

Sino-Nasal Status in Patients with Chronic Obstructive Pulmonary Disease

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Abstract

Background. Chronic obstructive pulmonary disease (COPD) is a preventable and treatable disease with serious impact on quality of life (QoL). There are limited studies available supporting coexistence of sino-nasal involvement in COPD.

Methods. A prospective study was conducted to evaluate sino-nasal status in patients with COPD (n=100) presenting to the Department of Respiratory Medicine, Mahatma Gandhi Medical College and Hospital, Jaipur from July 2011 to October 2012. COPD was diagnosed based on the Global initiative on Obstructive Lung Disease (GOLD) guidelines. Sino-nasal status was assessed by detailed history, radiograph of the para-nasal sinuses (PNS), nasal endoscopy and mucociliary clearance time.

Results. Sino-nasal symptoms were present in 74 patients with COPD; nasal discharge (75.7%) being the most common. Tobacco smokers with COPD had a higher occurrence of sino-nasal symptoms (76.8%). Radiograph of para-nasal sinuses showed that maxillary sinus was most commonly involved. Nasal endoscopy revealed discharge in 63.5% cases. Nasal mucociliary clearance time was delayed (>11 to >40 min) in 98% cases. Nasal mucociliary clearance time was significantly delayed (>20 min) in COPD patients who were tobacco smokers as compared to non-smokers (53.7% *versus* 16.7%) and also related with increasing severity of COPD.

Conclusions. Our observations suggest that sino-nasal involvement and delayed mucociliary clearance are common in patients with COPD, especially in tobacco smokers. Assessment of upper airway involvement in all the patients with COPD can help better therapeutic intervention and improvement in QoL.

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Key words: COPD, Airway, Sino-nasal, Rhinitis, Spirometry, Nasal endoscopy, Mucociliary clearance, Sinuses.

Introduction

Chronic obstructive pulmonary disease (COPD) is a preventable and treatable disease, characterised by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in airways and the lung to noxious particles and gases.¹ COPD is a major cause of mortality and morbidity world over. The Global Burden of Disease study¹ projected that COPD ranked sixth as a cause of death in 1990, will become third leading cause of death in the world by 2020, a newer projection estimated it to be fourth leading cause by 2030.

The nose is a gateway of respiratory apparatus, exposed constantly to the environment so that triggering agents affect the entire airways starting from nostrils to the alveoli. The upper and lower respiratory tract forms a single continuous pathway, having histological similarities, hence, the term "airway disease". In patients

with bronchial allergic and non-allergic rhinosinusitis, occurrence of airway disease has been well documented.²⁻⁴ Few studies support the view that tobacco smoking increases not only lower airway inflammation but also affects the upper airways.^{5,6}

Evidence is available suggesting that COPD is not only the disease of airways but is also a systemic disorder.⁷⁻¹⁰ The coexistence of upper airway disease with COPD is not well established. However, some studies¹¹⁻¹⁷ have supported this with coexistence of nasal symptoms in COPD ranging from 40% to 88%. To the best of our knowledge, only one study addressing this question was reported from India.¹⁷ Therefore, the present study was planned to evaluate the status of sino-nasal involvement in COPD patients.

Material and Methods

The study was conducted in the Department of Respiratory Medicine, Mahatma Gandhi Medical

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College and Hospital, Jaipur. Patients with COPD admitted to the respiratory medicine ward from July 2011 to October 2012 were included. Patients aged under 40 years, those having severe anatomical changes of nasal cavities, those receiving intra-nasal or systemic decongestants/antihistamines/steroids or having associated co-morbidities, like tuberculosis (TB), malignancy, diabetes mellitus, hypertension, pregnancy, and those who were unable to perform spirometry were excluded from the study. A written consent was obtained from all of them and the study was approved by ethical committee of the institution.

In all patients, detailed history was obtained and physical examination was carried out. Details regarding demographic data, clinical symptoms, tobacco smoking status, symptoms and signs of sino-nasal involvement, socio-economic status as per Kuppaswamay scale¹⁸ were recorded. Smokers were evaluated for pack years (1 pack year is equivalent to smoking 20 cigarettes a day for one year).¹⁹ Laboratory investigations included radiographs of the chest and para-nasal sinuses (PNS), spirometry, nasal endoscopy and nasal clearance saccharine test. Spirometry was performed using NDD true flow™ machine (nnd Medical Technologies, Inc, 300 Brickstone Square, Suite 604, Andover, MA 01810 USA). COPD was defined as forced expiratory volume in the first second (FEV₁) less than 70% predicted, reversibility with 200µg of levosalbutamol via a metered dose inhaler of less than 12% and ratio of FEV₁ to forced vital capacity (FVC) less than 70%.¹ The diagnosis and grading of COPD was done as per Global initiative on Obstructive Lung Disease (GOLD) criteria.¹

Plain radiograph of the PNS was analysed for sinusitis (mono-, multi- or pan-sinusitis), deviated nasal septum (DNS) and polyps. Nasal endoscopic examination was performed in the Otorhinolaryngology Department with Karl Storz 0/30 degree wide angle rigid nasal endoscope with external diameter of 4mm (KARL STORZ Gmbh & Co., Tuttigen Germany). Mucosal changes were estimated according to Lund-Kennedy scale²⁰ ranging from 0-20. Each nasal cavity examined and following scoring system was applied: polyps (0-2), discharge (0-2), oedema (0-2), scarring and crusting (0-2). Saccharine test was also performed for estimation of nasal mucociliary clearance (NMC). Saccharine test described by Anderson and Proctor²¹ is an inexpensive, simple and reproducible technique to access NMC and has been proposed as an effective screening test to detect abnormal NMC. Time from application of saccharine crystals (1mm diameter) 1cm from anterior end of inferior nasal turbinate to first feeling of sweet taste measures NMC.²¹ Eleven minute has been considered to be the upper limit of normal value.²³

Statistical Analysis

Data collected were entered in excel sheet and analysed using Statistical Package for the Social Sciences (SPSS, version 16.0). Qualitative data were summarised in the form of proportions. The difference in proportion was analysed using Chi square test. The level of significance was kept 95% (p value 0.05) for all statistical analysis.

Results

We studied 100 COPD patients satisfying the inclusion criteria. Their demographic characteristics, socio-economic and smoking status are given in table 1. Overall, sino-nasal symptoms were present in 74 cases.

Table 1. Demographic pattern of COPD patients (n=100)

Demography Pattern	No.	(%)
Gender		
Male	75	(75)
Female	25	(25)
Residence		
Urban	32	(32)
Rural	68	(68)
Age groups (in years)		
40-50	19	(19)
51-60	41	(41)
61-70	32	(32)
>70	8	(8)
Socio-economic status		
Upper	0	(0)
Middle	44	(44)
Lower	56	(56)
Smoking status		
Smoker	82	(82)
Non-smoker	18	(18)

Definition of abbreviation: COPD=Chronic obstructive pulmonary disease

Among sino-nasal symptoms, nasal discharge (75.7%) was the most common followed by sneezing (68.9%), nasal congestion (39.2%), itching (25.7%), headache (12.3%) and nasal obstruction (4.1%). Plain radiograph of the PNS in COPD patients with sino-nasal involvement revealed monosinusitis in 31.1%, followed by pansinusitis in 16.2% and multiple sinus involvement in 8.1%. Deviated nasal septum (DNS) was present in 37.8% while nasal polyps were seen in 18.9%. Maxillary sinuses were most commonly involved (Table 2). Among COPD smokers (n=82), occurrence of sino-nasal symptoms in relation to pack years smoking is shown in table 3. Frequency of occurrence of sino-nasal symptoms was significantly higher (p=0.04) with increasing number of pack-year of smoking (Table 3).

Nasal endoscopic findings in patients with sino-nasal symptoms included nasal discharge (63.5%),

Table 2. Radiograph findings of para-nasal sinus in COPD patients with nasal symptoms (n=74)

PNS Findings	Sino-nasal Symptoms (n=74)	
	No.	(%)
Mono sinusitis	23	(31.1)
Maxillary sinusitis	18	
Frontal sinusitis	4	
Ethmoidal sinusitis	1	
Multi sinusitis	6	(8.1)
Fronto maxillary sinusitis	4	
Ethmoido maxillary sinusitis	2	
Ethmoido frontal sinusitis	0	
Pan sinusitis	12	(16.2)
DNS	28	(37.8)
Polyp	14	(18.9)

Definition of abbreviation: PNS=Para-nasal sinus; COPD=Chronic obstructive pulmonary disease; DNS=Deviated nasal septum

Table 3. Sino-nasal symptoms in relation to pack years of smoking

Pack Years of Smoking	Somkers with COPD No. (%)	Sino-nasal Symptoms No. (%)
≤ 10	10 (12.2)	5 (50.0)
11-20	19 (23.2)	12 (63.2)
21-30	23 (28.0)	18 (78.3)
31-40	13 (15.9)	12 (92.3)
>40	17 (20.7)	16 (94.1)
Total	82 (100)	63 (76.8)

The sino-nasal symptoms according to pack-year smoking is significant (p=0.04)

Definition of abbreviation: COPD=Chronic obstructive pulmonary disease

followed by oedema (33.8%), crusting (21.6%), polyp (18.9%) and scarring (4.1%). NMC time was delayed in 98% (range >11 to >40 minutes) and much delayed in 47% (range 21 to >40 minutes). Delayed NMC (>20 min) was evident in 53.7% of COPD smokers, while it was 16.7% in COPD non-smoker patients (p=0.004). The delayed clearance was also significantly (p<0.001) observed with increasing severity of COPD (Table 4).

Table 4. Nasal mucociliary clearance time in relation to severity of COPD

Minutes	Grade I	Grade II	Grade III	Grade IV
	No. (%)	No. (%)	No. (%)	No. (%)
≤ 11	0	2 (4.9)	0	0
>11-20	24 (100)	18 (43.9)	6 (25)	2 (22.2)
>20	0	21 (51.2)	18 (75)	9 (81.8)
Total	24 (100)	41 (100)	24 (100)	11 (100)

Nasal mucociliary clearance is significantly more with increasing severity of COPD (p=0.001).

Definition of abbreviation: COPD=Chronic obstructive pulmonary disease

Discussion

Sino-nasal status should probably be considered as a co-morbid condition in patients with COPD as the upper and lower airways form one continuous and similar morphologically, histologically and functionally related organ system.²⁴ Upper and lower airways are frequently exposed to similar inflammatory stimuli, commonly dust, allergen and smoke etc.^{5,6} There is increasing interest in the possibility that the disease progress in one part of the airway may be manifested in another, thereby providing dual diagnosis and management.¹¹⁻¹³ In our study, two-thirds of the patients were from rural area which is consistent with earlier studies.²⁵⁻²⁷ Our study showed nasal symptoms in 74% COPD patients, while in a questionnaire-based study,¹¹ nasal symptoms were observed in 40% of COPD patients. In another study,¹³ sino-nasal symptoms were seen in 88% cases with moderate to severe COPD, a figure similar to what we observed in the present study. In the questionnaire-based study,¹¹ sino-nasal symptoms were evident in fewer patients, i.e., nasal discharge in 46% and sneezing in 29.3%, while nasal congestion was almost similar to our study. Less frequent occurrence of sino-nasal symptoms has also been reported by others.^{12,17} More frequent occurrence of sino-nasal symptoms was reported in another study¹⁵ and as we have observed, nasal symptoms were more frequently present with increasing number of pack years of smoking in this study also. Alper *et al*¹⁶ reported sinusitis in 64% COPD patients on CT of para-nasal sinuses. Based on the radiograph of PNS, we observed sinusitis in 55.4% patients while the figure was 46% in another study.¹⁷ Nasal endoscopic findings in our study revealed discharge, oedema and crusting as most common findings which were not reported in other studies.^{12,15,16}

The NMC time in our study was delayed in 98% COPD patients and this delay correlated with increasing severity of COPD, as has been reported in other studies.²⁸⁻³² In the present study, NMC was significantly more in smoker COPD patients as

compare to non-smokers. Similar observations were documented in another study.¹⁵ NMC time measured by saccharine test reflects one of the main physiologic features of upper and lower airway inflammation in smoking related COPD. In the present study, both sino-nasal symptoms and delayed NMC time were significantly associated with smoking status suggesting that tobacco smoking could be the most severe risk factor for damaging nasal as well as bronchial mucosa.²⁴ Several mechanisms, such as, including reduced cilia density on the nasal epithelium, increased mucus viscosity, ion transport disturbances or impairment of cilia activity could have been responsible for delayed NMC time in patients with COPD. The limitation of our study is that we have not done the bacteriological study of nasal discharge and allergy testing by skin prick test, which could have clarified whether the disease was of infective or non-infective origin. Our findings suggest that patients with COPD should be assessed for upper airway involvement.

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