

Silent Sinus Syndrome: Surgical Outcomes and a Proposed Algorithm for Orbital Reconstruction

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ABSTRACT

Introduction: silent sinus syndrome (SSS) is an uncommon entity characterized by progressive maxillary atelectasis associated with inferior displacement of the orbital floor, resulting in enophthalmos and hypoglobus in the absence of significant sinonasal symptoms. Although endoscopic maxillary sinus ventilation is considered the treatment of choice, the indication for simultaneous orbital floor reconstruction remains controversial.

Objective: to describe the surgical outcomes of patients with silent sinus syndrome and to propose a therapeutic algorithm for orbital floor reconstruction.

Methods: a retrospective descriptive study was conducted including patients diagnosed with SSS who underwent surgical treatment between March 2018 and October 2025.

Results: five patients were treated; all presented with enophthalmos and one also had diplopia. All patients underwent endoscopic endonasal surgery with middle meatal antrostomy to restore maxillary sinus ventilation. Simultaneous orbital floor reconstruction was performed in two patients with severe enophthalmos and associated diplopia. During follow-up, all maxillary antrostomies remained patent. Improvement of enophthalmos was observed in all patients, and resolution of diplopia was achieved in the affected patient.

Conclusions: our findings suggest that endoscopic maxillary sinus surgery alone may be sufficient in mild cases of SSS, whereas patients with severe orbital deformity or visual symptoms may benefit from simultaneous orbital floor reconstruction.

Keywords: silent sinus syndrome, chronic maxillary atelectasis, enophthalmos, orbit, endoscopic sinus surgery.

Síndrome de seno silente: resultados quirúrgicos y propuesta de algoritmo para la reconstrucción orbitaria

RESUMEN

Introducción: el síndrome de seno silente (SSS) es una entidad infrecuente caracterizada por atelectasia maxilar progresiva asociada al descenso del piso orbitario, que provoca enoftalmos e hipoglobo en ausencia de síntomas rinosinuales significativos. Aunque el tratamiento de elección consiste en la ventilación del seno maxilar mediante cirugía endoscópica, la indicación de reconstrucción simultánea del piso orbitario continúa siendo motivo de controversia.

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Objetivo: describir los resultados del tratamiento quirúrgico del síndrome de seno silente y proponer un algoritmo terapéutico para la indicación de reconstrucción del piso orbitario.

Métodos: se realizó un estudio descriptivo retrospectivo que incluyó pacientes con diagnóstico de SSS tratados quirúrgicamente entre marzo de 2018 y octubre de 2025.

Resultados: se trataron cinco pacientes; todos presentaron enoftalmos y uno asoció diplopía. En todos los casos se realizó cirugía endoscópica endonasal con antrostomía maxilar media para restablecer la ventilación sinusal. En dos pacientes con enoftalmos grave y diplopía asociada se efectuó reconstrucción simultánea del piso orbitario. Durante el seguimiento, todas las antrostomías permanecieron permeables. Se observó mejoría del enoftalmos en todos los pacientes y resolución de la diplopía en el caso afectado.

Conclusiones: nuestros hallazgos sugieren que la cirugía endoscópica maxilar puede ser suficiente en casos leves de SSS, mientras que los pacientes con deformidad orbitaria grave o síntomas visuales podrían beneficiarse de la reconstrucción simultánea del piso orbitario.

Palabras clave: síndrome de seno silente, atelectasia maxilar crónica, enoftalmos, órbita, cirugía endoscópica nasal.

INTRODUCTION

Silent sinus syndrome (SSS) is a rare condition that primarily affects the maxillary sinus.

It is characterized by centripetal collapse of the bony walls of the maxillary sinus, including the superior wall that forms the orbital floor.

It causes enophthalmos and hypoglobus and may result in cosmetic and visual disturbances without sinonasal symptoms.¹

Ventilation of the maxillary sinus through an endonasal middle meatal antrostomy is the mainstay of treatment; however, the indication for orbital floor reconstruction remains controversial.

We describe three cases of silent sinus syndrome treated with endoscopic maxillary sinus surgery and two cases treated using a combined approach consisting of endonasal surgery and an external approach with orbital floor reconstruction.

We designed an algorithm to determine when orbital floor reconstruction is required in addition to sinus drainage.

OBJECTIVES

To describe outcomes of surgical treatment for silent sinus syndrome and establish an algorithm to determine the indication for orbital floor reconstruction.

Study design: Retrospective descriptive study.

METHODS

We reviewed the electronic medical records of all patients treated for SSS at Hospital Italiano de Buenos Aires between March 2018 and October 2025.

We included patients with facial asymmetry and enophthalmos who showed collapse of the superior bony wall of the maxillary sinus (orbital floor) on computed tomography (CT).

We recorded the following data in an Excel® spreadsheet: age and sex; laterality; ophthalmologic signs and symptoms; whether orbital floor reconstruction was

performed; improvement in enophthalmos/hypoglobus and visual symptoms; and follow-up duration.

All patients underwent nasal endoscopy and noncontrast CT of the facial bones and orbits. Patients who reported visual symptoms or had severe enophthalmos underwent ophthalmologic evaluation.

We retrospectively determined the degree of enophthalmos using CT scans of the paranasal sinuses.

We identified the axial CT slice passing through the equator of both globes. We drew a reference line between the two zygomatic arches (interzygomatic line), which served as a fixed bony reference plane unaffected by the orbital pathological process. From this line, we measured the perpendicular distance to the most anterior point of the cornea in each eye. We calculated enophthalmos as the difference between the two measurements (affected vs. unaffected side), expressed in millimeters.

We considered an interocular difference ≥ 2 mm to represent radiologically significant enophthalmos. Cases were classified by severity as mild (2 mm), moderate (3–4 mm), or severe (≥ 5 mm).²

All patients underwent surgery under general anesthesia. In all cases, we performed endonasal maxillary sinus surgery using 0-degree endoscopes. We performed a retrograde uncinectomy or, when the uncinate process could not be identified, directly identified the ostium, followed by a wide middle meatal antrostomy. We aspirated thick mucus from the sinus.

When orbital floor reconstruction was required, we made a sub tarsal skin incision and dissected the fibers of the orbicularis oculi muscle until the inferior orbital rim was identified. We incised the periosteum and, with endoscopic assistance, dissected the periorbital fat from the bony floor when present, taking care to prevent orbital fat extrusion.

A titanium micromesh was then placed and secured to the orbital rim with screws to reconstruct the orbital floor.

The position of the micromesh was verified endonasally through the middle meatal antrostomy.

The sub tarsal incision was closed with 4-0 nylon sutures.

Follow-up evaluations were performed in the outpatient clinic using nasal endoscopy and with CT at one year.

Nasal endoscopy was used to assess maxillary antrostomy patency.

Outcomes were assessed based on resolution of visual symptoms; improvement in enophthalmos (reduction in the interocular difference in the distance from the interzygomatic line to the cornea, photographic comparison, and the patient's subjective assessment of cosmetic improvement: no improvement, partial improvement [$<50\%$], marked improvement [$>50\%$ and $<100\%$], or resolution); and postoperative CT findings confirming adequate ventilation of the maxillary sinus. The study protocol was approved by the Institutional Ethics Committee of Hospital Italiano de Buenos Aires (protocol No. 19546) and was conducted in accordance with the principles of the amended Declaration of Helsinki.

RESULTS

Five patients with SSS underwent surgical treatment: three were women, and two were men. The mean age was 44.8 years, with an age range of 9 to 66 years.

None of the patients had sinonasal symptoms, and only one had diplopia. CT showed collapse of the bony walls and accumulation of secretions within the maxillary sinus in all patients.

Two patients underwent orbital floor reconstruction with titanium micromesh. In one woman, enophthalmos and hypoglobus had a significant cosmetic impact; in the other patient, reconstruction was also indicated because of diplopia on upgaze.

In the latter patient, inferior orbitotomy revealed complete absence of bone in the orbital floor.

No patient experienced complications or required reoperation. All maxillary antrostomies remained patent, and enophthalmos improved in all patients; diplopia also resolved in the affected patient.

The mean follow-up was 2 years (Table 1 and Fig. 1).

DISCUSSION

Silent sinus syndrome (SSS) is a severe form of chronic maxillary atelectasis characterized by progressive collapse of the maxillary sinus associated with enophthalmos and hypoglobus.³

Its pathophysiology is not fully understood, although the most widely accepted hypothesis is that obstruction of the maxillary ostium leads to hypoventilation, gas resorption, and negative pressure generation.^{4,5}

Rose et al.⁶ compared the pathophysiology of SSS with the mechanism underlying tympanic membrane retraction and the development of serous otitis media due to Eustachian tube obstruction.

Although this mechanism may explain sinus collapse, the low incidence of SSS compared with chronic sinusitis suggests that additional factors may be involved. In our series, a history of nasal surgery in patients with more severe orbital involvement may have contributed to alterations of the ostiomeatal complex, consistent with previous reports linking nasal procedures and trauma to the development of this condition.⁷⁻⁹

Two patients in our series who underwent orbital floor reconstruction had a history of previous surgery (septoplasty with turbinoplasty and rhinoplasty). One of them had undergone surgery 12 months before consultation and reported no facial asymmetry or diplopia before septoplasty and inferior turbinoplasty.

Diagnosis is based on computed tomography, which allows assessment of sinus collapse and globe position,¹⁰ as well as exclusion of differential diagnoses such as sinus hypoplasia (which is stable and congenital), facial hemiatrophy, progressive lipodystrophy, Horner syndrome, and mucocoeles.¹¹ In mucocoeles, the maxillary sinus contains mucus that causes bone resorption of the orbital floor; however, the pressure exerted by the accumulated secretions displaces the globe upward.

Treatment consists of restoring maxillary sinus ventilation through endoscopic surgery.¹²

However, the indication for orbital floor reconstruction remains controversial.

Table 1. Patients Treated for Silent Sinus Syndrome

N	Sex/Age	Siden	Ophthalmologic signs/symptoms	Orbital floor reconstruction	Improvement in enophthalmos visual symptoms	Follow up (years)
1	M/9 years	Left	Mild enophthalmos	No	Yes (marked)	3
2	M/ 49 years	Right	Mild enophthalmos	No	Yes (marked)	1
3	H/66 years	Right	Mild enophthalmos	No	sí (resolución)	3
4	M/ 51 years	Right	Severe enophthalmos	Yes	Yes (resolution)	2
5	H/49 years	Right	Severe enophthalmos/diplopia on upgaze	Yes	Yes (resolution)	1

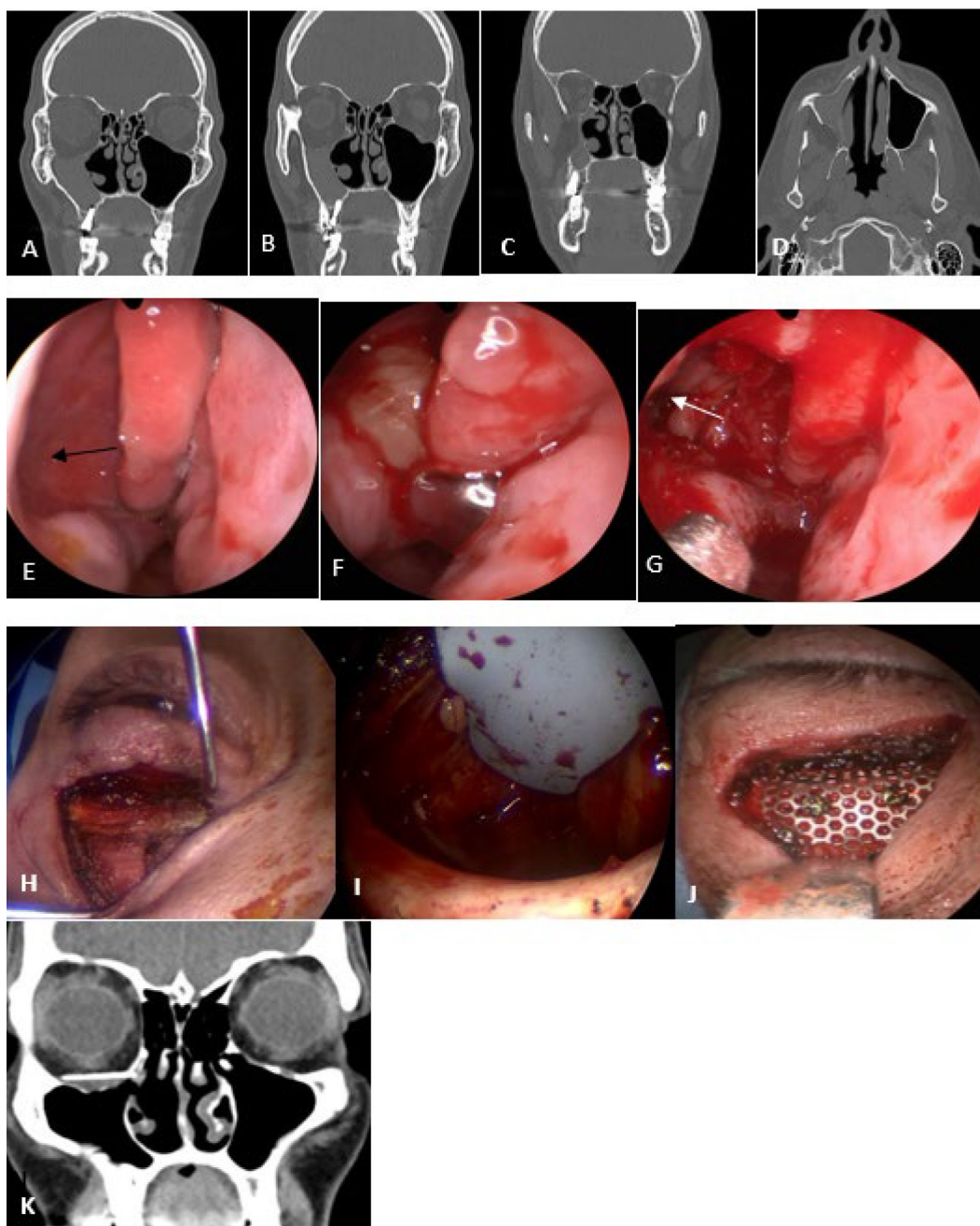


Figure 1. A, B, C: Noncontrast computed tomography (CT) of the facial bones, coronal views, showing the right maxillary sinus filled with hyperdense secretions, with collapse of the medial wall and marked hypoglobus due to erosion of the orbital floor. D: Axial CT image showing sinus opacification by secretions and collapse of the anterior, medial, and posterior walls. Endoscopic maxillary sinus surgery. E: View of the atelectatic medial wall of the sinus (black arrow). F: Antrostomy and aspiration of mucus. G: Middle meatal antrostomy (white arrow). H: Sub tarsal incision and exposure of the orbital rim. I: Incision of the periorbita and endoscope-assisted dissection to expose the orbital floor. J: Placement of the titanium micromesh. K: Postoperative CT showing a patent middle meatal antrostomy, a well-ventilated maxillary sinus, and the titanium mesh in the appropriate position along the right orbital floor.

While some authors maintain that drainage alone may reverse enophthalmos, others recommend a staged or combined approach. Retrograde uncinectomy is preferred to avoid injury to the globe, which is displaced downward

and is therefore vulnerable within the maxillary sinus. In three patients, the uncinate process could not be identified because of severe atelectasis of the medial maxillary wall. In these cases, we performed a middle meatal antrostomy

by entering the sinus above the inferior turbinate at the level of the head of the middle turbinate.

Some studies have reported that drainage and ventilation of the collapsed maxillary sinus are sufficient to reverse enophthalmos without orbital floor reconstruction and may also halt bone resorption.^{13,14}

Others suggest ventilating the maxillary sinus and waiting 6 months before performing orbital floor reconstruction, if necessary, to avoid placing an implant at a potentially infected site.¹⁵

Several studies favor a combined single-stage approach to achieve rapid rehabilitation.^{4,16-18}

One retrospective study compared the outcomes of endonasal drainage and ventilation of the maxillary sinus with those of drainage and orbital floor reconstruction performed during the same surgical procedure.

Patients who underwent maxillary sinus ventilation and orbital reconstruction showed greater improvement in enophthalmos and hypoglobus than those treated with endonasal maxillary drainage alone.¹⁹

In our experience, patients with more severe enophthalmos and hypoglobus benefited from simultaneous orbital reconstruction, with no infectious complications. These findings are consistent with studies reporting better cosmetic outcomes with the combined approach.

We believe that orbital reconstruction should be reserved for patients with significant deformity or visual impairment, whereas endoscopic drainage alone may be sufficient in mild cases.

This study's limitations include its small sample size and retrospective design (Fig. 2).

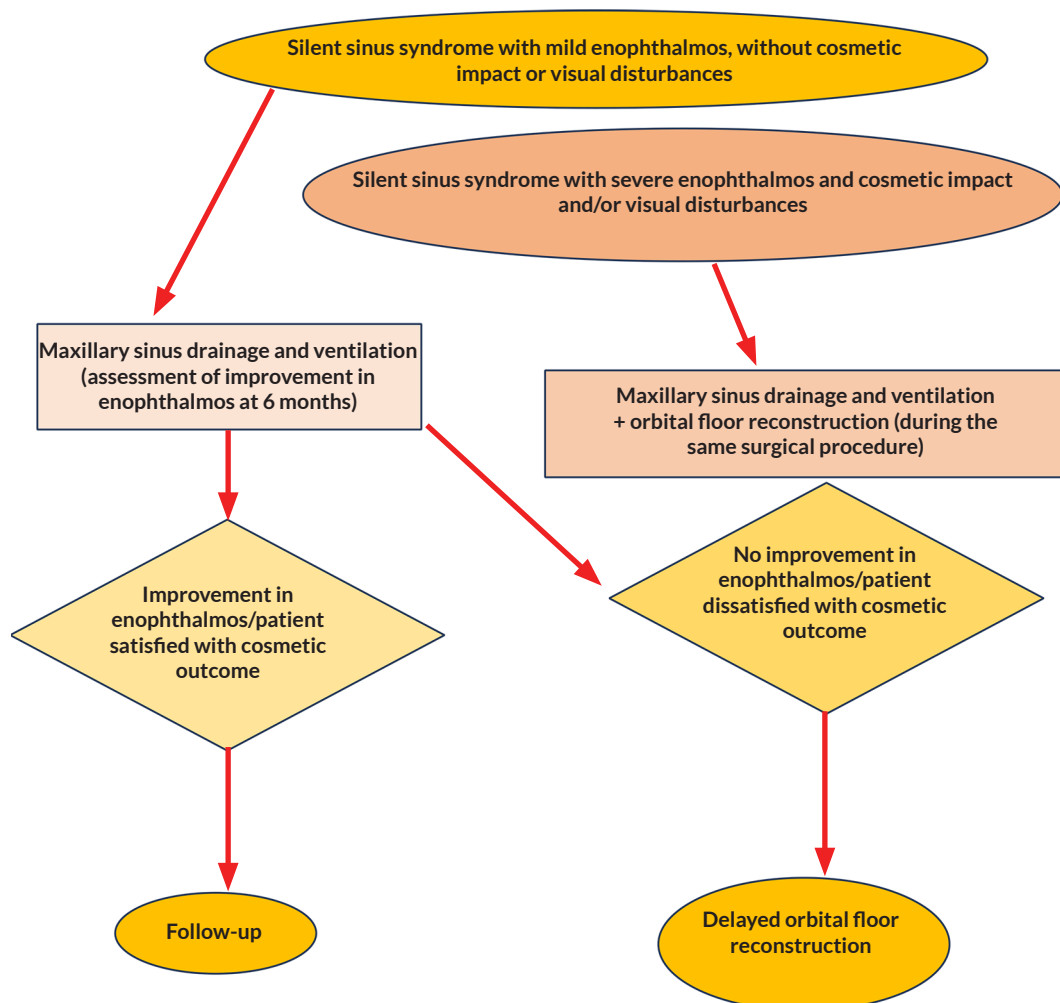


Figure 2. Flowchart: Surgical treatment algorithm for silent sinus syndrome.

CONCLUSIONS

Endonasal endoscopic drainage and ventilation of the maxillary sinus is the treatment of choice for silent sinus syndrome. Enophthalmos improved in all treated patients.

In patients with severe enophthalmos that has a significant cosmetic impact on quality of life and/or with visual symptoms, orbital floor reconstruction should be performed during the same surgical procedure.

Our results suggest that the initial clinical severity should guide the indication for immediate orbital reconstruction.

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