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The value of frontal sinusotomy in cases of sinonasal polyposis

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Abstract

Background Chronic frontal sinusitis is being treated with less invasive transnasal endoscopic treatments. Surgery relieves illness and prevents recurrence. Our study was conducted on 80 patients who suffer from frontal opacity with sinonasal polyposis and divided randomly into 2 groups: group A: 40 patients candidate for anterior ethmoidectomy without identification of frontal sinus ostium and group B: 40 patients candidate for anterior ethmoidectomy with identification of frontal sinus ostium. The study was conducted in the otolaryngology department faculty of medicine Cairo university.

Results CT score and sinonasal endoscopy score were statistically significantly improved postoperatively compared to preoperative scores in both groups. There are no significant differences between the 2 groups regarding recurrence rate and complications.

Conclusion Ethmoidectomy without frontal sinusotomy is a potential substitute for frontal sinusotomy for the treatment of chronic frontal sinusitis with sinonasal polyposis, and it can achieve similar improvements in symptoms and radiological evidence of frontal sinusitis.

Keywords Sinonasal polyposis, Frontal sinusotomy, FESS, Ethmoidectomy

Background

Anatomically, frontal sinuses are two in number and separated from each other by a bony septum. They lie in the lower central part of the frontal bone, above and medial to the orbital margin. Inferiorly, each frontal sinus narrows into a canal called the infundibulum which opens into the middle meatus of the nose at the anterior end of the hiatus semilunaris [1].

Treatment of frontal sinonasal polyposis is either medical or surgical. Medical treatment includes adequate antibiotics based on culture and sensitivity, intranasal corticosteroids, saline irrigation, systemic decongestants, topical vasoconstrictors, mucolytics, and antihistaminics for patients with nasal allergy together with immunotherapy. Treatment decisions are based on disease severity, polyp status, prior medical treatment, and patient choice. Systemic corticosteroids are also widely used in clinical practice [2].

Transnasal endoscopic treatments, which are less morbid but at least as effective as open approaches, have largely replaced open techniques in the surgical management of chronic frontal sinusitis [3].

The objectives of surgical intervention are to relieve symptoms of disease and stop it from returning [4].

Endoscopic approach to the frontal sinus varies from just opening of the frontal recess (type I, nasofrontal approach) to the endoscopic Lothrop technique (type IV, nasofrontal approach), Draf I procedure involves clearance of the frontal recess with anterior ethmoidectomy but no manipulation of the frontal ostium (type I), and Draf IIA procedure involves the removal of ethmoid cells protruding into the frontal sinus creating an opening between the middle

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turbinate medially and the lamina papyracea laterally (type II) [5].

Draf IIB involves the removal of the frontal sinus floor between the nasal septum medially and the lamina papyracea laterally (type III), and Draf III or trans-septal frontal sinusotomy involves bilateral resection of the frontal floor with the removal of the intersinus septum (type IV). The former two options might make it possible for the chronic frontal disease to be successfully treated [6].

Frontal sinus disease may be treated with endoscopic techniques that avoid instrumenting the frontal recess itself but address distal obstruction by removing anterior ethmoid cells. This is because the frontal sinus empties dependently into the frontal recess [7].

In patients with sinonasal polyps who had radiologic evidence of frontal opacity, our research's objective was to determine if anterior ethmoidectomy with or without frontal sinusotomy (Draf type I) improved the patients' symptoms and CT results.

Methods

This study was conducted on 80 patients who suffer from frontal opacity with sinonasal polyposis and divided randomly into 2 groups:

Group A: 40 patients candidate for anterior ethmoidectomy without identification of frontal sinus ostium
Group B: 40 patients candidate for anterior ethmoidectomy

The study was conducted in the otolaryngology department (BLINDED FOR PEER REVIEW).

The study participants were recruited from otolaryngology outpatient clinics at the Faculty of Medicine (BLINDED FOR PEER REVIEW), and the study was approved by the ethical committee of the Faculty of Medicine (BLINDED FOR PEER REVIEW) with ethical code number MS-94-2021.

Patient selection

Inclusion criteria

- Patients older than 18 years with bilateral symmetrical chronic sinusitis with nasal polyps with frontal opacity
- A CT scan that confirms chronic frontal sinusitis with at least partial opacification in one or both frontal sinus areas

Exclusion criteria

- Patients with trauma, mucocele, inverted papilloma, benign tumors, and previous nasal surgery
- Patients with any long-standing medical disease such as bronchial asthma, diabetes, and renal
- The presence of ciliary dyskinesia, cystic fibrosis, sinonasal neoplasms, and/or systemic immune disorders such as Wegener's granulomatosis, systemic vasculitis, and sarcoidosis because of the recognized intranasal clinical features of these pathologic processes, disease diversity, and variations in subsequent treatment
- Patients who were unfit for general anesthesia

Preoperative

- Detailed history taking was done for all patients including a history of nasal symptoms like nasal obstruction, stuffiness, sneezing, etc.
- Full general and otorhinolaryngologic examination was done including a detailed endoscopic nasal examination
- Routine preoperative investigations (CBC, coagulation profile, renal and liver function tests)
- CT imaging of associated paranasal sinuses and nasopharynx for any soft tissue enlargement was also done in all patients and these CT scans were scored according to the Lund-Mackay system [8]
- Photographic endoscopic documentation of the polyps and using the Lund-McKay staging system to get a sinonasal endoscopic score for each patient [8]

Technique

- In group A, 40 patients underwent anterior ethmoidectomy without identification of frontal sinus ostium and all operations were done under general hypotensive anesthesia with the patient in a supine position and the patient's head was elevated by 30° and FESS was performed using the Messerklinger technique as described by Kennedy [9].
- By putting in neurosurgical patties or ribbon gauze that has been soaked in 2 ml of 1:1000 adrenaline, topical decongestion was accomplished.
- Nasal polypectomy was the first step in the surgical method, followed by middle meatus enlargement.
- To enable a clear view of the uncinate process, ethmoid bulla, middle turbinate, and semilunar hiatus, the middle meatus field was cleaned.
- Under these circumstances, it was possible to see the lower two-thirds of the uncinate process. A resection of the uncinate process' lower two-thirds was performed. After inserting the endoscope into the middle meatus to view the upper portion of the unci-

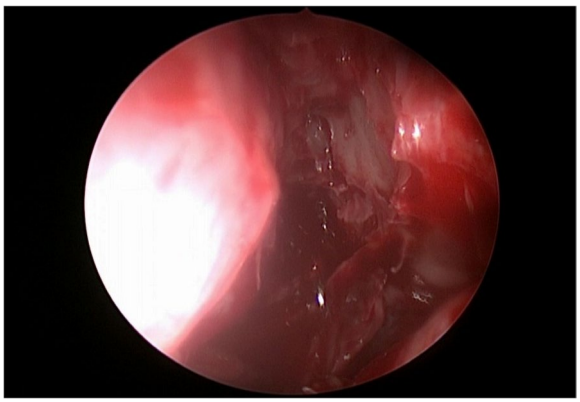

Fig. 1 Anterior ethmoidectomy without frontal ostium identification

nate process and its connection to the middle turbinate and ethmoid bulla, a full anterior and posterior ethmoidectomy was performed, as illustrated in Fig. 1. The anterior ethmoidal air cells are removed using angled (45°) cutting Blakesley-Wilde forceps. As the more superior cells are removed, care is taken to identify the anterior ethmoidal artery in the roof of the ethmoids. The posterior ethmoidal cells are usually 2 or 3 in number, and they are entered by piercing the ground or basal lamella (attachment of the middle turbinate to the lateral wall of the nose) at the junction of its vertical and horizontal parts. Once the posterior ethmoidal cells are entered, one should work medially, close to the middle turbinate.

- In group B, 40 patients underwent anterior ethmoidectomy with the identification of frontal sinus ostium:
- In addition to the same procedures performed in group A, the following was done: The next step was to explore the ostia of the frontal sinus.
- The middle meatus' dome-shaped entrance was created after the connection between the anterosuperior region of the middle turbinate and the anterior portion of the uncinate process was removed.
- In order to prevent synechiae in this region and make it easier for the frontal recess to open, the middle meatus was fashioned broadly. The frontal recess cells were then meticulously examined after that.
- The agger nasi cell and the frontal cells could be easily detected, but the cells on the frontal sinus ostia in the grooves of meatus were difficult to see due to the small gap between the uncinate process and the middle turbinate.
- Step-by-step ostia exploration from posterior to anterior and from medial to lateral was done with the frontal seeker. If the cavity had a deep dip, as in Fig. 2, the frontal sinus ostium was located.

- The operations were performed by different surgeons of the same level of competency.

Postoperative

- Nil per orally till full recovery from anesthesia
- Antibiotics for 2 weeks and analgesics if needed
- Nasal pack was removed after 48 h, and this was followed by the use of decongestant nasal drops for 5–10 days and alkaline nasal wash for 1 month.
- The patients were then seen at 1, 2, and 4 weeks postoperatively then one visit every month for 3 months.
- At each visit, the cavity was cleaned from debris, crusts, and clots under endoscopic control
- Postoperative CT scan after 3 months
- Details were collected as regards CT findings preoperative and postoperative after 3 months, endoscopic scores preoperative and 3 months postoperative, relieve of symptoms, and postoperative complications
- Data were collected and statistically analyzed.

Data management and analysis

A Wilcoxon signed-rank test was used to compare patients in group A and patients in group B. SPSS version 25 was used for data management and statistical analysis; a *P*-value of 0.05 or less is regarded as statistically significant. Using the Shapiro-Wilk test, the distribution of the data was examined for normality. Frequencies and relative percentages were used to depict qualitative data. The difference between the qualitative variables was calculated using the chi-square test (2) and Fisher exact, as shown. For parametric and non-parametric data,

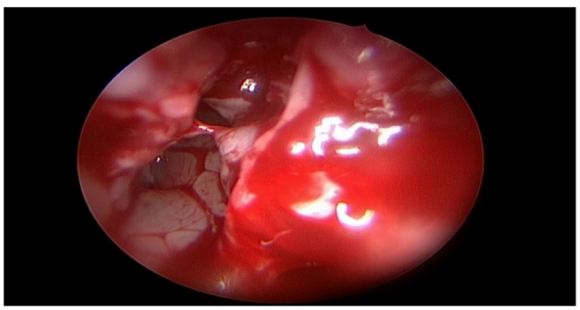

Fig. 2 Frontal ostium identification

Table 1 Demographic data of the two studied groups

Variable		*Group A (n=40)*	*Group B (n=40)*	*t/χ²*	*P*
Age *(years) Mean ± SD*		42.51 ± 7.29	43.84 ± 8.76	.738	.463
Sex	*Male*	8 (20%)	26 (65%)	2.26	.133
	Female	32 (80%)	14 (35%)		

Table 2 Complain distribution between the two studied groups

	Group A (n=40)	*Group B (n=40)*	*χ²*	*P*
Nasal obstruction	40 (100%)	38 (95)	2.05	.152
Headache/facial pain	14 (35%)	16 (40%)	.213	.644
Hyposmia	31 (77.5%)	30 (75%)	.069	.793
Postnasal secretion	27 (67.5%)	29 (72.5%)	.238	.626
Rhinorrhea	32 (80%)	34 (85%)	.346	.556
Cough	34 (85%)	35 (87.5%)	.105	.745

respectively, the mean and SD (standard deviation) were used to express quantitative data. For parametric and non-parametric variables, respectively, the independent *T* test and the Mann-Whitney test were employed to calculate the difference between quantitative variables in the two groups. Every statistical comparison used a two-tailed significance test.

Results

Description of our sample

In group A, the mean age was 42.51 ± 7.29. There were 8 (20%) males and 32 (80%) females. In group B, the mean age was 43.84 ± 8.76. There were 26 (65%) males and 14 (35%) females so there was no significant difference between the two studied groups regarding age (*P*-value = 0.463) and sex (*P*-value = 0.133) as shown in Table 1.

As shown in Table 2, all patients in group A had nasal obstruction, while in group B, 38 (95%) patients had nasal obstruction. There was a non-significant difference between the 2 studied groups (*P*-value = 0.152). In group A, 14 (35%) patients had headache and facial pain compared with 16 (40%) patients in group B who had headache and facial pain. There was a non-significant difference between the 2 studied groups (*P*-value = 0.644). In group A, 31 (77.5%) patients had hyposmia compared with 30 (75%) patients in group B who had hyposmia. There was a non-significant difference between the 2 studied groups (*P*-value = 0.793). In group A, 27 (67.5%) patients had postnasal secretion compared with 29 (72.5%) patients in group B. There was a non-significant difference between the 2 studied groups (*P*-value = 0.626). Thirty-two (80%) patients in group A had rhinorrhea, while in group B, 34 (85%) had rhinorrhea. There was a non-significant difference between the 2 studied groups (*P*-value = 0.556). Cough was present in 34 (85%) cases in group A and in 35 (87.5%) cases in group B. There was a non-significant difference between the 2 studied groups (*P*-value = 0.754).

CT score and sinonasal endoscopy score are statistically significantly improved postoperatively compared to preoperative scores as shown in Table 3 and Figs. 3 and 4.

In group A, preoperatively, the mean CT score was 14.86 ± 5.36. Postoperatively, the mean CT score was 10.67 ± 5.86. There was a significant difference between the 2 studied groups regarding preoperative CT score and postoperative CT score (*P*-value = 0.003).

Preoperatively, the mean sinonasal endoscopy score was 7.54 ± 3.75. Postoperatively, the mean sinonasal endoscopy score was 4.23 ± 2.91. There was a significant difference between the 2 studied groups regarding preoperative sinonasal endoscopy score and postoperative sinonasal endoscopy score (*P*-value = 0.005).

Table 3 Preoperative and postoperative evaluation parameters between the two studied groups

p	*T*	Group B (*n*=40)	Group A (*n*=40)	
CT score (mean ± SD)				
0.24	6.31	11.35 ± 3.97	14.86 ± 5.36	**Preoperative (mean ± SD)**
0.36	8.43	8.13 ± 4.27	10.67 ± 5.86	**Postoperative (mean ± SD)**
		2.5	3.38	***T***
		0.026	**0.003**	***P***
Sinonasal endoscopy score (mean ± SD)				
0.29	9.71	4.17∓2.38	7.5∓3.75	**Preoperative (mean ± SD)**
0.15	6.49	2.53∓2.06	4.23∓2.91	**Postoperative (mean ± SD)**
		4.86	3.1	***T***
		0.001	**0.005**	***P***

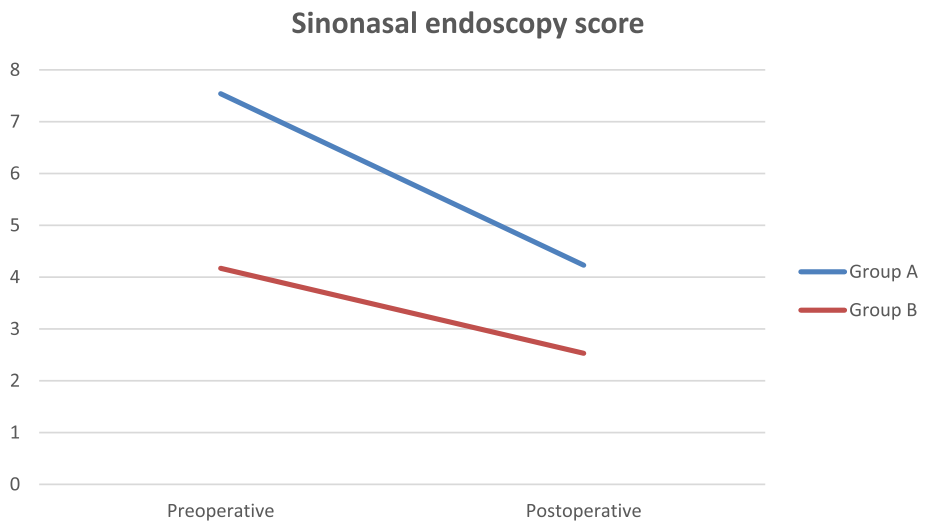

Fig. 3 Sinonasal endoscopy score

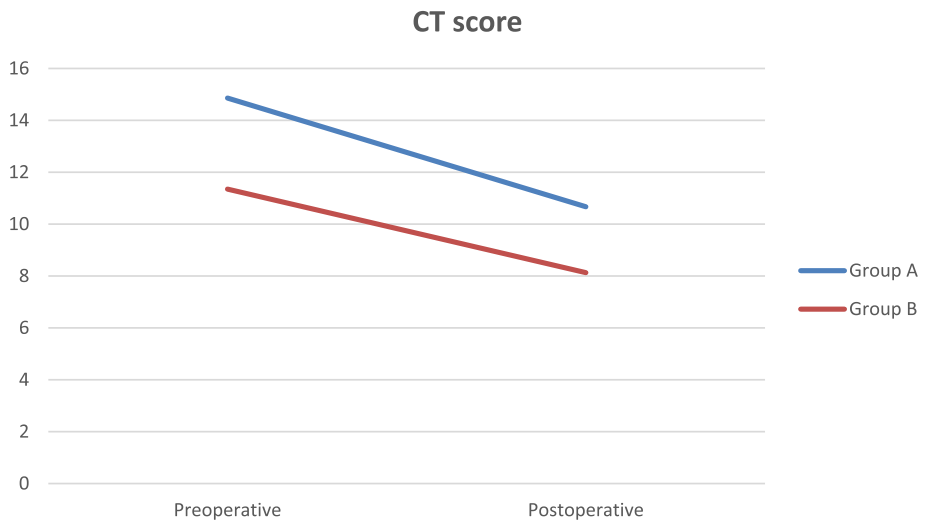

Fig. 4 CT score

In group B, preoperatively, the mean CT score was 11.35 ± 3.97. Postoperatively, the mean CT score was 8.13 ± 4.27. There was a significant difference between the 2 studied groups regarding preoperative CT score and postoperative CT score (*P*-value = 0.026).

Preoperatively, the mean sinonasal endoscopy score was 4.17 ± 2.38. Postoperatively, the mean sinonasal endoscopy score was 2.53 ± 2.06. There was a significant difference between the 2 studied groups regarding preoperative sinonasal endoscopy score and postoperative sinonasal endoscopy score (*P*-value = 0.001).

Between both groups A and B

There was no significant difference between both groups in preoperative CT score (*P*-value = 0.24) and postoperative CT score (*P*-value = 0.36).

There was no significant difference between both groups in the preoperative sinonasal endoscopic score (*P*-value = 0.29) and postoperative sinonasal endoscopic score (*P*-value = 0.15).

As shown in Table 4, in group A, 5 (12.5%) patients had bleeding complications, and in group B, 3 (7.5%) patients had bleeding complications. There was a non-significant

Table 4 Postoperative complications between the two studied groups

	Group A (n=40)	*Group B (n=40)*	χ^2	*P*
Bleeding complications	5 (12.5%)	3 (7.5%)	.556	.456
Sinusitis	7 (17.5%)	5 (12.5%)	.392	.531
Synechiae	4 (10%)	3 (7.5%)	.157	.692
CSF leak	1 (2.5%)	0	1.01	.316
Orbital complications	2 (5%)	1 (2.5%)	.346	.556

Table 5 Postoperative recurrence between the two studied groups

	Group A (n=40)	*Group B (n=40)*	χ^2	*P*
Recurrence	2 (5%)	1 (2.5%)	.346	.556
No	38 (95%)	39 (97.5%)		

difference between the 2 studied groups (*P*-value = 0.456). In group A, 7 (17.5%) patients had sinusitis, and in group B, 5 (12.5%) patients had sinusitis. There was a non-significant difference between the 2 studied groups (*P*-value = 0.531). In group A, 4 (10%) patients had synechiae, and in group B, 3 (7.5%) patients had synechiae. There was a non-significant difference between the 2 studied groups (*P*-value = 0.692).

CSF leak was present in 1 (2.5%) patient in group A with no patients in group B having a CSF leak. There was a non-significant difference between the 2 studied groups (*P*-value = 0.316). In group A, 2 (5%) patients had orbital complications compared with 1 (2.5%) patient in group B. There was a non-significant difference between the 2 studied groups (*P*-value = 0.556).

Recurrence occurred in 2 (5%) patients in group A and 1 (2.5%) patient in group B. There is no significant difference between the two studied groups regarding recurrence as shown in Table 5.

Discussion

Medical or surgical intervention is required in order to treat fronto-sinonasal polyposis. In addition to immunotherapy, medical treatment for nasal allergies includes intranasal corticosteroids, saline irrigation, systemic decongestants, topical vasoconstrictors, mucolytics, and antihistamines for people who suffer from this condition [10].

Endoscopic transnasal techniques, which are less destructive but at least as successful, have replaced open approaches as the major surgical method for treating chronic frontal sinusitis [11].

This study demonstrated that there is no significant difference between the two studied groups (group A for anterior ethmoidectomy without identification of frontal sinus ostium and group B for anterior ethmoidectomy with identification of frontal sinus ostium) regarding age and sex.

Abuzeid et al. [12] conducted a study to evaluate the effectiveness of ethmoidectomy alone for the treatment of chronic frontal sinusitis, which is consistent with our findings. In a prospective multi-center trial, adults with chronic rhinosinusitis who had computed CT evidence of frontal sinusitis were split into two groups: (1) endoscopic sinus surgery (ESS) incorporating ethmoidectomy but excluding frontal sinusotomy and (2) ESS incorporating frontal sinusotomy. Regarding age and sex, there is no discernible difference between the two study groups [12].

In agreement with our results, Mobashir et al. [13] aimed to assess different approaches addressing frontal sinus disease in twenty-four patients with chronic frontal sinusitis resistant to medical treatment for a period not less than 12 weeks. Their study included 24 patients. Six patients (25 %) were males and 18 patients (75 %) were females. Their age ranged from 20 to 58 with a mean age of 33.54±12 years old [13].

Ismail et al. [14] conducted an interventional randomized controlled clinical trial on 30 patients with chronic rhinosinusitis and nasal polyposis, and their findings are consistent with ours. Each patient underwent a nasal obstruction scale evaluation (NOSE) evaluation, nasal endoscopic examination, Lund-Mackay CT score, and pulmonary function test before and 3 months after FESS. The patients in this study were 22 men (73.3%) and 8 women (26.7%), ranging in age from 20 to 63. The median (IQR) age was 39 (31.5–50.3) [14].

This study reported that there is no significant difference between the two studied groups regarding complaints. All patients in group A had nasal obstruction, while in group B, 95% of patients had nasal obstruction. In group A, 35% of patients had headache and facial pain compared with 40% of patients in group B who had headache and facial pain. In group A, 77.5% of patients had hyposmia compared with 75% of patients in group B who had hyposmia. In group A, 67.5% of patients had postnasal secretion compared with 72.5% of patients in group B. Eighty percent of patients in group A had rhinorrhea, while in group B, 85% had rhinorrhea. Cough was present in 85% of cases in group A and in 87.5% of cases in group B.

In agreement with our results, Mobashir et al. [13] showed that all patients complained of headache/facial pain, 79.2% of hyposmia and nasal obstruction, 70.8% of postnasal secretions, 20.8% of rhinorrhea, and 12.5% of

cough. The studied patients had irrelevant past history, history of asthma, or trauma [13].

In agreement with our results, Al Shamy et al. [15] showed CRS symptoms among the studied group, 66.7% of the patients presented with nasal obstruction and postnasal discharge, most of the studied group (83.3%) presented with facial pain or headache, and 75% presented with hyposmia. Only 8.3% of the studied group presented with cough as a related symptom of CRS, while 4.2% presented with asthma [15].

Our study showed that CT score and sinonasal endoscopy score were statistically significantly improved postoperatively as compared to the preoperative score.

In line with our findings, Deepthi et al. [16] investigated the correlations between subjective symptom severity and objective endoscopic and radiologic findings in CRS and compared them prior to and following FESS. An analysis of prospectively collected data from 20 individuals who underwent FESS at a tertiary care medical facility and were monitored for at least 6 months following surgery. Preoperatively, at 8 weeks and 6 months after surgery, and based on endoscopic and CT findings, the RSI questionnaire, Lund-Mackay system, and other scores were recorded. Before surgery, there was a significant positive association between the three variables, especially between the endoscopic and radiological ratings (*P* 0.01 in all three). Even at the 6-month mark, all three metrics' postoperative improvement was statistically significant (*P* 0.001) [16].

In agreement with our results, Ismail et al. [14] showed that the study group parameters were put in comparison preoperatively and 3 months postoperatively. Most of the studied patients have a nasal endoscopic score of 2 (26.7%) or 3 (66.7%) before FESS with a median (IRR) of [3 (2, 3)], while postoperative all of them had a score of 0 with a median (IQR) of 0 (0–0) with a statistically significant difference (*P*=0.001). Furthermore, the Lund-Mackay sinus CT grading was statistically significantly decreased postoperatively compared to preoperative scores [20.5 (18.8–23) vs. 2 (2–4)] (*P*=0.001) [14].

Abuzeid et al. [12] demonstrated that considerable postoperative improvement for endoscopy scores was recorded for both subgroups with and without frontal sinusotomy, which is consistent with our findings. Additionally, subgroup comparisons showed similar improvement amplitudes (*P*=0.396) [12].

This study showed that there is no significant difference between the two studied groups regarding complications. In group A, 12.5% of patients had bleeding complications, and in group B, 7.5% of patients had bleeding complications. In group A, 17.5% of patients had sinusitis, and in group B, 12.5% of patients had sinusitis. CSF leak was present in 2.5% of the patients in group A with no patients in group B having a CSF leak. In group A, 5% of patients had orbital complications compared with 1 (2.5%) patient in group B.

In disagreement with our results, Mobashir et al. showed that as regards postoperative complications, no major complications (significant hemorrhages, orbital complications, or cerebrospinal fluid leak) occurred [13].

There is no significant difference between the two studied groups regarding recurrence. Recurrence occurred in 5% of patients in group A and in 2.5% of patients in group B.

Contrary to our findings, Bassiouni et al. (17) found that when patients in the standard ESS group ($n = 199$) were followed up for more than 6 months, the recurrence rate was 42%. When this cohort was tracked for more than a year, this number jumped to 49%. When patients were observed for more than 6 months after having a complete sphenoethmoidectomy, maxillary clearance, and a Draf 3 opening of their frontal sinuses ($n = 139$), there was a recurrence rate of 35%. For individuals who were followed up for more than 12 months, this stayed at 36% [17].

One of the limitations in our study was that the follow-up period was short (only 3 months). We recommend that it should be minimally 6 months in any upcoming study.

Conclusion

Ethmoidectomy without frontal sinusotomy is a potential substitute for frontal sinusotomy for the treatment of chronic frontal sinusitis with sinonasal polyposis, and it can achieve similar improvements in symptoms and radiological evidence of frontal sinusitis.

Acknowledgements

Not applicable.

Authors' contributions

All authors read and approved the final manuscript. AY was the main surgeon and gives us the idea of this study. OA shared in the revision of the manuscript and assisted in the operations. HA was responsible for the data collection and writing the manuscript. AF shared in the revision of the manuscript and shared in the data collection.

Funding

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Availability of data and materials

The datasets used or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study was approved by the Scientific Committee of the ORL Department of Cairo University and the ethics committee of the Faculty of Medicine Cairo University and ethical code number MS-94-2021. The informed written consent was obtained from all patients.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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