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Relationship Between Allergy and Chronic Rhinosinusitis

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Abstract: The role of allergy in chronic rhinosinusitis is still controversial. Numerous studies have demonstrated that atopy is highly prevalent in people with chronic rhinosinusitis (CRS), and that allergies may play a part in the pathogenesis of the condition. Allergy disorders, particularly those involving IgE-mediated in/flammation, are generally considered as triggering factors in the development of chronic rhinosinusitis or comorbidities/associated factors for the spread of chronic rhinosinusitis. The study aimed to determine the relationship between allergies and chronic rhinosinusitis. Observational analytical study with cross-sectional approach. 30 patients with symptoms of runny/blocked nose were examined. Allergy test, namely skin prick test, has been examined to categorize allergic and non-allergic patients. Total serum IgE and total eosinophil examination from blood were then categorized as increased and normal. The criteria for chronic rhinosinusitis are complaints of runny/blocked nose and facial pain and/or decreased sense of smell. Thirty patients (19 females and 11 males) aged 17 to 77 years were examined in this study. 19 patients were confirmed to have rhinosinusitis and 11 had rhinitis. The results of the analysis using the Chi Square test showed that there was no significant relationship between allergy, IgE, eosinophils, and chronic rhinosinusitis ($p>0.05$). There was no significant relationship between allergy, IgE, eosinophils with chronic rhinosinusitis.

Keywords: CRS, allergy, igE, eosinophil, skin prick test.

Introduction

Rhinosinusitis is the inflammation of one or more paranasal sinuses and impacts about 5-12% of people in the general population. The condition is estimated to have a prevalence of 10-30% in Western Europe and the United States (Fokkens *et al.,* 2020; Giri et al., 2022). The symptoms of rhinosinusitis might be not specific and look similar the common cold, such as coughing, clear nasal discharge, or nasal blockage, obstruction, or congestion. Chronic rhinosinusitis is a multifactorial inflammatory disease with an unclear origin that can manifest in patients with or without nasal cavity polyps (Giri et al., 2022; Brussow, 2017; Siddiqui et al., 2021).

Chronic rhinosinusitis is characterized by an elevated eosinophil count in the sinuses and nasal mucosa. Patients with or without polyps shows eosinophils. Chronic sinusitis and nasal cavity inflammation are closely correlated with the level of eosinophils in nasal secretions (Asghari et al., 2021). Eosinophil counts and nasal discharges in allergic patients have been found to be significantly correlated. Eosinophil granular protein is found in chronic epithelial regions of chronic rhinosinusitis and is extremely detrimental to the respiratory epithelium. However, nothing is known about how these cells contribute to the pathophysiology of CRSwNP (Bochner & Stevens, 2021).

Generally speaking, allergic disorders particularly those involving IgE-mediated inflammatory processes are thought to either cause chronic rhinosinusitis or operate as a comorbidity or related factor that contributes to

the disease's spread. This is because allergic mucosal irritation can lead to secondary infection by obstructing the sinus ostia. Although the association between allergies and chronic rhinosinusitis has already been investigated, the relationship is still poorly understood (Marcus et al., 2019; Tint et al., 2016).

Numerous studies have shown that allergies play a significant part in both chronic rhinosinusitis with and without polyps. The review also revealed contradicting information about this job. There is debate over the connection between allergies and chronic rhinosinusitis (CRS). The data is conflicting; some studies indicate no consistent link, resulting in grade D evidence, while others demonstrate an association, especially in CRS with nasal polyps (CRSwNP) (DelGaudio et al., 2020; Esen et al., 2021; De Corso et al., 2020). The aim of this study was to explore the connection between allergy and chronic rhinosinusitis. The aim of this study was to explore the connection between allergy and chronic rhinosinusitis.

Material and Method

This was an analytical observational study using a cross-sectional design**.** There were 30 patients at the ENT Clinic of Adam Malik Hospital and Prof Charuddin Panusunan Lubis USU Hospital. The study was approved by the ethics committee of the Faculty of Medicine University of Sumatra Utara, Adam Malik Hospital and Prof Charuddin Panusunan Lubis USU Hospital The study applied specific criteria for including and excluding participants..

Inclusion Criteria:
1. Patients with complaints of runny and stuffy nose experienced ≥ 3 months
2. Age ≥ 15 years
3. Not using decongestants 1 day before
4. Not using antihistamines 2-7 days before
5. Not using topical skin steroids for at least 7 days.
6. Not using immunotherapy
7. Not experiencing a severe allergy attack 24 hours before
8. No history of previous nasal surgery

Exclusion Criteria
1. Unwilling to participate in the study.
2. Contraindications to skin prick testing

Result and Discussion

Characteriscs of patients

30 patients with symptoms of runny/blocked nose were examined. Demographic characteristics of the patients are shown in Table 1. Most of the subjects were female, totaling 19 people (63.3%). The subjects had an average age of 35.3 years, ranging from a minimum of 15 years to a maximum of 77 years. A total of 19 subjects (63.3%) were diagnosed with chronic rhinosinusitis and 11 subjects (36.7%) were not diagnosed with chronic rhinosinusitis.

Table 1. Characteriscs of patients

Characteristics	n = 30
Gender, n (%)	
Man	11 (36,7)
Woman	19 (63,3)
Age, year	
Mean (SD)	35,3 (16,79)
Median (Min – Mak)	32 (15 – 77)
Chronic Rhinosinusitis, n (%)	
Yes	19 (63,3)
No.	11 (36,7)

Characteristics of allergen types

Skin prick test showed the most positive types of allergens were Dermatophagoides farinae as many as 14 people, Dermatophagoides pteronyssinus as many as 12 people, cockroaches 5 people and grass 1 person (Table 2).

Table 2. Characteristics of Allergen Types

Jenis Alergen	RSK (+) n=19	RSK (-) n=11
D. Farinae, n (%)		
Positif	7 (50)	7 (50)
Negatif	12 (75)	4 (25)
D. Pteronyssinus, n (%)		
Positif	6 (50)	6 (50)
Negatif	13 (72,2)	5 (27,8)
Rumput, n (%)		

Positif	0	1 (100)
Negatif	19 (65,5)	10 (34,5)
Kecoa, n (%)		
Positif	4 (80)	1 (20)
Negatif	15 (60)	10 (11)

16 subjects with increased IgE levels, 8 of whom (50%) had CRS. 14 subjects with normal IgE levels, 11 of whom (78.6%) had CRS. The Chi Square test analysis results indicated that there was no significant association between IgE and chronic rhinosinusitis. (p = 0.105) (Table 3).

Table 3. Relationship between total serum IgE and Chronic Rhinosinusitis

Variable	CRS (+) n=19	CRS (-) n=11	p
IgE, n (%)			
Increase	8 (50)	8 (50)	0,105*
Normal	11 (78,6)	3 (21,4)	

6 subjects with increased eosinophil levels, 3 people (50%) with CRS. Meanwhile, out of 24 subjects with normal eosinophil levels, 16 people (66.7%) had CRS. The analysis results from Fischer's Exact test demonstrated that there was no significant correlation between eosinophils and chronic rhinosinusitis. (p = 0.641) (table 4).

Table 4. Relationship between Total Serum Eosinophils and Chronic Rhinosinusitis

Variable	CRS (+) n=19	CRS (-) n=11	p
Eosinophil, n (%)			
Menigkat	3 (50)	3 (50)	0,641*
Normal	16 (66,7)	8 (33,3)	

Table 5. Relationship between Allergies and Chronic Rhinosinusitis

Variable	CRS (+) n=19	CRS (-) n=11	p
Allergy, n (%)			
Yes	8 (57,1)	6 (42,9)	0,510*
No	11 (68,8)	5 (31,2)	

14 subjects with allergies, 8 (57.1%) had CRS. Meanwhile, out of 16 subjects without allergies, 11 (68.8%) had CRS. The analysis using the Chi Square test found no significant link between allergies and chronic rhinosinusitis. (p = 0.510) (Table 5).

Discussion

The theory states that rhinosinusitis could be brought on by an allergy-induced inflammation of the sinonasal mucosa, which is followed by ostial blockage, which promotes the growth of bacteria and further inflammation (Marcus et al., 2019). Patients with chronic rhinosinusitis frequently have impaired mucociliary clearance, which can be caused by allergies and eosinophilic inflammation, This is frequently seen in individuals with persistent rhinosinusitis. Over time, ciliary abnormalities may result from the chronic inflammation associated with rhinosinusitis, concomitant allergic rhinitis may exacerbate chronic rhinosinusitis and impact the disease process (Brook et al., 2017; AES, 2017).

Inflammation of the sinuses and nasal mucosa is the hallmark of chronic rhinosinusitis (CRS), a common ailment that is frequently linked to a number of allergic and non-allergic causes. Research has focused on the function of total immunoglobulin E (IgE) in CRS, especially in connection to its association with the severity of the disease and the results of treatment (Vlaminck et al., 2021; Sanchez et al., 2024). Eosinophil levels are higher in patients with cancer, connective tissue disorders, severe atopic diseases, parasite infections, medication hypersensitivity reactions, and rare hypereosinophilic syndromes.

Monogenic disorders resulting from immunodeficiency or dysregulation should also be taken into consideration, particularly in children. Clinical signs of atopy, including atopic dermatitis or food allergies, are among these syndromes (Williams et al., 2015; Leru et al., 2019). The connection between allergies and chronic rhinosinusitis (CRS) is still unclear. Among 11 studies reviewed, four found a link, three were uncertain, and four found no link, underscoring the complexity of how allergic inflammation may influence CRS (Tantilipikorn et al., 2020). A study conducted by Tjahjono et

al., (2020), found no significant correlation between allergic and rhinosinusitis. The researchers concluded that rhinosinusitis is a multifactorial disease, meaning that allergies do not always cause CRS (Tjahjono et al., 2020).

The symptoms of chronic rhinosinusitis include nasal congestion, facial pain, and loss of smell, which are caused by inflammation of the sinuses and nasal mucosa (Fokkens et al., 2020). Allergies, especially allergic rhinitis, are often discussed as potential causative factors for CRS. Some factors that cause no relationship between allergies and CRS are the multifactors of CRS such as infections, anatomical abnormalities and environmental irritants. Allergies are not considered a direct cause of rhinosinusitis. Although allergic rhinitis may contribute to this condition by causing inflammation and obstruction of the sinus passages, the relationship between the two is not causal. Allergic rhinitis is more viewed as a factor that can worsen inflammation in chronic rhinosinusitis, but not the main cause of the disease (Hussain & Gardiner, 2024).

Dermatophagoides pteronyssinus was the allergen most frequently detected in the samples in this investigation. These findings were consistent with earlier studies by Sarma and Khaund (2023), which found that the most prevalent allergens that the participants tested positive for were Dermatophagoides pteronyssinus. In this study, no significant relationship was found between igE and CRS ($p = 0.105$). In contrast to a study conducted by Rao, that study suggests that elevated serum IgE levels are associated with rhinosinusitis (Rao, 2020). IgE is the main antibody involved in allergic responses, and its levels are often increased in patients with allergic conditions. In the context of chronic rhinosinusitis, especially CRSwNP, igE plays an important role in the inflammatory process that characterizes the disease. Increased total serum igE levels are generally caused by allergic reactions, parasitic infections, immune system diseases, malignancies (Shen et al., 2022; Kostova et al., 2023).

The relationship between total serum igE and rhinosinusitis is indeed complex and remains a subject of debate. While some studies indicate that elevated IgE levels correlate with allergic rhinitis and may exacerbate chronic rhinosinusitis (CRS), others suggest that CRS can occur independently of IgE-mediated pathways. This multifaceted relationship can be explored through various dimensions (Marcus et al., 2023).

Eosinophils and CRS did not significantly correlate, according to the study. According to a study by Suresh et al., there is a strong positive association between CRS and eosinophilia. Patients with parasitic infections, severe atopic diseases, drug hypersensitivity reactions, connective tissue disorders, cancers, and uncommon hypereosinophilic syndromes have elevated eosinophil levels. Monogenic disorders resulting from immunological deficiency or dysregulation should also be taken into consideration, particularly in children. Clinical signs of atopy, including atopic dermatitis or food allergies, are among these syndromes (Williams et al 2015) (Suresh et al., 2024; Williams et al., 2015).

The correlation between eosinophils and chronic rhinosinusitis underscores the importance of understanding this relationship for better management strategies. Elevated eosinophil levels not only serve as an indicator of disease severity but also inform treatment approaches, especially in patients with eCRS. Further research into the mechanisms by which eosinophils influence CRS may lead to improved therapeutic interventions and patient outcomes (Ho et al., 2020).

Conclusion

The conclusion is that there is no significant relationship between allergies and chronic rhinosinusitis. From the results of blood tests, namely IgE and eosinophils, there was no significant relationship between IgE and eosinophils with chronic rhinosinusitis.

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