

TITLE PAGE

Correlation of features of Allergic Rhinitis and Allergic Conjunctivitis with Treatment Modalities

Abstract

Introduction:

Allergic Rhinitis (AR) is a chronic, symptomatic allergic disorder of the nose that is usually caused by IgE-mediated inflammatory response following exposure to an allergen. The allergen could be in the form of dust, pollen, flower, animal dander, mold, cold, food allergens or insect. Clinically, AR occurs when there are recurrent nasal symptoms which are reversible either spontaneously or with medication in the preceding one year. Such symptoms include at least two of the following; excessive sneezing, running nose, nasal itching, nasal discharge, nasal congestion or obstruction.

Previous studies have linked AR to be co-existed with another form of allergic disorders including AC, Atopic dermatitis and Allergic Asthma.

This study is aimed at assessing the feature of AR patients with coexistent AC as well as evaluating the effectiveness of the treatments offered to them.

Objectives:

The study was aimed at finding the correlation between the nasal and eye features in a patient who has co-existing allergic rhinitis and allergic conjunctivitis

Methodology:

This was a cross-sectional descriptive study conducted between August 2018 and November 2019 among 38 patients who presented to ENT and Ophthalmology departments of Federal

Teaching Hospital Ido-Ekiti, Ekiti State, Southwestern Nigeria and was diagnosed with both allergic rhinitis and allergic conjunctivitis. Relevant data obtained were analyzed using SPSS version 20. $P \leq 0.05$ was taken as significant.

Results:

The patients' age range between 8 and 81 years with a median age of 33 years. The majority were less than 45 years (63.2%) with the male to female ratio of almost. Eye pain, itching, and redness account for 97.4% of all the eye features, while the presence of Cobblestone-like papillae is the least and accounted for 5%. Nasal itching (92.1%) was the commonest nasal symptom. Sleep disturbance was found to be the most common among those with eye itching (29.7%).

Conclusion:

This research was conducted to correlate the features of allergic rhinitis with those of conjunctivitis and common management and preventive measures offered to the patients seen in our clinics. The majority of the patients were less than 45 years with almost equal sex ratio. Eye pain, itching, and redness account for the majority of all the eye features, while the presence of Cobblestone-like papillae is the least eye feature. Nasal itching was the commonest nasal symptom and this was seen in the majority of the patients with eye symptoms.

Introduction

Allergic Rhinitis (AR) is a chronic, symptomatic allergic disorder of the nose that is caused by IgE-mediated inflammatory response following exposure to an allergen.¹ The allergen could be in form of dust, pollen, flower, animal dander, mold, cold or insect.² Clinically, Allergic rhinitis occurs when there are recurrent nasal symptoms which are reversible either spontaneously or with medication in the preceding one year.³ Such symptoms include at least two of the following; excessive sneezing, running nose, nasal itching, nasal discharge, nasal congestion or obstruction.³

The aim of this study was to determine the correlation between clinical features of Allergic Rhinitis (AR) with Allergic conjunctivitis (AC). The availability of such data will be necessary, not only for epidemiological purposes but also for clinical diagnosis and treatment of the affected individuals.

Methodology

This is cross-sectional descriptive study was conducted between August 2018 and November 2019 among 38 patients who presented to ENT and Ophthalmology departments of Federal Teaching Hospital Ido-Ekiti, Ekiti State, Southwestern Nigeria and were diagnosed with both allergic rhinitis and allergic conjunctivitis. Sample size was obtained using G*Power version 3.1.9 software to calculate the power analysis and determine the optimal sample size. The type of power analysis chosen within G*Power is “a priori: computer required sample size – given α , power, and effect size” and the test family chosen was Chi square tests. The statistical test chosen was Goodness of fit tests: contingency tables. The effect size identified was 0.5 (large effect size), the alpha level was 0.05 while the power level was 0.80. The total sample size calculated was 32 however all 38 patients that presented to ENT and Ophthalmology with both allergic rhinitis and allergic conjunctivitis between August 2018 and November 2018 were enrolled into the study. Relevant history was taken and clinical examinations were carried out on the patients. Adequate treatment was offered and each patient was followed up for 3 months to evaluate the response to the treatment given. The data collected from the patients were entered into the computer software and analyzed using SPSS version 20. $P \leq 0.05$ was taken as significant.

Results

The patients' age range between 8 and 81 years with a median age of 33 years. The majority were less than 45 years (63.2%) with the male to female ratio of almost 1:1 (Figure 1). Eye pain, itching, and redness account for 97.4% of all the eye features (Table 1), while the presence of cobblestone-like papillae was the least and accounted for 5%. Nasal itching (92.1%) was the commonest nasal symptom (Table 2) while the least nasal presentations were nasal polyps (18.4%) and sleep disturbance (28.9%). Only about one-tenth of the patients had used allergen

immunotherapy while all of them had used an antihistamine (Table 2). Sleep disturbance (Tables 4a & 4b) was found to be the most common among those with eye itching (29.7%), blurring of vision (31.8%) and those on a steroid (37.5%). All the patients (100%) benefitted from antihistamine treatment (Table 2 & 5), steroid in 28.9% and allergen immunotherapy treatment in 10.5%. Table 5 shows the correlations of the eye and nasal features with the treatment modalities offered.

Discussion

Previous studies have linked Allergic Rhinitis (AR) to be co-existed with another form of allergic disorders including Allergic Conjunctivitis (AC), Atopic dermatitis and Allergic Asthma.^{4, 5, 6}

Allergic conjunctivitis (AC) is an acute or chronic inflammatory disorder of the conjunctiva and other ocular surfaces that are usually caused by IgE-mediated hypersensitivity reaction to an allergen.^{4, 7}

The age of the patients seen in our study ranged between 8 and 81 years with a median age of 33 years. Most of them were less than 45 years (63.2%) while the male to female ratio was almost 1:1 (Figure 1). This showed that there was no gender predilection to allergic rhinitis nor allergic conjunctivitis.

The usual presentation of AC includes bilateral intense itching, lacrimation, redness, swollen eyelids, burning sensation with photophobia.^{7, 8} These are similar to what was found in our patients. The eye features and the treatment offered to our patients are highlighted in Table 1. The most prevalent eye symptoms were the pain, itching, and redness (97.4%) while cobble stone

was the least common presentation (13.2%) and about half of the patients were treated with VCT (52.6%). The commonest nasal symptom was nasal itching (92.1%) while the least presentations were nasal polyp (18.4%) and sleep disturbance (28.9%). Only about one-tenth of the patients had allergen immunotherapy while all of them had antihistamine (Table 2).

AC when co-existed with AR and allergic is referred to as Allergic Rhinoconjunctivitis.^{6,8} An allergic Rhinitis and allergic conjunctivitis disorder follow a pattern of seasonal and perennial forms, although, the pattern of nasal symptoms is mostly of perennial type with a peak incidence during the dry season while the pattern of ocular symptoms is mostly of seasonal type with a peak incidence during the rainy season.^{9,10}

Correlating the nasal and eye features of our patients revealed that Eye itching was found to be higher among those with nasal blockage, sleep disturbance, post nasal drip, and nasal polyps. This category of the patients benefited from treatment with steroid, allergen immunotherapy as well as environmental control. Also, eye pain was observed to be more among those with nasal discharge, hawking, excoriation of external nares, post nasal drip, nasal polyps, steroid use, and allergen immunotherapy. Similarly, eye redness was found to be higher among those with nasal discharge, hawking, excoriation of external nares, post nasal drip, nasal polyps, steroid use, and allergen immunotherapy. The proportion of patients with eye tearing was found to be higher among patients with nasal discharge, impaired activities of daily living, hawking and pale/ grey mucosa. As shown in the table, there was no significant association between the major eye symptoms and nasal features (Table 3a and 3b).

The cause of AR and AC and other forms of allergens is an interaction between genetic factors (Race, allergic predisposition, family history) and environmental factors (Allergens, air

pollution, diet, water and exposure to cigarette smoke).¹¹ AR and AC are diseases of childhood, adolescence and young adult irrespective of races, though, can occur at any age.² Before puberty, more boys than girls are affected but after puberty, there is no gender bias.^{12, 13}

In tables 4a and 4b, sleep disturbance was found to be common among those with eye itching (29.7%), blurring of vision (31.8%) and those on a steroid (37.5%). Also, a greater proportion of patients with the blurring of vision (90.9%) and hyperemia (88.9%) had sneezing while nasal itching was found to be higher among those with a blurring of vision, eye discharge, cobblestones, corneal abrasion and those on mast cell stabilizer as well as those on steroids. Furthermore, patients with eye redness, eye tearing, blurring of vision, eye discharge, eye pain hyperemia, and those on VCT were shown to have a higher prevalence of nasal discharge. Overall, major nasal symptoms were not found to be statistically associated with eye symptoms.

AR and AC and other forms of allergies have impacted heavy social and economic burdens on the general population, causing a reduction in the quality of life of the affected people, especially during the acute episode.^{14, 15} According to a study by Olajide and colleagues from Ido-Ekiti, commonly affected quality of life among children are irritability, absenteeism, sleep disruption and impaired social life.¹⁵

The disorder of AR and AC are said to be common among the teenagers of high social economic class and those living in an industrial and urban area.¹⁷ AR has a close epidemiological relationship with AC and exhibits similar pathophysiological mechanism.⁶

These disorders are common in the population and many studies have observed the increasing prevalence of them in many countries.

The epidemiology of ocular allergy in an adult population was explored in the National Health and Nutritional Examination survey III.⁵ The survey found 6.4% reported ocular symptoms, 16.5% nasal symptoms and 29.7% both.⁵ However, Michael R. Perkin et.al found the prevalence of AC as 17.5%, AR 15.1%, and Rhino-conjunctivitis 13.4%.⁴ Oladimeji S.M. and colleagues found the prevalence of AC as 26.0% and AR 40.6%.⁹ In a study by Uche Okonkwo KC and colleagues, the Prevalence of Allergic rhinitis was 56.7% of which 28.8% had allergic conjunctivitis.¹ Generally, AC affects 5 – 22% of the general population.¹⁶

Previous studies have demonstrated the increasing knowledge of the relationship between AR and AC. Clinical trials of intranasal therapies have proven efficacy in the treatment of AR and AC.⁶ Majority of the respondents with AR also experienced symptoms of AC and other forms of allergies. Such clinical correlates include among others recurrent itching, redness of the eyes, persistent sneezing, runny nose with a positive family history of allergy.¹⁷ These correlate with the findings in our study (Table 4a & 4b). However, none of these previous studies were available in this study area. This was the reason for our study.

Conclusion

This research was conducted to correlate the features of allergic rhinitis with those of conjunctivitis and common management and preventive measures offered to the patients seen in our clinics. The majority of the patients were less than 45 years with almost equal sex ratio. Eye pain, itching, and redness account for the majority of all the eye features, while the presence of Cobblestone-like papillae is the least eye feature. Nasal itching was the commonest nasal symptom and this was seen in the majority of the patients with eye symptoms.

Ethical Approval

This was obtained from the Ethical and research committee of our institution

Consent Disclaimer:

As per international standard or university standard, patient's consent has been collected and preserved by the authors.

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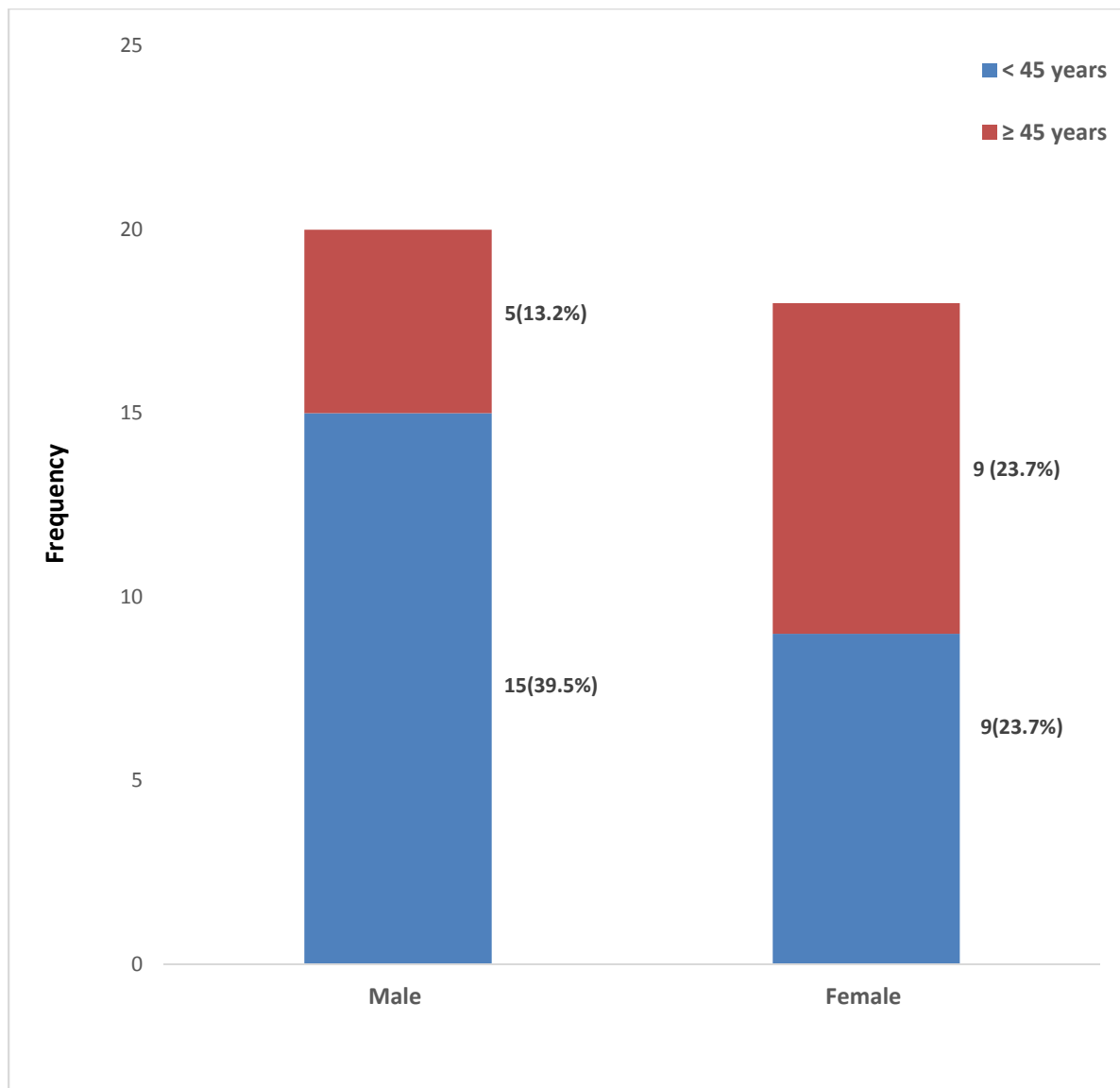


Figure 1: Age and sex distribution of the patients

Table 1: Eye features and Treatment options offered

	Yes	No
Variable	n (%)	n (%)
Symptoms		
Cobblestone-like papillae	5 (13.2)	33 (86.8)
Blurring of vision	22 (57.9)	16 (42.1)
Eye tearing	32 (84.2)	6 (15.8)
Eye discharge	35 (92.1)	3 (7.9)
Hyperemia	36 (94.7)	2 (5.3)
Eye redness	37 (97.4)	1 (2.6)
Eye itching	37 (97.4)	1 (2.6)
Eye pain	37 (97.4)	1 (2.6)
Treatment		
Mast cell stabilizer	7 (18.4)	31 (81.6)
Steroid	8 (21.1)	30 (78.9)
VCT	20 (52.6)	18 (47.4)

Table 2: Nasal Features and Treatment options offered

Variable	Yes n (%)	No n (%)
Symptoms		
Nasal polyp	7 (18.4)	31 (81.6)
Sleep disturbance	11 (28.9)	27 (71.1)
Post nasal drip	16 (42.1)	22 (57.9)
Impairment of daily activities	18 (47.4)	20 (52.6)
Nasal blockage	24 (63.2)	14 (36.8)
Hawking	29 (76.3)	9 (23.7)
Excoriation of external nares	31 (81.6)	7 (18.4)
Pale mucosa / grey mucosa	31 (81.6)	7 (18.4)
Nasal discharge	32 (84.7)	6 (15.8)
Sneezing	33 (86.8)	5 (13.2)
Engorged inferior turbinate	34 (89.5)	4 (10.5)
Nasal itching	35 (92.1)	3 (7.9)
Treatment		
Allergen immunotherapy	4 (10.5)	34 (89.5)
Environmental control	8 (21.1)	30 (78.9)
Steroid	11 (28.9)	27 (71.1)
Anti-histamine	38 (100.0)	0 (0.0)

Table 3A: Correlating Major Eye symptoms with the nasal features

Variable	Eye Itching			Eye Pain			Eye Redness			Eye Tearing		
	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value
Sneezing												
Yes	32 (97.0)	1 (3.0)	0.269	32 (97.0)	1 (3.0)	0.269	32 (97.0)	1 (3.0)	0.269	27 (81.8)	6 (18.2)	0.703
No	5 (100.0)	0 (0.0)		5 (100.0)	0 (0.0)		5 (100.0)	0 (0.0)		5 (100.0)	0 (0.0)	
Nasal Discharge												
Yes	31 (96.9)	1 (3.1)	0.341	32 (100.0)	0 (0.0)	0.341	32 (100.0)	0 (0.0)	0.341	27 (84.4)	5 (15.6)	0.585
No	6 (100.0)	0 (0.0)		5 (83.3)	1 (16.7)		5 (83.3)	1 (16.7)		5 (83.3)	1 (16.7)	
Nasal Itching												
Yes	34 (97.1)	1 (2.9)	0.113	34 (97.1)	1 (2.9)	0.113	34 (97.1)	1 (2.9)	0.113	29 (82.9)	6 (17.1)	0.964
No	3 (100.0)	0 (0.0)		3 (100.0)	0 (0.0)		3 (100.0)	0 (0.0)		3 (100.0)	0 (0.0)	
Nasal Blockage												
Yes	24 (100.0)	0 (0.0)	0.782	23 (95.8)	1 (4.2)	0.782	23 (95.8)	1 (4.2)	0.782	20 (83.3)	4 (16.7)	0.789
No	13 (92.9)	1 (7.1)		14 (100.0)	0 (0.0)		14 (100.0)	0 (0.0)		12 (85.7)	2 (14.3)	
Sleep Disturbance												
Yes	11 (100.0)	0 (0.0)	0.638	10 (90.9)	1 (9.1)	0.638	10 (90.9)	1 (9.1)	0.638	9 (81.8)	2 (18.2)	0.816
No	26 (96.3)	1 (3.7)		27 (100.0)	0 (0.0)		27 (100.0)	0 (0.0)		23 (85.2)	4 (14.8)	
Impairment of Daily Activities												
Yes	17 (94.4)	1 (5.6)	0.956	17 (94.4)	1 (5.6)	0.956	17 (94.4)	1 (5.6)	0.956	16 (88.9)	2 (11.1)	0.760
No	20 (100.0)	0 (0.0)		20 (100.0)	0 (0.0)		20 (100.0)	0 (0.0)		16 (80.0)	4 (20.0)	
Hawking												
Yes	28 (96.6)	1 (3.4)	0.530	29 (100.0)	0 (0.0)	0.530	29 (100.0)	0 (0.0)	0.530	25 (86.2)	4 (13.8)	0.709
No	9 (100.0)	0 (0.0)		8 (88.9)	1 (11.1)		8 (88.9)	1 (11.1)		7 (77.8)	2 (22.2)	
Excoriation of External Nares												
Yes	30 (96.8)	1 (3.2)	0.408	31 (100.0)	0 (0.0)	0.408	31 (100.0)	0 (0.0)	0.408	25 (80.6)	6 (19.4)	0.487
No	7 (100.0)	0 (0.0)		6 (85.7)	1 (14.3)		6 (85.7)	1 (14.3)		7 (100.0)	0 (0.0)	

NB: Chi square test use to determine association as well as Yates corrected Chi square as appropriate

Table 3B: Correlating Major Eye symptoms with the nasal features

Variable	Eye Itching			Eye pain			Eye redness			Eye tearing		
	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value
Pale/ Grey Mucosa												
Yes	30(96.8)	1(3.2)	0.408	30(96.8)	1(3.2)	0.408	30(96.8)	1(3.2)	0.408	27(87.1)	4(12.9)	0.650
No	7(100.0)	0(0.0)		7(100.0)	0(0.0)		7(100.0)	0(0.0)		5(71.4)	2(28.6)	
Engorged Inferior Turbinate												
Yes	33(97.1)	1(2.9)	0.192	33(97.1)	1(2.9)	0.192	33(97.1)	1(2.9)	0.192	28(82.4)	6(17.6)	0.849
No	4(100.0)	0(0.0)		4(100.0)	0(0.0)		4(100.0)	0(0.0)		4(100.0)	0(0.0)	
Post Nasal drip												
Yes	16(100.0)	0(0.0)	0.871	16(100.0)	0(0.0)	0.871	16(100.0)	0(0.0)	0.871	13(81.3)	3(18.8)	0.974
No	21(95.5)	1(4.5)		21(95.5)	1(4.5)		21(95.5)	1(4.5)		19(86.4)	3(13.6)	
Nasal Polyp												
Yes	7(100.0)	0(0.0)	0.408	7(100.0)	0(0.0)	0.408	7(100.0)	0(0.0)	0.408	5(71.4)	2(28.6)	0.650
No	30(96.8)	1(3.2)		30(96.8)	1(3.2)		30(96.8)	1(3.2)		27(87.1)	4(12.9)	
Anti-histamine												
Yes	37(97.4)	1(2.6)		37(97.4)	1(2.6)		37(97.4)	1(2.6)		32(84.2)	6(15.8)	
Steroid												
Yes	11(100.0)	0(0.0)	0.638	11(100.0)	0(0.0)	0.638	11(100.0)	0(0.0)	0.638	7(63.6)	4(36.4)	0.083
No	26(96.3)	1(3.7)		26(96.3)	1(3.7)		26(96.3)	1(3.7)		25(92.6)	2(7.4)	

Allergen Immunotherapy												
Yes	4(100.0)	0(0.0)	0.192	4(100.0)	0(0.0)	0.192	4(100.0)	0(0.0)	0.192	2(50.0)	2(50.0)	0.208
No	33(97.1)	1(2.9)		33(97.1)	1(2.9)		33(97.1)	1(2.9)		30(88.2)	4(11.8)	
Environmental Control												
Yes	8(100.0)	0(0.0)	0.471	7(87.5)	1(12.5)	0.471	7(87.5)	1(12.5)	0.471	5(62.5)	3(37.5)	0.177
No	29(96.7)	1(3.3)		30(100.0)	0(0.0)		30(100.0)	0(0.0)		27(90.0)	3(10.0)	
Asthma												
Yes	9(100.0)	0(0.0)	0.530	8(88.9)	1(11.1)	0.530	8(88.9)	1(11.1)	0.530	6(66.7)	3(33.3)	0.258
No	28(96.6)	1(3.4)		29(100.0)	0(0.0)		29(100.0)	0(0.0)		26(89.7)	3(10.3)	

NB: Chi square test use to determine association as well as Yates corrected Chi square as appropriate

Table 4A: Correlating Major Nasal symptoms with the Eye Symptoms

Variable	Sleep disturbance			Sneezing			Nasal itching			Nasal discharge		
	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value
Eye redness												
Yes	10(27.0)	27(73.0)	0.638	32(86.5)	5(13.5)	0.269	34(91.9)	3(8.1)	0.114	32(86.5)	5(13.5)	0.342
No	1(100.0)	0(0.0)		1(100.0)	0(0.0)		1(100.0)	0(0.0)		0(0.0)	1(100.0)	
Eye itching												
Yes	11(29.7)	26(70.3)	0.638	32(86.5)	5(13.5)	0.269	34(91.9)	3(8.1)	0.114	31(83.8)	6(16.2)	0.341
No	0(0.0)	1(100.0)		1(100.0)	0(0.0)		1(100.0)	0(0.0)		1(100.0)	0(0.0)	
Eye tearing												
Yes	9(28.1)	23(71.9)	0.816	27(84.4)	5(15.6)	0.703	29(90.6)	3(9.4)	0.964	27(84.4)	5(15.6)	0.585
No	2(33.3)	4(66.7)		6(100.0)	0(0.0)		6(100.0)	0(0.0)		5(83.3)	1(16.7)	
Blurring of vision												
Yes	7(31.8)	15(68.2)	0.924	20(90.9)	2(9.1)	0.701	21(95.5)	1(4.5)		19(86.4)	3(13.6)	0.975
No	4(25.0)	12(75.0)		13(81.3)	3(18.8)		14(87.5)	2(12.5)	0.773	13(81.3)	3(18.8)	

Eye pain												
Yes	10(27.0)	27(73.0)	0.638	32(86.5)	5(13.5)	0.269	34(91.9)	3(8.1)		32(86.5)	5(13.5)	0.342
No	1(100.0)	0(0.0)		1(100.0)	0(0.0)		1(100.0)	0(0.0)	0.114	0(0.0)	1(100.0)	
Eye discharge												
Yes	10(28.6)	25(71.4)	0.625	30(85.7)	5(14.3)	0.852	33(94.3)	2(5.7)		30(85.7)	5(14.3)	0.964
No	1(33.3)	2(66.7)		3(100.0)	0(0.0)		2(66.7)	1(33.3)	0.557	2(66.7)	1(33.3)	
Hyperemia												
Yes	10(27.8)	26(72.2)	0.899	32(88.9)	4(11.1)	0.611	33(91.7)	3(8.3)		31(86.1)	5(13.9)	0.713
No	1(50.0)	1(50.0)		1(50.0)	1(50.0)		2(100.0)	0(0.0)	0.357	1(50.0)	1(50.0)	

NB: Chi square test use to determine association as well as Yates corrected Chi square as appropriate

Table 4B: Correlating Major Nasal symptoms with the Eye Symptoms

Variable	Sleep disturbance			Sneezing			Nasal itching			Nasal discharge		
	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value
Cobblestone-like papillae												
Yes	0(0.0)	5(100.0)	0.316	4(80.0)	1(20.0)	0.823	5(100.0)	0(0.0)	0.852	4(80.0)	1(20.0)	0.703
No	11(33.3)	22(66.7)		29(87.9)	4(12.1)		30(90.9)	3(9.1)		28(84.8)	5(15.2)	

Cornea abrasion												
Yes	1(20.0)	4(80.0)	0.956	4(80.0)	1(20.0)	0.823	5(100.0)	0(0.0)	0.852	4(80.0)	1(20.0)	0.703
No	10(30.3)	23(69.7)		29(87.9)	4(12.1)		30(90.9)	3(9.1)		28(84.8)	5(15.2)	
VCT												
Yes	5(25.0)	15(75.0)	0.572	17(85.0)	3(15.0)	0.899	18(90.0)	2(10.0)	0.924	17(85.0)	3(15.0)	0.760
No	6(33.3)	12(66.7)		16(88.9)	2(11.1)		17(94.4)	1(5.6)		15(83.3)	3(16.7)	
Mast cell stabilizer												
Yes	1(14.3)	6(85.7)	0.627	6(85.7)	1(14.3)	0.602	7(100.0)	0(0.0)	0.933	5(71.4)	2(28.6)	0.651
No	10(32.3)	21(67.7)		27(87.1)	4(12.9)		28(90.3)	3(9.7)		27(87.1)	4(12.9)	
Steroid												
Yes	3(37.5)	5(62.5)	0.872	6(75.0)	2(25.0)	0.599	8(100.0)	0(0.0)	0.845	6(75.0)	2(25.0)	0.796
No	8(26.7)	22(73.3)		27(90.0)	3(10.0)		27(90.0)	3(10.0)		26(86.7)	4(13.3)	

NB: Chi square test use to determine association as well as Yates corrected Chi square as appropriate

Table 5:Correlating the Eye and Nasal features with the treatment modalities

Variable	Eye Itching			Eye pain			Eye redness			Eye tearing		
	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value
Anti-histamine												
Yes	37(97.4)	1(2.6)		37(97.4)	1(2.6)		37(97.4)	1(2.6)		32(84.2)	6(15.8)	
Steroid												
Yes	11(100.0)	0(0.0)	0.638	11(100.0)	0(0.0)	0.638	11(100.0)	0(0.0)	0.638	7(63.6)	4(36.4)	0.083
No	26(96.3)	1(3.7)		26(96.3)	1(3.7)		26(96.3)	1(3.7)		25(92.6)	2(7.4)	
Allergen Immunotherapy												
Yes	4(100.0)	0(0.0)	0.192	4(100.0)	0(0.0)	0.192	4(100.0)	0(0.0)	0.192	2(50.0)	2(50.0)	0.208
No	33(97.1)	1(2.9)		33(97.1)	1(2.9)		33(97.1)	1(2.9)		30(88.2)	4(11.8)	
Environmental Control												
Yes	8(100.0)	0(0.0)	0.471	7(87.5)	1(12.5)	0.471	7(87.5)	1(12.5)	0.471	5(62.5)	3(37.5)	0.177
No	29(96.7)	1(3.3)		30(100.0)	0(0.0)		30(100.0)	0(0.0)		27(90.0)	3(10.0)	

	Sleep disturbance			Sneezing			Nasal itching			Nasal discharge		
	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value	Yes n (%)	No n (%)	p value
VCT												
Yes	5(25.0)	15(75.0)	0.572	17(85.0)	3(15.0)	0.899	18(90.0)	2(10.0)		17(85.0)	3(15.0)	0.760
No	6(33.3)	12(66.7)		16(88.9)	2(11.1)		17(94.4)	1(5.6)	0.924	15(83.3)	3(16.7)	
Mast cell stabilizer												
Yes	1(14.3)	6(85.7)	0.627	6(85.7)	1(14.3)	0.602	7(100.0)	0(0.0)		5(71.4)	2(28.6)	0.651
No	10(32.3)	21(67.7)		27(87.1)	4(12.9)		28(90.3)	3(9.7)	0.933	27(87.1)	4(12.9)	
Steroid												
Yes	3(37.5)	5(62.5)	0.872	6(75.0)	2(25.0)	0.599	8(100.0)	0(0.0)		6(75.0)	2(25.0)	0.796
No	8(26.7)	22(73.3)		27(90.0)	3(10.0)		27(90.0)	3(10.0)	0.845	26(86.7)	4(13.3)	

NB: Chi square test use to determine association as well as Yates corrected Chi square as appropriate

