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Functional Endoscopic Sinus Surgery Comparison in a Tertiary Care Hospital

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Abstract Two of the commonest indications for FESS are chronic rhinosinusitis without polyps and chronic rhinosinusitis with ethmoid polyps. This prospective study was carried out in Manipal Teaching Hospital, Pokhara to compare the results of FESS for bilateral chronic rhinosinusitis with and without ethmoid polyps. The study comprised of a cohort of 104 patients with bilateral chronic rhinosinusitis who underwent FESS between January 2012 and December 2014. The patients were divided into group 1 (without ethmoid polyps) and group 2 (with ethmoid polyps). Results in the two groups were assessed by comparing the Lund-Kennedy nasal endoscopic grading scores and Sino Nasal Outcome Test (SNOT-22) scores. Statistical analysis was done with Statistical Package for Social Sciences (SPSS) version 16.0. Statistical significance was set at $p<0.05$. The Lund-Mackay CT scan mean scores for group 1 and group 2 were 14.02 and 15.28 respectively before surgery ($p = 0.11$). Lund-Kennedy endoscopic score 3 months after FESS were much better in group 2 patients than in group 1($p<0.00001$). After FESS, there was significant improvement in SNOT-22 scores in both groups. The SNOT-22 scores 3 months after FESS were much better in patients of group 2 than in patients of group 1($p<0.0001$). The improvement in post-operative endoscopic grading and SNOT-22 scores wasmore in patients of chronic rhinosinusitis with ethmoid polyps than in patients without ethmoid polyps. There was no improvement in decreased sense of smell after FESS in most patients with ethmoid polyps.

Keywords: *functional endoscopic sinus surgery, chronic rhinosinusitis, ethmoid polyps*

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1. Introduction

The term Functional Endoscopic Sinus Surgery (FESS) was coined in 1985 by Kennedy [1]. Two of the commonest indications for FESS are chronic rhinosinusitis without polyps and chronic rhinosinusitis with ethmoid polyps. This study aims to compare the endoscopic and sino-nasal outcome test (SNOT) results of FESS for these two conditions. Diagnosis of chronic rhinosinusitis in this study was based on the criteria given by the 1997 Task Force on Rhinosinusitis of the American Academy of Otolaryngology–Head and Neck Surgery [2].

Major criteria are:

1. Facial pain / pressure.
2. Nasal obstruction.
3. Nasal discharge or discolored postnasal drip.
4. Hyposmia / anosmia.
5. Purulence on examination.

Minor criteria are:

1. Headache.
2. Fever.
3. Halitosis.
4. Fatigue.
5. Dental pain.
6. Cough.
7. Ear pain / pressure / fullness.

Presence of either 2 major (or 1 major + 2 minor) criteria were taken as positive for chronic rhinosinusitis.

Lund-Kennedy endoscopic grading [3] is a three-point scoring system (0=absent, 1=mild, 2=severe) to analyze five variables: polyps, edema, discharge, scarring and crusting. A combined score (right + left side) of 0-20 is possible. In the Lund-Mackay CT scan scoring [4] a numerical score is given for the maxillary, anterior ethmoid, posterior ethmoid, sphenoid and frontal sinuses plus the ostiomeatal complex. For the sinuses a score of 0 means no opacity, 1 means partial opacity and 2 means complete opacity. For the ostiomeatal complex the score is 0 for no obstruction and 2 for obstruction. A combined score (right + left side) of 0-24 is possible.

SNOT-22 is a patient-reported outcome measure of symptom severity and quality of life in sino-nasal conditions. It is a modified version of SNOT-20 that was introduced by Piccirillo [5] in 2002 and was used first in 2003 by Buckland et al [6] for evaluation of septal surgery. The symptoms are categorized into nasal symptoms (need to blow nose, nasal blockage, sneezing, runny nose, thick nasal discharge, decreased sense of smell); ear symptoms

(ear fullness, dizziness, ear pain); oropharyngeal and facial symptoms (cough, post-nasal drip, facial pain); sleep-related symptoms (difficulty falling sleep, wake up at night, lack of good night sleep, wake up tired) and systemic symptoms (fatigue, reduced productivity, reduced concentration, frustrated, sad, embarrassed). Each symptom is evaluated by the patient on a scale of 0 to 5. 0 being no problem, 1 very mild, 2 mild, 3 moderate, 4 severe and 5 as bad as it can be. A score of 0-110 is possible.

2. Material and Methods

The study comprised of 104 patients who underwent FESS at Manipal Teaching Hospital Pokhara, between January 2012 and December 2014.

2.1. Inclusion Criteria

1. Suffering from bilateral chronic rhinosinusitis with or without ethmoid polyps.
2. Refractory to medical treatment for three months.
3. Underwent FESS.
4. Minimum follow up period of three months after the surgery.

2.2. Exclusion Criteria

1. Age below 18 years.
2. Complicated chronic rhinosinusitis.
3. Acute sinusitis.
4. Revision FESS.
5. Previous nasal surgery.
6. Associated malignant disease of the nose or sinuses.
7. Systemic or neurologic diseases that could affect the quality of life and bias the SNOT results.

2.3. Ethical Clearance

The study was performed after approval from the institutional Ethical Committee and prior written, informed consent were obtained from all the patients.

2.4. Statistical Analysis

It was done with Statistical Package for Social Sciences (SPSS) version 16.0. Statistical significance was set at $p<0.05$.

2.5. Sample Size Calculation

In a pilot study done in 10 patients, Hypothesis testing for two means (equal variances), Standard deviation in group 1 = 2.2, Standard deviation in group 2 = 2.1, Mean difference = 4.3, Effect size = 2, Alpha Error(%) = 5, Power(%) = 95, sided = 2, Required sample size per group = 7 [7].

2.6. Cohort

Originally 120 patients were enrolled for this study and were put into 2 groups. Patients of chronic rhinosinusitis without ethmoid polyps were allotted group 1 and patients with ethmoid polyps allotted group 2. However 16 patients were excluded later as they did not come for the minimum follow-up of 3 months. Thus, 104 patients were left in the study with 51 in group 1and 53 in group 2.

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 in all patients to see the extent of the disease and perform the Lund-Mackay radiological scoring. The SNOT-22 questionnaire was used to assess the quality of life of the patient before and 3 months after FESS.

2.7. Surgical Technique

All the surgeries were performed under general hypotensive anesthesia. In case of coexisting deviated nasal septum and inferior turbinate hypertrophy, septoplasty with turbinate reduction was done prior to FESS where access to the middle meatus was denied. Messerklinger technique of FESS as described by Stammberger [8] was used. If the sinus disease was limited to the anterior ethmoid cells and the maxillary sinus, the procedure ended with simple anterior ethmoidectomy and maxillary antrostomy. If significant disease of the posterior ethmoid and sphenoid were present, then posterior ethmoidectomy and adequate sphenoidotomy were performed too. Frontal recess surgery was required if agger nasi cells were present and blocking the frontal recess. Anterior nasal packing was then done using ribbon gauze impregnated in antibiotic ointment and liquid paraffin. Postoperative management was continued with systemic antibiotics, oral decongestants and non-steroidal anti–inflammatory drugs. Nasal pack was removed after 72 hours. Patients were discharged usually a day after removal of pack. Patients were called for follow up 1 week later. Nasal endoscopic debridement and removing fibrin clot was performed where necessary. Nasal douching was advised for 1 month. The second postoperative visit was after 1 month. Nasal endoscopy was performed, evaluating the need for additional cleaning on the next visit. The next visit was scheduled on the third month after surgery for endoscopic and SNOT-22 reassessment.

Results in the 2 groups were assessed by comparing the Lund-Kennedy nasal endoscopic grading scores and Sino Nasal Outcome Test (SNOT-22) scores. All results were analyzed using Statistical Package for Social Sciences (SPSS) version 16.0. Statistical significance was set at a 2-sided p value <0.05.

3. Results

Of the 104 patients in our study, 57 were males and 47 were females. The mean age was 34.91 years (sample standard deviation 14.52). The mean follow-up period was 5.4 months for group 1 and 9.2 months for group 2.

Table 1 shows Lund-Mackay CT scan score categories in both groups. The mean scores for group 1 and group 2 were 14.02 (S.D. 4.01) and 15.28 (S.D. 4.18) respectively.

Table 2 shows mean Lund-Kennedy endoscopic score comparison. The mean pre-operative scores for group 1 and group 2 were 8.24 (S.D. 2.17) and 9.54 (S.D. 4.44) respectively. The mean post-operative scores for group 1 and group 2 were 2.33 (S.D. 1.07) and 1.11 (S.D. 0.93) respectively. The endoscopic score difference between the 2 groups before FESS was not significant ($p = 0.06$). There was significant improvement in endoscopic scores of patients after FESS in both groups. The endoscopic

scores 3 months after FESS were much better in patients of group 2 than in patients with group 1($p<0.0001$).

Table 1. Lund-Mackay CT scan score categories

Lund-Mackay CT scan score categories	Group 1		Group 2	
	Number of cases	%	Number of cases	%
5-8	4	7.84	2	3.77
9-12	12	23.53	11	20.75
13-16	20	39.22	18	33.96
17-20	15	29.41	20	37.75
21-24	0	0	2	3.77
Total	51	100	53	100
Mean score	14.02 (S.D. 4.01)		15.28 (S.D. 4.18)	
P value by independent samples T-test = 0.119				

Table 2. Mean Lund-Kennedy endoscopic score comparison

	Pre-operative mean endoscopic score	Post-operative mean endoscopic score
Group 1 (51)	8.23 (S.D. 2.17)	2.33 (S.D. 1.07)
Group 2 (53)	9.54 (S.D. 4.44)	1.11 (S.D. 0.93)
P value by independent samples T-test	0.061	< 0.0001

Table 3 shows the comparison of improvement following FESS in individual SNOT-22 categories. P value was obtained by paired samples T-test. The top five pre-operative complaints in the group 1 patients were nasal blockage, need to blow nose, runny nose, thick nasal discharge and facial pain. The top five pre-operative complaints in group 2 patients were need to blow nose, nasal blockage, sneezing, decreased sense of smell and runny nose. Seventeen out of 22 symptoms in group 1 and 21 out of 22 symptoms in group 2 improved significantly after FESS. Decreased sense of smell was not improved in 94.3% patients after FESS in the group 2.

Table 3. Comparison of improvement in individual SNOT-22 categories

SNOT-22 category	Group 1			Group 2		
	Pre-op mean SNOT	Post-op mean SNOT	P value	Pre-op mean SNOT	Post-op mean SNOT	P value
1. Need to blow nose	3.50	1.39	< 0.01	3.75	0.07	< 0.01
2. Nasal blockage	3.54	1.35	< 0.01	3.75	0.20	< 0.01
3. Sneezing	2.72	1.27	< 0.01	2.86	1.01	< 0.01
4. Runny nose	3.15	1.21	< 0.01	2.26	1.00	< 0.01
5. Thick nasal discharge	2.96	1.11	< 0.01	2.16	0.98	< 0.01
6. Decreased sense of smell	1.92	1.03	< 0.01	2.86	2.81	0.08
7. Ear fullness	1.19	1.03	0.08	2.24	1.0	< 0.01
8. Dizziness	1.29	1.03	0.02	1.26	0.98	< 0.01
9. Ear pain	1.05	1.01	0.53	1.98	0.98	< 0.01
10. Cough	0.88	0.84	0.70	0.73	0.62	0.013
11. Facial pain / pressure	2.96	1.07	< 0.01	1.98	1.01	< 0.01
12. Post-nasal discharge	2.15	1.01	< 0.01	2.24	0.98	< 0.01
13. Difficulty falling asleep	2.25	1.03	< 0.01	2.18	1.0	< 0.01
14. Wake up at night	2.03	0.98	< 0.01	2.07	0.83	< 0.01
15. Lack of goodnight's sleep	1.66	0.84	< 0.01	1.43	0.52	< 0.01
16. Wake up tired	1.86	0.96	< 0.01	1.92	0.83	< 0.01
17. Fatigue	1.13	0.94	0.08	0.96	0.39	< 0.01
18. Reduced productivity	1.66	0.90	< 0.01	1.83	0.56	< 0.01
19. Reduced concentration	1.88	0.94	< 0.01	2.01	0.49	< 0.01
20. Frustrated / irritable	1.94	0.90	< 0.01	2.16	0.52	< 0.01
21. Sad	1.72	1.21	< 0.01	1.94	0.32	< 0.01
22. Embarrassed	0.62	0.58	0.72	0.45	0.20	< 0.01

Table 4 shows mean SNOT-22 score comparison. The mean pre-operative scores for group 1 and group 2 were 44.21 (S.D. 2.85) and 45.13 (S.D. 2.87) respectively. The mean post-operative scores for group 1 and group 2 were 22.74 (S.D. 2.59) and 17.37 (S.D. 1.67) respectively. The SNOT-22 score difference between the 2 groups before FESS was not significant ($p = 0.10$). After FESS there was significant improvement in SNOT-22 scores by 21.47 (S.D. 2.24) in group 1 and 27.75 (S.D. 2.78) in group 2. The SNOT-22 scores 3 months after FESS were much better in patients of group 2 than in patients of group 1($p<0.0001$).

Table 4. Mean SNOT-22 score comparison

	Pre-operative mean SNOT-22 score	Post-operative mean SNOT-22 score	Mean SNOT-22 score improvement
Group 1 (51)	44.21 (S.D. 2.85)	22.74 (S.D. 2.59)	21.47 (S.D. 2.24)
Group 2 (53)	45.13 (S.D. 2.87)	17.37 (S.D. 1.67)	27.75 (S.D. 2.78)
P value by independent samples T-test	0.106	< 0.0001	

The following postoperative complications were seen in this study. Epistaxis was seen in 3 (5.66%) cases of group 2 and 1 (1.96%) case of group 1. It was controlled by application of absorbable gelfoam inside the nasal cavity along with Tranexemic acid injection. The bleeding did not require any further intervention such as repacking of the nasal cavity or electrocautery in the operation theatre. Nasal synaechia was seen in 3 (5.66%) cases of group 2 and 1 (1.96%) case of group 1. These cases were managed by breaking of synaechiae in the O.P.D. with application of nasal splint to avoid further synaechiae formation. Nasal splints were removed after 7 days. Nasal douching with normal saline was continued in these patients four times a day and they were called for follow up after one week of removal of the wax plate. These cases did not develop further synaechiae within the study period. Residual disease was seen in 4 (7.54%) cases of ethmoid group 2. In all 4 cases the group 2 were limited to middle meatus and were managed by topical steroid spray plus antihistamines for 6 months. No revision surgery was required for these cases as they were happy with the symptomatic result.

Discussions

In this study, 3 months after FESS there was significant improvement in SNOT-22 scores by 21.47 points (S.D. 2.24) in group 1 and 27.75 points (S.D. 2.78) in group 2. Thus the SNOT-22 scores after FESS were much better in patients with ethmoid polyps than in patients without them. Hopkins et al [9] reported SNOT-22 preoperative and post-operative scores in chronic sinusitis as 43.9 & 31.3 respectively. In nasal polyps this comparison was 40.8 & 23.1. They also suggested that the smallest change in SNOT-22 score that can be detected by a patient is 8.9 points. Moghaddasi et al [10] presented the outcome of FESS in 50 patients with chronic rhinosinusitis according to SNOT-20 as 45±8.7 before the procedure and 19±8.4 after FESS. They also mentioned that patients with a more severe disease on CT scan will have better symptom improvement after treatment.

In this study most of the SNOT-22 symptoms showed significant improvement after FESS especially in group 2 with ethmoid polyps. Decreased sense of smell was not improved in 94.3% patients after FESS in group 2. Jiang et al [11] reported 270 adolescents with chronic sinusitis who underwent FESS. Using the SNOT-20, they found that some symptoms (dizziness, sense of facial oppression, sleep difficulty, embarrassment, and fatigue) had no significant differences before and after surgery ($p > 0.05$).

Conclusion

FESS is a safe and effective treatment for chronic rhinosinusitis as well as ethmoid polypi. The improvement in post-operative endoscopic grading and SNOT-22 scores was more in patients with ethmoid polyps than in patients with chronic rhinosinusitis. There was no improvement in smell sensation after FESS in most patients who had ethmoid polyps with decreased smell sensation prior to the operation.

Abbreviations

FESS = Functional Endoscopic Sinus Surgery
SNOT = Sino Nasal Outcome Test
SPSS = Statistical Package for Social Sciences
CT = Computerized Tomography

Authors' contribution

VS worked on study proposal, literature review, data collection, statistical analysis and manuscript preparation. SR assisted in surgery & worked on manuscript review. BS helped with patient coordination & manuscript review. All authors read and approved the final manuscript.

Financial or other competing interests

None.

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