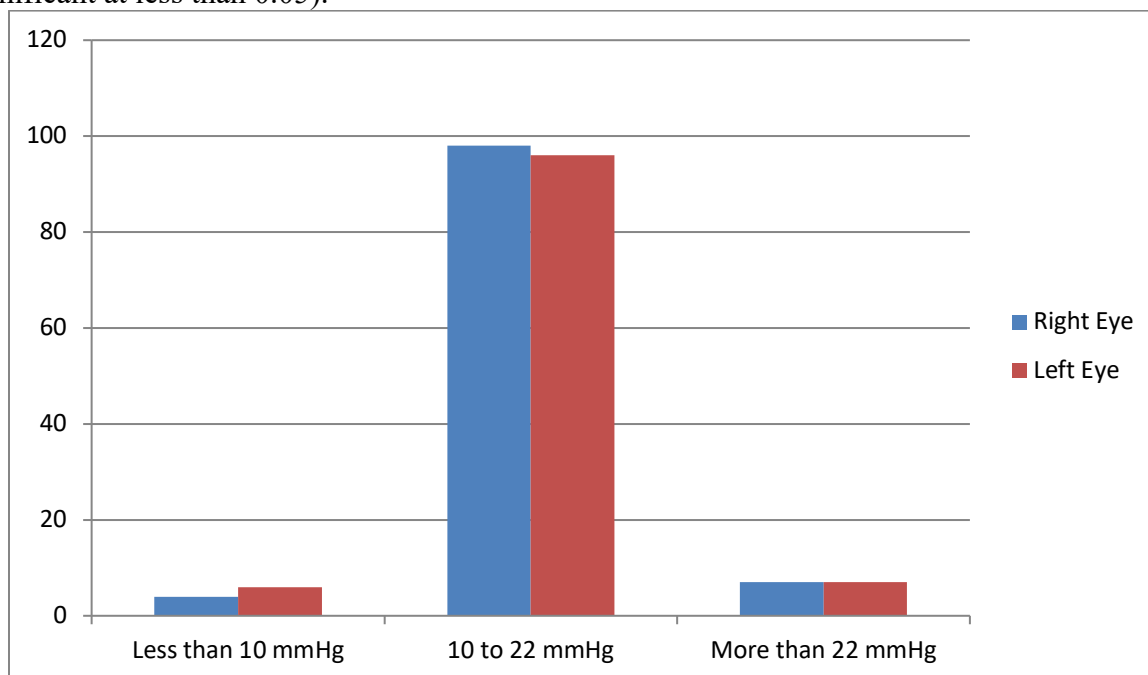
Allergic Rhinitis score was good in 71/109 (65.13%) patients, moderate in 25/109 (22.93%) patients, average in 08/109 (07.33%) patients, poor in 05/109 (04.58%) patients. (Table 1).

**Table 1: Shows the demographic data of the subjects (n-109).**

<b>Observation</b>	<b>Number</b>	<b>Percentage</b>	<b>P value</b>
<b><u>Age</u></b>			
15 to 24	07	06.42	0.115
25 to 34	11	10.09	
35 to 44	36	33.02	
45 to 54	38	34.86	
55 to 64	17	15.59	
<b><u>Gender</u></b>			
Male	69	63.30	0.204
Female	40	36.69	
<b><u>Socio-economic</u></b>			
Low	45	41.28	0.311
Middle	38	34.86	
High	27	24.77	
<b><u>BMI- Kg/m2</u></b>			
20 to 25	41	37.61	0.174
25 to 30	26	23.85	
Above 35	36	33.02	
<b><u>Smoking</u></b>			
Yes	29	26.60	0.312
No	80	73.39	
<b><u>Area of living</u></b>			
Urban	75	68.80	0.102
Rural	34	31.19	
<b><u>Number of Puffs in each nostril daily</u></b>			
01	14	12.84	0.001
02	84	77.06	
03	11	10.09	
<b><u>Allergic Rhinitis score</u></b>			
Good- 45 to 60	71	65.13	0.001
Moderate- 30 to 45	25	22.93	
Average- 20 to 30	08	07.33	
Poor- Less than 20	05	04.58	

Using Goldmann applanation tonometry the intra ocular pressure in both the eyes in all the 109 patients was measured and the results were shown in the Figure 1. In this study normal intra ocular pressure was found in 86 to 89 percent of the subjects, low pressure was noted in 03 to 06 percent individuals and high pressure was noted among 06.42% of the patients. (Fig 1) Pearson coefficient correlations was used to find the significance of this observation and found that there

was statistically significance between tonometry results and steroid usage (p value was 0.021; p significant at less than 0.05).



**Figure 1: Shows the Intra ocular pressure changes (in mmHg) observed in the study (n-109).**

Pearson coefficient correlations were used to find the significance of the usage of intranasal steroids and Goldman applanometry intraocular pressures in the study. It was observed that there was statistically significance between tonometry results and steroid usage in both the eyes (p value was 0.021; p significant at less than 0.05), (Table 2).

**Table 2: Shows the Pearson coefficient correlation between the intraocular pressure and the usage of steroids in the study (n -109).**

Mean IOP of Eyes/ mmHg	Number of Puffs	Number of times per day	Number of weeks used
<b>Right</b> 14.56±2.10	0.114	0.251	0.021
<b>Left</b> 13.85±3.04	0.230	0.101	0.001

## Discussion

Review of literature showed not much enthusiasm in the studies for intraocular pressure in patients in long term usage of steroids in many diseases. In the present study intraocular pressure was monitored in patients with AR who were for more than 6 weeks of usage of intranasal steroids. 109

AR patients on intranasal steroids (INS) were studied for their intraocular pressure. The mean age was 32.35±4.15 years in males and 28.45±2.15 years in females. There were 69/109 (63.30%) male patients and 40/109 (36.69%) female patients. The present study was conducted with a

hypothesis that the intraocular pressure might be higher in patients using INS. But the study showed normal intra ocular pressure was in 86 to 89 percent of the subjects, low pressure was noted in 03 to 06 percent individuals and high pressure was noted among 06.42% of the patients. The normal IOP taken in this study was 12 to 22 mmHg. An IOP more than 22 mmHg was considered as a risk factor for glaucoma in the long term [21]. The mean values of the Goldmann applanation tonometry in the right eye were  $14.56 \pm 2.10$  and in the left eye it was  $13.85 \pm 3.04$ ; (Normal values of IOP; 10 to 22 mmHg). Pearson coefficient correlations were used to find the significance of the usage of intranasal steroids and Goldman applanationometry intraocular pressures in the study. It was observed that there was statistically significance between tonometry results and steroid usage in both the eyes (p value was 0.021; p significant at less than 0.05), (Table 2). Dereci *et al* [22] from their study of 248 patients, concluded that there was no raise in IOP in children and adults who were treated with INS an inhaled steroid. Schlenker M, Kansal V *et al* [23]. from their study of usage of INS versus IOP and lens opacities observed that there was no rise in IOP or onset of glaucoma in their 4376 patients. There were further exhaustive studies and trials focused on the INS of different combinations of steroids used over two to 74 weeks for AR; none of the studies showed changed in IOP and they suggested that INS was a low-risk drug to manage Allergic symptoms of Upper tract respiratory inflammation [24-27]. They suggested that IOP could alter depending upon the duration of usage of INS by the patients. Valenzuela *et al.* conducted a study similar to the above study and showed that there was no statistically significant raised IOP among the patients who used INS for more than 90 weeks. There was no case of

glaucoma among the 2,837 patients, with a confidence interval of 95% [28]. In another study by Yenigun *et al* [29]. who worked on patients using INS for dry eye and AR observed that there was no raise in IOP. IN this study the patients had used INS for 6 weeks only. However, a study by Mohd Zain *et al* [30]. revealed raise in IOP of their patients who used INS for more than 50 weeks; the raise in IOP was higher in the study group than the control one. The present study did not reveal any direct relation between using INS in patients with AR and raised IOP; the INS was proved to be safer in these patients. This could be due to the reason that these INS were formulated to be delivered at the local site rather than for systemic absorption. The limitations to the present study were that it was a small sample, hence required a larger sample and a cohort study would be better.

## Conclusions

This cross-sectional study showed that Intra nasal steroids were safer in patients with Allergic Rhinitis without any Intra ocular pressure changes. The study showed a statistical significant data in favour of INS. However the Ophthalmologists should be aware of INS causing IOP in patients using INS. The ENT surgeons should cautious of occurrence of IOP in Allergic Rhinitis patients treated with INS. Such awareness remains significant in patients with glaucoma risk. Large sample cohort study would be welcome to evaluate the long-term results.

## References

1. Overview on the pathomechanisms of allergic rhinitis. Pawankar R, Mori S, Ozu C, Kimura S. *Asia Pac Allergy*. 2011; 1:157–167.
2. Nasal allergies in the Middle Eastern population: results from the "Allergies in Middle East Survey". Abdulrahman H,

- Hadi U, Tarraf H, *et al.* Am J Rhinol Allergy. 2012; 26:3–23.
3. Allergic rhinitis: an overview. Varshney J, Varshney H. Indian J Otolaryngol Head Neck Surg. 2015;67:143–149.
  4. Al Rayes H, Al Enazi F, Al Rayes H, *et al.* Saudi Arabia. 2014. Allergic rhinitis. Ministry of Health of Saudi Arabia and McMaster University Clinical Practice Guidelines on the allergic rhinitis.
  5. Vinokurtseva A, Fung M, Ai Li E, Zhang R, Armstrong JJ, Hutnik CML. Impact of Inhaled and Intranasal Corticosteroids Exposure on the Risk of Ocular Hypertension and Glaucoma: A Systematic Review and Meta-Analysis. Clin. Ophthalmol. 2022 May 30; 16:1675-1695.
  6. Wijnants D, Stalmans I, Vandewalle E.J Clin Med. The Effects of Intranasal, Inhaled and Systemic Glucocorticoids on Intraocular Pressure: A Literature Review. 2022 Apr 3;11(7):2007.
  7. Evaluating the safety of intranasal steroids in the treatment of allergic rhinitis. Sheth K. Allergy Asthma Clin Immunol. 2008; 4:125–129.
  8. Safety of intranasal corticosteroids. Bensch GW. Ann Allergy Asthma Immunol. 2016; 117:601–605.
  9. Intranasal corticosteroids for allergic rhinitis: how do different agents compare? Corren J. J Allergy Clin Immunol. 1999; 104:144–149.
  10. Anderson DR. Pearls of glaucoma management. Berlin, Heidelberg: Springer; IOP: The Importance of Intraocular Pressure; 2010; 75–78.
  11. Machiele R, Motlagh M, Patel BC. Treasure Island (FL): StatPearls; 2019. Intraocular Pressure.
  12. The effect of long-term use of intranasal steroids on intraocular pressure. Şimşek A, Bayraktar C, Doğan S, Karataş M, Sarıkaya Y. Clin Ophthalmol. 2016; 10:1079–1082.
  13. Stevens S, Gilbert C, Astbury N. How to measure intraocular pressure: applanation tonometry. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2206330/> Community Eye Health. 2007; 20:74–75.
  14. Comparison of intraocular pressure as measured by three different non-contact tonometers and Goldmann applanation tonometer for non-glaucomatous subjects. Bang SP, Lee CE, Kim YC. BMC Ophthalmol. 2017; 17:199.
  15. Effect of inhaled fluticasone propionate on retinal nerve fiber layer thickness in asthmatic children. Dereci S, Pirgon O, Akcam M, Turkyilmaz K, Dundar B. Eur J Ophthalmol. 2015; 25:535–538.
  16. 17. Intranasal corticosteroids do not lead to ocular changes: a systematic review and meta-analysis. Valenzuela CV, Liu JC, Vila PM, Simon L, Doering M, Lieu JEC. Laryngoscope. 2019; 129:6–12.
  17. A pilot study investigating the impact of topical nasal steroid spray in allergic rhinitis patients with dry eye. Yenigun A, Elbay A, Dogan R, Ozturan O, Ozdemir MH. Int Arch Allergy Immunol. 2018; 176:157–162.
  18. Renfro L, Snow JS. Ocular effects of topical and systemic steroids. Dermatol Clin. 1992;10(3):505–512.
  19. Novak-Lauš K, Kukulj S, Iveković R, Tedeschi-Reiner E, Koršić J, Matanić D. Inhaled corticosteroids and the risk of glaucoma and intraocular hypertension. Acta Clin Croat. 2003;42(1):41–45.
  20. Rosenblut A, Bardin PG, Muller B, *et al.* Long-term safety of fluticasone furoate nasal spray in adults and adolescents with perennial allergic rhinitis. Allergy Eur J Allergy Clin Immunol. 2007;62(9):1071–1077.
  21. Rotenberg BW, Zhang I, Arra I, Payton KB. Postoperative care for Samter's triad patients undergoing endoscopic sinus surgery: a double-blinded,

- randomized controlled trial. *Laryngoscope*. 2011;121(12):2702–2705. –
22. Dereci S, Pirgon O, Akcam M, Turkyilmaz K, Dundar B. Effect of inhaled fluticasone propionate on retinal nerve fiber layer thickness in asthmatic children. *Eur J Ophthalmol*. 2015;25(6):535–538.
  23. Schlenker M, Kansal V. How Mean Intraocular Pressures Are Failing Patients. *OphthalmolGlaucoma*. 2021; 1:1
  24. Alsaadi M, Osuagwu U, Almubrad T. Effects of inhaled fluticasone on intraocular pressure and central corneal thickness in asthmatic children without a family history of glaucoma. *Middle East Afr J Ophthalmol*. 2012;19(3):314–319.
  25. Gunay M, Dogru M, Celik G, Gunay BO. Swept-source optical coherence tomography analysis in asthmatic children under inhaled corticosteroid therapy. *Cutan Ocul Toxicol*. 2019;38(2):131–135.
  26. Donaldson AM, Choby G, Kim DH, Marks LA, Lal D. Intranasal Corticosteroid Therapy: systematic Review and Meta-analysis of Reported Safety and Adverse Effects in Adults. *Otolaryngol Head Neck Surg*. 2020;163(6):1097–1108.
  27. Valenzuela CV, Liu JC, Vila PM, Simon L, Doering M, Lieu JEC. Intranasal Corticosteroids Do Not Lead to Ocular Changes: a Systematic Review and Meta-analysis. *Laryngoscope*. 2019; 129:6–12.
  28. Valenzuela CV, Liu JC, Vila PM, Simon L, Doering M, Lieu JEC. Intranasal Corticosteroids Do Not Lead to Ocular Changes: a Systematic Review and Meta-analysis. *Laryngoscope*. 2019; 129:6–12.
  29. Yenigun A, Elbay A, Dogan R, Ozturan O, Ozdemir MH, Pilot Study A. Investigating the Impact of Topical Nasal Steroid Spray in Allergic Rhinitis Patients with Dry Eye. *Int Arch Allergy Immunol*. 2018;176(2):157–162.
  30. Mohd Zain A, Md Noh UK, Hussein S, Che Hamzah J, Mohd Khialdin S, Md Din N. The Relationship between Long-term Use of Intranasal Corticosteroid and Intraocular Pressure. *J Glaucoma*. 2019;28(4):321–324.