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DOES BACTERIAL BIOFILM AFFECT QUALITY OF LIFE AND PROGNOSIS IN PATIENTS OF CHRONIC RHINOSINUSITIS ?

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ABSTRACT **Aims: -** To assess the presence of bacterial biofilm on the sinus mucosa of chronic rhinosinusitis (CRS) patients and to evaluate the relationship between biofilm and clinical features of CRS.

Methods and Material: – It is a prospective study carried out on 100 patients. Samples of diseased paranasal sinus mucosa with CRS who underwent functional endoscopic sinus surgery were analyzed with tube method to detect bacterial biofilm.

Results: Bacterial bio film was observed in 29 out of 50 (58%) disease group cases and 3 out of 50 (6%) control group , ($p < 0.001$).The average Lund Mackay score and symptom score and preoperative Lund Kennedy endoscopic score were significantly higher in biofilm positive than bio film negative patients.

Conclusions: This study demonstrates bio film, a possible cause for the persistent inflammation, antibiotics resistance and clinical characteristics of CRS patients. Bio film delays healing process in CRS patients.

KEYWORDS : Chronic rhinosinusitis, Biofilm, Tube method

INTRODUCTION:

Chronic rhinosinusitis is a group of disorders characterized by inflammation of the mucosa of the nose and paranasal sinuses lasting for at least 12 weeks. It is defined as the presence of at least two of the following symptoms: nasal obstruction, nasal discharge/purulence, facial pain or pressure, hyposmia or anosmia. Patients with rhinosinusitis recalcitrant to standard medical and surgical therapy often show rapid disease recurrence after an primary response to a course of antibiotics. All patients who meet the clinical criteria for CRS should have a CT scan or nasal endoscopy to confirm the diagnosis.[1]CRS is a dysfunctional interaction that occurs at the site of interface between the host and the environment – the sinonasal mucosa.[2]

Presence of biofilm on sinus mucosa of CRS patient implies that it might add to nasal mucosa inflammation, mucosal damage and lead to recurrent or chronic infections. It is responsible for recurrent, persistent or recalcitrant CRS. Biofilms are highly organized, complex structures composed of communities of bacteria encased within a protective extracellular matrix. This external matrix, composed of polysaccharides, nucleic acids, and proteins, provides a mechanism for bacteria to reducing their metabolic rates in conditions that are less than optimal for growth, protecting them from both host defenses and conventional antibiotics[1-3].

So, aim of present study is to demonstrate the pathological role of bacterial biofilm in chronic rhinosinusitis patient and to compare the clinical features and quality of life with SNOT 22 questionnaire in biofilm positive patient with biofilm negative patients. Study also includes the comparison between CT scan finding and nasal endoscopic finding between these two groups.

MATERIALS AND METHODS:

Inclusion Criteria- Chronic rhinosinusitis diagnosed on the basis of their medical history and physical examination, according to the criteria established by the European Position paper on Rhinosinusitis and Nasal Polyps 2. Age group 15 yr to 50 yrs. 3.Did not responds to medical therapy 4. Patients who agreed to sign the free informed consent form.

Exclusion Criteria- Malignancy of paranasal sinuses, acute rhinosinusitis, fungal rhinosinusitis, pregnancy, immune compromised state, cystic fibrosis, any systemic and neurologic disease and autoimmune disease. Patients submitted to some type of treatment for CRS in the past 15 days before the deployment of the questionnaire, and those who refused to contribute in the study.

Diseased mucosal specimen was harvested from the maxillary sinus of case group during Functional endoscopic sinus surgery and healthy mucosal specimen were taken in the control group who underwent septoplasty and rhinoplasty.These specimen immediately sent to the microbiology department of RNT medical college and processed within 2 hours.Isolates were identified by standard microbiological procedures (Gram staining, colonial morphology, catalase test, cytochrome oxidase reaction, motility, biochemical tests).Biofilm detection was done by tube method.

Tube method- It is qualitative method described by Christensen et al [4-5]. A loopful of test organisms was inoculated in 10 mL of trypticase soy broth with 1% glucose in test tubes. The tubes were incubated at 37oC for 24 h. After incubation, tubes were decanted and washed with phosphate buffer saline (pH 7.3) and dried. Tubes were then stained with crystal violet (0.1%). Excess stain was washed with deionised water. Tubes were dried in inverted position. The scoring for tube method was done according to the results of the control strains. Biofilm formation was considered positive when a visible film lined the wall and the bottom of the tube. The amount of biofilm formed was scored as 1-weak/none, 2-moderate and 3-high/strong. The experiment was performed in triplicate and repeated three times.

Pre and post operative finding - SNOT-22 questionnaire was used to assess the symptom severity and quality of life in sino-nasal diseased patients before surgery. A nasal endoscopy was performed with a 0 degree rigid nasal endoscope to confirm the diagnosis and perform a Lund-Kennedy endoscopic grading. A plain CT scan of paranasal sinuses was done with 5 mm coronal cuts to see the extent of the disease and perform the Lund-Mackay radiological scoring. All chronic rhinosinusitis patients underwent FESS. Follow up was done at 1wk, 4wk, 12 wk, and 24 wk and noted any crust formation, mucosal oedema, and discharge. Healing period was compared between biofilm positive and negative group.

RESULTS AND ANALYSIS:

Student t test was used. Biofilms were detected in 32 (42.4%) of the 100 patients by Tube method. Biofilms were present in 29 (50%) of the 50 patients in the CRS group, but in only 3 (14.3%) of the 50 patients in

the control group.

The average preoperative symptom scores were 40.79 ± 9.05 points in biofilm-positive patients and 24.29 ± 6.53 points in biofilm-negative patients, this difference was statistically significant (P<0.05).The average Lund–Mackay scores were 14.31 ± 4.86 points in biofilm-positive patients and 9.24 ± 3.14 points the biofilm-negative patients, and the difference was statistically significant (P<0.05). The preoperative nasal Lund–Kennedy endoscopic scores were 11.83 ± 3.41 points in the biofilm-positive group and 6.57 ± 2.44 points in the biofilm-negative group (P<0.05).

With regard to follow-up findings, the time until complete resolution was much longer in the biofilm-positive patients (24.97±2.49 weeks) than in the biofilm-negative patients (20.67 ± 1.32 weeks) (P<0.05). The average Lund Mackay score and symptom score were significantly higher in biofilm positive than biofilm negative patients. Preoperative Lund Kennedy endoscopic score was also significant in biofilm positive patients. Postoperative healing time was also longer in biofilm positive patients.

DISCUSSION:

Study showed the differences in clinical characteristics of biofilm positive patients compared to those in whom biofilms were not detected. No difference was found with respects to age or gender distribution. This study demonstrates a new pathological factor for chronic rhinosinusitis. Study also showed a high preoperative symptom score indicating lower quality of life. Higher CT score and longer healing period shows that biofilm causes persistent mucosal inflammation and delays the recovery time .These all lead to poorer surgery outcome and affect the prognosis of disease.

P SINGH et al demonstrated biofilm in 26 out of 50 disease group (52%) and 4 out of 50 control group (8%)[3].ThiagoFreire Pinto Bezerra et al observed biofilm in 55.56% (5/9) of patients by observing three dimensional structures with scanning electron microscopy[6]. Jolanta Dlugaszewska et al showed 76.7% of patients had evidence of biogilm[7].In our study we observed bacterial biofilm in 58% of patients in disease group and 6% in control group.

Our results revealed that among the microbiological samples obtained from CRS patients during the FESS and the control group, the most often isolated microorganism was coagulase-negative cocci (CNS) (32.60 %).Nigro et al [16] isolated CNS in 12.1 % of patients, whereas Mantovani et al [17,18] isolated S. epidermidis in 13.9 % of CRS patients. Jolanta Dlugaszewska et al revealed bacterias in 29 out of 30 tested samples. Out of 62 different strains isolated from patients with CRS, 23 strains of coagulase negative Staphylococcus epidermidis and 6 strains of Escherichia coli. . The presence of CNS was revealed in 83.3 % of infected patients. In comparison to the results obtained by our study, results are significantly higher.

Symptom score was calculated by using the SNOT-22 questionnaire to assess the quality of life of individuals with chronic rhinosinusitis preoperatively. In our study mean preoperative SNOT-22 score was 40.79 ± 9.05 in biofilm positive patients and 24.29 ± 6.53 in biofilm negative patients. Pablo Pinillos Marambaia et al in 2013[19] conducted prospective and analytical cohort and cross-sectional controlled clinical trial which showed the SNOT-22 median value in the study group was 53, compared to 8 in the control group (p = 0.001) .

Preoperative Lund Mackay score was also significantly high in our study. This result is consistent with study done by Psaltis et al [11] and Joo Hyun Jung et al[8]. In our study complete healing time was noted upto 24 weeks postoperatively. Endoscopic finding post surgery was compared between biofilm positive and biofilm negative patients. Longer healing time was noted in biofilm positive patient that may be due to persistent inflammation caused by biofilm and incomplete removal of biofilm layer. Hochstim et al also reported the same[9]. The sinus Lund–Kennedy endoscopic score was significantly higher in the biofilm-positive group than the biofilm-negative group. This result is consistent with that reported by Psaltis et al[11.] This may be due to the sustained inflammatory process caused by the presence of biofilms but it was not similar to the study done by Joo Hyun Jung et al[8].

In biofilm positive patients poorer ct score, extra postoperative visits, postoperative symptoms, mucosal outcome and multiple antibiotic therapy was seen[11,13].Psaltis et al demonstrated that CRS patients with bacterial biofilms had worse preoperative imaging scores and, at a median of 8 months follow-up, these patients were more likely to have ongoing post-operative symptoms relative to patients without biofilms.

Lakshmi Vaid et al[14] showed in their study that the group with positive biofilms had higher SNOT-20 scores than the group without biofilms. Several reasons have been postulated for these findings; firstly biofilm formation is advantageous for the bacteria as it provides protection from favours like temperature, moisture, ph, phagocytosis, host immune system, etc. Secondly, it also provide the bacteria with resistant against the antimicrobial agents[14].Those patients with S. aureus biofilms had worse objective symptom scores, worse nasal endoscopy scores, worse quality of life outcomes, and required more post-operative visits when compared to patients with other biofilms[15]. Bendouah et al in 2006 evaluated that patients with biofilm have higher symptom score, worse objective findings and more recurrence as compared to patients without biofilms that show more improvement after surgical intervention.

Summary

- Study suggests that bacterial biofilms play a role in the pathogenesis of chronic rhinosinusitis.
- CRS patients with biofilm are more likely to have post-operative evidence of ongoing symptoms and inflammation than patients without these structures.
- Research suggests that quality of life is poorer in biofilm positive patients of chronic rhinosinusitis as they suffer with high symptom score than biofilm negative patients.
- Longer healing period and persistence of disease are associated with biofilm mediated CRS.

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