Endoscopic and CT Findings in the Nose and Paranasal Sinuses of Bronchial Asthma Patients

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Introduction: Most patients with asthma have rhinitis and/or Sinusitis suggesting the concept of (one airway one disease). The presence of allergic rhinitis and/or Sinusitis commonly exacerbates asthma, increasing the risk of asthma attacks, emergency visits and hospitalizations for asthma. However the precise nature of their relationship is poorly understood.

Objective: to evaluate the sino-nasal endoscopic examination and the sinus CT findings to detect the diagnosis of nasal diseases in bronchial asthma patients. Methods: A total of 100 patients with bronchial asthma attending the outpatient clinic of chest department in Bab Elsharia Al-Azhar University hospital referred to ENT outpatient clinic were evaluated in the period from January 2013- May 2014. The patients were classified into 2 groups:- Group (A): asthmatic patients presented with nasal symptoms (72%) and Group (B): asthmatic patients without any nasal symptoms (28%). The patients were evaluated by the sino-nasal endoscopy and Sinus CT scans.

Results: The present study reveled that the most significant difference of nasal disease between the patients of Group (A) and Group (B) were: (1) Rhinosinusitis with P value (0.04), (2) CRS with Allergic sinonasal polyposis with P value (0.02) and (2) Free nasal disease patients with P value (<0.001). Other diseases showed no significant difference between patients of Group (A) and Group (B) as allergic rhinitis ± HIT, allergic rhinosinusitis ± HIT, rhinosinusitis and allergic fungal sinusitis as their P value were (> 0.05). The CT scan (score ≥12) appeared to be significantly associated with the diagnosis of (1) Allergic HIT with P value (0.03), (2) CRS with Allergic sinonasal polyposis with P value (<0.001), (3) MP discharge with P value (0.002), (4) CRS with Inflammatory polyp with P value (<0.001) and (5) free nasal endoscopic patients.

Conclusion: To improve asthma control, our data indicate that both sino-nasal endoscope and the sinus CT are a useful and practicable techniques as they play important roles in the management of asthmatic patients, because they can assess what are the situation of nose and paranasal sinuses at the time of examination which allow immediate management of both upper and lower airway simultaneously.

Keywords: CT, FESS, BA

INTRODUCTION

It has long been recognized that diseases of the upper and lower airways may coexist, but it is still a matter of controversy whether a causal relationship exists, wherein rhinosinusitis worsens asthma, or whether they are manifestations in different parts of the respiratory tract of the same underlying disease process.

Sinusitis and asthma are closely interrelated diseases and sinusitis is known to influence bronchial asthma in its severity and chronicity. However the precise nature of their relationship is poorly understood.

Various studies, have confirmed that rhinitis has a significant impact on health-related quality of life and the treatment of rhinitis has been shown to some extent to be beneficial to the lower airways. [1,2]

In this respect, a strategy for preventing bronchial asthma through the management of allergic rhinitis has recently been developed. [3] Therefore, asthma management should include the investigation of rhinosinusitis to improve asthma control, and often leads the physician to perform sinonasal imaging and/or nasal endoscopy. Computed tomography (CT) is

nowadays the most suitable technique for studying the nose and paranasal sinuses.

Nasal endoscopy makes it possible to directly investigate the upper airway and is considered as the reference technique for the diagnosis of sinonasal diseases.[4] However, it requires specific training and is less frequently used in common practice.

The present study was designed to evaluate the sinonasal endoscopic examinations and the sinus CT scan to diagnose the nasal diseases in asthmatic patients with or without nasal symptoms.

PATIENTS AND METHODS

In this study, a 100 patients suffering from bronchial asthma were subjected to the following:

- **History taking:** chest symptoms, duration of asthma, medical treatment used, all patients completed a questionnaire on nasal symptoms administered by the ENT physician, history of nasal treatment and operations.
- General examination.
- Chest examination.
- The bronchial asthma patients were classified into:
- **Group (A):** bronchial asthma patients with nasal symptoms.
- **Group (B):** bronchial asthma patients without nasal symptoms.
- Sino-nasal endoscope was performed by an ENT specialist.
- Sinus C.T. was performed on the same day. Coronal and axial 1.5 mm slices were performed with high resolution CT. A CT scan score (Lund-Mackay score) was assigned as previously described by Crater et al., 1999. The total CT scan score was used to classify the patients as having limited (CT score: 0–11) or extensive (CT score: ≥12) involvement. The range of possible scores was 0–30.
- All patients gave their informed consent and the University Ethics Committee approved the study.

RESULTS

In the our prospective study, A total of 100 asthmatic patients were classified into 2 groups:

Group (A) asthmatic patients presented with nasal symptoms were totally 72 patients (72%) divided into 36 males and 36 females.

Group (B) asthmatic patients without any nasal symptoms were totally 28 patients (28%) divided into 11 males and 17 females with no significant difference as their P value were (0.4): as in Table 1.

Table 1 Gender distribution versus presence or absence of nasal symptoms

Gender	Study groups				P value
	Group (A) (n=72)		Group (B) (n=28)		
	N	%	N	%	
Male	36	50.0	11	39.3	0.4
Female	36	50.0	17	60.7	NS

In this study, we were found that the most presenting symptom was nasal obstruction in 50% followed by loss of smell in 32%, nasal discharge and headache in 24%, sneezing in 20% and lastly itching in 13% of patients. Most of these patients were presented with more than one nasal symptom as shown in Table 2.

Table 2 Frequency of nasal symptoms in asthmatic patients

Nasal symptoms	Frequency (n=100)	Percentage
Nasal obstruction	50	50%
Loss of smell	32	32%
Headache	24	24%
Discharge	24	24%
Sneezing	20	20%
Itching	13	13%

In this study, we found that the significant endoscopic findings between Group (A) and Group (B) asthmatic patients were:

(1) CRS with Allergic sinonasal polyposis (Fig. 5B&C) were presented in 13 patients of Group (A) and none of Group (B) with significant difference as their P value was (0.02).
(2) Mucopurulent discharges (Fig. 7B) were presented in 24 patients of Group (A) and 2 patients of Group (B) with significant difference as their P value was (0.01).
(3) free nasal endoscopic examination were presented in 9 patients of Group (B) and none of Group (A) with significant difference as their P value was (<0.001).

On the other hand, other endoscopic findings showed no significant difference between Group (A) and Group (B) asthmatic patients in the following findings: Allergic hypertrophied inferior turbinate (HIT), Deviated Septum, HIT, Mucus threads (Fig. 7C), Mammillated IT (Fig. 6B), Allergic IT and Inflammatory Polyp (Fig. 6C) as significant P value should be (<0.05). We should to notify that the most of patients of Group (A) were present with more than one endoscopic finding as shown in Table 3.

Table 3 Frequency of nasal endoscopic findings in asthmatic patients with their P value

Endoscopic findings	Study groups				P value
	Group (A) (n=72)		Group (B) (n=28)		
Allergic HIT	**N**	**%**	**N**	**%**	
Yes	17	23.6	6	21.4	1.0
No	55	76.4	22	78.6	NS
Deviated Septum					
Yes	15	20.8	5	17.9	1.0
No	57	79.2	23	82.1	NS
HIT					
Yes	6	8.3	3	10.7	0.7
No	66	91.7	25	89.3	NS
Mucus threads					
Yes	30	41.7	9	32.1	0.5
No	42	58.3	19	67.9	NS
Mammillated IT					
Yes	9	12.5	0	0.0	0.06
No	63	87.5	28	100.0	NS
Allergic IT					
Yes	24	33.3	7	25.0	0.5
No	48	66.7	21	75.0	NS
CRS with Allergic sinonasal polyposis					
Yes	13	18.1	0	0.0	0.02
No	59	81.9	28	100.0	S
Mucopurulent discharge					
Yes	24	33.3	2	7.1	0.01
No	48	66.7	26	92.9	S
CRS with Inflammatory Polyp					
Yes	10	13.9	1	3.6	0.2
No	62	86.1	27	96.4	NS
Free endoscopy					
Yes	0	0.0	9	32.1	<0.001
No	72	100.0	19	67.1	S

In this study, we found that the sinus CT findings of the patients which were significant include:

(1) Rhinosinusitis (Fig. 7A) were presented in 33 patients of Group (A) and 6 patients of Group (B) with significant difference as their P value was (0.04).

(2) CRS with Allergic sinonasal polyposis (Fig. 5A) were presented in 13 patients of Group (A) and none of Group (B) with significant difference as their P value was (0.02).

(3) Free CT findings (Fig. 3A) were presented in 11 patients of Group (B) and 6 patients of Group (A) with significant difference as their P value was (0.001).

On the other hand, other CT findings showed no significant difference between Group (A) and Group (B) asthmatic patients in the following findings: HIT and allergic fungal sinusitis (Fig. 8) as significant P value should be (<0.05). We should to notify that the most of Group (A) patients were present with more than one CT finding. Bar graph (Fig. 1) demonstrates frequency of CT findings in asthmatic patients with their P value.

We were found that there is highly significant difference of patients of Group (A) with CT score ≥ 12 and of patients of Group (B) with CT score < 12 as their P value were (<0.001). Bar graph (Fig. 2) demonstrates the frequency of CT score in asthmatic patients with their P value.

In this study, we found that there was significant difference between patients with extensive disease (CT score ≥12) and patients with limited disease (CT score < 12) for the following endoscopic findings:(1) Allergic HIT with P value (0.03), (2) CRS with Allergic sinonasal polyposis with P value (<0.001), (3) MP discharge with P value (0.002), (4) CRS with Inflammatory polyp with P value (<0.001) and (5) free nasal endoscopic patients indicate that the patients represent with limited disease (CT score < 12) with P value (0.01). There is no significant difference between patients with extensive disease (CT score ≥12) and patients with limited disease (CT score < 12) for the following endoscopic finding: HIT, mucus threads, mammillated IT and allergic IT as their P value (>0.05). Table (4) demonstrates comparison of CT scores regarding endoscopic findings with their P value.

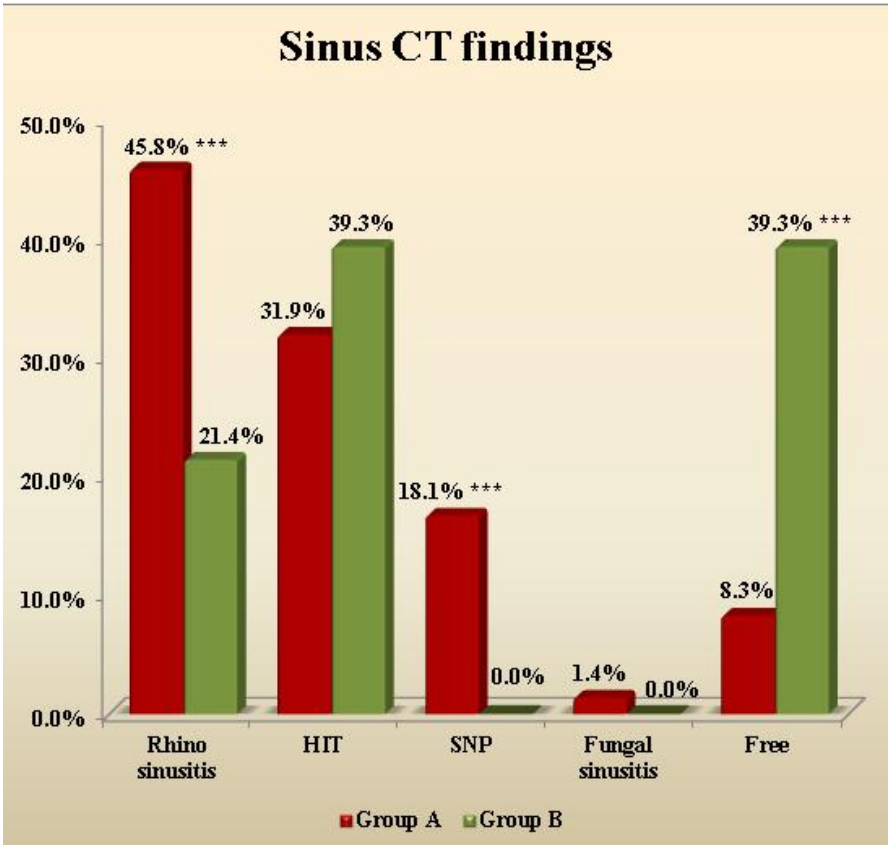


Fig 1 Bar graph representative of the frequency of CT findings in asthmatic patients with their *P* value.(* = significant *P* value < 0.05)**

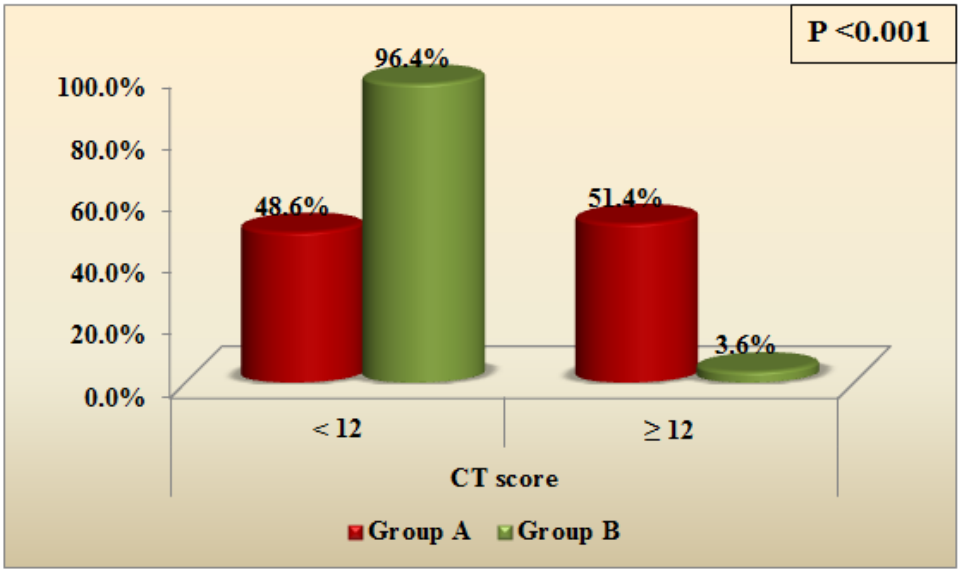
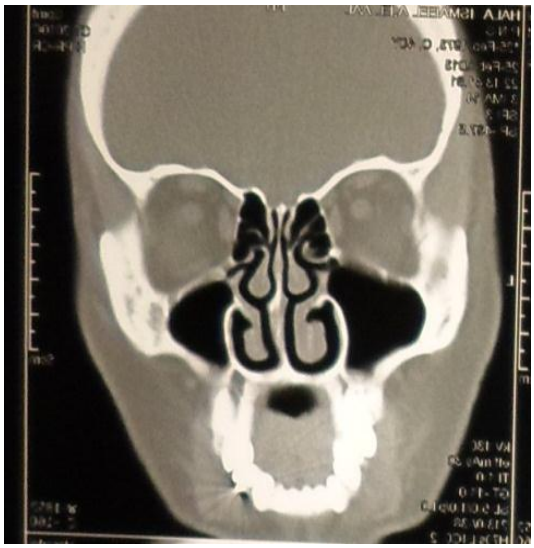
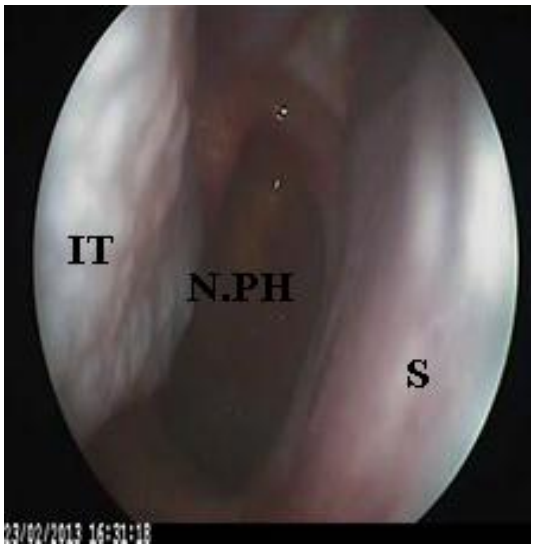


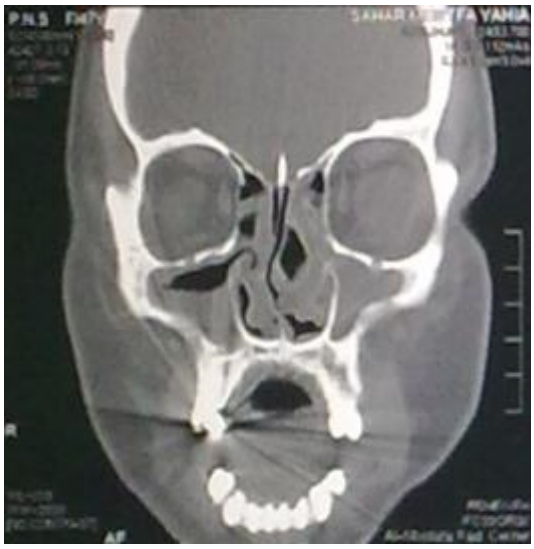
Fig 2 Bar graph representative of the frequency of CT score in asthmatic patients with their P value

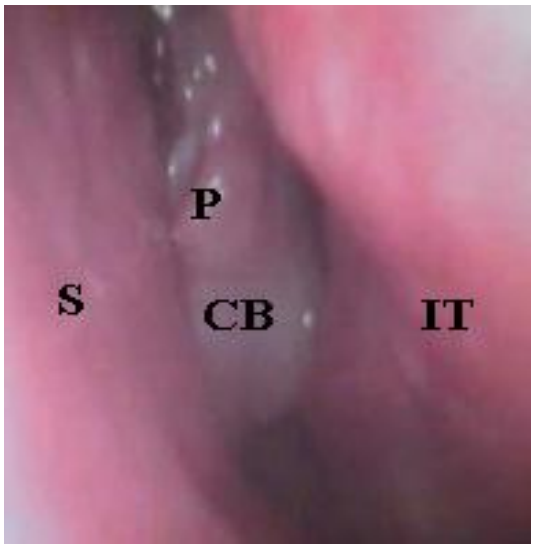




A **B**

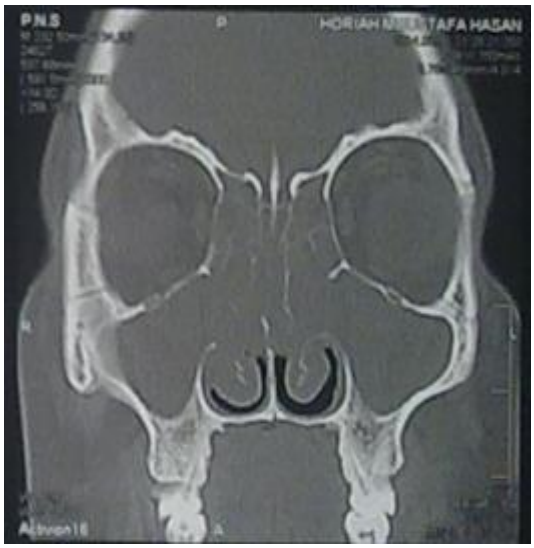
Fig 3 43 year's old female with history of asthma 3 years ago without nasal symptoms. (A) Coronal CT scan shows absence of mucosal thickening in any paranasal sinuses. CT score = 0 points. (B) Endoscopic view of right nasal cavity shows allergic pale bluish inferior turbinate, N.PH., nasopharynx; IT, inferior turbinate; S., septum



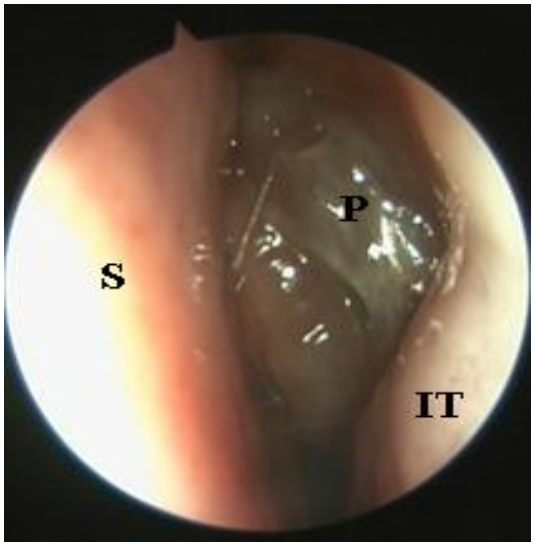


A **B**

Fig 4 47 year's old female with history of asthma 7 year ago and nasal obstruction 3 year ago. (A) Coronal CT scan shows bilateral maxillary & ethmoidal opacity with left concha bullosa (star). CT score = 16 points. (B) Endoscopic view of left nasal cavity shows inflammatory nasal polyp from middle meatus, S., septum; P, inflammatory polyp of middle meatus; CB, concha bullosa and IT, inferior turbinate



A



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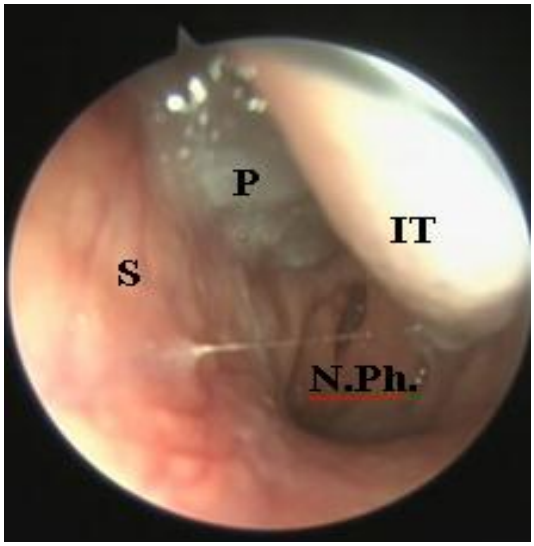
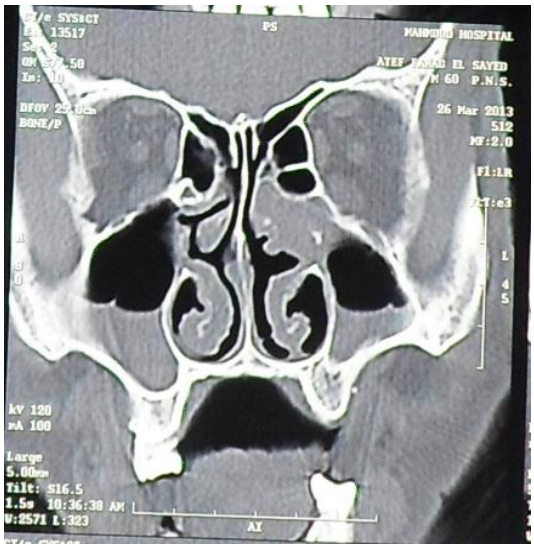
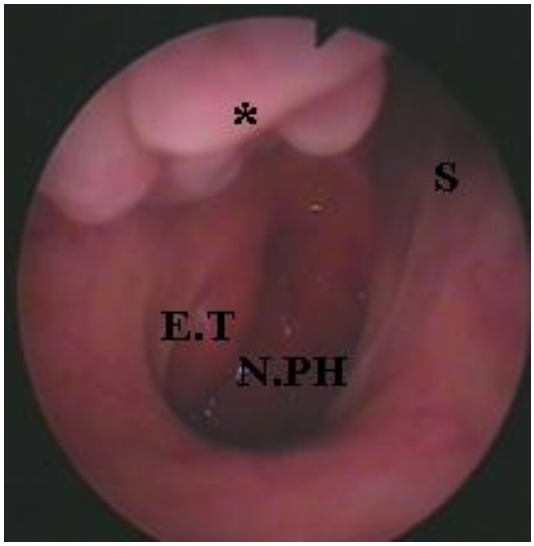


C

Fig 5 31 year's old female with history of asthma since childhood and nasal obstruction 10 year ago. (A) Coronal CT scan shows complete opacity of all sinuses. CT score = 28 points. (B) Endoscopic view of left nasal cavity shows nasal polyp from middle meatus obstructing it completely. (C) Endoscopic view of left nasal cavity shows nasal polyp from posterior ethmoid reaching posterior end of inferior turbinate. P, allergic polyp; S., septum; N.ph., nasopharynx; IT, inferior turbinate



A



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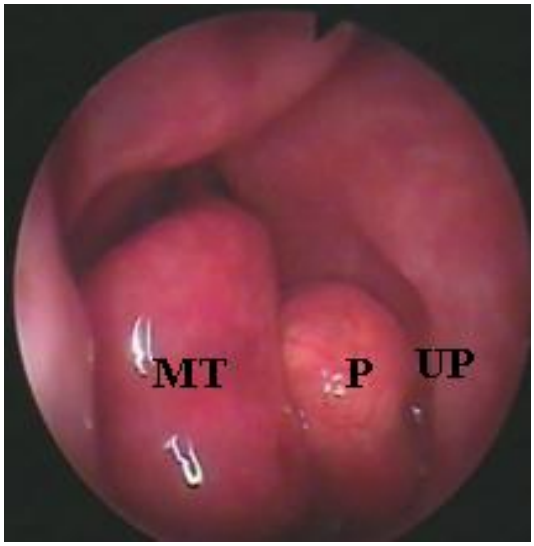
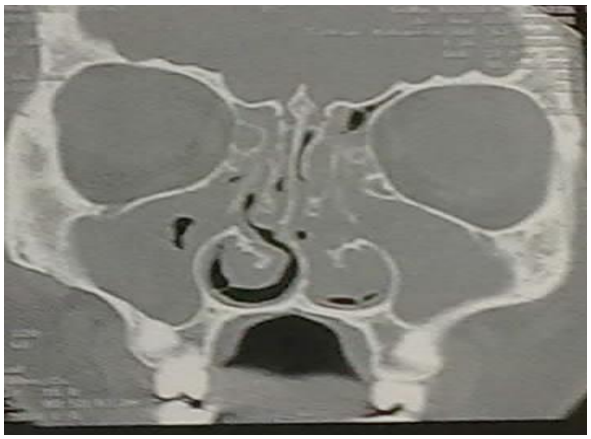
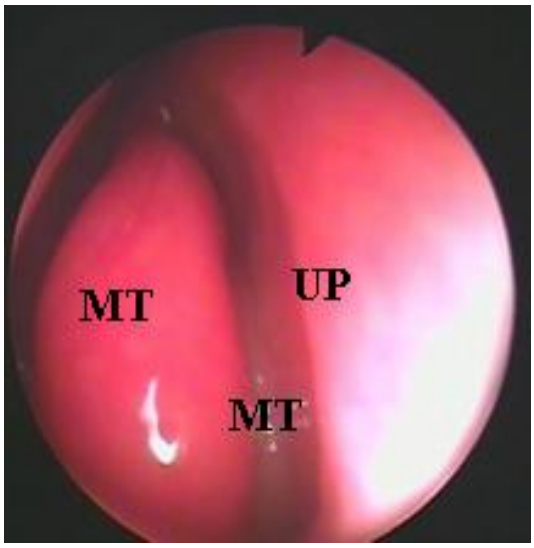


C

Fig 6 60 year's old male with history of asthma 20 year ago with nasal obstruction & headache 9 year. (A) Coronal CT scan shows opacity of left MM with mild opacity of both maxillary & ethmoid sinuses. Additional views (not shown) demonstrated mild thickening in the frontal and sphenoid sinuses, MM, middle meatus. CT score = 15 points. (B) Endoscopic view of right nasal cavity show right mammillated posterior end of Inferior turbinate (*); N.ph, nasopharynx; ET, Eustachian tube. (C) Endoscopic view of left MM shows inflammatory polyp obstructing OMC, P, inflammatory polyp; MT, middle turbinate; UP, uncinate process;S,septum



A



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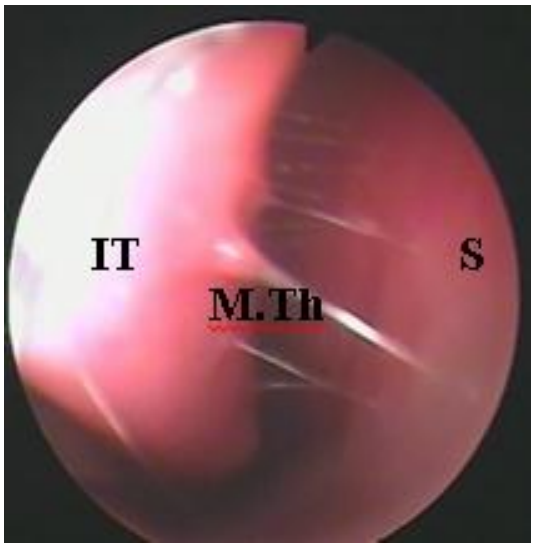

C

Fig 7 24 year's old male with history of asthma 2 year ago with nasal obstruction& headache 3 year ago. (A) Coronal CT scan shows opacity of both maxillary & ethmoidal sinuses. Additional views (not shown) demonstrated opacity in the frontal and sphenoid sinuses. CT score = 28 points. (B) Endoscopic view of left middle meatus shows mucopurulent discharge from it (MP); MT, middle turbinate;UP uncinate process (C) Endoscopic view of right nasal cavity shows mucopurulent thread's (M.Th) filling nasal cavity, IT, inferior turbinate; S., septum

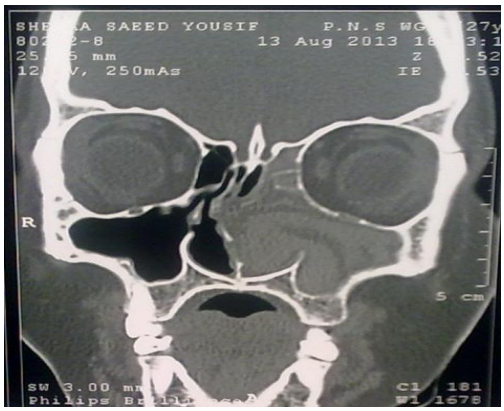

Fig 8 27 year's old female with history of asthma 13 year and left sided nasal obstruction & headache 5 year. Coronal CT scan shows heterogonous opacity of both left maxillary and ethmoidal sinuses, The high density of the opacifications (stars) are a typical finding in allergic fungal sinusitis (a case of recurrent allergic fungal sinusitis, patient with history of previous ESS twice). CT score =12 points

Table 4 Comparison of CT scores regarding endoscopic findings with their P value

Endoscopic findings	CT score				
	< 12 (n=62)	≥ 12 (n=38)	P value		
	N	%	N	%	
Allergic HIT					
Yes	19	30.6	4	10.5	0.03
No	43	69.4	34	89.5	S
HIT					
Yes	6	9.7	3	7.9	1.0
No	56	90.3	35	92.1	NS
Mucus threads					
Yes	26	41.9	13	34.2	0.5
No	36	58.1	25	65.8	NS
Mammillated IT					
Yes	5	8.1	4	10.5	0.7
No	57	91.9	34	89.5	NS
Allergic IT					
Yes	18	29.0	13	34.2	0.7
No	44	71.0	25	65.8	NS
CRS with Allergic sinonasal polyposis					
Yes	0	0.0	13	34.2	<0.001
No	62	100.0	25	65.8	S
MP discharge					
Yes	9	14.5	17	44.7	0.002
No	53	85.5	21	55.3	S
CRS with Inflammatory Polyp					
Yes	1	1.6	10	26.3	<0.001
No	61	98.4	28	73.7	S
Free endoscopy					
Yes	9	14.5	0	0.0	0.01
No	53	85.5	38	100.0	S

DISCUSSION

It has long been recognized that diseases of the upper and lower airways may coexist, but it is still a matter of controversy whether a causal relationship exists, wherein rhinosinusitis worsens asthma, or whether they are manifestations in different parts of the respiratory tract of the same underlying disease process. Many of the same triggers prominently affect the upper and lower airways. A typical allergen exposure can evoke both nasal and pulmonary symptoms.The association of asthma with rhinosinusitis has been noted and described in the medical literature for many decades. [5]

This present study showed that nasal symptoms are very common in asthmatic patients (72%) with the most presenting symptom was nasal obstruction in 50% of asthmatic patients followed by smell disorder in 32%, nasal discharge and headache in 24%, sneezing in 20% and lastly itching in 13% of patients. The most of these patients were presented with more than one nasal symptom. These results differed as previously described study [6] in bronchial Asthmatic patients (80.6%, n = 83) reported nasal symptoms during the month preceding the study, including nasal obstruction (67%), sneezing (67%), runny nose (54.5%) and/or loss of smell (42.8%) because in our study we were act in 2 groups of asthmatic patients (group A): asthmatic patients presented with nasal symptoms (72%) and (2) Group B: asthmatic patients without any nasal symptoms (28%).

In the present study, the ENT examination of the asthmatic patients using nasal endoscope and sinus CT revealed and detect more nasal diseases (90%). These results agreed as previously described study. [6-8] The majority of patients (90.3%) also presented with an abnormal nasal endoscopy. Nasal endoscopy revealed architecture abnormalities in 93.2% of cases, mucosal thickening in 94.2% and secretion abnormalities in 70%.

In the present study, we have found that the most significant difference of nasal disease between the patients of Group (A) and Group (B) were: (1) Rhinosinusitis with P value (0.04), (2)CRS with Allergic sinonasal polyposis with P value (0.02) and (2) Free nasal disease patients with P value (<0.001). Other diseases showed no significant difference between patients of Group (A) and Group (B) as allergic rhinitis ± HIT, allergic rhinosinusitis ± HIT, rhinosinusitis and allergic fungal sinusitis as their P value were (> 0.05).

Even if rhinitis (both allergic and non-allergic) is very common in asthmatic patients, our data suggested that rhinosinusitis and polyposis are frequent in asthma.

As we studied the patients, the group (A) of patients with nasal symptoms, who had nasal endoscopic examination and high sinus CT score, can be characterized as having symptoms of severe nasal

diseases as allergic rhinitis, rhinosinusitis, recurrent fungal sinusitis and CRS with allergic sinonasal polyposis (SNP).

After full assessment of the asthmatic patients, we have found that allergic rhinitis represent 69%, the near results as previously described study [9] who reported that up to 80% of patients with asthma have rhinitis.

Coexistence of rhinosinusitis with asthma on the basis of clinical findings has been found to range between 34% to 58% patients in various studies. [9,10]

In the present study, we have found that rhinosinusitis present in 28% of patients, while in contrary, with previously described study [12] in which rhinosinusitis present in more than 50% of asthmatic patients.

The available study [13] in which demonstrated sinus abnormalities in patients with asthma used conventional sinus radiographs. These studies are flawed because conventional sinus radiographs are much less sensitive than CT scans for detecting sinus abnormalities. [14]

In previously described studies [15,19] the variable incidence of sinusitis in asthmatic patients as detected by conventional radiography, such variability reflecting the difficulty of accurately diagnosing sinus disease using conventional sinus radiography. Whereas, in the present study, we were used sinus CT scan with the Lund-Mackay score as the most suitable technique for studying paranasal sinuses.

When adults with asthma are evaluated by means of CT scanning, approximately 74% to 90% have some degree of mucosal hyperplasia which is often asymptomatic. [17] In the other study [18] confirm this association; more importantly, however, it takes advantage of a validated scoring system using the CT scan to correlate severity of sinusitis with parameters of asthma.

Radiological CT scan abnormalities in our study, presented in 83% of asthmatic patients, these results are correlated with results of previously described studies [11,18] who's reported that CT scans showed abnormalities in 84% and 78% of patients with bronchial asthma respectively.

In the present study, We have found that there is high significant difference of asthmatic patients with nasal symptoms (group A) with CT score ≥ 12 and of asthmatic patients without nasal symptoms (group B) with CT score < 12 indicating that group (A) patients are presented with more extensive disease. CT scan for detection of abnormalities (i.e. architectural, mucosal thickening, secretion) did not appear to be very efficient in rhinitis, but can be useful in rhinosinusitis and even better in polyposis because, our sinus CT scores were significantly higher in polyposis and rhinosinusitis than in rhinitis, these results are agreed with previously described study. [19]

In the present study,, we described the combination of upper and lower airways disease symptoms in 72%, endoscopic abnormalities in 91% and CT scan abnormalities presented in 83% of asthmatic patients; moreover, 24% of them had NPs divided into 13% with SNP and 11% with inflammatory polyp indicating CRS. This incidence of concomitant asthma is similar to previously reported incidence of 34–50% in patients with CRS. [10]

The role of allergy in the generation of nasal polyps (NPs) is even more unclear than in CRS. Both allergic rhinitis and NPs are characterized by an inflammatory response that shows many similarities. However, until now, no clear epidemiologic data support a role of allergy in NPs. [3] In the present study, CRS with inflammatory nasal polyps were present in 24% and CRS with allergic sinonasal polyposis present in 13% of asthmatic patients with rhinosinusitis, while in previously described study [20] the nasal polyps in general (not, differed between inflammatory polypi and allergic polypi) were presented in 51.5% of patients with rhinosinusitis.

The previously described studies [21 ,22] reported that the link between fungi and severe asthma is recognized and even the term "severe asthma with fungal sensitization" is proposed. In the present study, we had found a single case with recurrent allergic fungal sinusitis that perform FESS twice.

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