

## Effect of Active Smoking on Microbiological Profile of Chronic Rhinosinusitis

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| Received: 28.01.2020 | Accepted: 04.02.2020 | Published: 12.02.2020

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### Abstract

### Original Research Article

**Introduction:** The study was conducted to evaluate the effect of active smoking over microbiological profile of patient with symptomatic chronic rhinosinusitis (CRS) and compare the result with that of non-smokers. **Methods:** A cross sectional, longitudinal study, was conducted on 100 patients (15-70yr) of diagnosed chronic rhinosinusitis. Total duration of study was about one year from October 2017 to October 2018. Patients after screening were selected for study and divided in two groups, group A (n= 48, smoker) and group B (n =52, non-smokers). All subjects then underwent detail history, examination and diagnostic nasal endoscopy (DNE) and sample were collected through middle meatus swab for microbiological profile. **Observation:** After analyzing both group it was observed that there is significant difference in symptomatology and microbial profile in both groups. Percentage of patient presented with fever was 18% in group A vs 7% in group B. Similarly, percentage of Posterior nasal drip was 80% vs 49%, anterior nasal discharge 71% vs 29%, headache 82% vs 34% in group A and group B respectively. Percentage of KOH mount and Gram Stain positivity were significantly higher among smokers as compare with non-smokers. Proportion of aerobic bacterial isolate were higher among smoker 70% (n=28) compared with non-smokers 57.8% (n=22). **Conclusion:** In the study it was concluded that symptomatic presentation of CRS was more in smokers as compare with non-smokers. There is also significant higher rate of KOH mount, gram stain and aerobic culture positivity in smokers as compare to non-smokers.

**Keywords:** CRS: Chronic-rhinosinusitis; DNE: Diagnostic nasal endoscopy.

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## INTRODUCTION

Chronic rhinosinusitis (CRS) is a prevalent condition that has a significant health and economic impact. There are numerous proposed aetiologies of CRS which include alterations in innate immunity, inflammatory dysregulation, biofilms, and super-antigen effects [1]. American Academy of Otolaryngology – Head and Neck Surgery published their most recent and revised guidelines on the diagnosis and management of rhinosinusitis. Rhinosinusitis is traditionally classified by duration as acute (<4 week), subacute (4–12 week), or chronic (>12 week, with or without exacerbations) [2]. CRS diagnosed by persistent symptoms that usually include at least two of the following: nasal obstruction (81–95%), facial congestion/pressure/fullness (70–85%), discoloured nasal discharge (51–83%), and hyposmia (61–69%) [3]. CRS often coexists with other medical conditions such as allergic rhinitis, asthma, and cystic fibrosis, and with less common conditions, such as

sarcoidosis, Churg-Strauss, and Wegener granulomatosis.

The most appropriate broad classification of predisposing factors for chronic sinusitis is into environmental factors (e.g., pollution, allergens, viruses, bacteria, and moulds), general host factors (genetic, granulomatous disorders, immune deficiency, cystic fibrosis, and ciliary defects), and local host factors (chronic localized inflammation, anatomic obstruction, polyps, and tumours).

Smoking leads to increased mucociliary transport times may lead to mucostasis with resultant inflammation of the sinuses leading to chronic rhinosinusitis. It is also possible that upregulation and production of proinflammatory cytokines such as interleukin-5, interleukin-8, and granulocyte-macrophage colony-stimulating factor from the tobacco smoke itself may be other factors responsible for inflammation of the sinuses in this setting [4]. Increased

nasal airway resistance and reduced maximum inspiratory flow were also observed after exposure to side stream tobacco smoke. Sino-nasal epithelial cells utilize mucociliary clearance (MCC) which relies on an airway surface liquid (ASL) barrier and proper ciliary beating to effectively transport mucus and clear potentially toxic irritants. Prior experiments have shown that tobacco smoke can adversely affect MCC. Zhou *et al.*, analysed the ciliary beat frequency (CBF) in biopsy samples of 61 patients; 21 non-smokers, 27 smokers, and 13 non-smokers who were regularly exposed to SHS (Second Hand Smoke). They found that CBF was increased in smokers and non-smokers exposed to high levels of SHS as compared to non-smokers [5].

## OBJECTIVES

To evaluate the effect of active smoking over microbiological profile of patient with symptomatic chronic rhinosinusitis (CRS) and compare the result with that of non-smokers.

## MATERIALS AND METHODS

A cross sectional, longitudinal study, was conducted on 100 patients (15-70yr) of diagnosed chronic rhinosinusitis. Total duration of study was about one year from October 2017 to October 2018. Study subjects were taken from IPD and OPD of LLR hospital, GSVM Medical College Kanpur and prior consent was obtained before the start of study.

It is a hospital based experimental study conducted over patients of diagnosed chronic rhinosinusitis. Detailed history was taken by direct interview, clinical examination was performed, relevant laboratory investigation was done and data was recorded on the case sheet.

Inclusion criteria followed in study were age more than 15 years, diagnosed case of chronic rhinosinusitis, active smoker. Exclusion criteria were patient age less than 15 years, patient with acute exacerbation, patient with benign or malignant tumours of nose or paranasal sinus, patient with diabetes mellitus, tuberculosis and patient on steroid therapy, antibiotics.

During the screening phase, patients were selected according to the inclusion criteria and exclusion criteria then eligible patients were entered into randomization.

All patient after selection were divided in two groups. Group A -active smokers and Group B -non-smokers. Then middle meatus swab was collected by diagnostic nasal endoscopy. Two sample were collected one for bacterial culture and other for fungal isolation. Sample were sent to microbiology department for further testing.

## STATISTICAL ANALYSIS

Data obtained from the study groups were compiled and tabulated and Continuous variables are expressed as mean  $\pm$  SD. For comparing effects, paired t-test was applied and t-calculated was compared with t-observed.

## OBSERVATIONS

Total 100 patients (15-70yr) of diagnosed chronic rhinosinusitis were enrolled in study. Total duration of study was about one year from October 2017 to October 2018. Patients after screening were selected for study and divided in two groups, group A (n= 48, smoker) and group B (n =52, non-smokers). Out of 100 patients of CRS majority were male (n=59) as compared with female (n=41). Difference in gender of smoker and non-smoker patient of chronic sinusitis was found to be statistically highly significant were very less in females. Nasal obstruction being reported in all patient irrespective of smoking status. Percentage of patient presented with fever was 18% in group A vs 7% in group B. Similarly, percentage of posterior nasal drip was 80% vs 49%, anterior nasal discharge 71% vs 29%, headache 82% vs 34% in group A and group B respectively (Figure-1). While there was no statistically significant difference being observed for aural symptoms, cough and ocular symptoms.

Fungal culture and KOH preparation were found negative in 91.66% (n=44) in group A compared with 96.15% (n=50) in group B. Proportion of smokers with positive fungal culture were more as compared with non-smokers (8.4% vs 3.85%) (Figure-2).

There were total 78 positive bacterial culture in both groups out of which 64.10% (n=50) were aerobic as compared with 35.89% (n=28) were anaerobic. Proportion of aerobic bacterial isolate were higher among smoker 70% (n=28) compared with non-smokers 57.8% (n=22). This difference was found to be statistically significant. Percentage of gram-positive vs gram negative were 57.14% (n=16) vs 42.8% (n=12) in group A compared with 36.36% (n=8) vs 63.3% (n=14) in group B, difference was found to be statistically significant (Figure-3).

Proportion of culture positivity for staphylococcus aureus were 46% vs 31%, streptococcus pneumonia 15% vs 4.54%, streptococcus viridans 11.60% vs 5.96%, respectively in group A and B. Proportion of aerobic bacterial isolate higher in nonsmokers as compared with smokers were Pseudomonas aeruginosa (24% vs 14.58%), Klebsiella (18.52% vs 8.65%), Citrobacter (5.65% vs 1.9%). Difference of bacterial isolate were found to be statistically significant.

Proportion of anaerobic isolate higher in smokers as compared with non-smokers was Bacteroides (32.1% vs 28.54%), Clostridium (10.45% vs 5.65%), Eubacterium (11.25% vs 17.5%),

Fusobacterium (12.54% vs 13.5%), Pepto streptococci (32.25% vs 38.54%). This difference of bacterial isolate was found to be statistically significant (Figure-4).

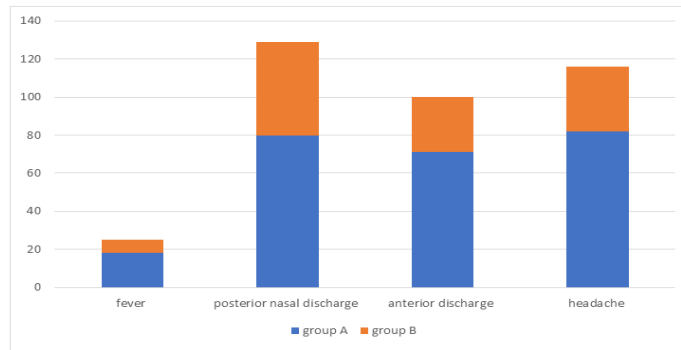


Fig-1: Showing symptoms correlation among smokers and non-smokers

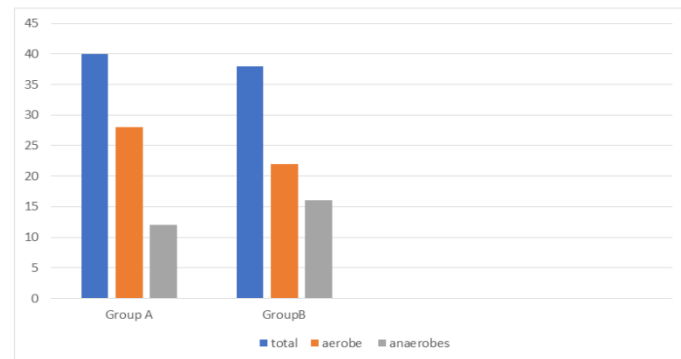


Fig-2: Showing relative number of aerobic and anaerobic culture positivity in both groups

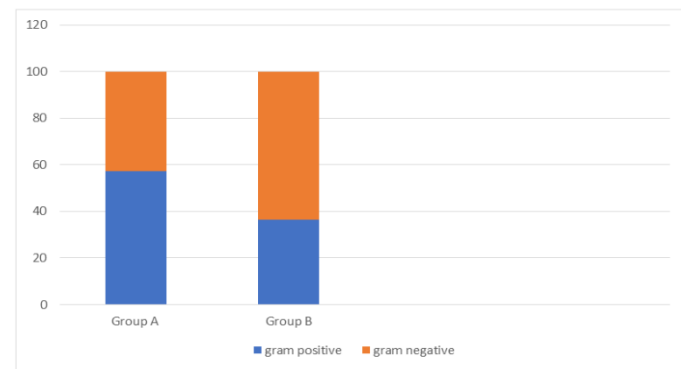


Fig-3: Showing gram stain result of both groups

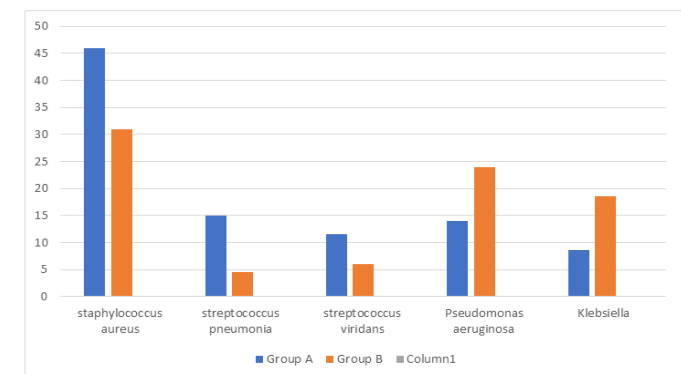


Fig-4: Showing results of bacterial isolates in both groups

## DISCUSSION

The observation of present study denotes that there were significant association of smoking with severity of symptoms and microbiological profile in patient with CRS. Campbell AP, Hoehle LP *et al.*, [6] found that Smoking is associated with worsening sinonasal symptoms and Smoking (likely driven by active smoking) is independently associated with missed days of work or school in patients with CRS.

Huang CC, Wang CH *et al.*, [7] studied that Interleukin (IL)-17A might contribute to cigarette smoke-related inflammation of the airway. This study aimed to investigate the association between cigarette smoking and IL-17A expression in the nasal tissues of patients with CRS.

Similar result were also reported by Lorenzo Drago, Lorenzo Pignataro *et al.*, [8], There were significant differences in the microbiological aspects of CRS and ARS. *Staphylococcus aureus*, *S. epidermidis*, and anaerobic Gram-negative bacteria predominate in CRS but, although persistent infection can promote the growth of anaerobic bacteria.

Bhattacharyya N *et al.*, [9] reported that Coagulase-negative staphylococci were the most commonly recovered bacteria followed by *Staphylococcus aureus* from the diseased side of the sinuses with similar findings for the control sinus. Bacterial species were recovered from 87.8% of the diseased side of the sinuses versus 85.7% from the control sinuses ( $p = 0.50$ ). Re-analysis with coagulase-negative staphylococci considered as nonpathogen showed a 46.9 and 49.0% positive bacterial culture rate in diseased and control groups, respectively ( $p = 0.50$ ). The result was comparable to our study.

Like our study Boase *et al.*, [10] reported that prevalence of anaerobes to be lower than aerobes. The overall bacterial positivity rate was higher in smokers as compared with non-smokers. However, anaerobe positivity rate was significantly higher among non-smokers.

## CONCLUSIONS

In the study it was concluded that smoking had direct effect over symptoms, severity and microbiological status of patients with CRS. Bacterial culture positivity, aerobic isolation, KOH positivity was significantly higher among smokers as compared to non-smokers. Anaerobic culture positivity was more among non-smokers as compared with smokers. With respect to Gram positive strain were found significantly

more among smokers. More common Gram-positive isolate in smoker were *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Pseudomonas*. Further longer duration of follow-up study needed to comment on effect of smoking on treatment outcomes.

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