"OVIDIUS" UNIVERSITY CONSTANȚA

DOCTORAL SCHOOL OF MEDICINE

DOCTORAL FIELD MEDICINE

ENDOSCOPIC SPHENOIDOTOMY - ANATOMO-CLINICAL AND IMAGISTIC STUDY REGARDING SURGICAL TECHNICS AND TEHNOLOGIES

-PhD thesis abstract-

Scientific coordinator
Prof. Univ. Dr. Comșa Gheorghe Ionel

PhD Student
Lupașcu Mihai Victor

Constanța, 2014

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Key words: endoscopic sinus surgery, sphenoid sinus, surgical approaches

I. Introduction

It was O.E. Van Alyea that said “the sphenoid sinus is the most neglected of all the sinuses”, Levine in 1978 completing the affirmation by adding that “the sinus is neglected by disease because of its placement, neglected by the clinician because of the subtle symptomatology and by the surgeon because of its inaccessibility”.

The current thesis proposes a study on the endoscopic interventions on the sphenoid sinus, both therapeutically and as a tactical step in transsphenoidal surgery.

The aims of the study are:

- An update an centralisation of the scientific data in literature regarding this type of intervention
- A review of the modern technologies, many of them indispensable, and evaluating the indication of usage reported to the type pathology encountered in sphenoidal surgery
- An anatomo- clinical and imagistic study that would indicate the preference for certain approaches to address anatomical obstacles and various encountered pathology
- Reporting our7 year experience to the international tendencies, regarding surgical indications, extension of interventions, intra and postoperative complications
- Opening new paths of scientific study by completing and developing the studies in the current thesis, through collaboration with other surgical fields, especially neurosurgery.

The clinical trials have been conducted, courtesy Prof. Dr. Viorel Zainea and Prof. Gheorghe I. Comșa, on 2 groups of patients diagnosed and surgically treated during 2007-2009 in the retrospective study, and between 2010 -2013, for the prospective study, the study group being comprised of patients with pathologies involving the sphenoid sinus, hospitalized in ENT clinic Constanta County Hospital and the IFACF-ORL "Dr. D. Hociota "- Bucharest.

II. Data regarding sphenoid sinus anatomy and physiology

The sphenoid sinus is the only one sinus that does not have primary fetal pneumatisation, in the fourth fetal month it appears as a posterior recess, after words stagnating in evolution, in fact, it is the only paranasal sinus not to develop from the lateral wall of the nose.

Sizes vary according to age, which should be considered in paediatric surgery. Depending on secondary pneumatisation of the sinus and development of the other sinuses, there are many variations of form and extension of pneumatisation to the sphenoid large and small wings pterygoidian processes, clinoid processes , palatine bone and the ethmoid perpendicular blade. A marked asymmetry between the right and left sphenoid sinuses is very common, symmetrical development being exceptional.

The sphenoid is an unpaired bone that is located in the centre of the skull base. It has been compared to a butterfly or a wasp in flight, and similar to this, the sphenoid bone has a body and three pairs of extensions: the small wings, the large wings, the pterygoidian processes. The sphenoid sinuses open up into the nasal cavity in the spheno-ethmoidal recess by an ostium on each side of the sphenoid ridge.

This opening is on average 1.3 cm from the sinus floor, so that leakage of endosinusal secretions is not gravitational, but through movement of mucociliary carpet. Sphenoid sinuses respond Sella Turcica upwards and the pituitary gland, downwards the nasopharynx and anteriorly to the nasal cavity, posteriorly to the basilar portion of the occipital and laterally to cavernous sinus and the structures that that pass through these sinuses, the internal carotid artery, the oculomotor nerve, the ophthalmic nerve, trochlear nerve, abducent nerve, maxillary nerve, and optic nerve. From these reports it is well understood the lethal potential of any pathology that extends beyond the walls of the sinus.

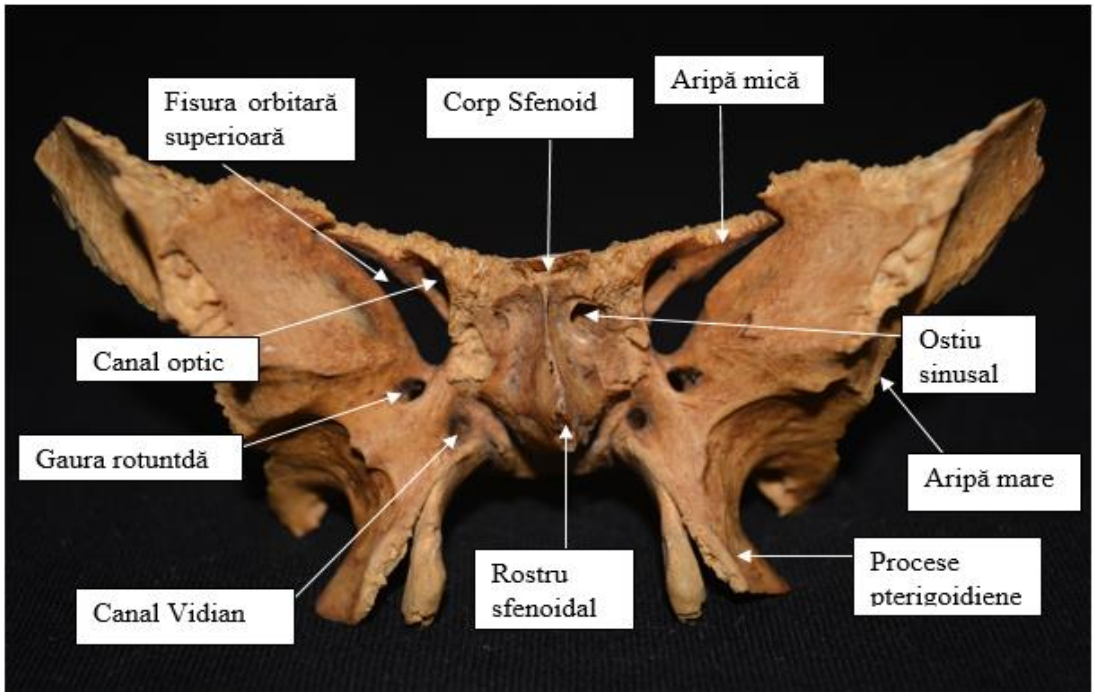


Figure 1 The sphenoid, anterior view

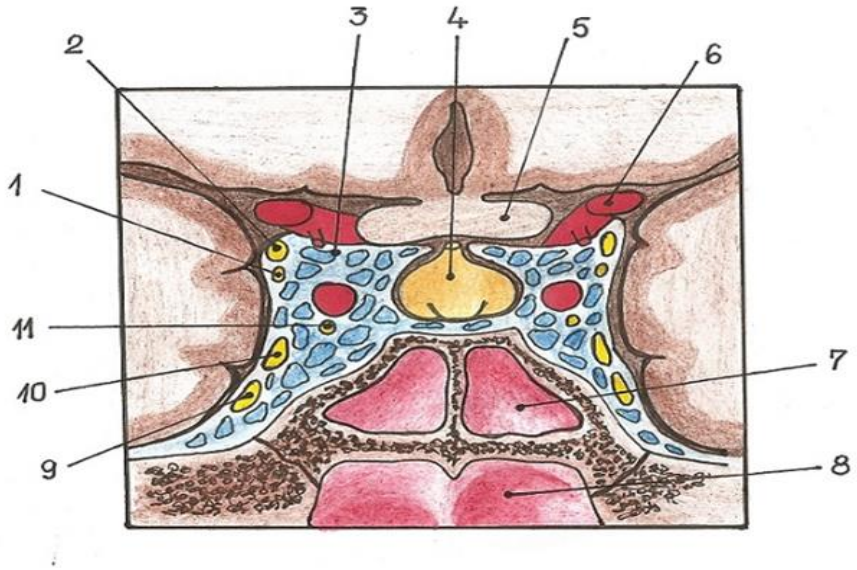


Figure 2 Relations of the sphenoid sinus with cavernous sinus structures: 1 - trochlear n 2 - oculomotor n. 3 - cavernous sinus, 4 - pituitary gland, 5 - optic chiasm 6 - the internal carotid artery, 7 - sphenoid sinus, 8 - nasopharynx, 9 – maxillary n, 10 - ophthalmic n 11 - abducent n

Anatomo-clinical and imagistic study regarding surgical technics and technologies in endoscopic sphenoidotomy

III.1. Objectives of the study

- Trying to standardize and equalize indications modern surgery, endoscopic , according to principal and associated rhinological pathology
- Updating surgical knowledge, technical and technological developments relevant to the sphenoid and transsphenoidal surgery, this area of nasosinusal surgery and skull base being closely related to technological developments .
- To establish an optimal surgical indication for each type of pathology in the sphenoid part, taking into account individual anatomical variations, by anatomical correlation of endoscopic and imaging
- Analysis and critical evaluation of endoscopic techniques and open procedures on the sphenoid sinus pathology, in the light of current information on sphenoidsurgery, taking into account data from the literature and from the experience of the clinic.
- Reporting our casuistry past 7 years to international trends regarding surgical indications , extension of interventions , intra-and postoperative complications

III.2. Material and methods

We conducted three studies:

- an imagistic study in which we assessed 200 computed tomography examinations performed in the Imaging Services Medimar for various diseases both neurosurgical and rhinosinusal. In this study we sought anatomical variability and sphenoid sinus pneumatisation types and identifying areas of surgical "high risk" surrounding sphenoid.
- Two clinical trials, one retrospective in the period of 2007 - 2009 and a prospective study in 2010-2013 , the study group was comprised of patients with diseases affecting the sphenoid sinus, hospitalized in ENT clinic Constanta County Hospital and the IFACF - ORL " Dr. D. Hociota "- Bucharest. The first group was composed of 522 patients who underwent surgery that involved the sphenoid sinus and approach between 01.01.2007-31.12.2009. The second group was composed of 1175 patients who underwent surgery during the period 01.01.2010 - 06.07.2013 upon the sphenoid. All patients were diagnosed by clinical examination corroborated with flexible or rigid rod endoscopy and computed tomography or MRI that comprised at least one ill sphenoid sinus and were treated endoscopically or by combined approach.

The method of achieving the clinical studies was the clinical statistical analysis of cases with sphenoid disease, which required surgery, during studied period of time. The study was both retrospective and prospective, based on case observation.

Databases were provided by primary registers (admission sheet, operative protocols consultation records). The main criterion for inclusion in the study was to confirm radiographic (tomography or MRI) of the existence of damage sphenoid.

By analysing and comparing these three studies, we focused on the evolution sphenoid disease incidence, establishing more precise indications and limits, accidents, incidents and complications of each surgical technique practiced, both endoscopic,open or combined.

III.3. Imagistic study on the anatomical variations and types of pneumatisation of the sphenoid sinus. Comparative aspects

Of the 400 measured 138 sinuses (69 %) were type sellar , 56 (28 %) presellar type and only 6 (3%) Conchal type. This type has been found mainly in connection with excessive development, way above average of the controlateral sinus (4 of 6 cases). Their prevalence varies within quite a wide range, so as sellar type is found in 53-89 % of cases, presellar type in 10-38 % and concal in 0-9 %. The conchal type of pneumatisation is even nowadays a major contraindication in transsphenoidal interventions, especially in the absence of a microdrill and a neuronavigation of the skull.

Average dimensions were 24/20 , 5/18 mm (depth / height / width) 23.4 / 22.1 / 19.2 mm in males , 24.5 / 18.6 / 17.1 mm in women , the left sphenoid sinus having a volume on average about 14 % higher than the right one. This leads to constraints in endoscopic sphenoid surgery and transsphenoidal surgery due to the limitation of the surgical field and can lead to a number of complications higher than that suffered by males. Consider also that there are variations in size anteroposteriorly and laterally, depending on the height at which we stand against the inferior sinus wall.

In 33% of cases we encountered pneumatised pterygoidian processes, in 10 % of cases the anterior clinoid processes were pneumatised forming deep interoptico - carotic recesses and 8% of cases found in the lateral extensions of pneumatisation in the sphenoid wings. In 18 % we found Onodi sphenoethmoidal cells, when they existed, the sphenoid sinuses were below average in size.

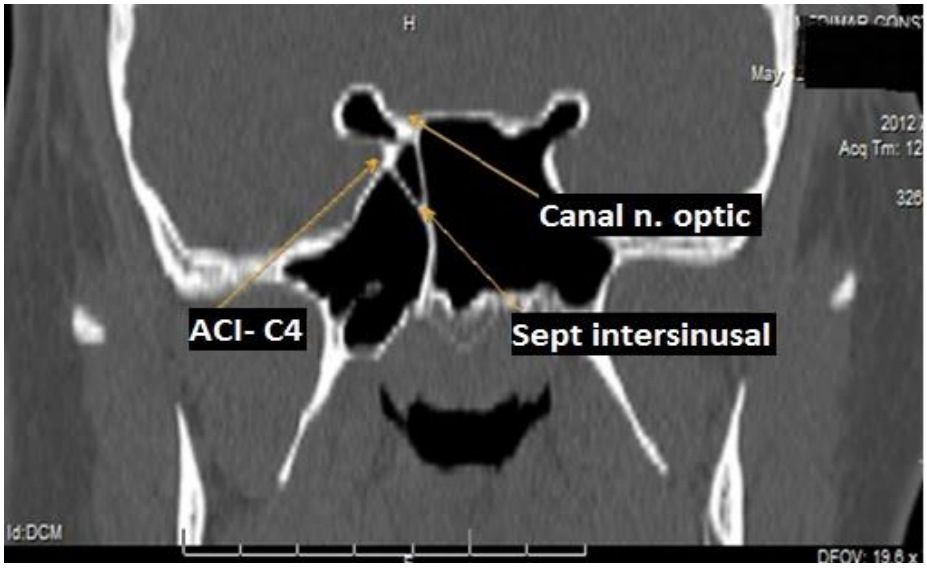


Figure 3 Sphenoid sinus with anterior clinoid and pterygoid pneumatisation and secondary septa on the optic canal and internal carotid

The internal carotid artery gave intrasinusal impression of the C3segment 55% and of the C4 segment in 57% of the cases, 2% of patients presenting dehiscent parts. The optic nerve gave impressions in 65% of cases presenting within its channel dehiscences in 5% of cases. In 16% of cases we encountered protrusion of the vidian canal and foramen rotundum in7%.

Incidence of protrusions and dehiscences of neurovascular structures

	ICA	ICA dehiscence	ON	ON dehiscence	Vidian canal	Maxilary nerve
Lupașcu	68.3%	2%	65%	5%	16%	7%
Elwany et al.	18.2%	4.8%	29%	0%	7.5%	12.9%
Heskova et al.	-	-	3.,3%	11.7%	-	-
Kazkayasi et al.	5.2%	1.5%	4.1%	0.7%	36.7%	14.2%
Araújo Filho et al.	48.8%	32.1%	36.9%	9.1%	45.4%	49.8%
Unal et al.	26.5%	4.7%	27.3%	7%	31.1%	26.5%
Fujii et al.	98%	8%	94%	4%	-	-

Tabel 1

The prevalence of impressions of the internal carotid and optic nerve is far superior the studies of Elwany et al. (18.2% and 29%), Kazkayasi et al. (5.2% and 4.1%) and Unal et al. (26.5% and 27.3%), close to Araújo Filho et al. (48.8% and 36.9%), but significantly lower than Fuji et al. who finds intrasinusal impressions of the internal carotid and optic nerve in most of the evaluated specimens.

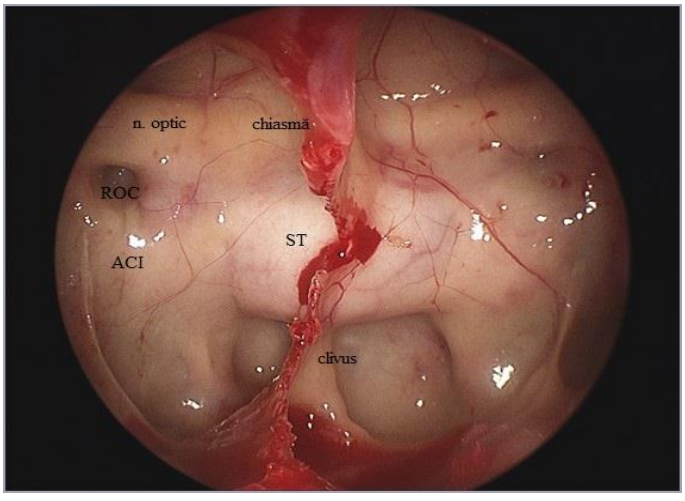


Figure 4 Intrasinusal endoscopic view after partial removal of the intersinusal septum. Visible protrusions of the optic nerve, the sellar and clival portion of the internal carotid (ICA), sela turcica (ST) Optical-carotid recess (ROC).

The frequency of ntrasinusal dehiscence of the internal carotid and optic nerve is similar to that found in most published studies .

We found intrasinusal secondary septa in 47 % of scans analysed , sometimes leading to tricameral sinuses, the sphenoid septum in 32 % ofcases had either primary or secondary septa with insertion on optic nerve canal or the internal carotid artery.

Distance from anterior nasal spine to the sphenoid sinus ostium (S -OS) varied between 58 and 84 mm , with a mean of 71.9 mm , an angle of attack from the floor of the nasal passages that varied between 23 ° and 41 °, with a mean angle of 31.2 °. There were intersex variations in women , the distance from the anterior nasal spine sphenoid sinus ostium is , on average, 69.1 mm , compared to men , 73.9 mm , and the angle of the women and 32.1 versus 30 6 and in men. The results are consistent with the literature, there is a notable difference in men and women, the distance S -OS, measured on bone in women with an average of 6% lower than those in men. There are authors who report much lower distances and angles of approach higher in Asian populations, variability to be known for the surgical safety of these patients.

III.4.Comparative analysis of the studies. General discussion

The two trials amounted a total of 1697 patients who underwent surgery involving the sphenoid sinus, of a total number of 6167 patients who underwent endoscopic nasosinusal interventions in period of 01.01.2007-07.06.2013 in IFACF-ORL "Dr. D. Hociota "Bucharest.

The number of interventions increased annually from 117 in 2007 to 364 interventions in 2012.

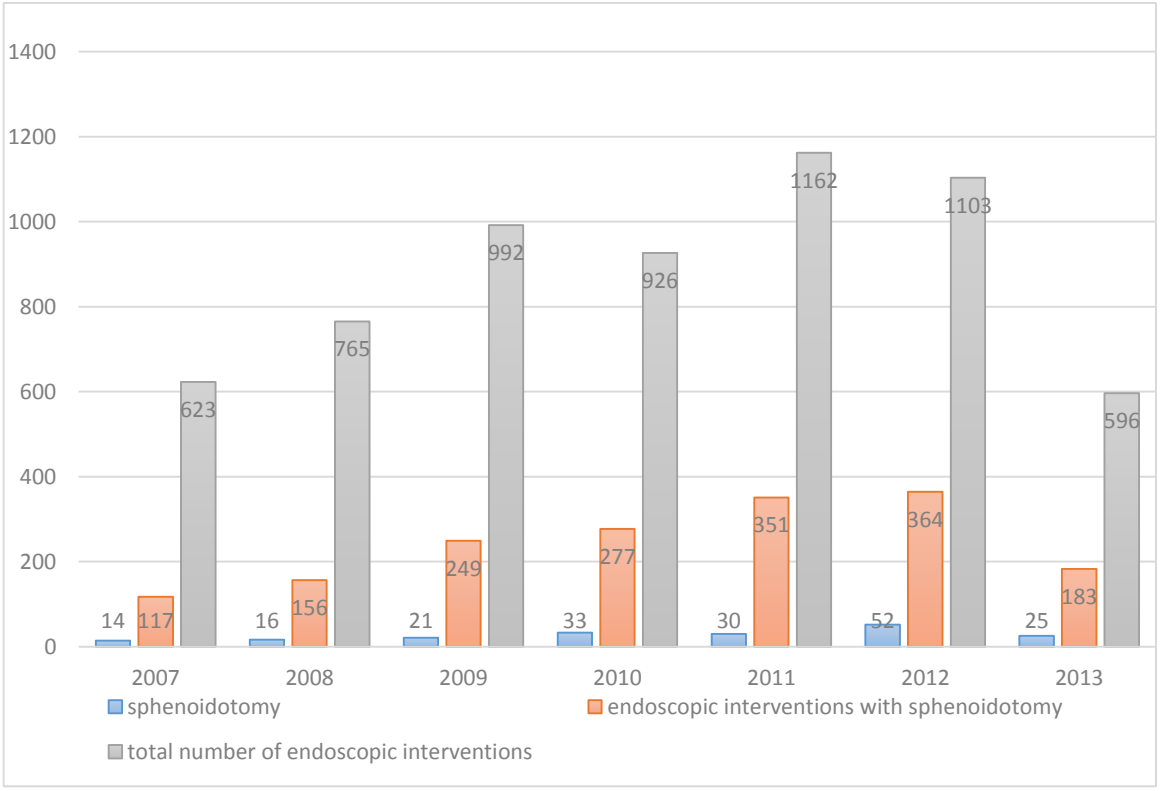


Figure 5 Distribution by years of solitary endoscopic sphenoidotomy interventions compared to the total number of extensive rhinosinusal endoscopic interventions

The number of endoscopic interventions that aimed mainly sphenoid pathology has also increased from 14 interventions in 2007 to 52 interventions in 2012 , 2013, data on more than

half a year showing a higher number of interventions than in the retrospective study evaluated (2009 , 20110 , 2011) .

If in the retrospective study sphenoid pathology is 2 times more common in females (F : B = 34:17) in the prospective study there is almost equal gender distribution (F : B = 71 : B 69) global women in much more sphenoid commonly affected almost a quarter of the cases more than men in the study (F : B = 1,22:1) . This difference is even more significant if we consider that general surgical pathology rhinosinusal affected mostly men in the study period. (F : B = 1:1,41)

Percentage interventions sphenoid disease suffered mainly minor variations in the years of the study, representing 3.1 % of all endoscopic rhinosinusal interventions. This incidence is similar to those in the literature.

The average age of patients presenting predominantly sphenoid pathology was lower than the average age of the general pathologies both retrospective study, 41.9 years versus 43.9 years , and in the prospective study , 43.3 years to 45.3 years , and overall , was 42.6 years versus 44.6 years .

Sphenoid most frequent pathology was the sphenoid sinusitis, it represents 71 % of surgical pathology sphenoid, most cases are chronic sinusitis and sphenoid mucocele, of sphenoid sinusitis 135 cases, 113 had unilateral involvement and only 22 showed bilateral involvement of the sphenoid sinus. In cases of unilateral sinus affection there is almost perfect equality between the parties, 56 patients affected with left sphenoid sinus and 57 patients on the right. In these cases separately as well, women were most affected, accounting for 56 % of patients with sphenoid sinusitis.

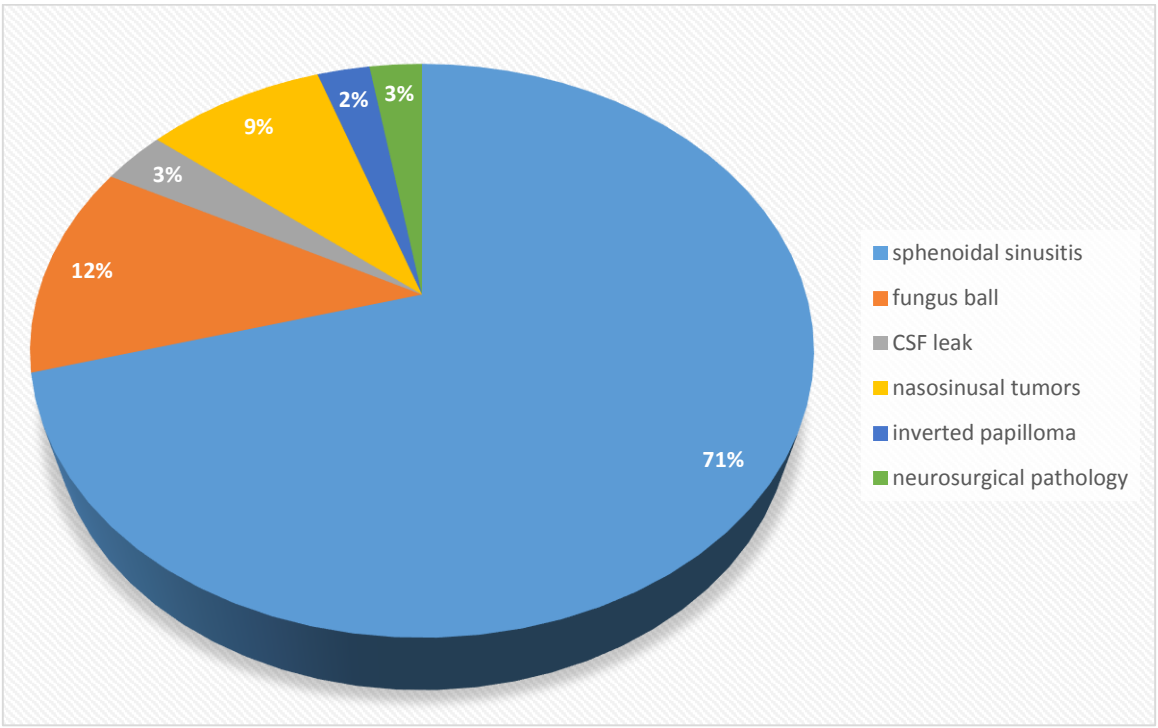


Figure 6 Prevalence of surgical sphenoidal pathology in total

Fungus balls were 12% of the cases with sphenoid disease, surgery in all 23 cases being unilateral, with a slight predominance of the right side (13:10) , the same report was found between men and women, 13:10 in favour of women.

Nasosinusal tumours represented 11.5 % of cases (9% without taking into account inverted papillomas) in more than one third of cases, surgery was limited to targeted biopsy and tumor debulking. There have been five cases of inverted papilloma originating in the sphenoid or sfenoetmoidal recess, all affecting unilateral, one of the cases relapsed during the study and had to undergo a reintervention. I followed this type of tumour separately due to the extremely low incidence of such locales encountered in practice and communicated in the literature.

Of the 6 cases of cerebrospinal fluid fistula localized sphenoid four patients were female, 2 male patients in these two cases are idiopathic fistula, 2 have been complications of interventions of conventional polypectomy performed in other surgical services , one case was published late posttraumatic fistula and 1 case of persistent breach after neurosurgical intervention for pituitary adenoma . Dural gaps were covered by the "underlay" technique in several layers, with Duraseal , pieces of vomer , Hadad posterior septal flap type and Tissucol. A single case of idiopathic gap probably due to a remnant of the Stenvert duct, relapsed and required reintervention at 4 months postoperatively, initial intervention aimed sphenoid sinus obturation respectively.

In the prospective study have also entered neurosurgical pathologies since 2012 , in collaboration with neurosurgery, approaching neurosurgical pathologies through the posterior transseptal approach, exclusively endoscopic mono or binarinar. Of the 5 cases neurosurgical 2 were pituitary adenomas, one microadenoma pituitary ACTH hypersecretion 1 relapsed Craniopharyngiomas and 1 case of sphenoid tumour with extension to the middle cerebral fossa. Patients were mostly male (M : F = 4:1) , all interventions were performed with removal of posterior transseptal sphenoid ridge and intrasfenoidal septa .

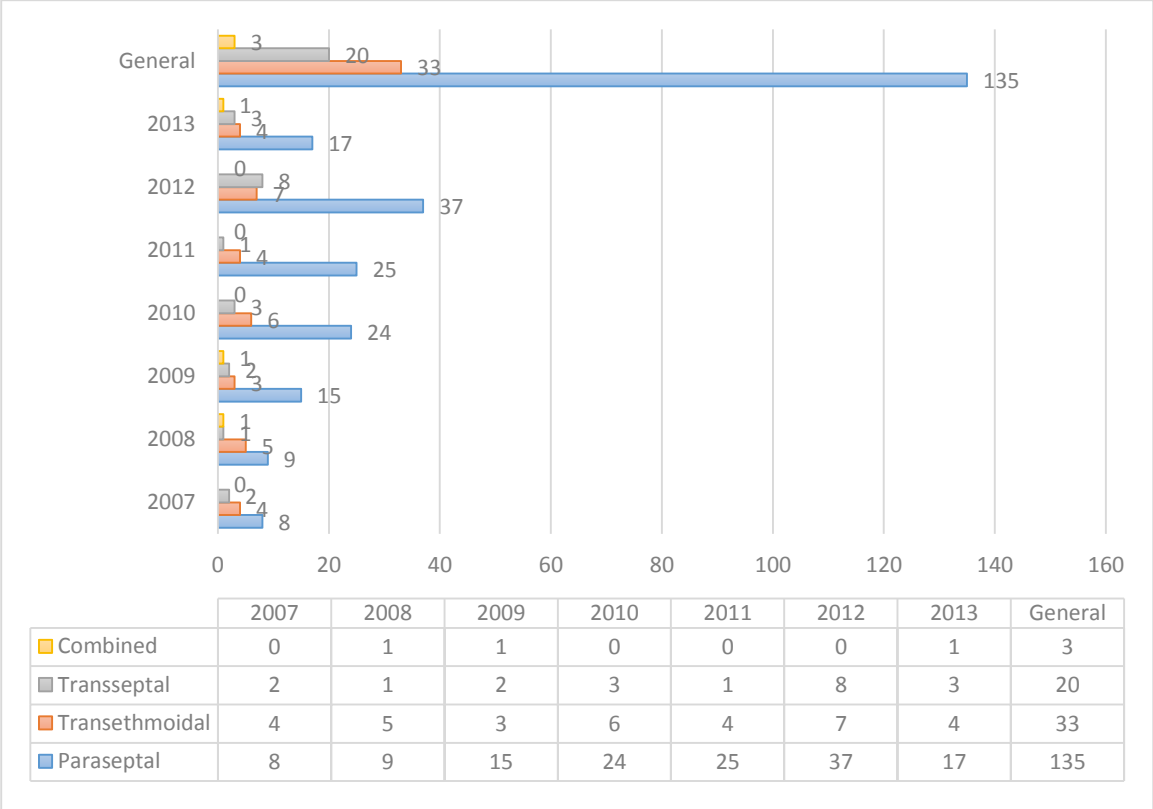
Through this collaboration and by using the endoscopic technique we managed to minimize postoperative complications of endoscopic nasal specific neurosurgical interventions classical microscopic.

The most widely used approach has been the paraseptal, which is used in 70.7 % of the sphenoid interventions , followed by transethmoidal of 17.3 %, and the transseptal in 10.5 % of cases. Approach combined endoscopic and external way by lateral rinotomy was used in only three cases of nasosinusal tumours with sphenoid starting point, opting for resection "en bloc“ of the tumour .

When sinus disease was present we used mainly endoscopic sphenoidotomy usually unilateral, both in individual study and overall unilateral approach is almost 6 times more frequently than bilateral sfenoidotomy that was practiced only in 14.1 % of cases of sphenoid localised disease. There was no statistically significant predilection in unilateral interventions for a certain part (dr : stg = 83:81) . These data are consistent with the predominant pathology encountered that was essentially unilateral in the sphenoid.

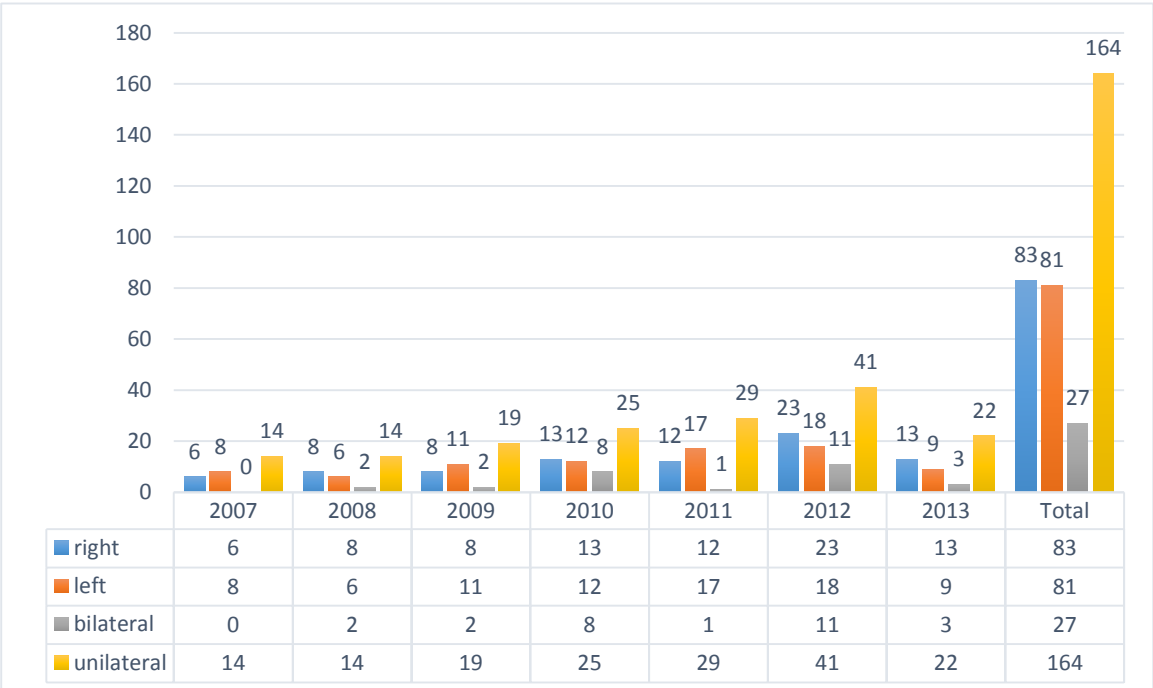
In the case of nasosinusal disorders involving the other paranasal sinuses, the sphenoidotomies were predominantly bilateral, at the level of each study and overall, this is the case in 1107 cases out of 1697 , representing 65.2 % of them , compared to 34 8% one-sided ,

but not even in this case can we say that there is a propensity for a certain part of unilateral disease , statistically significant . (51.6 % versus 48.4% left right)



	2007	2008	2009	2010	2011	2012	2013	General
Combined	0	1	1	0	0	0	1	3
Transseptal	2	1	2	3	1	8	3	20
Transethmoidal	4	5	3	6	4	7	4	33
Paraseptal	8	9	15	24	25	37	17	135

Figure 7 Approaches used in sphenoidal pathology



	2007	2008	2009	2010	2011	2012	2013	Total
right	6	8	8	13	12	23	13	83
left	8	6	11	12	17	18	9	81
bilateral	0	2	2	8	1	11	3	27
unilateral	14	14	19	25	29	41	22	164

Figure 8 Comparison between unilateral and bilateral affliction in strictly sphenoidal pathology

Polypoid chronic rhinosinusitis is a disorder that affects the lining rhinosinusal essentially bilateral, so the fact that a high percentage of patients had bilateral impairment is justified, given the large number of cases of polypoid chronic rhinosinusitis . There was an allergic underlining of the disease in many cases, of the 1287 patients with polypoid rhinosinusitis treated surgically 69 (5.3 %) were known at the time of admission with asthma and / or allergy to NSAIDs (Sdr. Widal) . The number of patients with Fernand Widal syndrome may be higher, but as shown by recent studies, bronchial allergic manifestations can be subtle, in about 40 % of cases, thus many patients remain undiagnosed.

Polypoid rhinosinusitis was the most frequent disease for which rhinosinusal sfenoidotomy practiced, both on each study, and the entire study, representing 76 % of all interventions involving the sphenoid sinus 1697. This is followed by purulent polisinusitis, here polisinusitis including fungal -allergic, representing 10% of sphenoid sinusitis cases and 8% of cases, this sinusitis including acute, chronic, and sphenoid mucocelele . The rest of the encountered pathologies have between 0 and 3 % of cases.

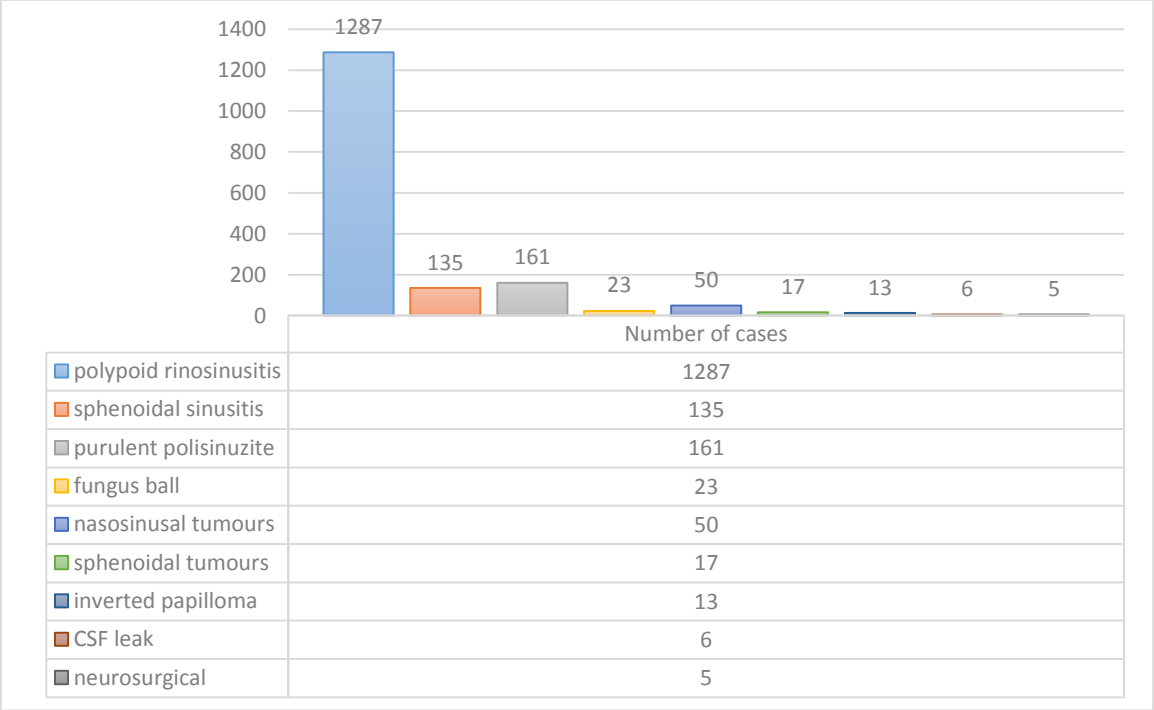


Figure 9 The total number of interventions for each type of pathology

In 313 interventions (18.44%) of 1697 that focused interventions and sphenoid sinus had to resort to resection of septal crests or repositioning of the nasal septum to create an optimal working corridor, concha bullossa being addressed surgically in 53 patients (3.11%) for the same reasons.

The percentage of interventions that required septal resection varied through the years of study from 7% in 2007 and 25% in 2010 and 2011.

In 34 cases it was necessary to partial resection of the superior nasal concha, its lateralization sinus ostium or non-disclosure which is involved in inflammation or showing polypoid degeneration.

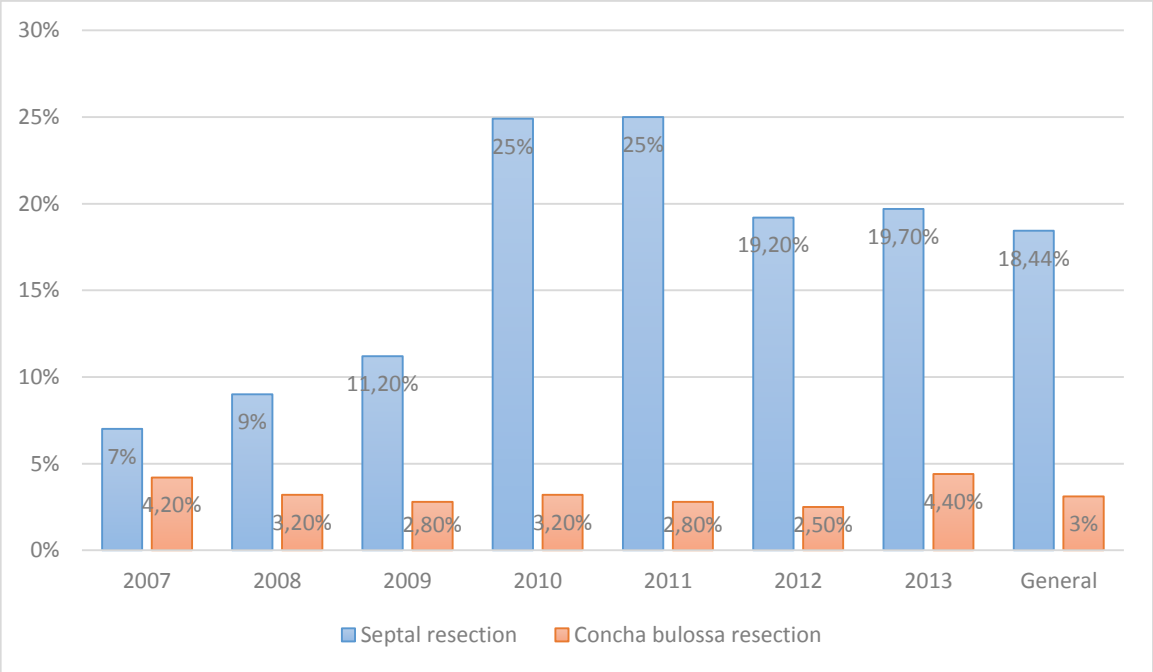


Figure 10 Incidence of Concha bulossa and septal resection through the study

Of the 191 patients presenting sphenoid pathologies only 13 (6.8%) presented major postoperative complications:

- 11 cases of postoperative bleeding that required no retamponare or cautery
- Orbital hematoma, compression of the optic nerve after transetmoidal approach that is surgically drained endoscopically without repercussions delayed visual
- CSF fistulae, following resection of a tumor invading the rinobază

Complication rate is average for rhinosinusal complications of endoscopic interventions reported worldwide by experienced rhinologysts such as May, Kennedy or Stammberger, complication rate after them, ranging from 1.2 to 16%.

III.5. Illustrative clinical cases

Case 1 - Fungic allergic sphenoiditis

Patient RG aged 44, is sent by the family doctor with old unilateral nasal obstruction, aggravated in the last two months, when the character appeared and headache with right hemicrania, the pain is constant and moderate intensity, and pressure sensation facial. The patient has no other associated diseases.

Clinical and endoscopic examination revealed polyps mass occupying the left nasal fossa almost for entirely with pus in small quantities. Ethmoid sinuses tomography shows that left șphfenoid sinus occupied by a heterogeneous mass with radiolucent zones lateronasal wall, suggesting a tumor.

We decided endoscopic intervention to be appropriate, biopsy and reducing visa to alleged tumors, but after removing polyps superficial masses, reaching philanthe secretion, greenish brown, with areas of condensation fungal, around which the mucosa is degenerate and bleed easily prejudice. Septa of the ethmoid cells are mostly destroyed by pathology.

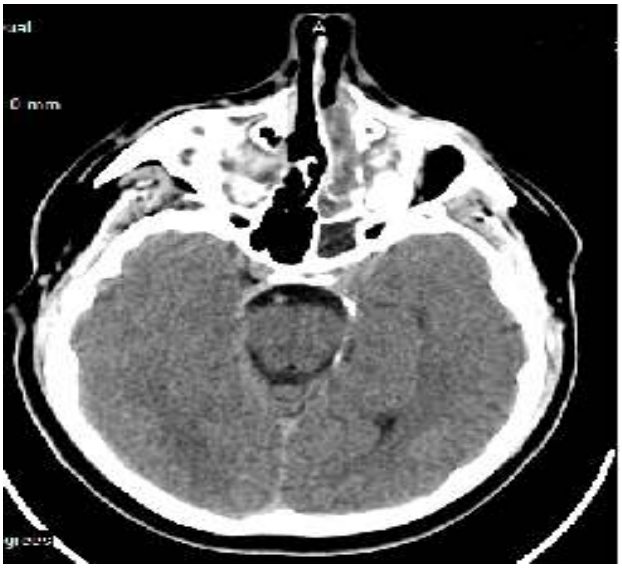


Figure 11 Fungic allergic sinusitis , ct aspect

Figure 12 Fungic allergic sinusitis endoscopic view

Sphenoid approach is transethmoidal with paraseptal check after ablation of nearby masses polyps, polypoid mucosa and mucus degenerate meliceric aspect that emerges weight of mucosa.

Intrasfenoidal deposits are heterogeneous and fungal degenerate mucosa, that are carefully ablate with the risk of breaches sidewall sinus bone.

Postoperative nasal fossa cleaned with packs with clotrimazole, the patient receives systemic antifungals for 3 weeks.

Pathological examination confirmed mucosal inflammatory degeneration excised and mycological examination reveals micelles genus Aspergillus.

Case 2 – Sphenoidal polyp

Patient I. M. 38 years old are hospitalized for persistent headache vertex debut three months ago, the patient following multiple systemic antibiotic treatments. In this period, with partial relief of symptoms. Patient has nasal obstruction and rhinorrhea.

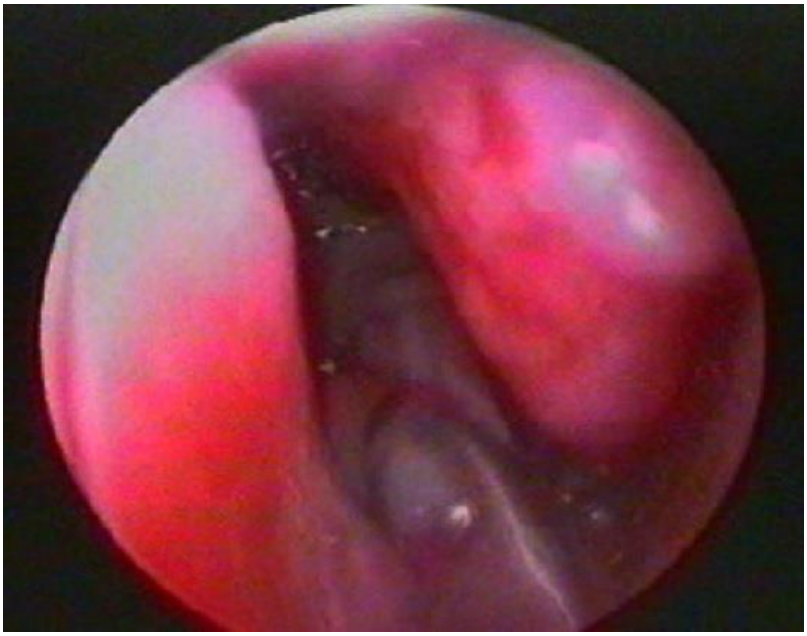


Figure 13 Sphenoidal polyp endoscopic view

ENT clinical examination reveals nothing, instead endoscopic examination revealed a polypoid mass degeneration in the right sphenoetmoidal recess and down to the choanal framework. CT scan confirmed the diagnosis of right sphenoid sinusitis, sinus ostium is blocked by thickened mucosa and polyps degenerate.

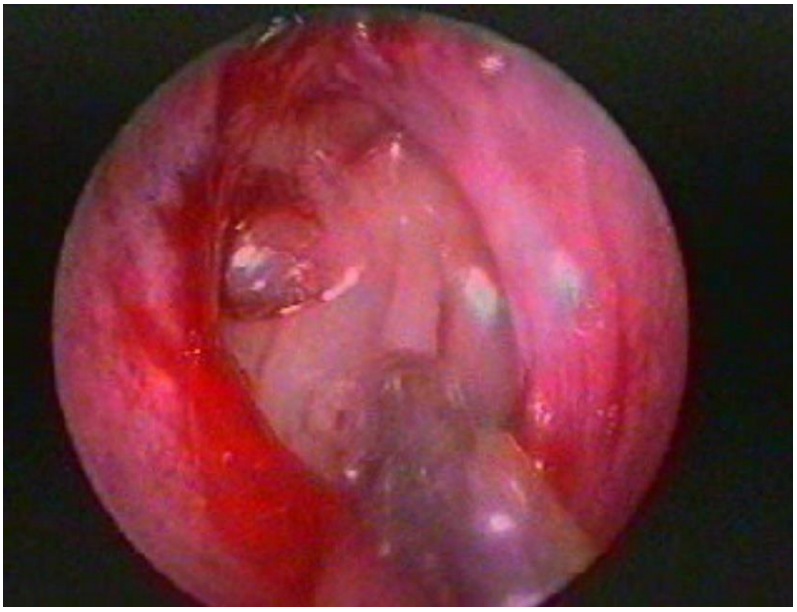


Figure 14 Intrasinusal aspect after removal of the polyp

Systemic antibiotic therapy, endoscopic approach paraseptal practice with cold instruments, after removal of polyp formation endoscopic sinus ostium obstruction, we

visualize philanthe pus, very thick, intrasinusal, without intrasinusal mucosal degeneration that aspiring and sent to the laboratory without have, however, a conclusive result on a pathogen.

Symptoms are improved immediately after surgery, the patient does not require pacjing and is released 3 days postoperatively.

Case 3 – Sphenoidal "fungus ball"

Patient aged 58 years, known with insulinodependant diabetes is presented for tightness in vertex when bending head, so, for more than six months, without any other complaints for otorhinolaryngology. Blood tests show mild eosinophilia, inflammatory samples positive.

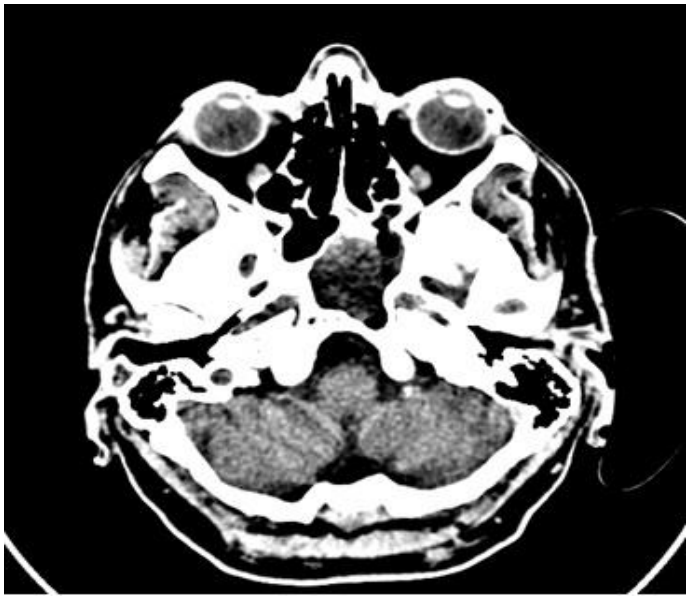


Figure 15 Ct shows typical aspect of Fungus ball

Figure 16 Intraoperative aspect

Sphenoid sinuses CT scan shows a disproportion in nasal septum showing deviation posteriorly occluding the natural ostium of the left sinus, which is occupied by a heterogeneous

mass with hiperdensity tone metal opacities in the middle of inhomogeneous alternating air leakage areas, is suggestive for a fungal infection.

Endoscopic surgery is, it is a tempting approach paraseptal endocopic but because septal obstruction is necessary to use a transethmoidal approach followed by resection of sphenoidal rostrum to create proper drainage of the sinus after removal of the "fungus ball" with qurettes and buttoned vacuum cleaners.

There are no complications postoperatively, after one year the patient is still symptom free.

Case 4 – Acute sphenoidal sinusitis.

Patient aged 38 years presented in the clinic for chronic retrobulbar headache , constant, low intensity, with insidious onset about three weeks ago , the pain following an acute nasopharyngitis. On examination and endoscopic not see congestion or stuffy nose , runny nose , or throat , sinus points are painless . The patient received treatment with anti-inflammatory drugs, broad spectrum antibiotics and nasal decongestants minimal effect or partial blend of pain. Blood tests do not show relevant changes.

CT scan reveals a left sphenoid sinus completely opacified with no apparent mechanical obstruction causes natural ostium, nasal septum deviation or growth without requiring intervention on it. No dehiscence view of neighbouring structures . Deciding appropriate endoscopic surgery through paraseptal approach, considered minimally invasive approach in this case the ethmoid sinus is not affected.

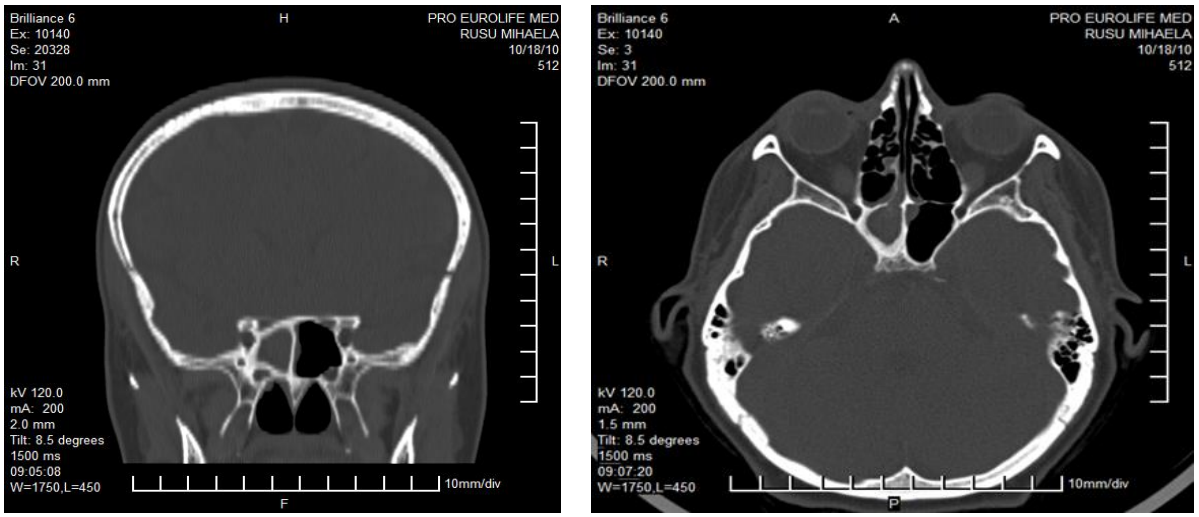


Figure 17 Ct aspect of the lesion

Intraoperative inspection with a 0 ºoptical rod it is observed an edematous, enlarged upper turbinate hiding the sphenoid sinus ostium on the right side. We decide its partial transection, following this procedure exteriorisation of muco-purulent discharge from the sinus.

The mucopiocele drains through cannulation and instilled saline sinus, the sinuses natural ostium is widened infero-medial to the sphenoid rostrum with a Stammberger "punch" with mushroom type bite, right after intrasinusal viewable aspect, it does not present degenerate mucosa.

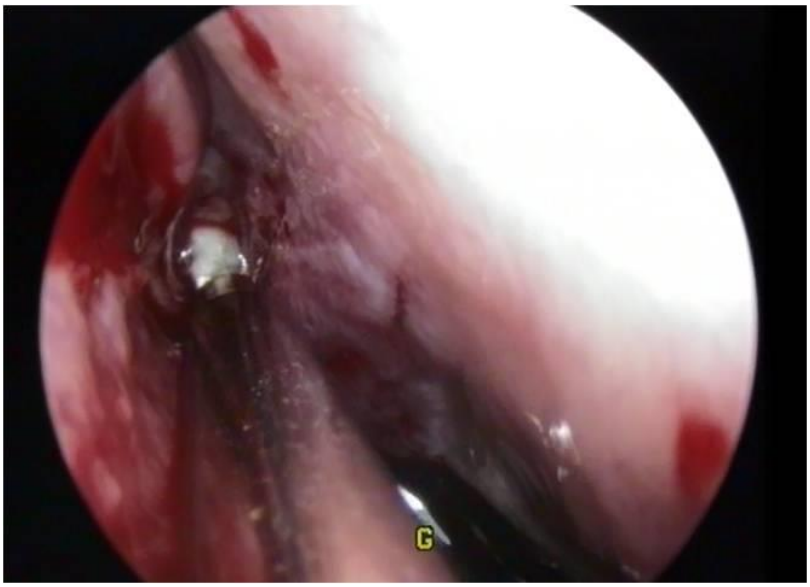


Figure 18 Drainage of the piocelle

Postoperative evolution is favourable, the patient undergoing treatment with anti-inflammatory steroids for topical local postoperative month. Control at 6 months showed a patent ostiu, easily visible by endoscopic examination.

Bacteriological examination indicates that the pathogen is sensitive to antibiotics commonly streptococcus pnaeumoniae.

IV.1. Conclusions

- Currently sphenoid sinus surgical pathology has predominantly an endocopic solution. Transnasal endoscopic interventions are also having more and more followers and among neurosurgeons .
- The modern surgeon must be familiar with and master the modern investigative techniques and technologies and surgical treatment , without forgetting , however, classical techniques , tumour pathology and intraoperative complications sometimes forcing the surgeon to turn to the latter or to use in combination with endoscopic techniques for a better view and a top resectional accuracy .
- Learning minimally invasive endoscopic techniques work involves on one hand supported training and a good grasp of modern technology arena by rhinology surgeon and an ongoing effort to continuously supply ENT departments and clinics in the country, with the ultimate goal of standardize the diagnosis and treatment of pathologies rhinosinusal .
- This paper has among the main goals updating technical knowledge and modern technological surgery while setting future research trends sphenoid and transsphenoidal surgery.
- To achieve the desire of modern minimal invasive surgery in-depth knowledge of both anatomy and anatomical variations is imperative, sphenoid sinus is one of the sinuses with the most anatomical variability.
- Imaging studies are imperative to define surgical risk areas , highlighting the increased risk of sinus small operator or parts intrasinusal procidence and dehiscence . Sphenoid

sinuses shows a remarkable variability in shape , size and position relative to their surrounding structures , preoperative knowledge of the relationship sphenoid sinus with these structures can make the difference between successful surgery and fatal complications .

- Surgical intervention on the paranasal sinuses in general , and sphenoid , particularly should not be done without a computer tomographic evaluation in advance, it should be analysed , in both the axial and coronal plane , both in terms of pathology and the elements high surgical risk who report sinuses. If nasosinusal tumours are present, completing investigations with MRI image analysis may be necessary, in three-dimensional preoperative simulations and it will minimise intraoperative risk leads, to the optimal choice of surgical approach for the given extension of pathology
- Preoperative imaging investigations should be systematically assessed, emphasizing each element surgical risk may be encountered intraoperatively and assessing possible degree of pneumatisation, protrusion of anatomical perisinusal structure, especially their wall dehiscence relatively rare in the population , but potentially fatal intraoperatively. Sphenoid sinuses shows a remarkable variability in shape , size and position relative to their surrounding structures , preoperative knowledge of the relationship sphenoid sinus with these structures can make the difference between successful surgery and fatal complications .
- A particular element of risk and intraoperative confusion is the presence up to a fifth of cases of Onodi sphenoetmoidal cells , the risk of optic nerve damage in the sphenoid transethmoidal approach in their presence is greatly increased.
- We believe that this study provides a better view of the preoperative evaluation and planning interventions to minimize risks should be assessed preoperatively operators all the anatomical risk and optimal approach should be used according to individual anatomical variations for each patient.
- Intrasinusale multiple septa were found in about half of the cases studied, in a third of cases intersinusal septum primary or secondary septa were inserted on the optic nerve canal or the internal carotid, with the risk of intraoperative injury to these structures being formidable .
- There is a notable difference between the genders in the distance from the anterior nasal spine to the ostium of the sinus and the ostium angle to be taken into account, women having a greater angle and a shorter distance , an additional element of difficulty for women the smaller size of the sinus cavities, limiting the operative field . This aspect is especially important because, according to clinical studies revealed that females have a higher incidence of strictly sphenoid pathologies, contrary to general rhinosinusal incidence pathologies more common in men.
- Marked anatomical variability makes sphenoid sinus advantages of using navigation systems in intra- and retrosphenoidal surgery is becoming more evident , especially in tumor pathology and reinterventions, endoscopic landmarks are often destroyed.
- The number of endoscopic interventions performed annually has nearly doubled during the two trials and the number of interventions that involve the opening sphenoid increased three times , with improved technical facilities , but also gradually train more surgeons in endoscopic surgical techniques rhinosinusal . However, the percentage of intervention for diseases suffered slight variations sphenoid mainly at the level of learning , representing 3.1 % of the overall endoscopic interventions .

- In case of isolated sphenoid pathology approach of choice was the paraseptal in more than 70 % of cases, it has been used in most mucocele, sphenoid sinusitis and illustrating the concept of minimal invasiveness adopted by surgeons, transethmoidal approach was used 17 % of cases when the extension pathology dictate this way, and in exceptional cases where the anatomy did not allow direct approach to the sinus ostia.
- Transseptal approach was used more frequently in recent years of the study, with the development of cooperation with neurosurgical specialty, all neurosurgical interventions assuming resection of the posterior portion of the nasal septum and sphenoid ridge. In particular situations dictated by anatomical variations of this approach has been used in isolated sphenoid pathology.
- Combined surgical approaches aimed exclusively tumor pathology , it is used in cases where intervention had curative intent , with the possibility of resecting "en block" the tumour
- Most common rhinosinusal surgical pathology, in 76 % of cases were polypoid chronic rinosinusitis, this predominantly affecting both sphenoid sinuses , which makes it necessary to open both sphenoid sinuses. Purulent polisinusitis was second with common pathology in 10 % of cases, their impairment is predominantly unilateral . Polisinusitis had the most complications at presentation , presenting more intra -and postoperative complications was polyposis.
- Isolated sphenoid pathology was an overwhelming percentage unilateral with no statistically significant variations between the left and right sinus . Another aspect worth mentioning is the lower average age of patients with isolated sphenoid , to those with general rhinosinusal affection , mean age of 42.6 years and 44.6 years.
- To create a corridor optimal operator was needed in 18% of cases to resort to partial resection of the nasal septum or septal ridge in only 3% of cases requiring resection of concha bullosa and .
- The rate of postoperative complications was 6.8 %, which is average for complications of endoscopic rhinosinusal interventions, metadata studies giving complications rates ranging between 1.2 and 16 % .
- Among the advantages of endoscopic surgery include:
    - a minimal surgical trauma with minimal intra-and postoperative bleeding
    - a low frequency of intra and postoperative complications compared with conventional interventions or open interventions , especially at sphenoidal level
    - a decrease in perioperative morbidity and mortality , the latter being 0 in the personal study
    - increased economic efficiency by lowering hospital costs due to lower number of days of hospitalization and postoperative rapid healing
    - increasing quality of life by being able to act targeted , minimally invasive , without damaging adjacent free sturcturi

IV.2. Original features and personal contributions

The study gives an interesting perspective in the angle of data analysis by correlating clinical and anatomical imaging with modern surgical techniques and technologies . This modern perspective generates some original features and useful contributions in practice:

- the imagistic study brings morphometric data that can be used in the adequacy of endoscopic surgical treatment involving the sphenoid sinus

- Though the cost / efficiency is quite high, given the practical implementation of new technologies , it will be diluted due to increased efficiency of care by decreasing length of hospitalisation, precision surgical approach leads to a shorter operating time and faster postoperative recovery
- Through the study we identified and intraoperative use of materials of high quality materials, especially during reconstructive surgery and CSF fistulas bring a durable surgical outcome , reducing the number of surgical reinterventions
- We managed to provide improvements in diagnostic protocols by incorporating performance data imaging, rhinosinusal morphometric data and the newest surgical technologies
- We illustrate through case studies with relevant data surgical pathology and surgical action
- A review of endoscopic anatomy and imaging used in diagnosis and preoperative planning sphenoid endoscopic interventions, identifying and highlighting the elements of high surgical risk
- The study gives an updated information on the latest diagnostic and surgical technologies used in the management of sphenoid and transsphenoidal surgical pathology
- The thesis is abundant with modern data applied to the relevant case law of over 6,000 endoscopic rhinosinusal interventions made within seven years, of wich, almost 1,700 interventions (more than a quarter) with sphenoidal pathology
- The study allows options and makes recommendations for the practical use of technological devices applied to modern ethmoidosphenoidal and rhinologycal, surgery, microanalysis based on statistical parameters on a significant lot of surgical patients
- The data presented are consistent with the literature and modern technological trends in European surgical procedures

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