

Research Article

Evaluating the Efficacy of the Endoscopic Surgical Management of Frontal Sinus Osteomas

Thuy Phan Chung Tran^{1,2,*} and Hon Minh Hao Nguyen¹

¹ Ear-Nose-Throat Hospital at Ho Chi Minh City, Ho Chi Minh City 700000, Vietnam

² Ear-Nose-Throat Department, Faculty of Medicine, Vietnam National University Ho Chi Minh City, Ho Chi Minh City 700000, Vietnam.

***Correspondence author: Assoc. Prof. Dr. Tran Phan Chung Thuy**

Director Ear-Nose-Throat Hospital of Ho Chi Minh City, Ho Chi Minh City 700000, Vietnam.

Ear-Nose-Throat Department, Faculty of Medicine, Vietnam National University Ho Chi Minh City, Ho Chi Minh City 700000, Vietnam.

Add: 155-157 Tran Quoc Thao street, Ward 9, District 3, Ho Chi Minh City 700000, Vietnam

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ABSTRACT

Objectives: Osteomas are the most common, benign tumours of the paranasal sinuses (60%). The endonasal endoscopic approach is chosen to remove osteomas of the frontal sinus and recess because it has the advantage of leaving no external scars. However, this approach is still limited and requires experienced surgeons.

Methods: This non-randomized trial study and retrospective study were conducted at the Ear, Nose and Throat (ENT) Hospital in Ho Chi Minh City, with a total of 34 patients having osteomas endoscopically removed to evaluate the surgery's effectiveness.

Results: In 14 months (from January 2016 to August 2017), 34 patients presented with osteomas of the frontal sinus and recess. 67.65% of these osteomas were removed via the endonasal endoscopic approach, and, in 32.35% of cases, a combined endoscopic and external approach (Jacques incision) was chosen. 88.24% of osteomas were completely removed (52.95% by leverage and 35.29% by drills), and 11.76% were not completely removed. In 35.29% of cases, the operation was navigation-assisted. 17.65% of cases had scarring and cauterisation of the frontal recess during the first four weeks after operation; 11.76% of them were successfully repaired successfully in the clinic, while 5.89% necessitated surgical revision. Intraoperatively, complication of injury to the lamina papyracea was observed in one case (2.94%), and bleeding from the anterior ethmoidal artery was also observed in one case (2.94%); however, both were successfully controlled without severe consequences.

Conclusion: The endoscopic approach is advantageous over the external approach for osteomas of the frontal sinus and recess. It avoids external scars and loss of forehead sensation and shortens hospitalisation. It should be noted that not all osteomas should be completely removed by the endoscopic approach, and the surgeon should stop at the appropriate time. The external approach is still helpful in managing frontal sinus diseases.

Keywords: Evaluation, Endoscopic, Frontal Sinus Osteomas, Surgery

INTRODUCTION

Osteomas of the frontal sinus are the most common, benign tumours of the paranasal sinuses (60%), followed by those in the ethmoid sinus (30%), the maxillary sinus (9%) and,

rarely, the sphenoid sinus (1%) [3]. The tumours grow slowly and seldom cause severe clinical symptoms. Some cases cause headaches and sensations of pressure in the paranasal sinus region or the middle of the forehead, spreading to the sides. However, the tumour's size may increase considerably over time, causing obstructed drainage of the sinuses and subsequent chronic rhinosinusitis or secondary formation of frontal sinus mucocele, which may invade the skull base and lead to meningitis. However, some cases of osteomas develop silently and do not cause any symptoms. They are often detected as incidental findings on CT images (about 3%) [5].

Indications for removing frontal sinus osteomas in particular, as well as paranasal sinuses in general, are still a matter of discussion. In the past, surgery to remove frontal sinus osteoma through the external pathway was performed by Lynch, Jacques, and Montgomery [7], [8]. Endoscopic surgery was introduced and strongly developed in the early 20th century, along with advances in science fields such as computed tomography (CT) scans and suitable surgical instruments for approaching the difficult positions required by endonasal, endoscopic surgery [6], [7], [8]. Moreover, as living standards improve, patients desire more aesthetic surgery. Therefore, surgeons prefer endoscopic resection of frontal sinus osteomas more and more because it does not leave scars and overcomes sequelae, such as facial area numbness and loss of sensation; postoperative recovery is also lighter than in the external approach.

However, the endonasal surgical technique for frontal sinuses is still limited by the restricted visual field in the area, the narrowness of the area for surgery, the difficulty of accessing injuries with surgical instruments, the necessity of the surgeon performing the operation with one hand, and the complications that may occur—such as skull damage leading to cerebrospinal fluid leaks, orbital lesions, anterior ethmoidal artery damage, etc. - if the surgeon is not sufficiently experienced

[6], [8]. Due to the complicated frontal sinus structure, some existing instruments still cannot endoscopically access frontal sinus osteomas, and successful surgery also relies on factors such as experienced surgeons and the patient's safety. Therefore, endoscopic frontal sinus osteoma surgery presents many challenges. Consequently, we carried out this study (*“Evaluating the efficacy of the endoscopic surgical management of frontal sinus osteomas”*) aiming to select the appropriate surgical path—gradually overcoming external approaches and, thereby, preventing external scars, while proceeding to endoscopic osteoma surgery to introduce high therapeutic effects and aesthetic factors.

METHODS

Study design and subject

The non-randomized trial study and retrospective study were conducted at the Ear, Nose and Throat (ENT) Hospital in Ho Chi Minh City from June 2016 to August 2017. The selected patients were examined and diagnosed with frontal sinus and recess osteomas and had endonasal, endoscopic surgery indications, with or without combined extranasal approaches (Jacques). This research sought to evaluate the efficacy of endoscopic surgical management of frontal sinus osteomas in a hospital database compared with extranasal surgery.

Sampling method

Patients' indications for surgery to remove the frontal sinus and recess osteomas [3] matched the following criteria: (1) the tumour caused headaches; (2) the osteomas caused obstructed drainage of the sinuses and subsequent chronic rhinosinusitis; (3) the tumours caused bone destruction and/or facial deformity. This study eliminated elderly patients at high risk of surgical complications. Patients who did not have adequate data due to referral or discharge from the hospital without having the surgery's effectiveness assessed or complications monitored were also

excluded. A total of 34 patients who met the research criteria and were included in the analysis.

Statistical analysis

The patients' information in the hospital's electronic database included gender, age, complaints at the time of admission, characteristics and level of headaches, information about frontal sinus and recess osteomas and their relation to rhinosinusitis, the position of the frontal sinus and recess osteomas, characteristics of the frontal sinus and recess osteomas, surgical procedures and the results of removing the frontal sinus and recess osteomas. Evaluation results from

six months after surgery, as well as any complications, were imported into Microsoft Excel 2016. Statistics on frequencies and percentages were performed for each patient characteristic.

Ethical considerations

This study received approval from the Science Research Committee of the ENT Hospital in Ho Chi Minh City. The research data was collected only for scientific purposes and does not use patients' personal information other than for this purpose.

RESULTS

Table 1. General characteristics of patients with osteomas (frequency, proportion)

Characteristic	n	%
Gender		
Male	12	35.29
Female	22	64.71
Age group		
17-29	4	11.76
30-49	16	47.06
50-60	9	26.47
> 60	5	14.71
Complaints at the time of admission to the clinic		
Headache	23	67.64
Rhinosinusitis	8	23.53
Drooping of the upper orbital	1	3.95
Incidental	2	5.88
Character of headache		
Dull pain	16	47.09
Throbbing pain	4	11.74
Intense pain	9	26.47
No pain	5	14.70
Level of pain		
Pretty severe	4	11.77
Moderate	14	41.18
Mild	11	32.30
No pain	5	14.70
Chronic frontal sinusitis		
Osteomas completely obstructed drainage	4	11.76
Osteomas did not completely obstruct drainage	6	17.65
Osteomas unrelated to rhinosinusitis	5	14.70
No rhinosinusitis present	19	55.89
Position		
Frontal recess	16	47.05
Frontal infundibulum	10	29.41
1/3 medial in frontal sinus	4	11.76

1/2 frontal sinus	3	8.82
Entire frontal sinus	1	2.96
Characteristic		
Pediculate	3	8.82
Small Base (< 3mm)	14	41.17
Medium Base (3-6mm)	12	35.29
Wide base (> 6mm)	5	14.72

Table 1 shows the characteristics of patients treated for osteomas at the ENT hospital in Ho Chi Minh City. 34 patients were included in the study. They consisted of 12 males and 22 females, so the male-to-female ratio was 1:1.8. The most common age group was 30-49-year-olds (47.06%); the most common complaint at the time of admission was headaches (67.64%); and the most frequent pain level was moderate (41.18%) followed by mild (32.30%).

Table 2. Surgical procedure and evaluation of results

Variable	n	%
Surgical procedure		
Draf I	13	38.23
Draf IIA	6	17.64
Draf IIB	4	11.78
Combined endoscopic and external approach (Jacques)	11	32.35
Results of removing the frontal sinus and recess osteomas		
Completely removed	30	88.24
Not completely removed	4	11.76
Evaluating results six months after surgery		
Good	21	61.77
Pretty good	3	8.82
Average	1	2.94
Not good	1	2.94
Not re-examined	8	23.53

Table 2 shows that Draf I is the most commonly used procedure (38.23%), while the combined endoscopic and external approach is the second most used technique (32.35%). In general, the surgery had a success rate of approximately 90%, and evaluations six months after surgery showed high rates of “good” results (61.77%).

This study noted that surgical complications destroying the lamina papyracea and causing herniation of the orbital fat into the ethmoid sinuses was observed in one case (2.94%), and bleeding from the anterior ethmoidal artery was also observed in one case (2.94%). However, both were successfully controlled without severe consequences, and no case was affected by severe complications.

DISCUSSION

In our study group, osteomas of the frontal sinuses and recesses occurred in males more than in females—with the male-to-female ratio 1.8:1. In a study group organized by Ledderose, Betz, Stelter Leunig (2011) study group, frontal sinus and recess osteomas occurred in 24 patients (11 males and 13 females). Migraine headaches are more common in females and are generally the reason for diagnostic imaging; therefore, osteomas are often diagnosed in these patients. In our research, headache was the patients’ main complaint (23/34 cases, 67.64%) because frontal sinus and recess osteomas obstruct the frontal drainage pathway, causing referred pain. However, many patients with large osteomas do not have headaches.

Similar to the results from Ledderose, Betz, Stelter, and Leunig [5], the location, severity and characteristics of headaches are not specified for frontal sinus and recess osteomas; therefore, this symptom is just a suggestion for diagnostic imaging.

Because of available surgical instruments and the complicated structure of the frontal sinus and recess, not all the frontal sinus osteomas can be endoscopically removed, depending on the location and size of the osteomas' origins and the relation between the osteomas and the ostia. In our study, frontal osteomas were endoscopically removed (23/34 cases, 67.65%), and 11/34 cases (32.35%) used combined endo- and extranasal approaches. In Ledderose, Betz, Stelter and Leunig's study [5], 8/20 cases (40%) were endoscopically treated and 12/20 (60%) utilised combined endo- and extranasal approaches. In our study, there were 16 cases of frontal recess osteomas (47%), which was more than exhibited in Ledderose, Betz, Stelter and Leunig's [5] work (7/20 cases (35%)).

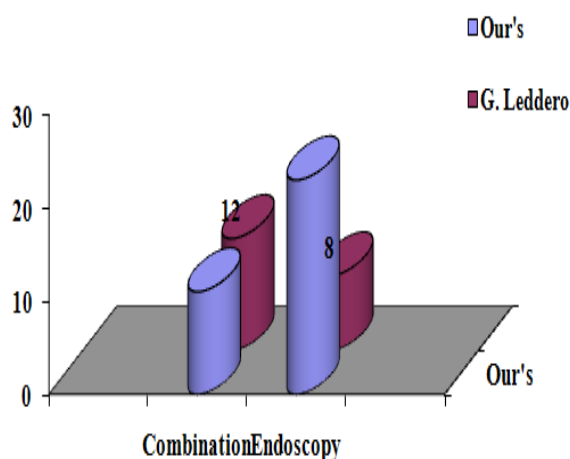


Figure 1. Comparison of surgical approaches

However, in Ledderose, Betz, Stelter and Leunig's study, there was one case of grade IV osteoma, according to Chiu's grading system [5]. This osteoma, which filled the entire left frontal sinus, was removed via the Draf III technique (modified Lothrop) via an endoscopic approach. Our study only examined up to the Draf IIB technique.

After approaching an osteoma, we exposed it entirely, including its origin, then used a probe to dissect the surrounding bony walls and mucosa. We used appropriate spatula after estimating the safety of leverage. There were 18 cases (52.95%) of removing the osteomas by leverage. In cases where leverage was unsuccessful, we used drills to minimise the osteomas. 12 cases (35.29%) required drills. Afterwards, we removed the osteomas' origins. Paying attention to osteomas with origins attached firmly to the skull base or the posterior wall of the frontal sinus, we never violently leveraged the osteomas, but used drills to remove them gradually until safety was ensured. In these 12 cases, we used a three-dimensional image guiding system to help the surgeons be more comfortable [2]. There were four cases in which osteomas were not completely removed (11.76%), and we evaluated the clearance of the frontal ostium and recess before ending the surgery to ensure the patient's safety [4]. Six-month postoperative re-evaluations with CT scans showed no further development of these osteomas.

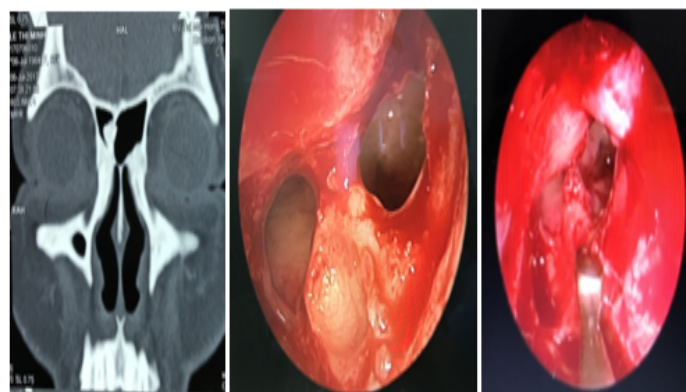


Figure 2. Draf IIB technique, the osteomas located at the right septum of the frontal sinus.

Six cases exhibited postoperative synechiae, and three cases had adhesions between the middle turbinates and the lateral nasal walls, which was easily separated at three weeks after surgery. In three cases using the Draf IIA technique, the heads of the middle turbinates' weakened and attached to the ethmoidal fovea, which caused re-obstruction of the frontal recesses. Adhesions of two cases could be separated at the clinic with nasal endoscopy. However, one case had bone

formation at the surgery site and required revision surgery. We noticed that, if we drilled centrally to widen the frontal ostium after removing the osteomas, the attachment of the middle turbinate would weaken and tend to be adhesive to the ethmoid fovea, obstructing the frontal recess. Furthermore, the bony and mucosal loss of the frontal recess, after being drilled, would cause bone formation and, again, obstruction of frontal recess. In this case, we performed the third revision surgery, including removing the middle turbinate, the bony formation and obstructive scar tissue and widening the frontal ostium laterally to the orbital wall and centrally to the septum (Draf IIB). Three-months postoperatively, this patient has not complained of frontal or orbital pain.

After six months, 21 patients from our study (61.76%) had good outcomes, including clear surgical sites, no complaints of headache and stable sinusitis. Three patients (8.82%) whose osteomas were not removed completely had a fair outcome, with clear surgical sites and no further development of osteomas on the CT scan. One patient (2.94%) had bad results, with complete

obstruction of the frontal recess caused by postoperative adhesions. After a third revision surgery, this patient had good results, with a clear frontal recess, no synechiae and no complaints of headaches. Eight cases (23.53%) did not return for follow-up visits because they lived far from the hospital and told us, by telephone, that they were in good condition. One case had the complication of lamina papyracea ingression and prolapse of the orbital fat into the ipsilateral ethmoid sinus, which impeded our drilling. Revision surgery on this case after three months had a good result. One case had the complication of an inadvertent injury of the anterior ethmoidal artery without orbital hematoma, and we had to leave part of the osteoma, which was attached firmly to this region. In Ledderose, Betz, Stelter and Leunig's study, 83% of cases had a good result; 95% of patients were satisfied with their surgery; one case had the complication of injury to the anterior ethmoidal artery and orbital hematoma but no effect on vision; and one case exhibited more severe headaches compared to preoperative levels.



Figure 3. Patient with large FSO and postoperative synechia



Figure 4. After the second surgery.

CONCLUSION

The endoscopic approach is advantageous over external approaches for osteomas of the frontal sinus and recess. It avoids external scars, is suitable to the physical drainage of the rhinosinus, prevents loss of forehead sensation and enables shorter hospitalisation. One disadvantage of the endoscopic approach is postoperative synechiae of the frontal recess region. Even highly-experienced surgeons should not try to remove the entire osteoma in all cases but should know when to stop. The external approach is still an effectively supportive technique for frontal sinus diseases.

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DISCLOSURE

The authors report no conflicts of interest in this work.

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