

ORIGINAL ARTICLE

Revision Endoscopic Sinonasal Surgery[☆]



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KEYWORDS

Endoscopic sinonasal surgery;
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Abstract

Introduction and objectives: Endoscopic sinonasal surgery is the procedure of choice in the treatment of chronic rhinosinusitis and sinonasal polyposis refractory to medical treatment, with high rates of success (76%–97.5%). However, 2.5%–24% of those patients will require revision surgery (RESS). In this study, we present the clinical, anatomical, radiological and histological features of patients receiving RESS in our centre during a 3-year period.

Methods: A retrospective review of clinical, anatomical, radiological and histopathological data of patients receiving revision endoscopic sinonasal surgery between 2012 and 2014 was carried out.

Results: From 299 surgery procedures performed, 27 (9%) were revision surgeries. The mean patient age was 46 years, with a male/female ratio of 1.4/1. The most frequent preoperative and postoperative diagnosis was chronic polypoid rhinosinusitis. The mean time since the previous surgery was 6.1 years, with 11.9 months of mean follow-up since that surgery. Stenotic antrostomy was found during revision in 81.5% of the patients and incomplete anterior ethmoidectomy and persistent uncinata process, in 59.3%. In radiology, 70.4% of patients had persistent anterior ethmoidal cells. Antrostomy or widening of antrostomy was performed in 96.3% of cases and anterior ethmoidectomy or completion of it was performed in 66.7%.

Conclusions: Polyps, stenotic antrostomy and incomplete ethmoidectomy were the most frequent causes of revision surgery, in concordance with the procedures performed. The patients had long periods of time without follow-up between surgeries. Further investigation is necessary to generate measures to reduce the number of revision surgeries.

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PALABRAS CLAVE

Cirugía endoscópica nasosinusal;
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Poliposis;
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Cirugía endoscópica nasosinusal de revisión**Resumen**

Introducción y objetivos: La cirugía endoscópica nasosinusal es el procedimiento de elección para tratar la rinosinusitis crónica y poliposis nasosinusal refractarias a tratamiento médico, con un alto porcentaje de éxito (76 a 97,5%). Sin embargo, de 2,5 a 24% de los pacientes requieren cirugía de revisión. En este estudio describimos las características clínicas, anatómicas, radiológicas e histológicas de pacientes sometidos a cirugía de revisión en nuestro centro, en un período de 3 años.

Métodos: Revisión retrospectiva de datos clínicos, anatómicos, radiológicos e histopatológicos de pacientes sometidos a revisión entre 2012 y 2014.

Resultados: De 299 procedimientos quirúrgicos realizados, 27 (9%) fueron de revisión. La edad promedio de los pacientes fue 46 años, con una relación hombre:mujer de 1,4:1. El diagnóstico preoperatorio y postoperatorio más frecuente fue rinosinusitis crónica poliposa. El tiempo promedio desde la cirugía previa fue de 6,1 años, con 11,9 meses de seguimiento promedio desde esa cirugía. Un 81,5% de los pacientes presentaba antrostomía estenótica durante la revisión, y un 59,3% etmoidectomía anterior incompleta y proceso unciforme persistente. El 70,4% de los pacientes tenía celdillas etmoidales anteriores persistentes en radiología. Se realizó en un 96,3% de los casos antrostomía o ampliación de esta, y en un 66,7% se realizó o se completó la etmoidectomía anterior.

Conclusiones: Las causas más frecuentes de revisión fueron los pólipos, antrostomía estenótica y etmoidectomía incompleta, concordante con los procedimientos realizados. Los pacientes tuvieron largos períodos sin seguimiento entre cirugías. Es necesario continuar la investigación para generar medidas que reduzcan el número de cirugías de revisión.

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Introduction

Endoscopic sinonasal surgery (ESS) is the procedure of choice in the treatment of chronic rhinosinusitis (CRS) and nasal polyposis (NP) refractory to medical treatment.¹ It is a safe and effective procedure for the treatment of these conditions, with a success rate ranging between 76% and 97.5%, which may drop to between 50% and 70% in the presence of NP,¹ among other factors.

The following factors have been reported to have an effect on the success rate of this procedure: spread of the disease and inflammation shown by CT scan, a medical history of previous ESS, with or without polypectomy, allergy, asthma (50% success in asthmatic patients vs 88% in non asthmatic patients), sensitivity to aspirin, cystic fibrosis, ciliary dyskinesia, presence of NP (commonly considered a predictor of poor results on ESS review) and depression.¹

Patients who do not respond sufficiently to ESS undergo one or more ESS revision surgeries (RESS), with or without a prior period of medical treatment. It has been reported in the literature that from 2.5% to 24% of patients will require some type of revision surgery.² It has been estimated that the average time between each ESS is 4.8 ± 3.6 years (range between 0.7 and 18.6 years), with the time being shorter in patients who are smokers (2.8 years in smokers vs 4.3 years in non smokers).³

Like all medical procedures RESS have well established indications, including: (1) incomplete previous surgery; (2) complications resulting from previous surgery; (3) recurrent or persistent sinus disease and (4) histological evidence

of neoplasia.⁴ The most common causes of RESS are those derived from the first three points mentioned above which are recurrent NP, synechiae in the middle meatus and stenosis or obstruction of the ostium of the maxillary and/or frontal sinus¹ (Figs. 1A, B and 2).

The possible causes of poor results from primary surgery have been studied through the sinonasal anatomy of patients who have undergone RESS. The 2011 study by Khalil et al.⁵ provided radiologic classification of patients who had undergone RESS. The results were as follows: residual frontal air cells (96%), posterior ethmoid air cells (96%) and persistent anterior air cells (92.1%), residual uncinat process (57.1%), significant septal deviation (15.9%) and middle lateral conchae (11.1% of the sides studied).

In 2004, Musy and Kountakis⁶ conducted a study in which they also studied the radiologic and intraoperative anatomy of this group of patients. Their findings were as follows: lateralised middle turbinate (78%), incomplete anterior ethmoidectomy (64%), healed frontal recess (50%), retained *aggr nasi* cells (49%), incomplete posterior ethmoidectomy (41%), stenosis of antrostomy of the middle meatus (39%), retained uncinat process (37%) and recurrent polyposis (37%). To a lesser extent, they also found persistent sphenoidal disease and stenosis of the sphenoidal ostium.

In the study referred to above⁶ the procedures carried out during the RESS were also analysed, with the following results: anterior ethmoidectomy (96%), frontal sinus surgery (95%), posterior ethmoidectomy (74%), antrostomy (68%), uncinectomy (53%), sphenoidotomy (52%) and turbinectomy (10%).

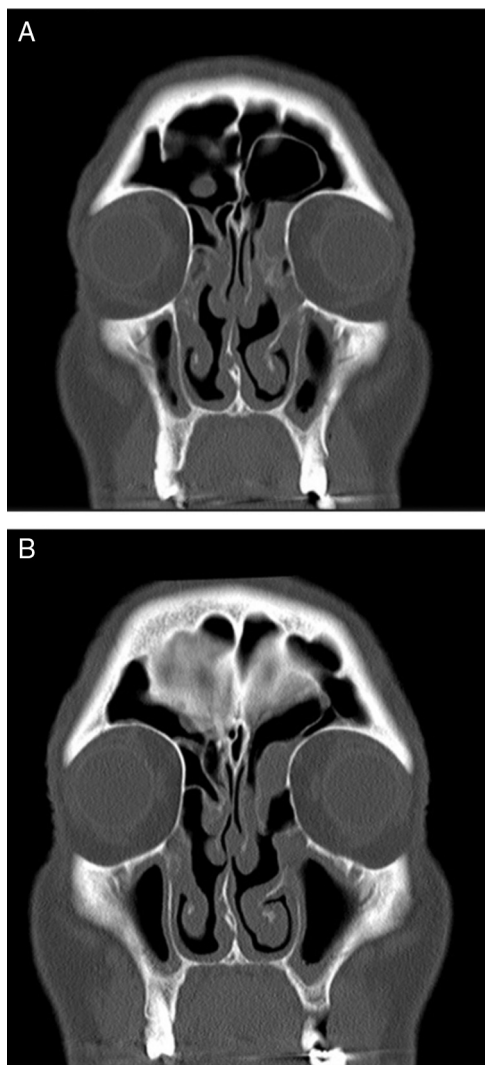


Figure 1 (A and B) CT scan of the nose and paranasal cavities. Coronal slices of the patient who underwent endoscopic sinonasal surgery 10 years previously. Remnants of uncinate apophysis and type III Kuhn frontal air cells may be observed.

This aim of this study is to analyse the clinical, anatomical, radiological and histological features of the group of patients who underwent RESS in our centre, and also analyse the procedures carried out during surgical intervention, during a three-year period.

Material and Methods

This retrospective descriptive study was performed by analysing the information of clinical files of patients who had undergone RESS during a three-year period, from between 1st January 2012 and 31st December 2014, in our centre.

Initially the whole database corresponding to patients who underwent ESS during this period was analysed, and as a result patients who underwent RESS were identified. Once the group of patients who had undergone RESS had been established, their data were clinically, anatomically, radiologically and histologically reviewed in accordance with the availability of said information for each patient. This

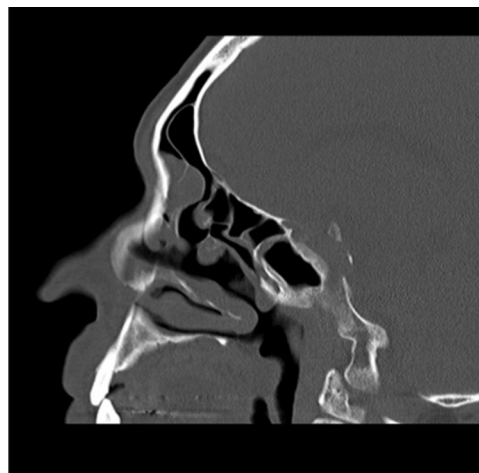


Figure 2 CT scan of the nose and paranasal cavities. Sagittal slice of patient who underwent endoscopic sinonasal surgery 10 years previously. Persistent type III Kuhn frontal air cells may be observed, with secondary inflammatory compromise. This was the indication for revision endoscopic sinonasal surgery.

information was obtained from analysis of pre-and-post-surgical medical care and the radiological findings from CR scans of paranasal cavities (both the radiological report, the description of the images by the ENT specialist treating the patient and the review of imaging by researchers). Intraoperative anatomical findings and procedures performed were also studied (by means of review of surgical protocols) and biopsies obtained previously or during surgery.

All data were put onto a table to facilitate their analysis and proceed to characterise this patient group. Due to its descriptive nature, it was not the aim of this study to characterise primary ESS patients, or compare both groups using statistical methods.

Results

Total Patients

During the period between 1st January 2012 and 31st December 2014 a total of 299 ESS were performed in our centre, 27 of which (9%) corresponded to RESS. The average age of the patients who underwent RESS was 45.89 years (range between 12 and 66 years). Distribution by gender of the patients shows a mild male predominance (male: female ratio of 1.4:1).

The most common preoperative diagnosis in these patients was polypoid CRS, followed by non polypoid CRS, inverted papilloma, mucous cyst, antrochoanal polyp and finally ototogenic sinusitis. Postoperative diagnoses by order of frequency of occurrence were as follows: polypoid CRS inverted papilloma, mucous cyst, non polypoid CRS, antrochoanal polyp and ototogenic sinusitis. [Table 1](#) contains pre and postoperative diagnoses obtained in this study and the data referred to in the literature.

Effective follow-up time after primary ESS was analysed (or the previous RESS if applicable), with this time being on average 11.9 months (range of between 3 and 23 months). The time interval between primary ESS (or prior RESS) and

Table 1 Pre and Post Operative Diagnoses in Decreasing Order of Frequency.

Preoperative diagnosis	Cases	Postoperative diagnosis	Cases
Chronic polypoid rhinosinusitis	15	Polypoid chronic rhinosinusitis	15
Non polypoid rhinosinusitis	5	Inverted papilloma	5
Mucous cyst	3	Mucous cyst	4
Inverted papilloma	2	Non polypoid chronic rhinosinusitis	3
Antrochoanal polyp	2	Antrochoanal polyp	2
Ototogenic sinusitis	1	Ototogenic	1

Table 2 Most Common Symptoms Presented in the Patients Analysed, in Decreasing Order of Frequency.

Symptoms	Cases
Nasal obstruction nasal	18
Rhinorrhea	9
Facial algia or cephalgia	5
Posterior discharge	5
Anosmia or hyposmia	4
Otalgia	1
Facial oedema	1
Cacosmia	1
Asymptomatic	1

RESS was on average 6.1 years (range of between 3 and 10 years).

The symptoms most frequently manifested by patients were nasal obstruction, followed by rhinorrhea and facial algia or cephalgia. Less common symptoms were otalgia, facial oedema, and cacosmia. The disease also presented asymptotically. The list of symptoms by order of frequency is found in [Table 2](#).

In 13 cases premedication for RESS was administered; of these cases, 6 were treated with systemic corticosteroids,

4 with oxymetazoline, 2 with montelukast and in one case amoxicillin/clavulanic acid were used. The other patients did not use previous medication or did not record its usage.

With regard to intraoperative anatomical events, the most commonly observed was stenotic antrostomy or that which required widening (81.5%), followed secondly by incomplete anterior ethmoidectomy and persistent uncinata process (both in 59.3% of cases). Incomplete anterior ethmoidectomy ranked third in frequency at 51.9%. The details from the intraoperative anatomical findings are contained in [Table 3](#), and compared with data from the literature.

From a radiological viewpoint, in the CT scan analysis of paranasal cavities, the most common findings corresponded to persistence of anterior (70.4%) and posterior (63%) ethmoid air cells. In the images the presence of persistent uncinata process was described in 8 patients (29.6%), whilst the lateralised middle turbinate was described in 4 patients (14.8%). It may be noted that there was no reported presence of Haller air cells. [Table 4](#) contains the radiological events described in patients who underwent RESS.

An antrostomy or widening of an antrostomy was performed in 26 of 27 patients during surgery, accounting for 96.3%. The second surgery most commonly performed

Table 3 Anatomical Events Described in the Surgical Protocols, in Decreasing Order of Frequency.

Anatomical events	Percentage		
	Present study	Khalil et al. ⁵	Musy and Kountakis ⁶
Stenotic antrostomy	81.5	–	39
Incomplete anterior ethmoidectomy	59.3	92.1	64
Persistent uncinata	59.3	57.1	37
Incomplete posterior ethmoidectomy	51.9	96	41
Polyposis	44.4	–	37
Compromised frontal recess	40.7	96	50
Others	33.3	–	–
Sphenoid compromise	25.9	–	–
Lateralised middle turbinate	22.2	11.1	78
Amputated middle turbinate	14.8	–	–
Inverted papilloma	11.1	–	–
Mucous cyst	7.4	–	–
Recirculation	3.7	–	–
Significant septal deviation	–	15.9	–
Retained <i>Agger nasi</i>	–	–	49

Note: The events described by Khalil et al. were compared as were those of Musy and Kountakis. The events not described or found are noted with a (–) sign.

Table 4 Radiological Findings Observed in CT Scan of Paranasal Cavities, in Decreasing Order of Frequency.

Radiological findings	Percentage	
	Cases	Percentage
Persistent anterior ethmoid sinuses	19	70.4
Persistent posterior ethmoid sinuses	17	63.0
Maxillary sinus compromise	14	51.9
Frontal recess residual air cells	11	40.7
Septal deviation	8	29.6
Persistent uncinata	8	29.6
Polyposis	8	29.6
Compromise of the sphenoid sinus	7	25.9
Occupation of the sinus cavity	6	22.2
Others	6	22.2
Compromise of the frontal sinus	5	18.5
Lateralised middle turbinate	4	14.8
Speno ethmoid recess compromise	3	11.1

was anterior ethmoidectomy in two thirds of the patients (66.7%). A polypectomy was performed in 59.3% of patients, and 51.9% of patients underwent procedures which involved frontal recess. An uncinectomy was performed during surgery in 13 patients (48.1%) and posterior ethmoidectomy was performed on 12 patients (44.4%). These findings are presented in Table 5 and compared to those in the literature.

Out of the total patients analysed in this study, 15 biopsies provided information regarding chronic, nonspecific inflammation, 9 of which corresponded to inflammatory polyps and 7 to inverted papilloma.

Breakdown by Diagnosis

The breakdown of patients according to their postoperative diagnosis into the groups of inverted papilloma (5 patients), polypoid CRS (15 patients) and non polypoid CRS (3 patients), was obtained from the following results: patients with inverted papilloma and polypoid CRS were similar in average age (48.4) and (48.8) and age range (29–66 years) and (27–66 years), respectively whilst patients with non polypoid CRS were younger (mean age of 38.3, range of

26–46 years). With regards to gender distribution, the first 2 groups were predominantly male (3:2 and 4:1 ratio respectively) and the third group was predominantly female (1:2 ratio). The range of effective time of control in patients with inverted papilloma was 3–11 months and that of polypoid CRS was 4–27 months. It was not possible to calculate the average of the 3 groups and the range of the non polypoid CRS patients due to the fact that not all of the patients' medical files contained these data. Time between surgery in the group of inverted papilloma was 52.2 months on average (range from 3 to 120 months), and it was not possible to calculate the mean in other groups for the reasons already stated (the range for polypoid CRS was from 8 to 240 months and for non polypoid CRS from 36 to 84 months).

The most common symptoms in patients with inverted papilloma was nasal obstruction and rhinorrhea (2 patients per condition), followed by rhinopathy and facial algia (one patient). Only one patient was symptom free. Furthermore, in the polypoid CRS group 11 patients suffered from nasal obstruction, 4 from rhinorrhea and posterior discharge, 2 from hyposmia and 1 each from facial oedema, nasal congestion, headaches and anosmia. No patients were asymptomatic. In the non polypoid CRS group the most frequently reported symptoms were nasal obstruction, hyposmia, rhinorrhea, facial algia, posterior discharge and cacosmia (all with a frequency of one patient in each).

Regarding premedication, only 2 patients with inverted papilloma received any medication (one patient was administered oxymetazoline and another betametasonone and moxifloxacin). However, premedication was more frequent in the polypoid CRS group (3 patients received prednisone, two received injectable Dacam Rapilento, one Iliadin and another Montelukast). In the non polypoid CRS group only one patient received premedication recorded on file (amoxicillin/clavunlanic acid). The main anatomical and radiological findings together with the surgeries performed in the 3 groups are shown in Table 6 by the frequency in which they were reported.

In the inverted papilloma group the pathological anatomy results confirmed the diagnosis in 3 patients. In the polypoid CRS patients the presence of polyps was described in 5 patients and they all presented with chronic inflammation.

Table 5 Procedures Performed Carried Out During Endoscopic Revision Surgery, in Decreasing Order of Frequency.

Procedure performed	Percentage	
	Present study	Musy and Kountakis ⁶
Antrostomy	96.3	68
Anterior ethmoidectomy	66.7	96
Polyps resection	59.3	–
Frontal sinustomy	51.9	95
Uncinectomy	48.1	53
Posterior ethmoidectomy	44.4	74
Shenoidotomy	29.6	52
Turbinectomy	22.2	10
Mucous cyst marsupialisation	11.1	–
Others	11.1	–

Note: They are compared with the results from Musy and Kountakis. The procedures not performed or not described are noted with a (–) sign.

Table 6 Main Findings Broken Down by Postoperative Diagnosis, by Frequency.

Main findings	Diagnosis		
	Inverted papilloma	Polypoid CRS	Non polypoid CRS
<i>Anatomical findings</i>			
Stenoid antrostomy	3	13	2
Incomplete anterior ethmoidectomy	2	12	1
Incomplete posterior ethmoidectomy	2	11	1
Persistent uncinata	2	13	1
Synechia	1	0	0
Mucous cyst	1	0	0
Changed frontal recess	0	9	1
Sphenoid disease	0	6	1
Lateralised middle turbinate	0	4	0
Amputated middle turbinate	0	2	0
Recirculation	0	0	1
<i>Radiological findings</i>			
Incomplete anterior ethmoidectomy	2	12	2
Incomplete posterior ethmoidectomy	1	12	2
Maxillary residual air cells	2	7	
Septal deviation	1	4	1
Lateralised middle turbinate	1	3	0
Persistent uncinata	1	6	0
Residual spheno-ethmoidal recess air cells	1	2	0
Frontal residual air cells	1	12	1
Sphenoid residual air cells	1	5	0
Obstructed sphenoid ostium	0	0	1
<i>Surgery performed</i>			
Antrostomy	5	14	3
Anterior ethmoidectomy	3	12	1
Posterior ethmoidectomy	2	9	1
Uncinectomy	2	11	0
Turbinectomy	2	2	0
Mucous cyst rupture	1	0	0
Frontal sinusotomy	0	11	1
Sphenoidotomy	0	6	1
Frontal mini-trephination	0	1	0

In the non polypoid CRS group chronic inflammation was described in all patients, with no other findings.

Discussion

In our centre a total of 299 ESS were performed, over a period of 3 years. Of these surgeries 27 corresponded to RESS, equivalent to 9%. This percentage of RESS is in keeping with that established in the literature.²

In our data we observed a substantial difference between effective control time after the primary ESS, compared with the average time to elapse between this surgery and RESS (11.9 months vs 6.1 years). On average, patients who underwent primary ESS withdrew from their medical check-ups before a year had passed since surgery and consulted again 6 years later for a condition that required resolution with new surgery.

The time elapsing between both operations in our series, on average is greater than that described in the literature,

but when comparing the range of this time, it is generally observed that it is earlier than the range of time recorded (3 months to 10 years in our series vs 0.7 to 18.6 years in the literature).³ It may be inferred from this that in our centre there was a tendency towards early revision surgery although further in-depth analysis of the various medical and non-medical variables which may have had some effect on this decision would need to be performed. It should be considered that we do not have data regarding the frequency of patients who were active smokers in our series, a factor which has an effect on the time elapsing between one operation and another, as these patients generally require earlier revision surgery.³

On comparing our data with those available in the literature reviewed for this study,^{5,6} we may observe greater frequency of maxillary compromise in our patients, which is reflected by a larger percentage of procedures carried out in the maxillary sinuses during surgery. By contrast, there are fewer procedures which involve the ethmoidal, sphenoidal and frontal sinuses. The frequency of persistent

uncinate process and uncinectomy observed is relatively similar to that described in the literature, but it should be taken into consideration that in our hospital uncinectomy is included within the concept of antrostomy which was the most commonly performed procedure, and the frequency of uncinectomy may therefore be underestimated in our series. There was a greater frequency of polyposis, inverted papilloma and mucous cyst than in the literature, together with their respective surgical procedures such as polypectomy and mucous cyst marsupialisation.

Notwithstanding, analysing the findings from radiological events it was observed that the changes in the maxillary sinus rank third in frequency, not first as was to be expected since it is the sinus most commonly compromised in surgical protocols. Ethmoidal compromise ranks first and second (anterior and posterior air cells respectively) despite the fact its frequency is even lower than that reported in the literature regarding the compromise observed during surgery.

With regard to the pre and post surgical diagnoses, polypoid rhinosinusitis corresponds to the primary diagnosis in both scenarios, with regards to frequency. It was observed that inverted papilloma was a less frequent diagnosis prior to surgery and increases in frequency after surgery, at the same time as non polypoid rhinosinusitis drops in frequency. By this we may infer that inverted papilloma is a pathology of difficult preoperative diagnosis. It is more frequently diagnosed on physical examination which may be interpreted as an increase in its diagnosis after surgical intervention. Furthermore, the incidence of inverted papilloma is even greater when the findings from differed biopsies are considered. In our series, only 2 patients were diagnosed with inverted papilloma prior to surgery, and this increased to 5 patients after surgery and to 7 patients when the histological report was available.

The differences between our series and the literature regarding anatomical findings and surgical procedures performed may possibly be explained by the number of patients analysed. Our series has a small number of patients who underwent RESS. There is therefore a need for studies with a larger patient sample, either multicentre to reduce the time necessary to accumulate a suitable sample size, or studies with a longer duration. Furthermore, this study is retrospective, with no established data recording protocol and no patient follow-up, thus minimising the reaching of conclusions from this study. Due to its descriptive nature, no formal statistical analysis was made to establish the meaning of the differences recorded compared with the literature, and it is therefore possible that several of the differences established in this study were not statistically significant.

It should also be emphasised that, as has been expressed above, the patient profile with diseases such as inverted papilloma and sinonasal polyposis is different to that of patients who only present with chronic sinusitis without polyps, i.e. the average age is older in the first 2 groups and very similar between them, whilst the patients without polyposis are younger patients and with less range of time elapsing between one operation and another. The lower upper limit is that of the first 2 groups, which may indicate earlier consultation or enquiry about the persistence of the disease in these patients compared with others, with the result that they develop fewer inflammatory changes at the time of secondary surgery. In future studies, we believe

it would be of interest to classify each group of patients and have a higher number of patients to better define these differences.

All of the above leads to the question of whether to pursue a more aggressive approach in primary surgery to reach those cavities most frequently compromised in revision surgery, and thus prevent the need for further surgery. Better follow-up of these patients is also required and improved adherence to treatment administered.

We believe further investigation on this matter needs to be conducted for a better understanding of the profile of this patient group and to generate cost-effective measures designed to reduce the number of patients who undergo revision surgery. In this context, our hospital has a rhinology/sinusitis committee, in which the ENT team is dedicated to sinonasal pathology and meets weekly to discuss the most complex and/or controversial cases attended to in our hospital. A joint decision is then reached on which guidelines to follow for the patient. The authors propose that this event be used to create and apply a system of standardised registration to record future structured information on these patients, which would result in more complete data in future studies, whether these be retrospective or prospective, on RESS and pathologies relevant to the said procedure. We hope this proposal may be applied to other hospitals nationally and even internationally, where similar committees exist, so that more enhanced studies may take place in the future.

Conclusion

Endoscopic sinonasal surgery is frequently performed in ENT departments, with a small percentage of patients requiring revision surgery. In our series the presence of sinonasal polyps was a major cause RESS indication, as were radiological and/or anatomical (intraoperative) events of stenotic antrostomy and incomplete (anterior and posterior) ethmoidectomy. All of the above leads to procedures being performed more frequently within surgery (antrostomy, ethmoidectomy and polyp resection, in general). Furthermore, the time elapsed from primary to revision surgery is generally extensive for these patients, who may withdraw from medical follow-up and adhere poorly to treatment, especially those patients with more intense inflammatory conditions, such as polyposis and inverted papilloma.

Periodical long term follow-up and control, particularly in the most severe forms of the disease are essential to obtain optimal therapy and correct long term management, are the classification of each group of rhinosinusal diseases.

Endoscopic revision surgery is a challenge for surgeons dedicated to paranasal cavity surgery, with regards to optimising medical management and indicating the surgery at the right moment.

Finally, it is highly important to define the type for revision surgery to be performed to attempt to reduce further surgical interventions in the future.

Conflict of Interests

The authors have no conflict of interests to declare.

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