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ORIGINAL ARTICLE

Endoscopic transnasal sphenoidotomy with or without ethmoidectomy

Etmoidektomili veya etmoidektomisiz endoskopik transnazal sfenoidotomi

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Objectives: We evaluated endoscopic transnasal sphenoidotomy (ETNS) with or without ethmoidectomy in patients with inflammatory sphenoid sinus disease (ISSD).

Patients and Methods: A retrospective review was conducted in 42 patients (17 males, 25 females; mean age 41 years; range 17 to 67 years) who underwent ETNS with (n=37) or without (n=5) ethmoidectomy for ISSD. The disase was staged according to our staging system based on computed tomography findings.

Results: Postnasal drainage was the most common symptom (n=37, 88.1%). Chronic rhinosinusitis was accompanied by sinonasal polyps in 25 patients (59.5%). Five patients (11.9%) had isolated sphenoid disease and 16 patients (38.1%) had unilateral disease. Five patients (11.9%) had stage 1, 15 patients (35.7%) had stage 2, and 22 patients (52.4%) had stage 3 disease. Surgery involved 68 sides. Ethmoidectomy was used in 63 sides of 37 patients, eight of whom required a supplementary procedure. At least one complication was seen in eight patients (19%), including severe perioperative hemorrhage (n=2), early postoperative hemorrhage (n=2), minor injuries to the lamina papyracea (n=4), and synechiae (n=5).

Conclusion: In patients with isolated ISSD, the direct approach to the sphenoid sinus by ETNS without ethmoidectomy is a favorable technique, whereas ETNS with ethmoidectomy is necessary for patients with concurrent disease in other paranasal sinuses.

Key Words: Ethmoid bone/surgery; sphenoid sinusitis/surgery; endoscopy/methods.

Amaç: Enflamatuvar sfenoid sinüs hastalığında (ESSH) etmoidektomili veya etmoidektomisiz endoskopik transnazal sfenoidotomi (ETNS) uygulaması değerlendirildi.

Hastalar ve Yöntemler: Çalışmada ESSH nedeniyle etmoidektomili (n=37) veya etmoidektomisiz (n=5) ETNS uygulanan 42 hasta (17 erkek, 25 kadın; ort. yaş 41; dağılım 17-67) geriye dönük olarak değerlendirildi. Hastalar bilgisayarlı tomografi bulgularına dayanan evreleme sistemimizle sınıflandırıldı.

Bulgular: En yaygın semptom postnazal akıntı idi (n=37, %88.1). Kronik sinüzite 25 hastada sinonazal polip eşlik etmekteydi (%59.5). Beş hastada (%11.9) izole hastalık vardı. On altı hastada (%38.1) tutulum tek taraflıydı. Beş olguda (%11.9) evre 1, 15 olguda (%35.7) evre 2, 22 olguda (%52.4) evre 3 hastalık görüldü. Cerrahi 68 tarafa uygulandı. Bunların 63'ünde cerrahiye etmoidektomi eklendi. Etmoidektomi uygulanan hastaların sekizinde destekleyici girişime ihtiyaç duyuldu. Sekiz hastada (%19) en az bir komplikasyonla karşılaşıldı. Bu komplikasyonlar şunlardı: ciddi perioperatif kanama (n=2), ameliyat sonrası erken dönem kanama (n=2), lamina papiraseada hafif yaralanma (n=4) ve sineşi (n=5).

Sonuç: İzole ESSH olan hastalarda etmoidektomisiz ETNS ile direkt yaklaşım tercih edilecek cerrahi tekniktir; diğer paranazal sinüslerde de hastalığı olanlarda ise ETNS'nin etmoidektomi ile birlikte uygulanması gerekir.

Anahtar Sözcükler: Etmoid kemik/cerrahi; sfenoid sinüzit/cerrahi; endoskopi/yöntem.

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Until several years ago, the sphenoid sinus truly had been the "neglected sinus", as it was once called by van Alyea.[1] It is a developmental out-growth of the sphenoid bone in the posterosuperior segment of the sphenoid recess. Its pneumatization is variable and can involve a portion or the entire body of the sphenoid bone and its processes. Vital and vulnerable structures are adjacent to the sphenoid sinus including superiorly, the pituitary gland, the middle cranial fossa and the optic nerve and chiasm; on both sides, the cavernous sinuses, the internal carotid arteries, and cranial nerves III, IV, V 1-2 and VI; and anteriorly, the nasopharynx, the pterygoid canals and nerves, and the pterygopalatine ganglion and artery.[1-3]

A number of surgical techniques has been used to access the sphenoid sinus, including subfrontal, frontotemporal, subtemporal transcranial approaches as well as various transfacial and transnasal procedures.[4,5] Improvements in radiographic imaging and endoscopic sinus surgery have allowed the use of a less invasive and more anatomically direct approach to the sphenoid sinus. Selecting an appropriate approach to the sphenoid sinus is a difficult endeavor which can be overcome only by a good preoperative judgment leading to a correct decision.[4]

The differential diagnosis of sphenoid sinus pathology is diverse, but dominated by infectious and inflammatory processes such as rhinosinusitis with or without polyposis.[4,6] Neoplastic, fibro-osseous, traumatic, developmental and vascular lesions, although rare, must also be considered.[2,4]

Our objective was to evaluate endoscopic transnasal sphenoidotomy (ETNS) with or without ethmoidectomy in patients with inflammatory sphenoid sinus disease (ISSD).

PATIENTS AND METHODS

Patients

The study involved 42 patients (17 males, 25 females; mean age 41 years; range 17 to 67 years) who underwent endoscopic surgery for ISSD between January 2000 and March 2005 in a single institution. The patients were analyzed retrospectively according to the type of endoscopic approaches. The data was drawn from detailed patients' charts and medical records; including history, demographic, radiologic and endoscopic findings as well as the follow-up. The patients with neoplastic, fibro-osseous, traumatic, developmental and vascular lesions were excluded from this study.

The patients were chosen from a larger sample with a diagnosis of chronic rhinosinusitis (CRS) with or without sinonasal polyposis (SNP). Definitions for rhinosinusitis were made according to the consensus report as follows:[7] acute (presumed bacterial) rhinosinusitis, CRS without sinonasal polyps, CRS with sinonasal polyps, and allergic fungal rhinosinusitis. The diagnosis of CRS was based on the criteria of Academy of Otolaryngology Head and Neck Surgery Rhinosinusitis Task Force (1997).[8] The patients were selected according to the symptoms and findings of nasal endoscopy and paranasal sinus computed tomography (CT). The diagnosis of CRS was based on the presence of persistent symptoms and signs over 12 weeks, or four or more episodes of recurrent acute sinusitis in a year each lasting for 10 days or more, in association with persistent changes on CT scans after four weeks of medical treatment without an intervening acute infection.

The patients were staged according to our staging system based on CT findings, whose details were previously described (Table I).[9] For stage 1 patients, another course of medical treatment was attempted. Patients with persistent disease in stage 1, and those having stage 2 or 3 disease underwent surgery.

Medical treatment consisted of three drug combinations which were used simultaneously before CT examination. Group 1: 4 weeks of antibiotics (amoxicillin-clavulanate or macrolide combined with ornidazole); group 2: 10 days of anti-inflammatory drugs (naproxen-sodium or etodolac or nimesulide); group 3: 7 days of topical and/or oral decongestants (pseudoephedrin, xylometazoline, or oxymetazoline). Patients with polyps and allergy also received antihistamines (cetirizine or loratadine) and topical nasal steroids (fluticasone propionate or mometasone furoate). Macrolide antibiotics were used in patients with nasal polyps because of their anti-inflammatory effects. In addition, patients with a polyp received a short course of 0.5-1 mg/kg/day oral prednisolone 10 days prior to surgery with a tapered dose postoperatively.

Nasal examination was performed by 2.7 mm or 4.0 mm rigid 0° or wide angle 30° Karl-Storz endoscopes without using topical decongestion.

TABLE I

THE STAGING OF THE PATIENTS

Stages	Stage 1		Stage 2		Stage 3		Bilateral		Unilateral	
Patients	n	%	n	%	n	%	n	%	n	%
CRS with SNP (n=17)										
Isolated sphenoid	5	11.9	–	–	–	–	–	–	5	11.9
Other	–	–	6	14.3	6	14.3	6	14.3	6	14.3
CRS without SNP (n=25)	–	–	9	21.4	16	38.1	20	47.6	5	11.9

CRS: Chronic rhinosinusitis; SNP: Sinonasal polyp.

The stages according to CT findings were as follows:[9] Stage 0: No opacification in any of the sinuses; Stage 1: Unilateral or bilateral opacification in only the ostiomeatal region and an adjacent sinus, or opacification in only one sinus without any opacification in the ostiomeatal region; Stage 2: Unilateral or bilateral opacification in the ostiomeatal region and in more than one adjacent sinus or opacification in more than one adjacent sinus without any opacification in the ostiomeatal region; Stage 3: Unilateral or bilateral opacification in all sinuses.

Preoperative CT examinations were performed in the same institution without using contrast material and coronal plane sections were obtained. In some patients, especially in revision cases and isolated sphenoid lesions, axial sections were also obtained using contrast material. In isolated sphenoid lesions, magnetic resonance images (MRI) were also included in the diagnostic work-up for differential diagnosis.

All patients were discharged on the first postoperative day. Operations were performed under local anesthesia with moderate sedation except children and unwilling adults. Endoscopic or Cottle septoplasty or removal of the bullous middle turbinate were performed in patients without adequate exposure. Two different techniques were performed and no nasal packing was applied if there was no bleeding. Two weeks of postoperative antibiotics (amoxicillin-clavulanate or macrolide) and topical buffered saline solution were prescribed. Nasal steroids were continued in patients with polyps. Crusts and clots were removed carefully on the second postoperative day. Endoscopic control and wound care were made weekly until epithelization of the cavity was completed.

Two endoscopic approaches

Endoscopic transnasal sphenoidotomy without ethmoidectomy: The technique is similar to that described by Wigand.[10] The sphenoid ostium is endoscopically visualized in the sphenoethmoidal recess which is bounded by the middle and superior turbinates laterally and the septum medially, and entered inferomedially. Some portions of the superior, middle, and inferior turbinates were removed in some cases to improve exposure.

Endoscopic transnasal sphenoidotomy with ethmoidectomy: It is the approach recommended by Stammberger[11] and Kennedy.[12] First, the maxillary ostium is identified (or maxillary antrostomy) and total ethmoidectomy is performed. At this stage, we are confronted with a rectangular window formed by the lamina papyracea laterally, the superior turbinate and basal lamella inferiorly, the lateral aspect of the superior turbinate medially, and the skull base superiorly, through which the anterior wall of the sphenoid sinus can be visualized. This opening is transected by a diagonal line running from the superomedial to inferolateral, thereby forming two triangles.[13] In order to protect the optic nerve and carotid artery lying in the superolateral region of the sphenoid sinus, entrance to this sinus is safely done inferomedially. Finally, this inferomedial entrance should communicate with the natural ostium.

In isolated sphenoid sinus disease, ETNS without ethmoidectomy was preferred, whereas in sphenoid sinus disease associated with other paranasal sinus pathologies ETNS with ethmoidectomy was applied.

RESULTS

According to the staging system based on CT findings, five patients (11.9%) had stage 1, 15 patients (35.7%) had stage 2, and 22 patients (52.4%) had stage 3 disease. Chronic rhinosinusitis was accompanied by sinonasal polyps in 25 patients (59.5%). Five patients (11.9%) had isolated sphenoid disease and 16 patients (38.1%) had unilateral disease (Table I). Fifteen (60%) of the patients with sinonasal polyps, and four (23.5%)

TABLE II

PRESENTING SYMPTOMS OF THE PATIENTS

Symptoms	n	%
Nasal discharge	29	69
Nasal obstruction	34	81
Postnasal drainage	37	88.1
Snoring-sleeping with an open mouth	32	76.2
Facial congestion- pain-pressure-fullness	31	73.8
Smell disorders	32	76.2
Headache	27	64.3
Ear pain-pressure	18	42.9
Halitosis	17	40.5
Dental pain	8	19
Cough	22	52.4
Fever	6	14.3
Fatigue	14	33.3

of the 17 patients without a sinonasal polyp had a previous history of surgery for CRS.

Postnasal drainage was the most common symptom (n=37, 88.1%) (Table II). Headache (100%), nasal obstruction (92%) and postnasal drainage (76.5%) were the most common symptoms in patients with isolated sphenoid disease, CRS with and without sinonasal polyps, respectively.

Endoscopic transnasal sphenoidotomy was performed with or without ethmoidectomy in 68 sides of 42 patients. Ethmoidectomy was used in 63 sides of 37 patients. Eight of the these patients required a supplementary procedure (Cottle septoplasty in 6 patients, endoscopic septoplasty in 1 patient and concha bullosa resection in 1 patient) for adequate exposure, whereas, in the absence of ethmoidectomy, none of the patients (n=5) required a supplementary procedure. Along with ethmoidectomy, additional procedures were performed such as maxillary antrostomy (n=32, 86.5%) and frontal sinusotomy (n=25, 67.6%).

At least one complication was seen in eight patients (19%), which were all minor. In the absence of ethmoidectomy, the only complication was synechia in one patient.

Two patients had severe perioperative hemorrhage that compromised further procedures. After placing anterior nasal packing, surgery was stopped. Early postoperative hemorrhage was seen in two patients, and these were controlled with anterior nasal packings. Four patients had minor injuries to the lamina papyracea, in two of them infraorbital edema and ecchymosis occurred on the first postoperative day, which resolved without specific treatment. Synechiae were found between the middle turbinate and lateral nasal wall in four patients, and between the middle turbinate and septum in one patient. Symptomatic synechiae in two patients compromised drainage and ventilation of paranasal sinuses and were corrected by simple office procedures.

DISCUSSION

In the preantibiotic era, the sphenoid sinus was involved in 15% to 33% of all cases of CRS.[4] Lew et al.[14] reported sphenoid sinus involvement in 2.7% of 1,087 patients with CRS. More recently, Zinreich et al.,[15] in a review of 100 computed tomography scans from patients with CRS, found that 29% had sphenoid sinus involvement.

Until the early 1980s, an external approach, through a Lynch incision and ethmoidectomy, was the most widely used sphenoid approach. Operating microscope has enhanced exposure in internal approaches such as sublabial-transseptal, intranasal, or transantral approaches.[4,16] Messerklinger and Stammberger made a big leap in the modern treatment of CRS by applying rigid nasal endoscopes.[11,12]

Although there are a number of excellent reports detailing various individual approaches to the sphenoid sinus, there are a few studies that collectively analyze all these approaches and indications for each.[2,4,5,13,17-23] The surgeon must consider several factors in the decision making process, including preoperative diagnosis, associated nasal and paranasal sinus diseases, anatomic location of the disease process, availability of computer-assisted surgical devices, prior sinus surgery, collaboration with other surgeons, and comfort level provided by each technique.[4]

The preoperative diagnosis is made by history and physical examination with other complementary diagnostic procedures such as nasal endoscopy and CT.[4,5,7,9,11,12,15] Magnetic resonance imaging is not used routinely, but helps detect inflammatory pathological features and boundaries of the adjacent structures. In isolated sphenoid disease, history and physical examination contribute little to the correct diagnosis, which is mainly based on nasal endoscopy and

CT/MRI.[3,22,24,25] In our opinion, in the presence of an isolated sphenoid opacification on CT scans, MRI should be obtained to exclude vascular lesions. However, in such patients, surgical exploration may sometimes be necessary for the definitive diagnosis.

Endoscopic transnasal sphenoidotomy without ethmoidectomy was performed in five patients and it was seen that it provided a very good access to the sphenoid sinus. This approach is ideal for patients with isolated sphenoid sinus disease. However, there are several drawbacks. This approach provides very little room for endoscopic maneuvers even in the most patent nasal cavity. Moreover, this approach also limits lateral dissection within the sphenoid sinus. Therefore, it may not be a good option, if the disease process extends to the far laterally in the sinus, or the sinus is pneumatized laterally into the greater wing of the sphenoid.[4] However, for selected patients with isolated ISSD and suitable anatomy, ETNS without ethmoidectomy provides the most direct and least invasive route to the sphenoid sinus.[3,4,19]

On the other hand, ETNS with ethmoidectomy is the other option and the most common route to the sphenoid sinus. In our study, it was performed in 37 patients. Concurrent disease in the other paranasal sinuses, especially the ethmoid sinuses is the primary indication for this procedure. Increased intraoperative flexibility and maneuverability are the other advantages of this approach. All anatomic structures, from the nasal septum to the lateral nasal wall and skull base, are accessible. All in all, ETNS with ethmoidectomy provides flexibility and wide exposure necessary for safe and comfortable surgery.[4,11,12]

Any ostiomeatal anatomic variation, such as septal deviation or middle concha bullosa, may reduce the surgeon's exposure. With both surgical routes, a supplementary procedure (septoplasty, turbinate resection) may be required for adequate exposure.

Our objective was to evaluate ETNS with or without ethmoidectomy in patients with ISSD. Based on our experience, in the presence of associated other paranasal sinus diseases, especially ethmoid disease, ETNS with ethmoidectomy is the best approach. In this route, an important point we emphasize is that the entrance to sphenoid sinus should be in communication with the natural ostium. If the ostium is not opened, persistent disease may remain in the sinus. Additionally, if a non-contiguous entrance is present, recirculation of mucus may occur. If there is isolated sphenoid disease, ETNS without ethmoidectomy is a favorable technique, preventing unnecessary dissection of ethmoid sinuses. However, some patients have lateral sphenoid disease to which access can be difficult by ETNS without ethmoidectomy. In such patients ETNS with ethmoidectomy should be preferred because of better exposure. Of our patients with isolated sphenoid disease, none had lateral sphenoid disease. Moreover, in our opinion, ETNS with ethmoidectomy should also be preferred in revision surgery to prevent serious complications.

In conclusion, several endoscopic transnasal approaches can be successfully employed for sphenoid pathology. Especially the anatomic location of the pathologic process and associated intranasal conditions must be considered in making a preoperative decision. In patients with isolated ISSD, the direct approach to the sphenoid sinus by ETNS without etmoidectomy is a favorable technique, whereas ETNS with etmoidectomy is necessary for patients with concurrent disease in other paranasal sinuses.

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