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Significance Of Nasal Polyps In Chronic Rhinosinusitis: Symptoms And Surgical Outcomes

medical science

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ABSTRACT

Chronic rhinosinusitis refers to a condition that lasts at least 12 weeks despite being treated and causes at least TWO of the symptoms like Nasal congestion, Mucus discharge from the nose or mucus that drips down the back of the throat, Facial pain, pressure, or "fullness", A decreased sense of smell. Patients with this diagnosis can be difficult to treat successfully. The most prevalent and studied pathologic entity associated with CRS is nasal polyposis. Chronic rhinosinusitis classified into two categories Chronic Rhinosinusithis with Polyps (CRSNP (+)) and Chronic Rhinosinusitis without Polyps (CRSNP (-)).The symptoms of patients were rated preoperatively using Sino Nasal Outcome Test (SNOT-20) scoring system and endoscopy scoring system. Patients with polyps (CRSNP+) have higher symptom scores and worse objective findings compared with patients without polyps (CRSNP-). In addition, CRS patients with polyps show less improvement after surgical intervention and a significantly higher need for revision surgery than CRS patients without polyps.

Introduction

Chronic Rhinosinusitis (CRS) remains one of the most challenging entities treated in the practice of Otolaryngology. Patients with this diagnosis can be difficult to treat successfully and the subjective nature of the disease makes quantifying success difficult. A confounding problem is the presence of nasal polyps that can further complicate the treatment of these patients. The definition of CRS is based on a series of clinical parameters and of symptoms persisting greater than 12 consecutive weeks.

The recent 2004 consensus statement on CRS broadly classifies the disease into two categories: one with nasal polyps (CRSNP $^{(+)}$) and one without nasal polyps (CRSNP $^{(-)}$) [1, 2]. Patients with nasal polyps are more likely to manifest with eosinophilia, asthma, and aspirin sensitivity, while patients with hypertrophic CRS are more likely to have bacterial infection. [2]

The most prevalent and studied pathologic entity associated with CRS is nasal polyposis. Numerous theories are proposed to improve our understanding of the cause and mechanism of formation of nasal polyps (NPs) [3, 4]. Among the different suggested theories, micro environmental factors are becoming popular, although no specific concept has been clearly demonstrated. The goal of this study is to further elucidate the impact of sinonasal polyposis on patients with CRS based on patients symptoms, objective findings and surgical outcomes.

Method and material

Our study involved the examination of 212 consecutive patients seen from August 2005 to December 2013, who were diagnosed as Chronic Rhinosinusitis with and without nasal polyps who failed to respond to medical therapy and were indicated for Endoscopic Sinus Surgery after taking informed consent. This study was conducted at Kovai Medical Center and Hospital, Coimbatore and Dept of ENT MLB medical college Jhansi UP, after obtaining the approval of the institutional ethical committee. All data were collected prospectively in the preoperative period, then at 1, 6, and 12 months post operatively and analyzed.

The diagnosis of CRS was made using American Academy of Otolaryngology- Head And Neck Surgery definition. This definition describes typical symptoms persisting for 12 weeks or more and either endoscopic signs and/or CT changes showing mucosal changes within ostiomeatal complex and /or sinuses and classified into two categories Chronic Rhinosinusithis with Polyps (CRSNP $^{(+)}$) and Chronic Rhinosinusitis without Polyps (CRSNP $^{(-)}$). The current classification suggests that it is possible to classify a patient with CRS as CRS with nasal polyps if, at any stage, they had polyps. Patients who have Orbital and Intracranial complication due to sinusitis, Noninvasive fungal balls and invasive fungal disease were excluded from the study.

Preoperative, Intraoperative and Post-operative Management

- At the time of presentation, a careful history was obtained including current medication use, allergy status, history of asthma and previous surgeries.
- Physical examination including Fibreoptic flexible nasal endoscopy was done for all patients.
- All patients were treated with medical therapy, antihistamines, nasal steroids, mucolytic, as required and antibiotics if purulence was present. Patients who failed to respond to medical therapy were taken for Endoscopic Sinus Surgery (ESS).
- Radiographic evaluation was done by X-ray PNS (Water's view)/CT scan PNS preoperatively.
- The symptoms of patients were rated preoperatively using Sino Nasal Outcome Test (SNOT-20) scoring system. Endoscopic physical findings were scored according to *Lanza and Kennedy*[5]
- Preoperative routine blood tests and urine examination were done.
- Endoscopic sinus surgeries were performed in patient un-

der local anaesthesia/general anaesthesia.

Outcome analysis

Patients were separated into two cohorts, those with sinonasal polyps present (polyps, n=80) and those without nasal polyps (CRS, n=120). For outcome measures, patients symptoms were rated using the Sino-Nasal Outcome Test (SNOT-20). The patients were followed for a minimum of 1 year after surgery with repeat endoscopic examination and SNOT-20 testing at 1 month, 6 months and 12 months.

The two cohorts were evaluated for the need for revision surgery in the follow-up period. Outcome analysis was performed on patients in the CRSNP $^{(-)}$ and CRSNP $^{(+)}$ groups by percentage improvements of SNOT-20 scores from baseline to 12 months. Finally, a correlation was sought between endoscopy scores and SNOT-20 scores preoperatively and postoperatively.

Endoscopy Scoring System (*Lanza and Kennedy*) [5]

The following parameters were graded; presence or absence and extent of nasal polyps, edema, discharge, crusting, and scarring. For nasal polyps, 0 was given for the absence of polyps, 1 for polyps present within the middle meatus, and 2 for polyps beyond the middle meatus. For edema, scarring, and crusting, 0 was given if the finding was absent, 1 if it was mild and 2 if it was of severe extent. For discharge, 0 was given if there was no discharge present, 1 for clear thin discharge, and 2 for thick, purulent discharge. Each side was graded separately, and the scores from each side were then added to determine the overall endoscopy score.

20-Item Sino Nasal Outcome Test (SNOT-20) (Table-1)

1. Need to blow nose 2. Sneezing 3. Runny nose 4. Cough 5. Postnasal discharge (dripping at the back of your throat) 6. Thick nasal discharge 7. Ear fullness 8. Dizziness 9. Ear pain 10. Facial pain/pressure	11. Difficulty falling asleep 12. Waking up at night 13. Lack of a good night's sleep 14. Waking up tired 15. Fatigue 16. Reduced productivity 17. Reduced concentration 18. Frustrated/restless/ irritable 19. Sad 20. Embarrassed.

SNOT- 20 scoring:

1. The Total SNOT – 20 score is calculated as the mean item score for all 20 items.
2. The possible range of SNOT-20 score is 0-5, with higher scores indicating greater rhinosinusitis-related health burden.
3. The SNOT-20 change Score is the difference between Pretreatment and Post-treatment Total SNOT-20 scores.
4. Impact of treatment is assessed with the SNOT-20 Change Score.
5. A separate SNOT-20 score and change score is also calculated based on the items rated as important.

John Patrick Browne, PhD et al., (2007) [6] in their original research "The Sino-Nasal Outcome Test (SNOT): Can we make it more clinically meaningful?" found evidence for the existence of four unique constructs within the SNOT. Two constructs address aspects of health-related quality of life (physiological issues and sleep function). Subscales of the SNOT that correspond to these constructs provided clinically meaningful information over and above that provided by the SNOT total score on the type of surgical benefits gained by patients without different sino-nasal conditions. But their finding require further exploration particularly: confirmation of the four underlying constructs in the other sino-nasal patient populations: the possibility of expanding the content of each of the proposed subscales to help improve precision and sensitivity; and the use of sophisticated psychometric techniques to elaborate further upon subscale performance

Instruction for scoring SNOT-20

Patient rates the severity of their condition on each of the 20 items using a 0-5 category rating system:

0 = Not present/ no problem
1 = Very mild problem
2 = Mild or slight problem
3 = Moderate problem
4 = Severe problem
5 = Problem as "bad as it can be"

Statistical Analysis

Statistical analysis was performed using the SPSS package (Statistical Package for Social Science Version 13). Besides standard descriptive statistical calculation (mean and Standard deviation), the paired t test was used in the comparison of groups. The chi-square test was used to evaluate demographics, presence of asthma and need for revision surgery.

Average endoscopic examination scores and SNOT – 20 scores were evaluated with student's t test. Pearson's coefficient of correlation analysis was used to evaluate the correlation between endoscopy and SNOT – 20 Scores. The statistical significance was established at $P < 0.05$.

Observation and Results

200 patients met the criteria for inclusion into the study. The average age of the patients was 38 years, with a range of 15 – 65 years. There were 100 male patients and 100 female patients. 120 of the patients had CRS without polyps (CRSNP $^{(-)}$ group). 80 patients had CRS with nasal polyps (CRSNP $^{(+)}$ group).

Table 2: Age and Sex distribution of the CRSNP $^{(+)}$ group

Sex	Male		Female		Total	
Age in years	N	%	N	%	N	%
15 - 25 Years	10	20.83	6	18.75	16	20.00
25 - 35 Years	10	20.83	12	37.50	22	27.50
35 - 45 Years	16	33.33	6	18.75	22	27.50
45 - 55 Years	10	20.83	2	6.25	12	15.00
55 - 65 Years	0	0.00	6	18.75	6	7.50
> 65 Years	2	4.17	0	0.00	2	2.50
Total	48	100	32	100	80	100

It is known from the above table that out of the patients belonging to CRSNP$^{(+)}$ group, 33.33% of male patients belong to the age group of 35 – 45 Years and 37.50% of the female patients belong to the age group of 25 – 35 Years. Majority of the patients belonging to the CRSNP $^{(+)}$ groups are in the age between 25 years to 45 years. (Table 2)

Table 3: Age and Sex distribution of CRSNP $^{(-)}$ group

Sex	Male		Female		Total	
Age in years	N	%	N	%	N	%
15 - 25 Years	12	23.08	8	11.76	20	16.67
25 - 35 Years	4	7.69	24	35.29	28	23.33

35 - 45 Years	20	38.46	28	41.18	48	40.00
45 - 55 Years	8	15.38	8	11.76	16	13.33
55 - 65 Years	8	15.38	0	0.00	8	6.67
>65 Years	0	0.00	0	0.00	0	0.00
Total	52	100	68	100	120	100

It is inferred from the above table that out of the patients belonging to the CRSNP $^{(-)}$ group, 38.46% of male patients and 41.18% of the female patients are belong to the age group of 35 – 45 years. (Table 3)

Table 4: Relation to Asthma

H/O Asthma	CRSNP$^{(+)}$		CRSNP$^{(-)}$		Total	
	N	%	N	%	N	%
Asthma	30	71.4	12	28.6	42	100
No Asthma	50	31.6	108	68.4	158	100
Total	80		120		200	

42 patients in the study had Asthma. 30 (71.4%) of these patients had polyps, and 12 (28.6%) did not have any polyps. 158 patients in the study were without Asthma. 50 (31.6%) of these had polyps, and 108 (68.4%) did not have any polyps. The *p* value 0.001 specifies that asthma patients have significant association with CRSNP $^{(+)}$ group. (Table 4)

Table 5: Comparison of Endoscopy Scores and SNOT – 20 Scores

SNOT-20 Scores		Endoscopy scores			
		Preop	Postop 1st month	Postop 6th month	Postop 12th month
Preop	r	0.829	0.768	0.694	0.681
	p	0.0001	0.0001	0.0001	0.0001
Postop 1st month	r	0.819	0.834	0.795	0.781
	p	0.0001	0.0001	0.0001	0.0001
Postop 6th month	r	0.785	0.874	0.856	0.841
	p	0.0001	0.0001	0.0001	0.0001
Postop 12th month	r	0.801	0.870	0.857	0.843
	p	0.0001	0.0001	0.0001	0.0001

All Correlation values are significant at 0.01 and 0.05 level.

Preoperatively, endoscopy total scores were positively correlated with total SNOT-20 scores, reaching statistical significance (r = 0.829, p = 0.0001). Post-operative endoscopy total scores were positively correlated with total SNOT-20 score at 1st month (r = 0.834, p = 0.0001), 6th month (r = 0.856, p = 0.0001) and 12th month (r = 0.843, p = 0.0001) respectively. It confirms that the endoscopy scores were strongly related to SNOT-20 scores. (Table 5)

Table 6 (a): Comparison of mean SNOT – 20 scores in CRSNP $^{(-)}$ and CRSNP $^{(+)}$ groups

SNOT-20	CRSNP$^{(+)}$	CRSNP$^{(-)}$	*t* value	*p*value
Preop	32.65 ± 5.32	25.61 ± 3.66	7.82	0.0001
Postop 1st month	9.50 ± 2.23	5.2 ± 1.31	12.12	0.0001
Postop 6th month	9.12 ± 2.3	5.18 ± 1.42	10.59	0.0001
Postop 12th month	9.17 ± 2.26	5.08 ± 1.23	11.64	0.0001
F value	499.13	1507.66		
p value	0.0001	0.0001		

The CRSNP $^{(+)}$ group had a baseline (Preop) mean SNOT-20 scores of 32.65± 5.32 with a CRSNP $^{(-)}$ group baseline of 25.61± 3.66. Preoperative mean SNOT-20 scores of the CRSNP $^{(+)}$ group were statistically higher than the CRSNP $^{(-)}$ group (t = 7.82, p = 0.0001).

The mean SNOT-20 scores of the CRSNP $^{(+)}$ group were statistically higher than the CRSNP $^{(-)}$ group at 1st month, 6th month, 12th months follow up [respectively (t = 12.12, p = 0.0001; t = 10.59, p = 0.0001; t = 11.64, p = 0.0001) (table 6(a))].

In both the CRSNP$^{(+)}$ and CRSNP$^{(-)}$ group, statistical difference was observed between the pre-operative mean SNOT–20 scores and post-operative 1st, 6th and 12th months mean SNOT–20 scores (CRSNP$^{(+)}$ group F = 499.13, p = 0.0001, CRSNP$^{(-)}$ F = 1507.66, p = 0.0001).

Patients with Polyps had 71.8% improvement in SNOT–20 scores and patients without polyps had 80.5% improvement in SNOT–20 scores (p = 0.001) (Table 6a)

Table 6 (b): Comparison of mean endoscopy scores in CRSNP $^{(+)}$ and CRSNP $^{(-)}$ groups

Endoscopy score	CRSNP$^{(+)}$	CRSNP$^{(-)}$	*t* value	*p* value
Preop	9.07 ± 2.24	3.53± 0.74	17.73	0.0001
Postop 1st month	2.77 ± 1.47	1.05± 0.81	7.51	0.0001
Postop 6th month	2.47 ± 1.58	0.833 ± 0.74	6.97	0.0001
Postop 12th month	2.30 ± 1.58	0.7000 ± 0.74	6.78	0.0001
F value	140.83	242.77		
p value	0.0001	0.0001		

The CRSNP $^{(+)}$ group and CRSNP $^{(-)}$ group baseline (Preop) mean endoscopic examination scores were 9.07±2.24 and 3.53±0.74 respectively. Preoperatively mean endoscopic scores were statistically higher in the CRSNP $^{(+)}$ group compared to CRSNP $^{(-)}$ group (t = 17.73, p = 0.0001). Mean endoscopic scores of both CRSNP $^{(+)}$ and CRSNP $^{(-)}$ group decreased significantly at postoperative 1st month, 6th month and 12th month (respectively CRSNP $^{(+)}$, F = 140.83, p = 0.0001; CRSNP $^{(-)}$, F = 242.77, p = 0.0001).

However compared to CRSNP $^{(-)}$ group, endoscopic scores in the CRSNP $^{(+)}$ group were statistically higher post operatively at the 1st month, 6th month and 12th month [respectively (t = 7.51, p = 0.0001; t = 6.97, p = 0.0001; t = 6.78, p = 0.0001) table 6(b)

Table 7: Comparison of preoperative and postoperative 1st, 6th and 12thmonth SNOT-20 scores in CRSNP $^{(+)}$ and CRSNP $^{(-)}$ group

Multiple component t-test	CRSNP$^{(+)}$	CRSNP$^{(-)}$
Preop / Postop 1st month	p < 0.001	p < 0.001
Preop / Postop 6th month	p < 0.001	p < 0.001
Preop / Postop 12th month	p < 0.001	p < 0.001
1st / 6th month	p < 0.001	p > 0.05
1st / 12th month	p < 0.001	p > 0.05
6th / 12th month	p > 0.05	p > 0.05

In the both groups, Preoperative SNOT–20 scores were significantly higher than the postoperative (1st, 6th and 12th months) SNOT – 20 scores (p < 0.0001).

In CRSNP $^{(-)}$ group, no statistical differences were observed between the post-operative follow up times (p > 0.05). However in contrast to the CRSNP$^{(-)}$ group, in CRSNP$^{(+)}$ group, post-operative SNOT–20 scores at 1st month was significantly higher than 6th and 12th month scores (p < 0.001). It shows a significant improvement in symptoms at 6th and 12th month compared to 1st month. (Table 7)

Table 8: Revision Surgery

Revision Surgery	CRSNP(+)		CRSNP(-)		Total	
	N	%	N	%	N	%
Revision surgery	10	12.5	2	1.7	12	6
Norevision surgery	70	87.5	118	98.3	188	94
Total	80	100	120	100	200	100

In the follow up period 12 patients required revision surgery 10 from the CRSNP (+) group (12.5%) and 2 from the CRSNP (-) group (1.7%). The chi-square value inferred from the above table is 4.994 and the *p* value (0.025) is significant at 5% level of significance. It is concluded that there is higher need for revision surgery in CRSNP (+) group. (Table 8)

Discussion

The diagnosis and management of CRS are still controversial. Numerous studies were performed to define criteria for the diagnosis of CRS. Its diagnosis relies on patients subjective symptoms and evidence of mucosal inflammation by objective tools. In present study, the SNOT-20 questionnaire is used as outcome measure. The objective evaluation of CRS is based on the CT appearance and endoscopic findings. Subjective improvement in patients was confirmed by endoscopy postoperatively.

Some authors have attempted to correlate patients symptoms with objective findings. *Kaplan et al* [7] showed in their study that there was a statistically significant correlation between preoperative CT grade and endoscopy scores. However, no correlation was seen between the endoscopic grade and SNOT 20 symptom scores at either pre-or post-operative visits.

Rosbe et al [8] showed in their study that there was a statistically significant correlation between preoperative CT scores and endoscopy scores. There was a statistically significant positive correlation between endoscopy total scores and total VAS symptom scores at pre- and postoperative follow up.

In our study, there was a statistically significant correlation between SNOT-20 scores and endoscopy scores, pre- and postoperatively. In the present study, the CRS with polyps (CRSNP (+)) and CRS without polyps (CRSNP (-)) were studied separately. Preoperative endoscopy and SNOT-20 scores were statistically higher in the CRSNP (+) group compared to the CRSNP (-) group. In both the groups, CRSNP (+) and CRSNP (-), mean endoscopy scores decreased significantly at 1 year follow up. But in comparison to the CRSNP (-) group, endoscopy scores in CRSNP (+) were statistically higher.

The SNOT-20 scores of the CRSNP (-) were statistically lower than the scores of CRSNP (+), at preoperative and postoperative follow up, indicating that CRSNP (-) show better clinical symptoms and signs compared to CRSNP (+) patients, preoperatively and postoperatively.

All these data showed that patients with CRSNP (+) had higher subjective and objective scores than the patients with CRSNP (-). Compared to patients with CRSNP (-), CRSNP (+) patients are known to have higher endoscopy scores, worse outcomes, and require revision surgery. This has also been shown in other following studies.

Sema Zer Toros et al [9] in their study collected the data from two groups of patients diagnosed as CRS with and without nasal polyps that underwent FESS with a 1 year postoperative follow up. They showed that there was a statistically significant correlation between the preoperative CT, symptom and endoscopic scores. Post-operative symptom and endoscopic scores also showed a significant correlation. Also preoperative endoscopy and symptom score were statistically lower in CRSNP (-) group compared to CRSNP (+). Endoscopy total scores and symptom scores of both groups were significantly decreased at postoperative 12th month. The patients with CRSNP (+) had higher symptom scores and worse objective findings compared to the patients with CRSNP (-).

R. Tyson Deal et al [10] in their study collected data comparing two groups of patients diagnosed with CRS with and without nasal polyps that underwent surgical management with a minimum 1 year follow up period. Subjective scoring was performed using the Sino Nasal Outcome Test (SNOT-20) questionnaire. CRSNP (-) group SNOT-20 scores were 26.5 preoperatively with improvement to 5.1 at 6 months and 5.0 at 12 months postoperatively (85% improvement). CRSNP (+) group SNOT-20 scores averaged 32.2 with improvement to 9.2 at 6 months and 9.1 at 12 months postoperatively (81% improvement, p=0.003). Patients with nasal polyps had higher CT scores at presentation and a significantly higher need for revision surgery.

Lakshmi Vaid et al [11] carried out a study over 30 patients diagnosed with CRS with and without polyps who underwent surgery with a minimum 3 months follow up period they found that CRSNP(+) group had an 86.21% improvement in SNOT-20 scores at 3 months postoperatively compared with 81.33% in the CRSNP(-) group. CRSNP (+) patients had higher symptom scores, worse objective findings compared with CRSNP (-) group, but CRSNP (+) patients showed more improvement after surgical intervention and need for revision surgery is equal in both groups.

As expected, patients who had the presence of polyps had higher mean SNOT-20 scores. We postulate several reasons for this finding. First, patients with nasal polyps tend to have a higher degree of nasal airway obstruction because of the mass effect of the polyps themselves. Second, polyps do not have ciliated surface [12] which results in decreased mucociliary transport leading to thicker postnasal drip and retained secretions. This also explains the higher incidence of nasal crusting found in polyp patients by *Orlandi and Terrel* [13] Patients with polyposis also have increased mucosal edema and inflammation. This inflammatory process can further lead to patient discomfort.

Endoscopy scores attribute points directly for the presence of polyps, thus explaining the corresponding higher endoscopy score in the CRSNP (+) patients [14]. One of the most significant findings in our study was the higher rate of need for revision surgery in the CRSNP (+) versus CRSNP (-) patients. Polyps have been shown to be refractory with a tendency to recur, often requiring long-term medical therapy despite successful surgical intervention; our results indicate that the very presence of polyps indicates a worse overall prognosis compared with patients with uncomplicated CRS, with patients with polyps having a significantly higher need for revision surgery. When stratified by total endoscopy score, our results show that the biology and inflammation associated with nasal polyps is responsible for worse outcomes seen in CRSNP(+) patients when compared with CRSNP(-) patients.

Several recent studies have discussed the relationship between asthma and FESS. The studies show that asthmatic patients require revision FESS more frequently than patients without asthma [15] but these studies did not document the prevalence of polyps in the study population. *R Tyson Deal et al* [10] in their study found that 76% of asthmatic patients with CRS had presence of polyps, whereas in nonasthmatic patients, 26% had CRS with polyps.

In our study, 71.4% of asthmatic patients with CRS had the presence of polyps, whereas only 31.6% of the nonasthmatic with CRS patients had polyps. Our study shows that polyps are more

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prevalent in the asthmatic population with CRS. Respiratory epithelium lines not only the lower airway in the trachea and bronchi but also the upper airway and paranasal sinuses. Asthmatics have been shown to have local inflammation in their respiratory epithelium. In addition, local inflammation found in the setting of nasal polyps is more prevalent in asthmatics as a consequence of the inflammatory process that affects the entire respiratory epithelium.

Subjective outcomes after sinus surgery were evaluated with SNOT-20 testing. We report relative percentage of improvement as in a previous study by *R Tyson Deal et al* [10] Our CRS patients without polyps ($CRSNP^{(-)}$) had a relative 80.5% improvement in symptoms in SNOT-20 at 1 year postoperatively, whereas the CRS patients with polyps ($CRSNP^{(+)}$) experienced only a 71.8% improvement (P=.001). This shows that patients with nasal polyps may not achieve the level of symptomatic improvement that a patient with simple CRS may attain.

Conclusion

In direct comparison, nasal polyps have a significant negative impact on patients with chronic rhinosinusitis. Patients with polyps ($CRSNP^{+}$) have higher symptom scores and worse objective findings compared with patients without polyps ($CRSNP^{-}$). In addition, CRS patients with polyps show less improvement after surgical intervention and a significantly higher need for revision surgery than CRS patients without polyps.

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