

Intact Bulla Technique versus Classic Technique as an Endoscopic Approaches to Frontal Sinus

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ABSTRACT

Background: The recent advances in imaging and endoscopic techniques have resulted in the resurgence of intranasal procedures for the treatment of frontal sinus disease.

Objective: This study aimed to compare the following parameters in patients undergoing endoscopic frontal sinus through intact bulla technique and classic technique regarding feasibility of the technique, operative time, success rate and complications.

Subjects and Methods: At Oto-Rhino-Laryngology, Department, Zagazig University Hospital, fifty patients with chronic frontal sinusitis resistant to medical treatment for a period not less than twelve weeks were included in this prospective clinical trial. The patients were divided into two groups: The first (the frontal sinus) group was approached by the classic approach from posterior to anterior, the second group, where the intact bulla technique was used to approach the frontal sinus. All the patients underwent ESS addressing their frontal sinus pathology.

Results: There was a statistically significant difference between the two surgical techniques regarding operative duration. Recurrence of symptoms occurred in one patient with intact bulla technique and one patient with the classic technique while frontal ostium restenosis occurred in one patient with intact bulla technique and two patients with the classic technique. Nasal adhesions occurred postoperative between inferior turbinate and septum in 3 sides only that were excised locally at outpatient clinic.

Conclusion: Addressing frontal sinus through intact bulla technique is less invasive and guards against anterior ethmoidal artery accidental injury during surgery.

Keywords: Intact bulla technique, Classic technique, Endoscopic approaches, Frontal sinus.

INTRODUCTION

As a result of its close embryological and anatomical link to the ethmoid sinus, the frontal sinus has been variously described as a "large ethmoidal cell" or as the "terminal" or "upper limit" of the complex ethmoidal labyrinth. As a rule, there will be two sinuses in the forehead. There is a thick anterior table and a thinner posterior table in each frontal sinus cavity, giving them the appearance of a pyramid ⁽¹⁾.

The infundibulum, ostium, and frontal recess make up the three main parts of the hourglass-shaped frontal sinus outflow system. Retained secretions, secondary bacterial colonization, hypoxia, pH shifts, and ciliary dysfunction may all result from a failure to keep the frontal sinus outflow tract open (due to edema, fibrosis, polyps, or tumors). Chronic rhinosinusitis can develop as a result of any one of these physiological alterations ⁽²⁾.

Patients with persistent frontal sinusitis typically also suffer from inflammation in the other sinuses of the face. In the case of a rhinologic patient, diagnostic nasal endoscopy is the gold standard in terms of physical examination. The presence of the following symptoms in post-operative patients raises the possibility of frontal sinus disease: Middle turbinate lateralization or amputation, synechia, and polypoid edema in the front of the ethmoid cavity ⁽³⁾.

At now, there is no frontal sinus treatment available in mainstream medicine. Selecting a course of treatment requires careful consideration and individualization. Adjuvant therapy is often suggested as well, especially when it can help reduce inflammation. Therapeutic

adjuncts for chronic frontal sinusitis include saline nasal spray, antihistamines, leukotriene modifiers, mucolytics, and intranasal and systemic steroid medications ⁽⁴⁾.

In 1750, the first documented treatment for sinus problems in the face was described. Intranasal operations for the treatment of frontal sinus disease have recently seen a comeback thanks to recent advancements in imaging and endoscopic techniques. The potential for complications makes frontal sinus illness, and chronic frontal sinusitis in particular, an extremely morbid and even life-threatening condition. Orbital and intracranial problems, such, intracerebral abscess, meningitis, osteomyelitis as well as subdural abscess, continue to occur despite the overall decline in complication rates over time ⁽⁵⁾.

The purpose of this research was to compare the following parameters in patients undergoing endoscopic frontal sinus through intact bulla technique and classic technique regarding feasibility of the technique, operative time, success rate and complications.

SUBJECTS AND METHODS

Subjects:

At Oto-Rhino-Laryngology, and Head and Neck Surgery Departments, Zagazig University Hospital, fifty patients with chronic frontal sinusitis resistant to medical treatment for a period not less than twelve weeks were included in this prospective clinical trial.

These Patients were divided randomly into two groups: The first group where the frontal sinus was

approached by the classic approach from posterior to anterior. The second group where the intact bulla technique was used to approach the frontal sinus.

Inclusion criteria:

- All patients proved to have chronic frontal sinusitis for more than three months duration not responding to medical treatment in whom CT scan was done and needed endoscopic sinus surgery.
- Patient must be fit for surgery.

Exclusion criteria:

- Patients with chronic frontal sinusitis who responded to medical treatment.
- Patients who were not willing to undergo ESS.
- Patients with osteomyelitis and infiltrating tumors.
- Patients who are not fit for surgery.
- Patients who need external approach.
- Contraindications to general anesthesia.
- Revision cases.

All participants in this research had to go through:

1. A thorough review of the patient's medical history.
2. Complete ENT examination
3. Nasal examination:

Nasal decongestion: To allow better examination of the nose and to see the response of mucosa to decongestion.

Nasal endoscopy: Diagnostic nasal endoscopy was done specially reporting on:

1. Presence of polyp, discharge and edema.
2. Exclude other nasal pathologies.

4. Investigations:

Computed tomography (CT) scans with 1 mm slices and 256 slices from a Phillips ICT BRILLIANCE were used for the radiologist's assessment. Patients routinely underwent a plain CT scan of their paranasal sinuses, axial and coronal cuts, and sagittal reconstructive bone window, all without contrast.

5. Preoperative preparation:

All patients with chronic sinusitis or chronic sinusitis with nasal polyposis were given a course of topical steroids prior to surgery as well as short doses of oral steroids, and patients with an infection were given antibiotics before surgery.

6. Operative procedure:

Patients were divided as follow: For the patients with bilateral lesions (33 patients), one side was operated by the classic technique and the other side was operated by intact bulla technique. While, patients with unilateral lesions (17 patients) were randomly divided into two groups one group (9 patients) were operated by the intact bulla technique and the other group (8 patients) were operated by the classic technique.

All procedures were performed under general hypotensive anaesthesia with oral endotracheal intubation, and nasal decongestion with oxymetazoline nasal spray was performed in both groups at least half an hour before surgery.

Intact bulla approach:

First, a zero-degree endoscope was used to raise the uncinate process with a ball probe. Next, the central portion of the uncinate process was removed with back-biting forceps, and the maxillary ostium was pinpointed. The lower attachment of the uncinate process was then cut off, and finally the uncinate process was raised until its top attachment was cut off.

Typically, kirschner wires were used to remote a section of the maxillary apex to improve the patient's view of the frontal recess. The bulla can be left whole, or a small piece can be removed if absolutely essential for pathological reasons.

Once the agger nasi air cells was located, we switched to a 30 or 45 degree angled endoscope. The frontal air cells were removed after the anterior, medial, and posterior walls of the nasopharynx were removed. Medially, the middle turbinate, anteriorly, the frontal peak, laterally, the lamina papracryae, and posteriorly, the scalloping of the frontal sinus defines the ostium. The bony divider between the supra orbital recess and the frontal sinus was removed if present. When expanding the frontal sinus ostium is necessary, the 70-degree endoscope was used.

Classic approach:

First, the middle turbinates were preserved after a standard uncinectomy and anterior & posterior ethmoidectomy. After locating the skull base, one proceeded anteriorly until one reached the frontal recess. Under direct observation, the superior attachment of the uncinate process was dissected free utilizing thru cutting frontal sinus punch forceps. Currently, the frontal recess's varied bony partitions had been recognized, and their anatomical correlations had been compared to those seen on preoperative imaging. Laterally joined on the upper orbital wall, the uncinate formed a recessus terminalis that, in some cases, may be continuous with the pneumatized agger nasi cell system in the anterior orbit. The interior frontal sinus ostium was often exposed after the residual uncinate process insertion was removed and the agger nasi cell was "uncapped."

In both techniques, the following were measured:

- Operation time.
- Complications.
- Types of scopes used (zero, 30, 45 or 70) degree.
- Need to use a drill.

Follow up after surgery

- Once a week for the first month, follow-up.
- Next, for the first six months, once a month.
- Crusts were scraped off, viscous secretions were sucked out with a suction instrument, and synechiae were carefully cut away in an effort to keep the sinuses draining open.
- For some patients, postoperative CT was performed, but for others, we used endoscopy.

Ethical consent:

After receiving written agreement from each participant, the Zagazig University Research Ethics Board (ZU-IRB#6789/3-1-2021) approved the study. The World Medical Association's Helsinki Declaration established standards for the treatment of patients who participated in medical trials.

Statistical analysis

In order to analyze the data acquired, Statistical Package of Social Services version 20 was used to execute it on a computer (SPSS). In order to convey the findings, tables and graphs were employed. The quantitative data were presented in the form of mean, median, standard deviation, and confidence intervals. The information was presented using qualitative statistics such as frequency and percentage. The student's t test (T) was used to assess the data while dealing with quantitative independent variables. Pearson Chi-Square and Chi-Square for Linear Trend (X²) were used to assess qualitatively independent data. The significance of a P value of 0.05 or less was determined.

RESULTS

This study included fifty patients with age range from 12 to 60 years with mean age 40.8 years. Female represented 72% of patients. Of them, 94% were married. 33 patients had bilateral frontal sinus pathology and were operated by the classic technique for one side and intact bulla technique for the other side, while 17 patients had unilateral frontal sinus pathology 9 of them were operated by intact bulla technique, while 8 patients were operated by the classic technique (Table 1).

Table (1): Distribution of the studied patients regarding demographic data

	N=50	%
Gender:		
Female	36	72%
Male	14	28%
Age (years)		
Mean ± SD	40.8 ± 11	
Range	12 – 60	
Marital status:		
Married	47	94%
Single	3	6%
Smoking:		
No	46	92%
Yes	4	8%
Laterality:		
Unilateral	17	34%
Bilateral	33	66%

Larger percentage of patients (70%) had no comorbidity and 39 patients (78%) had no past surgical history. Four patients had history of adenoidectomy and 10% had adenotonsillectomy. Six patients were

diabetic, one was hypertensive, three were allergic and five had comorbid asthma (Table 2).

Table (2): Distribution of the studied patients regarding clinical data

	N=50	%
Comorbidity:		
Null	35	70%
Allergic	3	6%
Asthma	5	10%
Diabetic	6	12%
Hypertensive	1	2%
Surgical history:		
Adenoidectomy	4	8%
Adeno-tonsillectomy	5	10%
Septoplasty	2	4%
Null	39	78%

Concerning endoscopic features of studied patients, 44% had bilateral ethmoid-frontal polyposis, 18% had panpolyposis, 16% had chronic pansinusitis, 12% had left isolated frontal sinusitis and 10% had right allergic fungal sinusitis. Twenty-three patients had nasal septum deviated to left (30% had been corrected endoscopically and 16% need no intervention). Twelve patients had septum deviated to right (16% had been corrected endoscopically and 8% need no intervention). (Table 3)

Table (3): Distribution of the studied patients regarding endoscopic data

	N=50	%
Endoscopic features		
Bilateral ethmoido-frontal polyposis	22	44%
Left isolated frontal sinusitis	6	12%
Chronic pansinusitis	8	16%
Panpolyposis	9	18%
Right allergic fungal sinusitis	5	10%
Septum:		
NAD	15	30%
Deviated septum to left:		
• Corrected endoscopically	15	30%
• Need no intervention	8	16%
Deviated septum to right:		
• Corrected endoscopically	8	16%
• Need no intervention	4	8%

There was statistically non-significant difference between the studied groups regarding laterality of lesion. Nine patients who underwent intact bulla technique had unilateral lesion versus eight patients within classic technique. Thirty-three patients with bilateral lesions had been operated by intact bulla technique in one side and classic technique in the other side (Table 4).

Table (4): Comparison between the studied patients regarding side of lesion

Parameter	Groups		Test	
	Intact bulla technique	Classic technique	χ^2	p
	42 sides	41 sides		
Laterality:				
Unilateral	9 (21.4%)	8 (19.5%)	0.047	0.829
Bilateral	33 (78.6%)	33 (80.5%)		

There was statistically non-significant difference between the studied groups regarding preservation of anterior ethmoid artery and middle turbinate and preservation of lamina papyracea. They were preserved in all sinuses. There was statistically significant difference between both techniques regarding time to reach frontal sinus which was significantly shorter in intact bulla technique (**Table 5**).

Table (5): Comparison between the studied patients regarding time to reach frontal sinus and other operative findings

Parameter	Groups		Test	
	Intact bulla technique	Classic technique	χ^2/t	p
	42 sides	41 sides		
Time (min):				
Mean \pm SD	26.57 \pm 1.86	35.61 \pm 2.13	-20.58	<0.001**
Range	24 – 29	33 – 39		
Preservation of ant ethmoid artery	42 (100%)	41 (100%)	0	>0.999
Preservation of middle turbinate	41 (97.6%)	39 (95.1%)	0	>0.999
Preservation of lamina papyracea	42 (100%)	41 (100%)	0	>0.999

There was statistically non-significant difference between the studied groups regarding recurrence, restenosis, nasal obstruction or mucopurulent discharge (**Table 6**).

Table (6): Comparison between the studied patients regarding postoperative findings

Parameter	Groups		Test	
	Intact bulla technique	Classic technique	χ^2	p
	42 sides	41 sides		
Recurrence	1 (2.4%)	1 (2.4%)	0	>0.999
Restenosis	1 (2.4%)	2 (4.9%)	Fisher	>0.999
Nasal obstruction:			Fisher	0.245
Present	2 (4.8%)	5 (12.2%)		
Absent	40 (95.2%)	36 (87.8%)		
Mucopurulent discharge			Fisher	0.483
Present	3 (7.1%)	5 (12.2%)		
Absent	39 (92.9%)	36 (87.8%)		
Middle turbinate lateralization	5(11.9 %)	3 (7.3 %)	Fisher	0.245

In both groups, 0, 30 and 45 degree endoscope was used in all the surgeries. The 70 degree endoscope was used in 8 sides in the intact bulla technique. There were no need for drilling in any case of both groups (**Figures 1-4**).

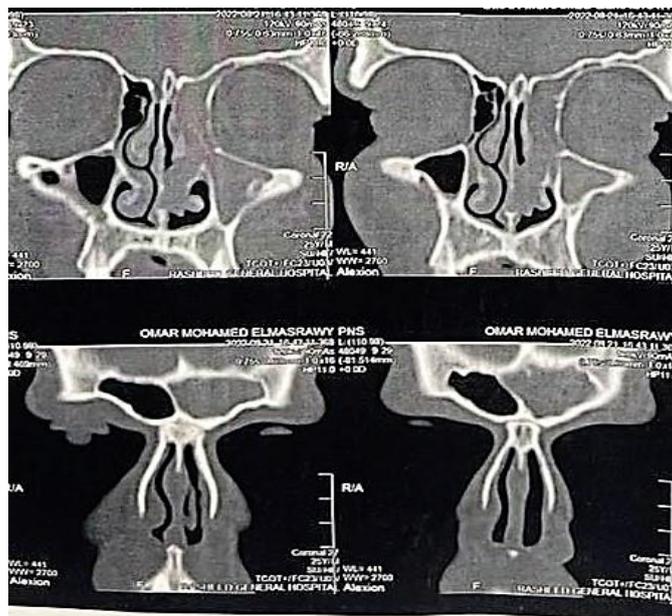


Figure (1): Preoperative CT scan (coronal cuts) showing isolated frontal sinusitis

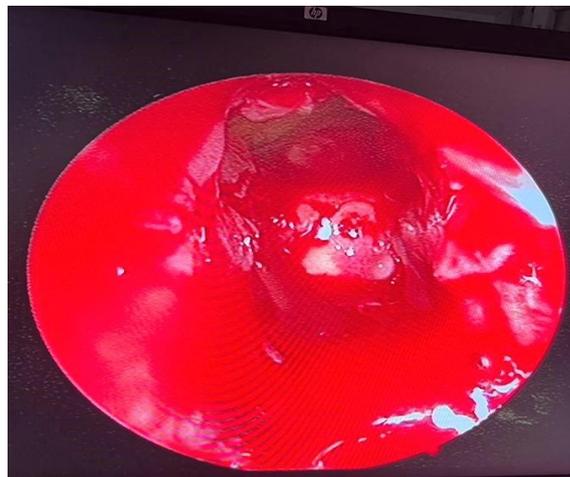


Figure (2): Intraoperative 30 degree endoscopic view showing frontal sinus ostium (intact bulla technique).

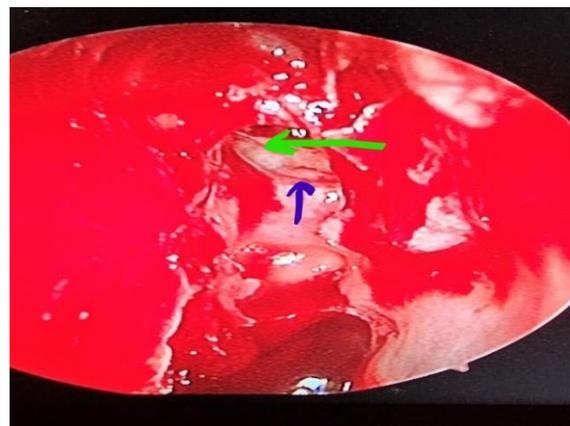


Figure (3): Intraoperative 30 degree endoscopic view showing frontal sinus ostium (green arrow) and anterior ethmoid artery (blue arrow)



Figure (4): Intraoperative trans illumination of the frontal sinus.

DISCUSSION

In adults, the presence of two or more symptoms qualifies as a diagnosis of chronic rhinosinusitis (with or without nasal polyps), with at least one of those symptoms being either nasal blockage, obstruction, congestion, or discharge (anterior or posterior nasal drip), a decrease or complete loss of scent, or pain/pressure in the face, lasting more than 12 weeks, which can be verified via phone/interview. Questions on common allergy symptoms including sneezing, runny nose, itchy nose, and watery, itchy eyes. The frontal sinuses present a greater surgical challenge, making endoscopic frontal sinus surgery more difficult. The frontal sinus and frontal recess region presents unique challenges for endoscopic surgery for a number of reasons, including the vast anatomical variation within this area and the presence of frontal cells in this space. Internal frontal ostia vary in terms of their location, diameter, and position ⁽⁶⁾.

This study included fifty patients with age range from 12 to 60 years with mean age 40.8 years. Female represented 72% of patients. Also, **Mobashir et al.** ⁽⁷⁾ revealed that twenty-four individuals with frontal sinus illness who had failed to improve on medical treatment for at least twelve weeks were studied. Twenty-four patients participated in the research. There were 6 male patients (25% of the total) and 18 female patients (75% of the total). They were between the ages of 20 and 58 and mean age was 33.54 ± 12 years old.

In our study, the middle turbinate was preserved in 41 cases in intact bulla technique and 39 cases in classic technique. In contrast to **Landsberg et al.** ⁽⁸⁾ who performed a bilateral middle turbinectomy on the same subject?

Endoscopic visualisation of the frontal recess can be hindered by a noticeable deviated septum or a high degree of septal deviation. Therefore, this condition may need to be addressed prior to frontal sinus surgery in order to ensure appropriate visualisation and access to the operating region. In our study, septoplasty was concurrently done in 23 patients, this in contrast to **Landsberg et al.** ⁽⁸⁾ who did septoplasty in 3 patients.

As regards postoperative complications, no major complications (significant hemorrhages, orbital complications or cerebrospinal fluid leak) occurred. At the end of follow-up period (3 months), all patients were assessed subjectively by presence of postoperative symptoms and objectively by postoperative nasal endoscopic examination and CT scan was done to some of the patients who have persistent complaint.

Residual mucopurulent discharge in the frontal recess area with endoscopic mucosal edema were found in 5 sides in the classic technique and 3 sides in the intact bulla technique and were managed medically. No patients required revision sinus surgery and all complications were managed medically.

Landsberg et al. ⁽⁸⁾ results showed no complications. The middle turbinate of two patients showed minor synechiae with the lateral nasal wall. They came to the conclusion that in some instances, a targeted endoscopic operation aimed solely at restoring frontal sinus outflow could effectively cure chronic isolated frontal sinusitis.

Inadequate anatomical knowledge, intraoperative challenges in locating the frontal recess, and the use of slanted endoscopes and tools while trying to maintain mucosa in a space confined by the skull base and the orbit all contribute to the high complication rate of frontal recess surgery ⁽⁹⁾.

In our study, subjective assessment revealed recurrence of symptoms in one patient with intact bulla technique and one patient with the classic technique, while frontal ostium restenosis occurred in one patient with intact bulla technique and two patients with the classic technique. Objective postoperative endoscopic assessment revealed nasal adhesions between inferior turbinate and septum in 3 sides only 1 in the intact bulla technique and 2 in the classic technique that were excised locally at outpatient clinic, **Mobashir et al.** ⁽⁷⁾ found nasal adhesions in 4 sides.

Huang et al. ⁽⁹⁾ have demonstrated that frontal recess disease persistence after endoscopic sinus surgery is a major cause of surgery failure. Iatrogenic illness of the frontal sinus is commonly caused by injudicious dissection of the frontal recess, severe

mucosal damage, and the accompanying unstable middle turbinate, which laterally obstructs the frontal outflow tract.

Many methods have been published in an effort to reduce middle turbinate lateralization (MTL), which is one of the most prevalent consequences of endoscopic sinus surgery with a reported prevalence of up to 43%. The ability to debride the sinonasal cavity, irrigate, and give topical treatments may be impaired by MTL, and frontal, anterior ethmoid, and maxillary sinus outflow may be impeded⁽¹⁰⁾. In our study, middle turbinate lateralization occurred in 5 patients in intact bulla technique and 3 patients in classic technique.

In our study, there was statistically significant difference between the two surgical techniques regarding operative duration. Intact bullae technique had the least duration with a mean of 26.57 ± 1.86 minutes compared to classic approach with a mean of 35.61 ± 2.13 minutes. Also, **Mobashir et al.**⁽⁷⁾ discovered a statistically significant distinction in operative time between the two procedures. The average time for the intact bullae procedure was only 26.14 minutes, while the time for the traditional method was 35.47 minutes.

The form of the disease, the amount of intraoperative bleeding, and the quantity of cells in the frontal recess all play a role in how long it takes to complete the operation until the ostium of the frontal sinus is located. These considerations need to be taken out of any future research. Another drawback is the short duration of the follow-up period (3 months), which we believe should be at least 6 months in any future research.

CONCLUSION

Addressing frontal sinus through intact bulla technique is less invasive and guards against anterior ethmoidal artery accidental injury during surgery. Also, it is much easier and faster to identify the frontal sinus

ostium during FESS operation through this approach saving time and effort for the surgeon.

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