

Corrélation entre le taux d'asymétrie du volume sinusien maxillaire et la symptomatologie clinique dans le silent sinus syndrome : étude rétrospective à propos de 13 cas

Correlation between the rate of asymmetry volume of maxillary sinuses and clinical symptomatology in the silent sinus syndrome: A retrospective study about 13 cases

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Résumé

Objectifs : le « silent sinus syndrome » (SSS) est caractérisé par la rétraction aseptique des parois du sinus maxillaire entraînant une énoptalmie progressive avec ptose du globe oculaire. Les buts de cette étude ont été de chercher une corrélation entre le taux d'asymétrie du volume sinusien maxillaire et la présence de signes ophtalmologiques et rhinosinusiens, de déterminer l'efficacité de la méatotomie moyenne dans le SSS, et d'évaluer le bénéfice de la neuronavigation dans la morbidité de cette chirurgie spécifique. **Matériel et méthode :** étude rétrospective de 13 patients ayant présenté un SSS, opérés par méatotomie moyenne, dont 7 sous neuronavigation. Une évaluation clinique de l'énoptalmie était réalisée en préopératoire ainsi qu'un examen ORL. Une analyse morphométrique et une modélisation du volume sinusien à partir du scanner préopératoire ont été réalisés afin d'évaluer l'impact du SSS en terme de perte de volume sinusien. **Résultats :** il existait une corrélation significative entre l'importance de la diminution du volume sinusien et les manifestations cliniques ophtalmologiques (énoptalmie). Seul 15 % des patients présentaient des signes de rhinosinusite chronique. Les symptômes ophtalmologiques n'ont pas régressé, mais il n'a pas été constaté de progression après traitement chirurgical avec un délai moyen de recul de 30 mois. Une complication ophtalmologique a été observée dans le groupe de patients opérés sans neuronavigation, aucune dans le groupe opéré avec neuronavigation. **Conclusion :** les symptômes du SSS étaient corrélés à l'importance de la perte volumétrique. La méatotomie moyenne semblerait suffisante pour stopper l'évolution du SSS et éviter l'apparition d'une énoptalmie sévère. La neuronavigation permet d'éviter des complications ophtalmiques graves.

Mots-clés : Silent sinus syndrome, énoptalmie, méatotomie moyenne, neuronavigation.

Summary

Objectives: The "silent sinus syndrome" (SSS) also known as imploding antrum syndrome or chronic maxillary sinus atelectasis consists of painless enophthalmos and inward retraction of the ipsilateral maxillary sinus walls. The aims of the present study were: i) to look for a correlation between the level of volume asymmetry of the maxillary sinuses and the presence of ophthalmological and rhinosinusitis signs, ii) to determine the benefits of a middle meatal antrostomy in SSS cases, and iii) to evaluate the preventive role of neuronavigation surgery in the morbidity of this specific surgery. **Materials and methods:** We retrospectively analyzed the data of 13 patients operated on for a SSS by middle meatal antrostomy, with the aid of neuronavigation in 7 cases. The median follow up was 30 months. No reconstruction of the orbital floor was performed. Morphometric analysis and modeling of the sinus volume from the preoperative CT scanners were performed to assess the impact of the loss of sinus volume on the symptoms. **Results:** all patients displayed a retraction of the orbital floor. There was a significant correlation between the magnitude of the decrease in sinus volume and clinical manifestations. Surgical treatment allowed rhinosinusitis symptom disappearance in 53% of patients. Ophthalmological symptoms did not decrease, but stayed stable after the surgical treatment. When neuronavigation surgery was performed, no complications were observed. **Conclusion:** SSS symptoms correlated with the reduction of volume of the maxillary sinuses. This measure may be related to the severity of the disease. The middle meatal antrostomy seemed sufficient to stop the evolution of the SSS, avoiding the occurrence of severe enophthalmos. Neuronavigation surgery helped preventing serious eye complications.

Key-words: Silent sinus syndrome, enophthalmos, middle meatal antrostomy, neuronavigation surgery, imploding antrum syndrome.

INTRODUCTION

The silent sinus syndrome (SSS) was first described in 1964 by Montgomery, but it was named so only in 1994 by Soparkar et al [1]. It is a unilateral collapse of

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Fig. 1: Coronal CT image shows unilateral collapse of the maxillary sinus and retraction of the left orbital floor.

the maxillary sinus and orbital floor that results in a negative pressure leading the sinus walls to migrate inward (fig 1). This syndrome is characterized by unilateral spontaneous enophthalmos and hypoglobus, and sometimes diplopia and facial asymmetry, without any nasal sinus symptoms. The most popular theory for its pathogenesis is that ostiomeatal obstruction results in reduced aeration of the antrum, causing negative sinus pressure and atelectasis [2]. This entity is often underdiagnosed clinically and radiologically because of a lack of knowledge of this condition. Typically, all walls of the maxillary sinus, including the orbital floor, are retracted. The treatment procedure of this syndrome consisting of a middle meatal antrostomy stops the evolution of enophthalmos and can avoid orbital reconstruction which becomes necessary when diplopia starts to be debilitating.

The aims of the present study were: i) to look for a correlation between the level of volume asymmetry of the maxillary sinuses and the presence of ophthalmological and rhinosinusitis signs, ii) to determine the benefits of middle meatal antrostomy in the SSS, and iii) to evaluate the preventive role of neuronavigation surgery in the morbidity of this specific surgery.

MATERIALS AND METHODS

This is a retrospective study of 13 patients, evaluated between January 2005 and December 2013, presenting with SSS. Patients presented to the Arthur Vernes Institute in the ENT department with a unilateral sinus atelectasis and enophthalmos. It should be noted that the enophthalmos could be minimal and did not necessarily constitute the initial symptom. Preoperative symptoms were evaluated as follows:

i) the presence of a Chronic Rhino Sinus Dysfunction (CRSD) was evaluated on 3 symptoms



Fig. 2: Right acquired maxillary hypoplasia with right unilateral collapse of the nasal valve.

using a grading from 0 to 2 for rhinorrhea, presence of facial pain and nasal obstruction.

ii) the enophthalmos was also graded: 0 corresponded to a diagnosis made during ophthalmological examination (not apparent), 1 corresponded to an enophthalmos assessed during the inspection, and 2 corresponded to an enophthalmos that was the main symptom.

iii) a facial asymmetry was systematically searched, as illustrated in figure 2.

iiii) morphometric analysis and modeling sinus volume from the preoperative CT scanner were performed to correlate the symptoms to the decrease of sinus volume (fig. 3). Maxillary sinus volumes were calculated using the method described by Sahlstrand et al [3] in 2011.

The formula utilized was the following: Width (W) multiplied by antero-posterior diameter (APD) multiplied by cranio-caudal diameter (CCD) multiplied by 0.5. The correlation between the volumetric loss and the presence of clinical signs was evaluated (study of covariates by linear regression).

All patients underwent endoscopic sinus surgery, 7 of them under neuronavigational guidance. No recons-



Fig. 3: Modeling and sinus volume calculation using the method developed by Sahlstrand et al. [3] ($W \times APD \times CCD \times 0,5$).

truction of the orbital floor was performed. Operative complications were evaluated.

A CT scan was systematically performed in the year following surgery and postoperative ENT and ophthalmologic consultations followed the evolution of the symptoms.

RESULTS

On average, patients were 34 years old (range: 13-61) with a female predominance (sex ratio 10 women / 3 men). Six patients were referred from ophthalmology clinics for enophthalmos, four patients presented to ENT clinics with nasal complaints. The last three cases were accidental imaging discoveries. Clinically, enophthalmos and headache were present in 77% of patients, facial asymmetry in 31%, diplopia in 21% and signs of CRSD, namely rhinorrhea and/or nasal obstruction and/or facial pain, in 15% of cases. On preoperative CT scanners, all patients showed a retraction of the orbital floor and a significant sinus volume decrease compared to the contralateral sinus. Only 10 of the 13 CT scanners were analyzed. The average volume of the pathological maxillary sinus was 8.4 ml, while the volume in the general population is known to be 15.7 ml on average [3]. The average volume loss compared to the healthy side was 9.4 ml.

The correlation coefficient (fig. 4) between the volumetric loss and the presence of enophthalmos was of 0.702, indicating a strong correlation. In contrast, the correlation coefficient between the volumetric loss and the presence of a rhinosinus dysfunction was not significant.

The orbit was breached twice in the group of patients operated without assistance of neuronavigation (one third of this sub-group). One case resulted in a cone hematoma that required an immediate decompression with a favorable outcome; the other breach was asymptomatic. No complication occurred in the sub-group operated under neuronavigational guidance.

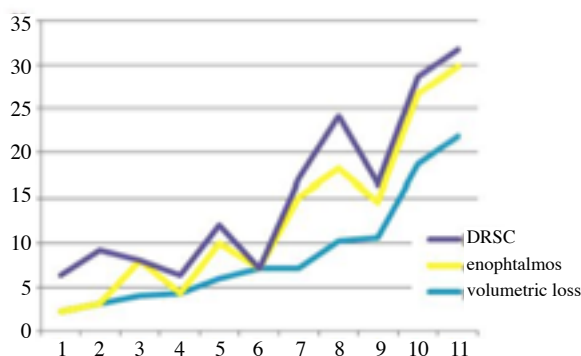


Fig. 4 : Calculation of correlation coefficients.

Correlation coefficient volumetric loss/enophthalmos: 0.702

Correlation coefficient volumetric loss/DRSC: -0.12

The mean follow up was 30 months. The evolution of the enophthalmos was stopped in all cases. The nasal sinus symptoms disappeared in 53% of cases.

DISCUSSION

The SSS usually occurs in 30 to 40 year-old patients [4]. It is a unilateral disease of the maxillary sinus, which can be secondary to a facial trauma or an endoscopic endonasal procedure. However, in most cases, no triggering factor is found [5]. The pathophysiology of SSS is still a subject of controversy. It has been compared to that of chronic otitis media: the obstruction of the ostiomeatal complex may result in a negative intra-luminal pressure responsible for the gradual collapse of the sinus walls [6, 7]. Some other authors consider that, as for chronic otitis media, the initial phenomenon is reversible and that the reabsorption of the effusion is the origin of the intra-luminal negative pressure [8, 9].

The clinical presentation of SSS is dominated by ophthalmologic symptoms that can associate spontaneous and progressive enophthalmos, ptosis, transitory vertical diplopia, and retraction of the upper eyelid sulcus. The visual acuity is always preserved, the intraocular pressure and the eye movement are normal [4]. The rhino-sinus symptoms are usually absent; for that reason this disease was named "silent sinus syndrome" [2]. When sinonasal symptoms are present, nasal obstruction, repetitive sinus infections, and posterior rhinorrhea are described. The relation between the SSS and these symptoms is however not proven. In the present study, these complains were present in 15% of patients only.

The diagnosis is made on the CT images (coronal and axial planes) [10] that show a reduced size of one maxillary sinus compared to the other. The maxillary infundibulum is occluded and the sinus is opaque [2]. This occlusion is caused by the retraction of the uncinete process towards the infero-medial part of the orbital wall [2]. Typically, all 4 walls of the sinus are retracted, though one of the medial, anterior, or posterolateral walls may be spared [4]. The orbital floor (maxillary roof) is always retracted and commonly thinned [4].

The SSS differs from the unilateral maxillary aplasia by the ophthalmic complications that are not observed in the latter. Unilateral maxillary aplasia does not require any treatment [7].

The treatment of SSS is surgical. Biopsy of the sinus mucosa is unnecessary; it would show a non-specific chronic inflammation. Bacterial cultures are generally negative [9].

The normal sinus drainage is restored by enlarging the maxillary ostium during a functional endoscopic sinus surgery procedure. The blockage of the ostiomeatal complex must be relieved by an endoscopic uncinectomy allowing for the opening the maxillary sinus ostium. This surgical intervention that improves sinus aeration typically halts the progress of maxillary sinus retraction, but

does not restore sinus volume, or only partially [12]. Given the anatomical changes driven by the SSS and the greater proximity of the orbital contents, the surgical procedure must be performed after having identified the free edge of the lateralized uncinat process, to avoid accidental orbital injury. The sinus atelectasis causes a collapse of the lateral nasal wall and of the orbital floor with adhesion of the uncinat process to the lamina papyracea. This adhesion is responsible for the possible complications of the surgical procedure.

In our series of patients, two orbital violations occurred in the group of patients operated on without neuro-navigational assistance: one breach resulted in a cone hematoma that required an immediate external drainage with a favorable result and no sequelae. This major risk has led many teams to recommend an inferior meatal antrostomy [11]. However, the advent of computer-assisted surgery or neuronavigation has significantly limited this risk by allowing easy identification of the ostium, followed by a middle meatal antrostomy, more physiological than the inferior antrostomy. Thus, no complication was observed in the sub-group of patients undergoing computer-assisted surgery.

Once sinus drainage has been restored, orbital floor augmentation surgery may be needed to restore orbital volume and decrease the enophthalmos. In patients with diplopia or severe cosmetic deformity, repair of the orbital floor with placement of a subperiosteal implant can be performed at the same time or after functional endoscopic sinus surgery. Different implants (titanium; silicone; Medpore implant) may be used, but autologous grafts with parietal bone or conchal cartilage are better solutions to restore the eye symmetry [13]. It is advised to wait at least six months before considering the surgical correction of enophthalmos because spontaneous improvement has been described. This improvement has been linked to a re-expansion of the sinus after the endonasal procedure, accompanied by partial reossification of the defect [14].

The results of the present study show a significant correlation between the decrease in sinus volume and enophthalmos. Surgical treatment permitted the regression of the sinonasal symptoms in 53% of patients. Ophthalmologic symptoms did not regress, but also did not deteriorate after the surgical procedure.

Volumetric postoperative evolution was not assessed in this study. However, some degree of improvement has been described in previous works [15, 16].

CONCLUSION

The enophthalmos in the SSS was correlated to the importance of the sinus volumetric loss. The middle meatal antrostomy stopped the progression of the disease during our mean follow up of 30 months, and prevented the development of severe enophthalmos. Neuronavigation surgery avoided surgical complications.

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