



ORIGINAL ARTICLE

Paranasal sinuses mucocoeles. Our experience in 72 patients

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Received January 19, 2009; accepted May 5, 2009
Available online September 5, 2009

KEYWORDS

Paranasal sinuses;
Mucocoele;
Endoscopic sinus
surgery;
Marsupialization

Abstract

Introduction: Traditional treatment for paranasal sinuses mucocoeles recommended total removal through external approaches. Since the 90s, endoscopic marsupialization has been proposed as optimal surgical treatment. We present our experience in the treatment of this pathology.

Material and method: A retrospective review of 72 patients treated for paranasal sinuses mucocoeles between 1980 and 2006 in our ENT department was performed. We describe clinical features, surgical approaches employed, and recurrence of disease.

Results: The sample was composed of 72 patients with average follow-up period of 44 months (range, 13–214 months). A total of 81 mucocoeles were presented, with 44% affecting the frontal sinus or frontoethmoidal cells, followed in frequency by maxillary sinus mucocoeles (35%). Twenty-nine percent of the patients did not present predisposing factors; 31% of patients had a history of nasal polyposis, 35% had undergone previous sinus surgery and 14% suffered previous facial fractures; 48 mucocoeles patients were treated endoscopically and 33 were treated with external or combined approaches. Recurrence was found in 7 patients, 2 in the endoscopic surgery group and 5 in the external/combined surgery group.

Conclusions: Endoscopic marsupialization is a safe approach with a low rate of recurrence. The endoscopic approach may be unsuitable for frontal lateral sinus mucocoeles or those with significant bone blockage.

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PALABRAS CLAVE

Senos paranasales;
Mucocèle;
Cirugía endoscópica
sinusal;
Marsupialización

Mucocèles de senos paranasales. Nuestra experiencia en 72 pacientes**Resumen**

Introducción: El tratamiento tradicional de los mucocèles paranasales consistía en la extirpación mediante abordajes externos. Desde los años noventa se ha propuesto la marsupialización endoscópica como tratamiento de elección. Exponemos nuestra experiencia en el tratamiento de estas lesiones.

Material y método: Se revisaron retrospectivamente 72 historias clínicas de pacientes intervenidos de mucocèles nasosinuales entre 1980 y 2006 en nuestro centro. Se describen las características clínicas, los abordajes quirúrgicos empleados y la aparición de recidivas.

Resultados: La muestra se compone de 72 pacientes con un seguimiento medio de 44 (intervalo, 13-214) meses. Se presentaron un total de 81 mucocèles, de los que el 44% afectaba al seno frontal o las cedillas frontoetmoidales y el 35% a los senos maxilares. El 29% de los pacientes no presentaban factores predisponentes. El 31% de los pacientes padecían poliposis nasal; el 35% antecedentes de cirugía nasosinusal, y el 14% fracturas faciales previas. Se trataron endoscópicamente 48 mucocèles y mediante abordajes externos o mixtos, 33. Apareció recidiva en 7 pacientes, 2 en el grupo de pacientes tratados endoscópicamente y 5 en el grupo de pacientes tratados mediante cirugía abierta o mixta.

Conclusiones: La marsupialización endoscópica es una técnica segura y con bajo índice de recidivas que encuentra como limitación relativa los mucocèles frontales laterales o con tabicación ósea significativa.

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Introduction

Paranasal mucocèle is defined as a lesion consisting of a cavity lined with respiratory epithelium containing mucoid substance within and affecting the paranasal sinuses. It can expand and produce bone remodelling which in its expansive process affects surrounding structures such as the orbit or the anterior base of the skull. Coinciding with periods of superinfection, acute infectious complications may occur.

It has been demonstrated that the epithelium of the mucocèle not lose the histological features of respiratory mucosa.¹ An increased expression of interleukin (IL) 12 has been found in the content of mucocèles, which correlates with increased expression of IL-2 and interferon (IFN) gamma, involved in activation of lymphocytes with Th2 phenotype. This, together with an increased expression of PGE₂ and macrophages (by 40%), relates to the capacity of bone resorption.³

Paranasal mucocèles predominantly affect the frontal sinus (60%-65%), followed in frequency by the ethmoidal (20%-30%), maxillary (10%), and sphenoid (2%-3%) sinuses.⁴ Although in Europe and America the incidence of maxillary mucocèles is low, in Japan it is a common location, where nearly 100% appear after Caldwell-Luc⁵ type surgery.

Several predisposing factors have been identified for the development of paranasal mucocèles, corresponding to conditions that cause a traumatic, inflammatory, or tumour distortion of the sinus drainage pathways. The occurrence of mucocèles has usually been associated with previous nasosinusal surgery, facial trauma, and chronic sinusitis with or without polyps.^{6,7} There are other, less common predisposing factors such as the presence of nasosinusal tumour lesions,⁸ cranial fibrous dysplasia⁹ and cystic fibrosis. Up to 16% of children with cystic fibrosis and symptoms

of chronic rhinosinusitis suffer from mucocèles.¹⁰ Those mucocèles in which no predisposing factors are identified are called primary mucocèles.

In the eighties, the complete removal by external approaches had been established as rule in the treatment of paranasal mucocèles.¹¹ With the advent of optic fibre endoscopes in the eighties, endoscopic marsupialization was proposed, especially by European rhinologists, as a treatment of choice.¹¹ Numerous case series have been published which demonstrate the benefits of endoscopic treatment, and a large number of them presented total absence of recurrences,^{6,12,22} although few exceed 3 years of average follow-up.^{13,16,21} In various series with over one hundred cases, treated endoscopically, the incidence of recurrences ranges between 0.9% and 2.2%.^{8,18,23} In other series with a small number of cases and a limited follow-up period, recurrences were found between 11% and 13% of cases.^{24,25}

The approach of mucocèles in which there is significant bone septation between the nasal light and the mucocèle still remains as a limitation on endoscopic marsupialization, as well as cases of lateral location within the frontal sinus.²⁶ Even mucocèles involving the skull base or the orbit can be treated satisfactorily by endoscopic marsupialization.^{15,27}

The purpose of this study is to add our results in the treatment, both endoscopic and open, of the mucocèles of the paranasal sinuses to the existing literature, and to describe their clinic and associated pathogenic factors.

Material and method

The surgical records of our department from 1980 to 2007 were retrospectively reviewed. We identified 72 consecutive

patients suffering from mucocoeles of the paranasal sinus, who presented a total of 81 lesions, intervened by endoscopic approach, open or combined, and with a follow-up >12 months.

We reviewed the medical records recording data on location, multifocality, relevant medical history, and clinical presentation. Location was associated with personal history and with surgical procedures employed. Postoperative complications and sequelae caused by the different approaches were recorded, as well as the incidence of recurrence detected clinically or radiologically. Other secondary data were correlated such as the average operative time and average hospital stay with surgical approach. Microbiological cultures were collected and the isolates obtained were provided.

Results

The 72 patients were aged between 15 and 86 years with an average of 52 years. The sample consisted of 45 males and 27 females. A total of 78 mucocoeles were presented at the time of diagnosis, and during follow-up a second mucocoele was found in 2 patients in a location unrelated to the first, one of them with a double mucocoele. Thus a total of 81 mucocoeles was obtained, considering that at the time of diagnosis 4 (5%) patients had a double mucocoele and 1 (1%), a triple mucocoele.

A total of 27 mucocoeles with exclusively frontal affectation and 36 affecting the frontal sinus or frontoethmoidal cells (44% of all mucocoeles) were registered. In 28 cases the location was maxillary (35% of all mucocoeles) and in 8, ethmoid (10% of all mucocoeles). The sphenoid sinus was affected by 7 mucocoeles, while 2 affected the sphenothmoidal cells (together, 11% of all mucocoeles).

In 21 (29%) patients there were no predisposing factors for the development of mucocoeles; 25 (35%) of the 72 patients had a history of previous nasosinusual surgery, of which 12 had undergone multiple surgical procedures. Endoscopic sinus surgery (ESS) had previously been performed in 2 patients (3% of the total) and in 23 (32%), open surgery. The latency between surgery and development of the mucocoele was between 1 and 40 (average, 15) years. In the 2 patients who had a history of ESS, latency was between 1 and 10 years. In 6 of the 26 patients who presented maxillary mucocoeles there was a history of Caldwell-Luc type surgery. In 10 (14%) patients there was a history of injury with frontal or nasal fracture. The latency between this history and the development of the mucocoele was between 5 and 40 (average, 25) years. Thirty-one patients met the criteria for clinical diagnosis of chronic rhinosinusitis, of which 17 had undergone previous surgery for that reason. In 22 (31%) patients, polyps were found, of whom 9 had undergone open nasosinusual surgery and 2 ESS before the diagnosis of mucocoele. Five of these patients with polyposis had undergone multiple prior polypectomies and in 4 of these cases, the ethmoidal air cells were at the location of mucocoele. In 2 (3%) patients the mucocoele had originated in a secondary manner to the presence of malignant rhinosinusual lesions and 1 (1.4%) suffered from cranial fibrous dysplasia.

The surgical history was distributed in a similar way depending on location. By contrast, up to 26% of patients affected by frontal or ethmoidal mucocoeles had a history of trauma, such as 7% and 11% of patients with maxillary and sphenoid mucocoeles respectively. Nasal polyposis was more common in patients with maxillary and sphenoid mucocoeles (37% and 44% respectively) than in those with frontal or ethmoidal (24%).

The most frequent clinical presentation in the case of frontal, ethmoidal or frontoethmoidal mucocoeles, were orbital symptoms (70%). Table 1 shows the clinical presentation depending on the location of the mucocoele. In the case of maxillary mucocoeles, the most common findings were nasal obstruction in 28% and casual diagnostic by imaging in 21%. Most mucocoeles diagnosed radiologically were presented together with mucocoeles symptomatic of another location which justified the image testing. In the case of sphenoidal or sphenothmoidal mucocoeles, the most common symptom was headache radiating to the vertex (33%). In total, in 4 (6%) of 72 patients in our series the diagnosis was obtained coincidentally through radiological tests performed due to a non nasosinusual clinic, while 5 maxillary mucocoeles, 2 of them simultaneous, were diagnosed by computed tomography (CT) in patients with symptomatic sinus mucocoeles in other locations; 3 of the 7 recurrences were diagnosed radiologically.

In 11 (15%) cases there was a loss of visual acuity at diagnosis; 2 of these patients had sphenoid mucocoeles and another, maxillary mucocoele, and in the remaining cases the ethmoidal or frontal cells were affected. Only in 2 cases was the loss of visual acuity the only symptom, while in 4 patients it was accompanied by a clinic of postseptal cellulitis and in 5, of exophthalmos. In all cases except 1, which continued with visual deficit, there was a near or total recovery of visual acuity. It should be noted that 2 of the cases with loss of visual acuity were diagnosed in the time before the availability of CT, so there could be a failure in early diagnosis.

Of the 81 mucocoeles, 48 were treated through endoscopic approach (59%), with a total of 43 surgical procedures; 27 mucocoeles (33%) were treated by external approaches, in 24 surgical procedures; 6 (8%) were treated with combined approaches, all of them frontal osteoplasties combined with ESS, in the treatment of frontal mucocoeles. Among the open approaches, 14 frontal osteoplasties were indicated, of which one was combined with a Caldwell-Luc antrostomy since there was a concomitant maxillary mucocoele, and on another occasion, 2 simultaneous frontal mucocoeles were resected using the same approach. Other open approaches consisted in 6 frontoethmoidectomies, 3 Caldwell-Luc antrostomies, and 1 bifrontal craniectomy. In a patient with a frontal mucocoele and 2 concomitant maxillary mucocoeles it was necessary to combine a frontal osteoplasty with ESS, although it cannot be considered a combined approach, since the endoscopic work was performed exclusively for the maxillary condition.

Up to 75% of surgical procedures in the frontal sinus were open or mixed. Eighty-six percent of the approaches in maxillary mucocoeles were endoscopic, while 75% of ethmoidal mucocoeles were treated by ESS. All procedures in the sphenoid sinus were made by endoscopic approach.

Table 1 Clinical presentation of mucocoeles depending on their location

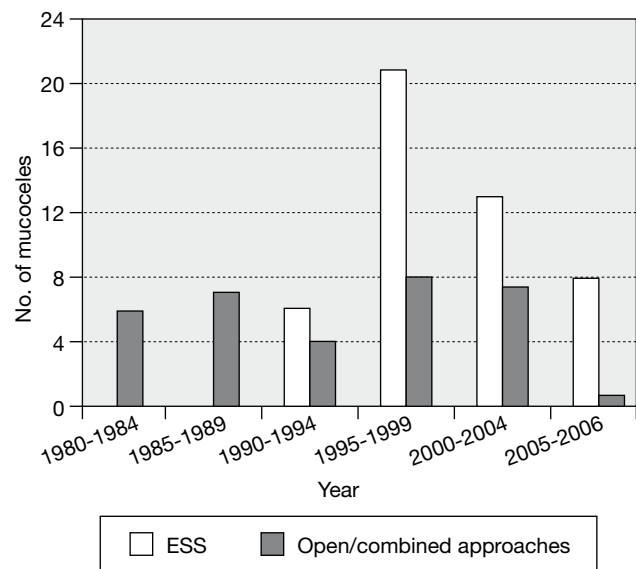
	Frontal, ethmoidal, or frontoethmoidal, No. (%)	Maxillary, No. (%)	Sphenoidal or sphenothmoidal, No. (%)	Total, No. (%)
Periorbital mass	13 (29)			13 (16)
Craniofacial algia	6 (14)	2 (7)	3 (34)	11 (14)
Radiological	2 (5)	6 (21)	1 (11)	9 (11)
Exophthalmic	8 (18)		1 (11)	9 (11)
Nasal obstruction		8 (28)		8 (10)
Postseptal cellulitis	6 (14)	1 (4)		7 (9)
Malar tumefaction		5 (18)		5 (6)
Frontal tumefaction	4 (9)			4 (5)
Diplopia	1 (2)	2 (7)		3 (4)
Preseptal cellulitis	1 (2)	1 (4)		2 (2)
Neuralgia of the trigeminal			2 (22)	2 (2)
Optic neuropathy			1 (11)	1 (1)
Snus syndrome cavernoso			1 (11)	1 (1)
Others	3 (7)	3 (11)		6 (8)
Total	44	28	9	81

Since our centre has had endoscopic surgery available (1991), 17 (65%) of the 26 frontal or frontoethmoidal mucocoeles have been treated by open approaches. With the exception of mucocoeles involving the frontal sinus, with the advent of endoscopic techniques it has been necessary to use open approaches in only 3 cases (2 maxillary mucocoeles and 1 ethmoidal), which appeared at the beginning of the learning curve. Figure shows the number of open and endoscopic or combined procedures as a function of time.

Of the 17 frontal or frontoethmoidal mucocoeles that could not be approached endoscopically, in 8 cases the cause of failure was the bone septation of the sinus or the bone stenosis of the frontal infundibulum. In 3 cases the location of the mucocoele was lateral, in 2 cases the nostrils had been treated surgically for neoplasia and the 4 remaining cases were presented at the beginning of the learning curve.

The average operating time in endoscopic approaches was 60 min, compared with 140 min in the external or mixed approaches. In patients treated with ESS, the average hospital stay was 3 days. In the group treated by open or mixed surgery, the average stay was 9 days. The material from the interior of the mucocoele was cultured in 18 cases, and it tested positive in 11; the most frequently isolated germs were coagulase-negative staphylococci in 7 cases and in 1 of them it was isolated along with *Corynebacterium* sp. Other bacteria isolated were *Streptococcus mutans*, *Haemophilus influenzae*, *Bacteroides distensis*, and *Enterobacter aerogenes*.

In the group treated by ESS there were no major complications and minor complications occurred in 2 (4%) patients: acute sinusitis and mild epistaxis. In the group of patients treated with open or combined approaches, there were 3 major complications: two abscesses in the frontal sinus and 1 cerebrospinal fluid fistula, which evolved satisfactorily. Of the patients undergoing open or combined

**Figure 1** Trends in the use of endoscopic approaches versus open or combined approaches.

surgery, 16 presented minor complications: facial oedema (7), frontal emphysema (2), postoperative acute sinusitis (2), frontal seroma (1), and frontal seroma with abdominal cellulitis (1), with extraction of abdominal fat to obliterate the frontal sinus.

There were sequels in 8 patients undergoing ESS (18%); 5 had nasal synechiae, of which 2 required surgical resection;

2 suffered from recurrent sinus infections and 1 from septal perforation with epiphora.

In patients undergoing open or combined surgery sequelae occurred in 4 (12%) patients: epiphora (1), anaesthesia of the first branch of the trigeminal (1), nasal synechia (1), and collapse of the frontal outer table (1). However, we must point out that we have not considered as sequels external scars, a fact which obviously affects 100% of the open approaches.

We performed an average follow-up of 44 (range, 13-214; median, 26) months. The average follow-up of patients undergoing ESS was 40 (median, 23) months. In the group treated by open or combined approaches, the average was 52 (median, 31) months. Seven patients (10% of the total) presented a recurrence of the mucocoele; of which the location was maxillary in 1 case, ethmoidal in 2, and frontal in 4. The latency period between treatment and the occurrence of relapse was an average of 36 (5-141) months. The recurrence in the group of patients treated with open or combined approaches was more frequent than in the group of patients treated by ESS (17% and 5% of patients intervened, respectively). Three of the recurrences were treated with external or combined approaches (2 ethmoidal mucocoeles and 1 frontal mucocoele), 2 were treated by ESS and in 2 cases, therapeutic abstention was chosen. Table 2 shows the characteristics of patients who had relapses. If we consider the total number of mucocoeles, relapse occurred in 9% (4% of those treated by endoscopy and 16% of those treated by external or combined approaches).

Marsupialization was carried out in 53 patients and recurrence appeared in 7% of the 19 patients who underwent complete removal of the mucocoele, recurrence occurred in 20%. Relapses were more frequent in patients with nasal polyposis (18%) than in those without polyposis (6%). Of the 25 patients with postoperative mucocoeles, in 20% they recurred after surgery; on the other hand, 4% of patients with no postoperative mucocoeles presented recurrence.

Discussion

The average age at diagnosis and male predominance in our series are comparable to those reported in the literature.^{8,13,14,18,23,26}

In our series the most common affectation is that of the ethmoidal or frontal cells, consistent with comparable series in which the frequency ranges from 65% to 80%.^{8,13,18,23,26} We highlight a higher frequency of maxillary involvement compared to that recorded in non-Eastern series, in which it ranges between 5.5% and 25%.^{8,13,18,23,26} The least common location was the sphenoid sinus, coinciding with the available literature, in which it ranges from 6% to 11%.^{8,13,18,23,26} It is noteworthy that only one maxillary mucocoele was treated in the time before the introduction of CT in our centre. We believe that many maxillary mucocoeles remained underdiagnosed, by the lower specificity and clinical exuberance of the early stages with respect to frontal or ethmoidal mucocoeles. In 6% of the cases there was multiple sinus affectation, whereas in previous series the available frequency ranges between 3% and 16%.^{8,13,18,23,26}

Twenty-nine percent of patients presented no factors that would justify the appearance of mucocoeles, a higher frequency than that reported in some series, ranging between 7% and 18%.^{8,13,14} The highest frequency of primary mucocoeles was registered in the series of Lund et al,¹⁷ with 52% although that series does not include maxillary mucocoeles, only registers 48 cases and also its results are not reproduced in other series.

Thirty-five percent of patients in our series had a history of previous nasosinusal surgery, with no significant differences depending on the location of the mucocoele. The history of open surgery is more common than that of ESS, as is the case in most series.^{13,20} In the most representative series the frequency of surgical history is between 35% and 66%.^{8,13,23,26} with an average latency between surgery and diagnosis of mucocoele of between 2.8 and 24 years.^{23,28} In our series the latency between the surgical history and the diagnosis of mucocoele was 15 years for the group with a history of open surgery and 5 years for the ESS group. The increased latency for the development of mucocoeles after open approaches is confirmed by other studies,^{13,23} although we must bear in mind that this data is very biased, given the late development of endoscopic surgical techniques. De Freitas et al²⁹ highlighted the long latency period existing for development of maxillary mucocoeles after Caldwell-Luc type surgery, with an average of 23 years.

Fourteen percent of patients in our series had a history of frontal or nasal bone fracture, with an average latency

Table 2 Clinical characteristics of patients who suffered relapses

Case	Age	Gender	Precedent	Location	Previous surgery	Latency until recurrence, mo
1	57	Female	Open sinus surgery	Maxillary	Caldwell-Luc	12
2	30	Female	Open sinus surgery	Frontal	Frontal osteoplasty	141
3	62	Male	Open sinus surgery. Polyposis	Frontal	Frontal osteoplasty	42
4	31	Male	Frontal fracture	Frontal	ESS + frontal osteoplasty	29
5	86	Female	Open sinus surgery. Polyposis	Ethmoidal	External ethmoidectomy	13
6	58	Female	Open sinus surgery. Polyposis	Ethmoidal	ESS	9
7	63	Female	No precedents	Frontal	ESS	5

of 25 years, more frequent in frontal and ethmoidal mucocoeles. The rate reflected in the series which include mucocoeles in any sinus location ranges between 1.6% and 14%,^{8,13,14,23,26} although in the series of Naudo et al,¹⁹ with a small number of cases, the history of trauma appears in 18% of patients. Considering the series with predominant or exclusive frontal affection, between 13% and 30% present a history of trauma,^{15,27,30,31} although only the series of Sautter et al³¹ has more than 25 cases. However, there are several series with high frequency of frontal affection and a low frequency of trauma history.^{13,17} Our experience and that of others^{8,13,14,23,26} link traumatic events in higher frequency with frontal and ethmoidal mucocoeles.

Thirty-one percent of patients presented nasal polyposis, a higher frequency than that of other series (6%–28%).^{13,14,19} A situation to be taken into account is to consider only non-surgical polyposis, since many patients with a history of polyposis also have a surgical background. In our series polyposis was more frequent in sphenoid mucocoeles than in maxillary, ethmoidal, or frontal mucocoeles.

In our series, up to 6% of patients were diagnosed incidentally by CT or MRI which was performed for non-sinus clinic, and the accidental diagnosis was more common in the case of maxillary mucocoeles, which remain asymptomatic for long periods. Until the availability of CT, few maxillary and sphenoidal mucocoeles were diagnosed and many mucocoeles of other locations were subjected to surgical explorations for suspected neoplastic disease. In the article by Marks et al,²¹ up to 11% of maxillary mucocoeles were diagnosed by chance. Series have been published in which, even in mucocoeles with orbital or skull base affection, up to 8% were diagnosed accidentally.^{27,31} We postulate that one of the causes which justifies the increased incidence of mucocoeles in recent years is the development of better diagnostic techniques.

Considering the cases with loss of visual acuity, the majority is produced due to intraorbital compression caused by the mucocoele, either acute and similar to postseptal cellulitis or chronic. A patient with a sphenoidal mucocoele suffered from compressive optic neuritis. As in the literature, in our series the rate of resolution of visual acuity loss is very high (10/11) after surgical treatment.^{24,27,31} Blindness and pupilar unresponsiveness are considered negative prognostic factors for visual recovery,²⁰ and surgical treatment, as early as possible, is favourable.

The total incidence of recurrence was 10% of patients; there were recurrences in 17% of the patients intervened by open or combined approach and in 5% of patients treated endoscopically. There are numerous case series that reproduce a lower incidence of recurrence in mucocoeles treated by ESS than in those treated by open or combined approaches. However, it is important to take into account the major bias existing, since the more complex mucocoeles and those with a worse prognosis, such as those affecting the lateral frontal recess or those with significant bone septation are preferably treated using open surgery. In series that include patients treated by open or endoscopic approaches, there is a lower incidence of recurrence in the groups treated endoscopically.^{8,13,26} It should be noted that in these series, except in the study of Serrano et al,¹³ the period of follow-up of endoscopic groups is not specified;

presumably it is less than that of the group treated by open surgery, given that the technology is more recent.

The widest range of mucocoeles treated exclusively with an endoscopic approach corresponds to Har-El et al,¹⁸ with 103 patients and an average follow-up of 4.6 years, in which only one relapse is noted. This low incidence of recurrence is confirmed in other series.^{14,20,31} Moreover, in the series of Khong et al,²⁷ which includes mucocoeles with orbital affection treated endoscopically, a recurrence rate of 8.3% is registered. There are several series with small numbers of patients which include maxillary mucocoeles treated endoscopically without recurrences,^{6,16,22} and in the only paediatric series, with 7 patients and ethmoidal and sphenoidal mucocoeles treated endoscopically, no recurrences are identified either.³² Table 3 details the characteristics of the most representative series of mucocoeles treated endoscopically. For all these reasons, our series confirms what is pointed at in others: marsupialization using an endoscopic approach does not entail a higher incidence of recurrence. In fact, in our series recurrences were more frequent in the excised mucocoeles than in the marsupialized ones, probably due to the approach necessary for the realization of one technique or another. It has been postulated that the loss of bone support for soft tissues in frontoethmoidectomies,⁸ the compartmentalization of the sinus mucosa and the scarring of facial tissues in Caldwell-Luc antrostomies⁶ and the remains of frontal mucosa in obliterative frontal osteoplasties facilitate the development of secondary mucocoeles. Relapses were also more frequent in patients with polyposis, given the perpetuation of this condition involved in incorrect sinus ventilation. Only one of the seven relapses occurred in a patient without predisposing factors for the development of mucocoeles; the anatomical distortion caused by trauma or previous surgery would facilitate recurrences.

There were no major complications in the group treated by endoscopic surgery. In the series of Serrano et al¹³ and Schaefer et al³³ there were 1% and 2.8% of major complications, respectively. In 4% of the endoscopic surgical procedures there were minor complications, which in different series ranged between 3.5% and 6%.^{13,14,33}

In the group treated by open surgery, major complications occurred in 10% of cases, all in the frontal or ethmoidal approaches. Up to 43% of cases presented minor complications, a higher number than that recorded in the series of Serrano et al¹³ (22%).

The occurrence of sequelae was more frequent in the group treated by ESS than in that treated by open or combined surgery, although most were clinically silent synechiae and represented lesser morbidity than sequels in open approaches. Considering the sequel represented by the cosmetic deformity caused by the external scars, it is clear that sequels were more common in the open approaches. In the series of Serrano et al¹³ there were no sequelae in the endoscopic approach, whereas in the endoscopic series of Khong et al¹⁴ they occurred in 10% (7% were synechiae) and in the series of Schaefer et al,³³ on endoscopic procedures of the frontal sinus, synechiae occurred in 8.3% of cases. Although frontal paresthesias are the norm in osteoplastic approaches in the frontal sinus, they usually disappear within 3 months.³⁴

Table 3 Incidence of recurrences in the most notable series which include mucocoeles treated endoscopically

	Patients ESS, No.	Location	Follow-up, average, mo	Patients with recurrences, %
Conboy et al 2003 ²⁶	44	All the sinuses	74 ^a	9
Serrano et al 2004 ¹³	33	All the sinuses	47.4	0
Rombaux et al 2000 ²³	132	All the sinuses	44 ^a	2.2
Har-El et al 2001 ¹⁸	103	All the sinuses	55.2 ^b	1
Khong et al 2004 ¹⁴	28	Maxillary, ethmoidal, and frontal	18	0
Moriyama et al 1992 ²⁰	47	Ethmoidal and sphenoidal	12–120 ^c	0
Sautter et al 2008 ³¹	57	Erosion of the orbit or the base of the skull	15 ^b	0
Khong et al 2004 ²⁷	15	Erosion of the orbit	16	20
Saito et al 2000 ¹⁶	21	Postoperative maxillary	12–60 ^c	0
Busaba et al 1999 ⁶	13	Maxillary	10–66 ^c	0
Caylakli et al 2006 ²²	14	Maxillary	17.8	0
Benninger et al 1995 ²⁴	15	Ethmoidal and sphenoidal	20	13
Hartley et al 1999 ³²	7	Paediatric ethmoidal and sphenoidal	>12	0
Lund et al 1998 ¹⁷	20	Frontal, frontoethmoidal, and sphenoidal	34	0

^aGeneral follow-up, of patients treated both by endoscopy and by open surgery.

^bMedian.

^cOnly the interval of follow-up is available.

In the light of the experience gained in our department, the use of CT is a cause of the increased incidence of paranasal mucocoeles observed since the nineties. Prior to the introduction of CT, maxillary mucocoeles were seldom diagnosed; we postulate that a large number of these injuries, due to remaining undiagnosed, were marsupialized and resolved spontaneously during their evolution. Considering ESS as predisposing to the development of mucocoeles, few patients present this history and we do not believe that the use of these surgical techniques warrants an increase in the incidence of mucocoeles. We believe that open techniques involve a greater risk of mucocoeles, although it is important to take into account the shorter postoperative follow-up in patients undergoing ESS.

Conclusions

The endoscopic approach of mucocoeles is presented as a safer and more effective technique, with fewer recurrences than the open sinus approach, besides being better tolerated and involving fewer costs due to postoperative admittance. The most common sequelae are nasal synechiae, often without clinical impact. The sequelae of open approaches are more severe and also involve external scars. The lateral location in the frontal sinus remains as a relative limitation of endoscopic surgery, as well as the bone septation of the mucocoele and those cases where the bone stenosis of the frontal outflow does not allow access to the sinus.

Conflict of interests

The authors have indicated there is no conflict of interests.

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