



## UNIFIED AIRWAY DISEASE - OUR EXPERIENCE

## ENT

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## ABSTRACT

Chronic Rhino Sinusitis and Bronchial Asthma have been studied together in many instances as Unified Airway Disease. The Link between the above two diseases has been many a times proved and is supposed to be the base for common treatment and referrals. Chronic Rhinosinusitis may be associated with polyps and mucosal edema, which can well hinder in the management of the same. Various parameters should be considered while commonly treating the conditions which include FEV1, FVC, DNE picture and various scores needed to stratify and treat the disease. Our study aims at linking an association between CRS and Bronchial Asthma by looking into treatment outcomes and proving the statistical significance. **Results** : A total of 100 patients, mean age was  $34 \pm 9$  years consisting of 61% females and 39% males presenting with the symptoms of nasal block, nasal discharge, facial pain and headache and olfactory dysfunction. The prevalence of bronchial asthma was 29%. DNE showed mucosal edema in 92% and polyps in 27%. Among the 29 BA patients 59.3% had polyps and 17.8% without polyps. The absolute eosinophil count was increased in 54% and IgE increased in 47% subjects. In the present study the mean FEV1 before treatment was 1.51L and the mean FEV1(%Pred) was 58.83 which improved to mean FEV1 of 1.93 Lt and mean FEV1(%Pred) 77.38 after treatment. The mean FVC before treatment was 2.57 Lt and the mean FVC(%Pred) was 84.03 which improved to mean FVC of 2.79 Lt and mean FVC(%Pred) of 90.17 after treatment of CRS. Statistically significant association was seen between DNE and CRS, before and after FEV1 and FVC. The study also found a significant association between AEC, IgE and bronchial asthma. Objective analysis of the impact of endoscopic sinus surgery (ESS) on asthma was conducted using pulmonary function tests (PFTs). Multiple readings were tabulated for each patient before and after surgery, and the mean of the various spiro-metric parameters was calculated as a percentage of the predicted value for that patient, considering their height, age, weight, and sex. An improvement was observed in the values of FEV1, FVC in asthmatic patients post-ESS. **Conclusion** : Treating chronic rhinosinusitis (CRS) can significantly enhance asthma control, particularly by alleviating symptoms and improving patients quality of life. Both medical and surgical interventions for CRS effectively manage respiratory symptoms; however, their direct impact on asthma control can vary, highlighting the importance of individualized treatment plans. Further research is essential to fully understand the inter-connected pathophysiology of CRS and asthma and to develop optimal treatment strategies for patients with both conditions.

## KEYWORDS

Unified Airway Disease, Chronic Rhino Sinusitis, Bronchial Asthma, Nasal Polyposis

## INTRODUCTION

Bronchial asthma and chronic rhinosinusitis (CRS) are two prevalent and often coexisting inflammatory diseases of the respiratory tract, impacting millions worldwide. Asthma is a common inflammatory disease of the lower respiratory tract that is marked by bronchial hyperresponsiveness (BHR), reversible airflow restriction, and a range of intermittent and variable symptoms. These individuals' symptoms could include coughing, chest tightness, wheezing, and dyspnea.

Chronic rhinosinusitis (CRS) has a complex etiology that includes immune system and epithelial barrier components. The micro biome, environment, and genetic factors all have a role in the development of these disorders. 10.9% to 13.4% of the overall population is thought to be affected.<sup>1,2</sup> An increasing number of people are suffering from chronic rhinosinusitis (CRS), a serious health issue that costs society a lot of economy.<sup>3,4</sup> CRS involves prolonged inflammation of the paranasal sinuses and nasal passages. The pathophysiological link between asthma and CRS includes shared inflammatory mediators, such as cytokines and leukotrienes, and common genetic predispositions.<sup>5,6</sup> Based on the existence of nasal polyps, CRS is classified into two phenotypes: CRS with nasal polyp (CRSwNP) and CRS without nasal polyp (CRSsNP). Despite much research, the etiology of CRS, including CRSwNP and CRSsNP, is still not fully known. In an effort to clarify the pathophysiology of CRS, a number of

theories have been put out. These include the immunological barrier, fungal, superantigen, and biofilm hypotheses, in addition to the possibility of eicosanoid pathway abnormalities.<sup>9</sup> For the diagnosis of CRS, at least two of the four cardinal symptoms facial pain/pressure, nasal discharge, hyposmia/anosmia, and nasal obstruction as well as objective proof are required. These symptoms must be present for at least 12 weeks consecutively. Objective proof of CRS can be obtained through physical examination (endoscopy, anterior rhinoscopy) or radiography, preferably from sinus computed tomography.<sup>10</sup> Further evidence for the strong relationship between CRSwNP and asthma comes from epidemiological, clinical, and pathophysiology studies.<sup>11,12</sup> Significant correlation has been found between the inflammatory profiles of nasal and bronchial biopsies in patients with CRSwNP. This finding supports the united airways concept, which has already been described in patients with asthma and comorbid allergic rhinitis, by demonstrating a direct relationship between inflammation in the nasal mucosa and lower airways.<sup>13,14,15</sup>

There are morphological and histological similarities between the upper and lower respiratory systems. Their shared histological features include glands, goblet cells, ciliary epithelium, basement membrane, and lamina propria. From a pathophysiological perspective, type 2 immunopathology (including IgE, eosinophils, interleukin-4 (IL-4)/IL-13, and IL-5) and epithelial barrier failure are shared by both

CRS with NP and asthma.<sup>16,17,18</sup> The unified airway theory, which views the upper and lower airways as a single functioning unit, is currently used to discuss CRS and BA.<sup>19</sup> Numerous studies have been conducted on the connection between CRS and BA. Research has demonstrated that rhinosinusitis contributed to asthma episodes, and that asthma symptoms improved following medical or surgical treatment of rhinosinusitis.<sup>20,21</sup> The rationale for treating the nose in asthmatic patients is because nasal inflammation can influence the lower airways as per the concept of “united airways” and treatment can cause improvement in symptoms of sinusitis and asthma.<sup>8</sup>

**AIM**

To study the association between chronic rhinosinusitis and bronchial asthma and understand unified airway disease

**OBJECTIVES**

1. To estimate the prevalence of bronchial asthma among patients with chronic rhinosinusitis
2. To assess the improvement of asthma after treatment of chronic rhinosinusitis.
3. To establish the concept of unified airway disease.

**PATIENTS AND METHODS**

**STUDY PLACE**

Department of ENT (Otorhinolaryngology), Bhaskar medical college and hospital, Moinabad, Telangana

**STUDY DESIGN**

Cross-sectional study

**STUDY PERIOD**

July 2022 to January 2024

**ETHICAL APPROVAL** : obtained prior to the study

**STUDY POPULATION**

All patients with symptoms of chronic rhinosinusitis and allergic rhinitis presented to the department of Otorhinolaryngology at Bhaskar Medical College & Hospital, Moinabad.

**INCLUSION CRITERIA**

1. Patients of either sex aged between 18 to 60 years.
2. All cases of chronic rhinosinusitis with or without polyps
3. Patients with rhinosinusitis with history of bronchial asthma
4. Patients with sino- nasal inflammation (CT-PNS)

**EXCLUSION CRITERIA**

1. Patients <18 years
2. Congenital disorders and genetic conditions related to nose
3. Post-operative FESS (within 6 months)
4. Sino- nasal tumors
5. Patients with lung and cardiac pathologies

**SAMPLE SIZE**

The prevalence of chronic rhinosinusitis was 5% in a previous epidemiological study. Based on that the sample size was calculated for the study using the formula  $N = 4pq/L^2$  (absolute precision) = 73. A total of 100 patients were included

**STUDY METHODS**

- In order to be eligible for enrolment, each patient assessed throughout the study phase underwent screening.
- Once informed consent was given and their sociodemographic data was obtained, the individuals who fit the study requirements were informed about the nature and goal of the research.
- To gather information about the patients and their outcomes, a research proforma was utilized.
- All the patients who presented with signs and symptoms suggesting chronic allergic rhinitis and rhinosinusitis will be supervised by the same examiner based on a guided history taking and specific physical examination.
- Patients will be asked about the onset of the disease, the number of nasal infections they get annually, and whether they have ever had nasal surgery throughout the history-taking process.
- All patients were also asked about symptoms of asthma like cough, wheezing, breathlessness, chest tightness.
- Patients with CRS underwent DNE, CT-PNS and Spirometry.
- Investigations done were

- Digital nasal endoscopy
- Spirometry
- CT-PNS
- AEC
- Serum IgE

**DIAGNOSTIC CRITERIA OF CHRONIC RHINOSINUSITIS**

As followed from the definition given in The European position paper on rhinosinusitis and nasal polyps (EPOS) that rhinosinusitis is a diagnosis made on clinical grounds based on the presence of characteristic symptoms, combined with objective evidence of mucosal inflammation

**TABLE : 1** : Clinical definition of chronic rhinosinusitis

Diagnostic criteria for chronic rhinosinusitis	Symptoms correlated by endoscopic and/or radiological findings
Primary symptoms (requires atleast one to be present but if both present it is sufficient to make diagnosis on the basis of symptoms)	Nasal blockage/obstruction/ congestion Nasal discharge (anterior/ posterior)
Additional symptoms (may also be present and at least one is needed if only one of the primary symptoms is present)	Facial pain/pressure Olfactory dysfunction Hyposmia/anosmia
Duration	>3 months = chronic
Endoscopy (any of these)	Nasal polyps Mucopurulent discharge (middle meatus) Oedema/mucosal obstruction in middle meatus
CT scan findings (as well as or instead of endoscopic findings)	Mucosal changes within the ostiomeatal complex and/or sinuses

The endoscopic findings were graded using Lund Kennedy endoscopic grading system and scored as

**TABLE : 2** : Endoscopic staging

Polyp	0= absence of polyp 1 = polyps in middle meatus only 2 = beyond middle meatus
Oedema	0 = absent 1 = mild 2 = severe
Discharge	0 = no discharge 1 = clear, thin discharge 2 = thick, purulent discharge

The radiological imaging scoring by Lund MacKay system with each side sinuses and osteo-meatal complexes considered separately and scored. The status of maxillary, anterior ethmoids, posterior ethmoids, frontal and sphenoid sinuses as

- 0- No abnormality
- 1- Partial opacity
- 2- Complete opacification
- Osteo-meatal complex 0- No obstruction 2-obstructed

**DIAGNOSTIC CRITERIA FOR ASTHMA:**

Once diagnosed to have chronic rhinosinusitis all the patients were evaluated with Spirometry the following parameters were assessed FEV1/FVC, FEV1 %predicted and bronchodilator reversibility. FEV1/FVC <70% is indicative of obstruction of lower airways FEV1 volume %predicted is measured and variability in the value by broncho responsiveness test is measured. Obstructive pathology again can be two types, either reversible or irreversible. Reversible variability in FEV1 values indicates the probability of bronchospasm which may be because of bronchial asthma.

According to the GINA 2024 guidelines the diagnosis of asthma was made by:

- 1) Presence of asthma symptoms: intermittent experience of wheeze (usually worse on expiration and characteristically relieved by inhaled b2-agonists), cough (usually unproductive), shortness of breath (not always associated with wheeze) and chest tightness

2) excessive variability in lung function by positive bronchodilator responsiveness test- in adults: increase in FEV1 of >12% and >200ml  
 All patients with confirmed diagnosis of CRS with bronchial asthma received medical treatment with antibiotics, anti-histaminics, nasal decongestants and intranasal corticosteroids for 3 weeks and planned for FESS due to various anatomical considerations on CT PNS, presence of polyps, osteo-meatal block and higher Lund-Mcckay scores of CT. All these patients underwent pre and 3 months post operative Spirometry to assess improvement.

**STATISTICAL ANALYSIS PLAN**

- The data was collected, coded, entered into Microsoft excel work sheet and exported to SPSS.
- Data was analyzed using statistical package for social sciences (SPSS) version 26.
- Quantitative data like age, AEC, spirometry, IgE are presented as means, standard deviations and standard errors.
- To determine the association between CRS and BA Chi-square and Independent t test was used.
- To evaluate the pre- and post- operative outcomes paired t test was used.
- A P- value less than 0.05 is considered as significant.

**RESULTS**

**Table 3:** Distribution according to age

Age in years	Count	Percentage
18-20	7	7.0%
21-30	31	31.0%
31-40	42	42.0%
41-50	15	15.0%
51-60	5	5.0%
Total	100	100.0%
Mean	34 + 9	

Table 3 shows the age distribution were 7% were below 20 years, 31% were between 21- 30 years, 42% were between 31 to 40 years, 15% were between 41 and 50 years, 5% were between 51 to 60 years. Majority of the study population were in 31 TO 40 years (40%), Mean age was 34 + 9 years.

**Table 2:** Gender distribution

Gender	Frequency	Percentage
Female	61	61.0%
Male	39	39.0%
Total	100	100.0%

The study consisted of 39% males and 61% females with the sex ratio being 0.6:1 [M: F] as shown in table 2. Majority of the study population were females (61%).

**Table 4:** Symptoms of CRS distribution

Symptoms of CRS	frequency	percentage
NASAL OBSTRUCTION	82	82.0%
NASAL DISCHARGE	73	73.0%
FACIAL PAIN AND HEADACHE	70	70.0%
OLFACTORY DYSFUNCTION	33	33.0%

The signs and symptoms observed in the study was nasal block, nasal discharge, facial pain and olfactory dysfunction. Majority of the study population were having nasal obstruction (82%), followed by nasal discharge (73%), followed by (70%), followed by olfactory dysfunction (33%).

**Table 5:** Diagnostic nasal endoscopy findings

DNE findings	Frequency	Percentage
Mucosal Edema	92	92.0%
Mucopurulent discharge	68	68.0%
Polyp	27	27.0%

In the study, majority of the study population were having Mucosal edema (92%), followed by Mucopurulent Discharge (68%), followed by polyps (27%) in Diagnostic nasal endoscopy as shown in Table.4

**Table 6 :** CRS and nasal polyps association

CRS	Frequency	Percent
CRS without nasal polyps ( CRSsNP)	73	73.0%

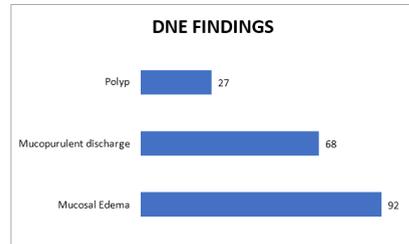
CRS with nasal polyps (CRSwNP)	27	27.0%
Total	100	100.0%

Table 5 shows that 27% of CRS patients has nasal polyps and 73% did not have nasal polyps.

**Table 7:** Incidence of asthma

Incidence of asthma	Frequency	Percent
No	71	71.0%
Yes	29	29.0%
Total	100	100.0%

**Figure 1:** Bar chart showing DNE findings distribution



**Figure 2:** Incidence of asthma

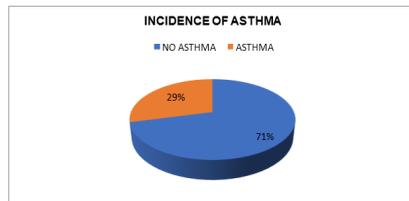
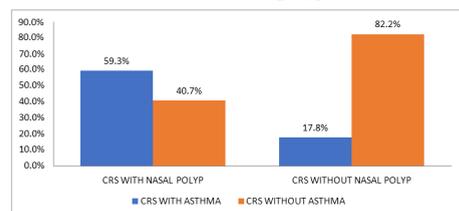


Table 7 shows the incidence of asthma is 29% among the chronic rhinosinusitis study population.

**Table 8:** Incidence of asthma and nasal polyps

Incidence of Asthma	CRS with nasal polyps		CRS without nasal polyps		Total	
	Count	Column N %	Count	Column N %	Count	Column N %
CRS with asthma	16	59.3%	13	17.8%	29	29.0%
CRS without asthma	11	40.7%	60	82.2%	71	71.0%
P value 0.00005						

**Figure 3:** Incidence of asthma and nasal polyps



In the study among CRS with nasal polyps cases, majority 59% were having asthma as seen in table 7 and this association was statistically significant.

**Table 9 :** Absolute eosinophil count

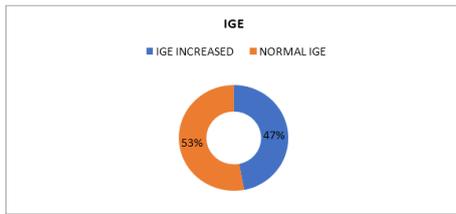
AEC	Frequency	Percent
Increased	54	54.0%
Normal	46	46.0%
Total	100	100.0%

Among the 100 chronic rhinosinusitis subjects AEC count was increased in 54% and remaining 46% was normal as shown in table 8.

**Table 10:** Immunoglobulin E

IgE	Frequency	Percent
Increased	47	47.0%
Normal	53	53.0%
Total	100	100.0%

**Figure 4:** Pie chart showing IgE



The IgE was increased in 47% and in the remaining 53% the levels were normal as seen in table 9.

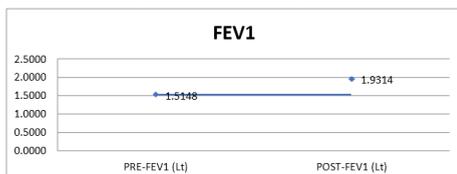
**Table 11:** Pre VS Post operative lung parameters

Paired Samples Statistics		Mean	Mean difference	Std. Deviation	P VALUE
PRE VS POST OPERATIVE					
Pre operative	FEV1 (Lt)	1.5148	0.41	0.38484	0.000*
Post operative	FEV1 (Lt)	1.9314		0.52095	
Pre operative	FEV1 (% Pred.)	58.83	18.55	8.456	0.000*
Post operative	FEV1 (% Pred.)	77.38		11.718	
Pre operative	FVC (Lt)	2.5741	0.33	0.59397	0.001*
Post operative	FVC (Lt)	2.7959		0.71082	
Pre operative	FVC (% Pred.)	84.03	6.14	8.144	0.000*
Post operative	FVC (% Pred.)	90.17		10.902	

\*significant

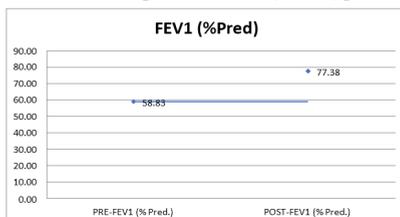
Among the patients with CRS and asthma who were surgically treated, all spirometry parameters [FEV1 (Lt), FEV1 (% Pred.), FVC (Lt), FVC (% Pred.)] were improved postoperatively in terms of mean values, and the difference was found to be significant.

**Figure 5:** Pre VS Post operative FEV1(Lt) parameters



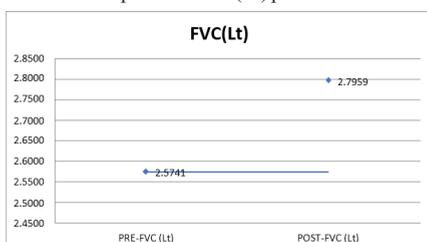
FEV1 mean was 1.5 Lt preoperatively which improved to 1.93 Lt postoperatively.

**Figure no. 6:** Pre VS Post operative FEV1 (%Pred) parameters



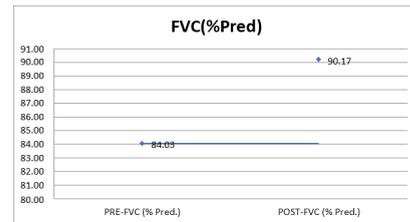
The mean FEV1(%Pred) was 58.83% preoperatively which improved to 77.38% postoperatively.

**Figure 7:** Pre VS Postoperative FVC(Lt) parameters



The mean FVC was 2.57 Lt preoperatively which improved to 2.79 Lt postoperatively.

**Figure 8:** Pre VS Postoperative FVC(%Pred) parameters



In the study the mean FVC(%Pred) before treatment was 84.03% which improved to 90.17% after treatment.

**DISCUSSION**

In this study, 7% were below 20 years, 31% were between 21- 30 years, 42% were between 31 to 40 years, 15% were between 41 and 50 years, 5% were between 51 to 60 years. The mean age was 34± 9 years. Around 39% were males and 61% were females and the sex ratio was 0.6: 1 [M: F].

The present study findings were similar to a study by Al- Ahmad et al in which mean age of patients was 43 ± 12 years and 49.4% were females.<sup>23</sup>

The present study findings were comparable to a study by Obaseki D et al in which mean age of participants was 47.4 years. Around 37.45% were males and 62.55% were females.<sup>24</sup>

The present study findings concurred with a study by Vikram J et al in which mean age of study subjects was found to be 40.41 ± 17.05 years.<sup>25</sup>

The present study finding differed with a study by Chinnakkannan SK et al in which mean age of study subjects was 6.7± 3.1 years and M:F ratio was 2.6:1.<sup>26</sup>

The present study findings were similar to a study by Monga S et al in which M: F ratio was 1.24:1 and 51.4% patients were in 21 – 30 years of age group.<sup>27</sup>

The present study findings were consistent with a study by Shruti GMR et al in which 51.7% patients were in the age group of 31- 40 years and mean age of study subjects was 35.2%. Males accounted for 81.7% of study population.<sup>28</sup>

In the present study, the most common clinical presentation included nasal block, nasal discharge, facial pain and olfactory dysfunction which were presented in combinations. Around 82% had nasal block, 73% had nasal discharge, and 70% had facial pain and headache and 33% had olfactory dysfunction.

The present study findings were comparable to a study by Obaseki D et al in which 100% of patients had nasal discharge and nasal block and 79.92% had facial pain and reduced sense of smell.<sup>29</sup>

The present study findings concurred with a study by Vikram J et al in which clinical presentation included sneezing (71.78%) and watery/runny nose (63.59%).<sup>25</sup>

The present study finding concurred with a study by Chinnakkannan SK et al in which nasal discharge and sneezing were the most common signs and symptoms.<sup>26</sup>

The present study findings were similar to a study by Monga S et al in which 87.8% had watering nose, 87.8% had sneezing, 78.3% had nasal blockage, 55.4% had nasal itching and 59.4% had red/itchy eyes.<sup>27</sup>

The present study findings were similar to a study by Patel AK et al in which most common symptom was rhinorrhea (100%) followed by sneezing (95.7%) and nasal block (22.8%).<sup>29</sup>

In the present study, the prevalence of bronchial asthma among chronic rhinosinusitis patients was 29%.

The present study findings were similar to a study by Al- Ahmad et al in which prevalence of asthma among chronic rhinosinusitis patients was 59.63%.<sup>30</sup>

The present study findings concurred with a study by Vikram J et al in which prevalence of BA among CRS patients was 65.24%.<sup>25</sup>The present study finding concurred with a study by Chinnakkannan SK et al in which Asthma was mild intermittent in 28%, mild persistent in 41%, and moderate persistent in 31%. None had severe persistent asthma.<sup>26</sup>

The present study findings were similar to a study by Monga S et al in which 81% had intermittent allergic rhinitis and 19% had persistent allergic rhinitis.<sup>27</sup>

The present study findings were comparable to a study by Orlandi RR et al in which prevalence of asthma among chronic rhinosinusitis was 67%.<sup>30</sup>

The present study findings concurred with a study by Castillo et al in which prevalence of asthma was 49.2% among chronic rhinosinusitis patients. Around 84% had mild to moderate asthma.<sup>22</sup>

Bhalla K et al reported that 72.3% of asthmatic patients had chronic rhinosinusitis.<sup>32</sup>

In this study, the DNE findings showed that 68% had mucopurulent discharge, 92% had mucosal edema and 27% had polyps. Among the 29 subjects with CRS and BA, 59.3% had polyps and the remaining 17.8% had no polyps. This association of DNE findings and chronic rhinosinusitis was found to be statistically significant.

The present study findings concurred with a study by Castillo et al in which 16.7% had nasal polyps and 19.5% had no nasal polyps.<sup>31</sup>

The present study findings were similar to a study by Ryu G et al in which there was positive association between patients with chronic rhino sinusitis & bronchial asthma and polyps. The odds ratio was found to be 1.85.<sup>33</sup>In this study, the absolute eosinophil count was increased in 54%, IgE was increased in 47%. The present study finding concurred with a study by Chinnakkannan SK et al. in which 80% of patients with bronchial asthma and chronic rhinosinusitis showed nasal eosinophilia.<sup>26</sup>

The present study findings were similar to a study by Monga S et al in which 37.8% had raised AEC and 74.3% had raised Ig E levels.<sup>27</sup>

The present study findings were consistent with a study by Shruti GMR et al in which mean absolute eosinophil count was 753.95 cells/cu mm and mean Ig E levels were 586 IU/ml.<sup>28</sup>

The present study findings were in accordance with a study by Kumar N et al. in which eosinophilia was noted among patients with chronic rhinosinusitis and bronchial asthma.<sup>34</sup>

The present study findings were consistent with a study by Venkateswarlu V et al in which there was raised IgE levels among patients with chronic rhinosinusitis and bronchial asthma.<sup>35</sup>

In the present study the mean FEV1 before treatment was 1.51Lt and the mean FEV1(%Pred) was 58.83 which improved to mean FEV1 of 1.93 Lt and mean FEV1(%Pred) 77.38 after treatment. The mean FVC before treatment was 2.57 Lt and the mean FVC(%Pred) was 84.03 which improved to mean FVC of 2.79 Lt and mean FVC(%Pred) of 90.17 after treatment of CRS. There was significant association between before and after treatment with regard to FEV1 and FVC. The present study findings were similar to a study by Al- Ahmad et al in which olfactory symptoms improved significantly after medical treatment.<sup>23</sup>

The present study findings were comparable to a study by Obaseki D et al in which mean FEV1 was 84.23 and FEV1/FVC was 73.01. There was significant association between pre- treatment and post treatment FEV1 and FEV1/FVC values.<sup>77</sup> The present study findings were similar to a study by Monga S et al in which pulmonary function tests showed reversible obstruction, i.e., >10% improvement in FEV1 with treatment.<sup>27</sup>

The present study findings were similar to a study by Sujatha S et al in

which there was significant association before and after treatment in terms of bronchial reversibility.<sup>36</sup>

The present study findings concurred with a study by Nair S et al in which pulmonary function tests predicted scores improved post treatment significantly.<sup>37</sup>

This study findings showed significant moderate correlation (between bronchial asthma and CRS which was also a similar finding reported by Matsuno O et al.<sup>25</sup> which demonstrated a significant correlation.

Additionally, Lin DC et al.<sup>38</sup> and Tay TR et al.<sup>39</sup> found that asthma severity may have a significant correlation with the presentation of CRS.

## SUMMARY & CONCLUSIONS

The present cross- sectional study was undertaken with an aim to study the association between chronic rhinosinusitis and bronchial asthma which was done between July 2022 and January 2024. A total of 100 patients were included who fulfilled the inclusion criteria. The study started following ethics clearance.

The results of the study were, the mean age was 34± 9 years consisting of 61% females and 39% males presenting with the symptoms of nasal block, nasal discharge, facial pain and headache and olfactory dysfunction.

In the study the prevalence of bronchial asthma was 29%. DNE showed mucosal edema in 92% and polyps in 27%. Among the 29 BA patients 59.3% had polyps and 17.8% without polyps.

The absolute eosinophil count was increased in 54% and IgE increased in 47% subjects. In the present study the mean FEV1 before treatment was 1.51Lt and the mean FEV1(%Pred) was 58.83 which improved to mean FEV1 of 1.93 Lt and mean FEV1(%Pred) 77.38 after treatment. The mean FVC before treatment was 2.57 Lt and the mean FVC(%Pred) was 84.03 which improved to mean FVC of 2.79 Lt and mean FVC(%Pred) of 90.17 after treatment of CRS.

Statistically significant association was seen between DNE and CRS, before and after FEV1 and FVC. The study also found a significant association between AEC, IgE and bronchial asthma.

Objective analysis of the impact of endoscopic sinus surgery (ESS) on asthma was conducted using pulmonary function tests (PFTs). Multiple readings were tabulated for each patient before and after surgery, and the mean of the various spirometric parameters was calculated as a percentage of the predicted value for that patient, considering their height, age, weight, and sex. An improvement was observed in the values of FEV1, FVC in asthmatic patients post-ESS. Treating chronic rhinosinusitis (CRS) can significantly enhance asthma control, particularly by alleviating symptoms and improving patients' quality of life. Both medical and surgical interventions for CRS effectively manage respiratory symptoms; however, their direct impact on asthma control can vary, highlighting the importance of individualized treatment plans. Continued research is essential to fully understand the interconnected pathophysiology of CRS and asthma and to develop optimal treatment strategies for patients with both conditions.

## LIMITATION

1. Small sample size
2. There could be an element of information bias in this study.
3. Limited previously conducted studies.
4. The role of trigger factors for asthma.

## RECOMMENDATIONS

1. To identify and diagnose patients as early as possible
2. Identification of risk/ triggering factors
3. Reduce further complications
4. Reduce the incidence
5. Early intervention

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