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Case Presentation

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Two Cases of the Sphenoid Sinusitis Under Local Infiltrative Anesthesia

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Abstract

The sphenoid sinus is the cavity derived sphenoid bone development in the posterosuperior segment of the sphenoid recess. Many important structures such as internal carotid artery are adjacent to the sphenoid sinus. The sphenoid sinus usually develops until age in 20s. The growth pattern of sphenoid sinus varies for each person. So, imaging scrutiny and a meticulous surgical strategy should precede the treatment involving the sphenoid sinus to avoid fatal complication preoperatively. Accordingly, the surgical treatment of sphenoid sinus lesion is usually recommended under general anesthesia for avoidance of the complications, for example, internal carotid artery rupture and blindness related to optic nerve damage. But, owing to the causes such as high-risk systemic disease and old age, it is very difficult to do surgical treatment under general anesthesia. In this case, it is useful to do the surgical approach under local infiltrative anesthesia. The author reports the successful treatment cases of sphenoid sinusitis with high-risk systemic disease and old age under local infiltrative anesthesia.

Keywords: Sphenoid sinus; Sinusitis; Preoperative imaging scrutiny; Surgical treatment; Local infiltrative anesthesia

Introduction

The sphenoid sinus is the deepest paranasal sinus adjacent to skull base. The sphenoid sinus is the cavity derived sphenoid bone development in the posterosuperior segment of the sphenoid recess. This structure usually

develops until age in 20s. The growth pattern of sphenoid sinus varies for each person and the shape of final-developed sphenoid sinus is diverse. Many important structures such as Internal Carotid Artery (ICA) are adjacent to the sphenoid sinus. So, imaging scrutiny and a meticulous surgical strategy should precede the treatment involving the sphenoid sinus to avoid fatal complication preoperatively. The sphenoid sinus can be affected by a wide range of pathogens due to its anatomical location. The sphenoid sinus occurs inflammatory diseases including fungal sinusitis, bacterial sinusitis, mucoceles and sinonasal polyps **[1-4]**. To solve these diseases, the standard treatment is a surgical approach. The surgical treatment is usually recommended under general anesthesia for evasion of fatal complications, for example, ICA rupture and blindness related to optic nerve damage. But, due to the causes such as high-risk systemic disease and old age, it is very difficult to do surgical treatment under general anesthesia. In this case, it is useful to do the surgical approach under local infiltrative anesthesia. The author reports the successful treatment cases of sphenoid sinusitis with high-risk systemic disease and old age under local infiltrative anesthesia.

Case Presentation

Case 1

The patient was 62 year-old female patient who visited the Outpatient Clinic Department (OPD) complaining of headaches. The patient had an underlying systemic disease and was continuously received treatment for the underlying disease. Endoscopy and Computed Tomography (CT) showed a soft tissue density heterogenous lesion in the left sphenoid sinus **(Figure 1)**. Accordingly, in consultation with the patient, endoscopic sinus surgery was planned under local infiltrative anesthesia. The surgery was performed in a comfortable mood while maintaining sufficient communication with the patient, and the surgery was performed by one author **(Figure 2A).** Surgical position is as follows. A monitor screen is installed on the head of patient, the surgeon is located to the left of the patient. And the progression of the surgery is as follows. First, in order to process the surgery smoothly, gauzes contained epinephrine and lidocaine were sufficiently applied to the nasal cavity. Afterwards, the left nasal cavity was infiltrative-anesthetized using a syringe containing solution with 4% lidocaine and epinephrine diluted 1:100,000. **(Figure 2B).** Infiltrative anesthesia was done to the nasal septum, inferior turbinate, middle turbinate, superior turbinate, uncinate process mucosa and sphenoid sinus mucosa of left nasal cavity. During the repeated local infiltrative anesthesia process, the author communicated with the patient to confirm that sufficient anesthesia had been achieved. Next, to secure a wide field of view, middle turbinate lateralization was performed during surgery. After identifying the sphenoid sinus ostium area using a seeker, opening the sphenoid sinus ostium using a curette was done. Then, the surgery is performed by expanding the removal area using an endoscopic debrider. As a result of the surgery, calcified fungal ball (FB) and sinusitis were confirmed within the left sphenoid sinus using a 70-degree endoscope. No anatomical structure abnormalities or complications occurred during the surgery. The patient remained in stable condition until the end of the surgery. To prevent postoperative bleeding, appropriate electrocauterization was performed on the left sphenoid sinus surgery site, and non-absorbable packing material was used. After surgery, the author confirmed the postoperative condition at an outpatient clinic. Pathologic finding was confirmed, fungal sinusitis. Until postoperative 3 months later, the chief complaint symptom of the patient, headache was disappeared. Following up the postoperative lesion, the opening of left sphenoid sinus was good condition state, not closed and the mucosa of sinus was well healed state. This case was done by same author of Kim JK et al. and the author wrote

out this case referring the paper **[5] (Figure 3)**.

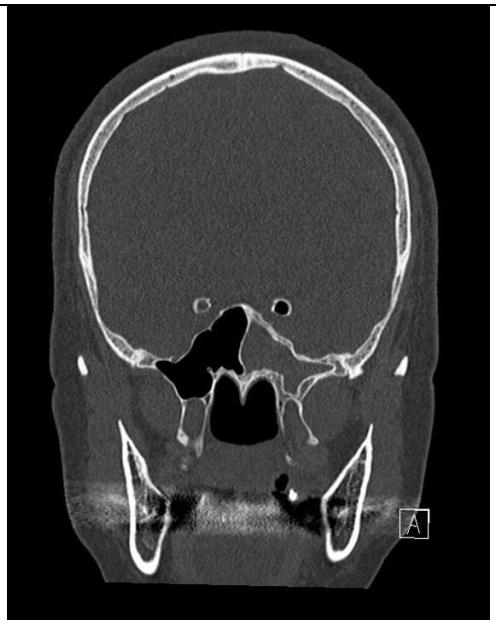
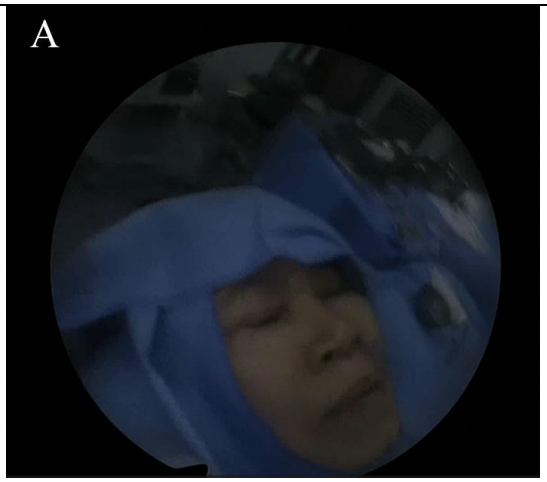


Figure 1: Preoperative evaluation. Using the Computed Tomography (CT) soft tissue density-heterogenous lesion of left sphenoid sinus was confirmed.



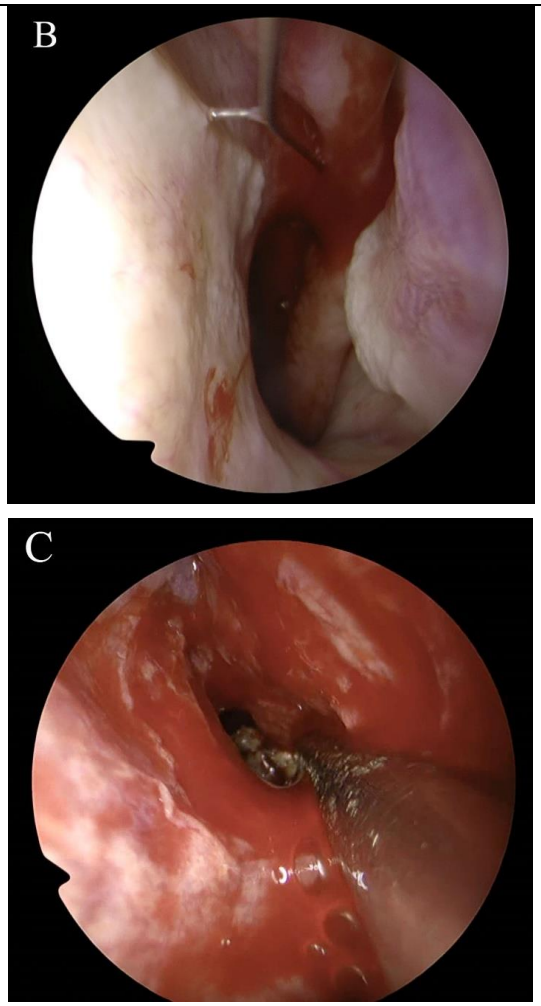


Figure 2: Intraoperative setting and endoscopic image. A. Preoperative operative field preparation for local anesthesia. B. Infiltrative local anesthesia to sphenopalatine artery area. C. The left sphenoid sinus opening procedure, Sphenoidotomy was done. The fungal material was confirmed.

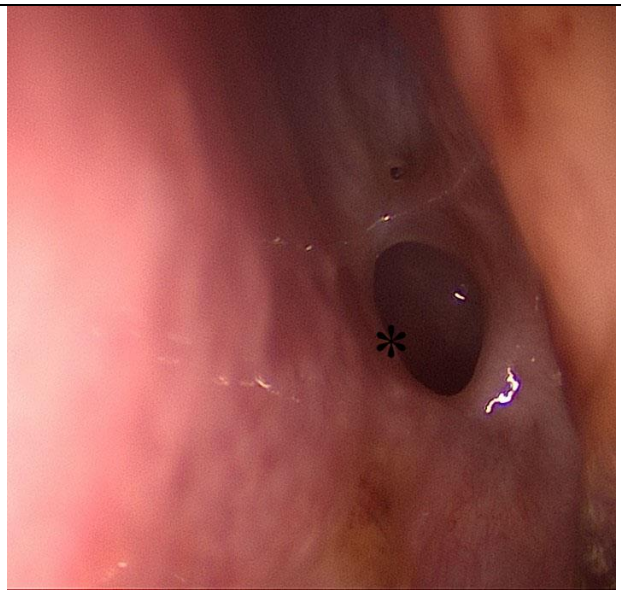


Figure 3: Postoperative Follow-up 3 months image of the left sphenoid sinus lesions. The asterisk presents the opening of left sphenoid sinus.

Case 2

The patient was 64 year-old male patient who visited the OPD complaining of postnasal drip. The patient had an underling systemic disease, diabetes mellitus and he was not steady state by medical treatment. In the OPD, the evaluation of him, for example, endoscopic exam and CT was done. The endoscopic finding was bulging and reddish discoloration of left uncinate process mucosa. CT showed that there were the soft tissue density lesions in the left maxillary sinus and sphenoid sinus **(Figure 4A and 4B)**. The author planned endoscopic sinus surgery under local infiltrative anesthesia considering the underlying disease and old age, in consultation with the patient. This surgery was performed as same methods of Case 1. for preoperative preparation and surgical position by one author **(Figure 5A)**. Because of the enlarged left middle turbinate, left middle meatus was concealed by it. So, the middle turbinate was de-contoured and the anterior portion of it was cut using the straight cutting forceps and debrider to secure operative vision. By the seeker and curved freer, the left maxillary sinus ostium was confirmed and the purulent discharge was flowed out to it **(Figure 5B)**. The uncinate process mucosa of left maxillary sinus was removed by the curved freer. And, middle meatal antrostomy was done and pathologic mucosa and pus were cleared off **(Figure 5C)**. After this procedure, the author confirmed the left sphenoid sinus ostium in detail, using diverse devices such as straight curette/curved J-curette and curved seeker owing to narrow-bony opening and laterally wide-cavitied sphenoid sinus structure **(Figure 5D)**. And, sphenoidotomy was performed and the mucopurulent discharge in the sphenoid sinus was checked. Finally, postoperative bleeding control and non-absorbable packing material insertion was done **(Figure 5E)**. Until the finish of the surgery, the author and the patient were well-communicated and the author checked the good condition of the patient. In the OPD, the pathologic findings (maxillary sinus mucosa and sphenoid sinus mucosa) were identified as chronic sinusitis and the main symptom of visiting the clinic, headache was vanished.

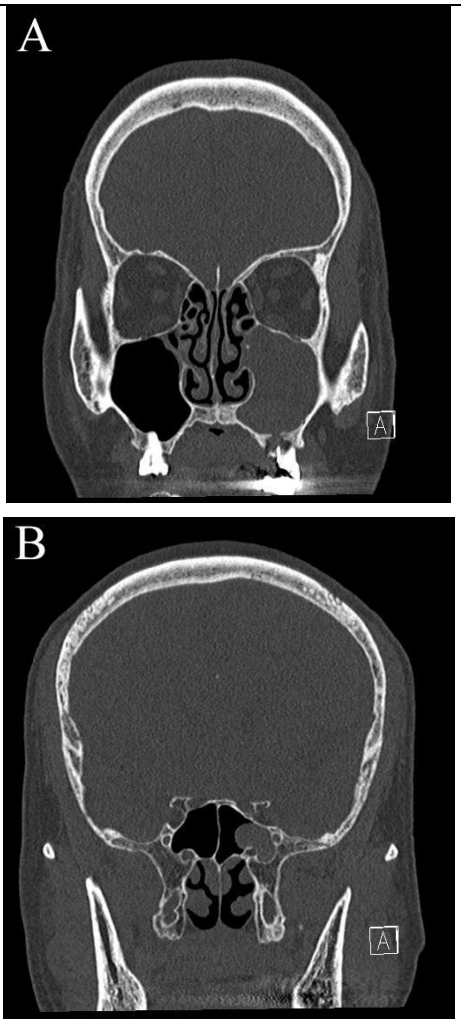


Figure 4: Preoperative evaluation. Using the Computed Tomography (CT) soft tissue density-heterogenous lesion of left maxillary sinus and sphenoid sinus were confirmed. A. Left maxillary sinus lesion, B. Left sphenoid sinus lesion.

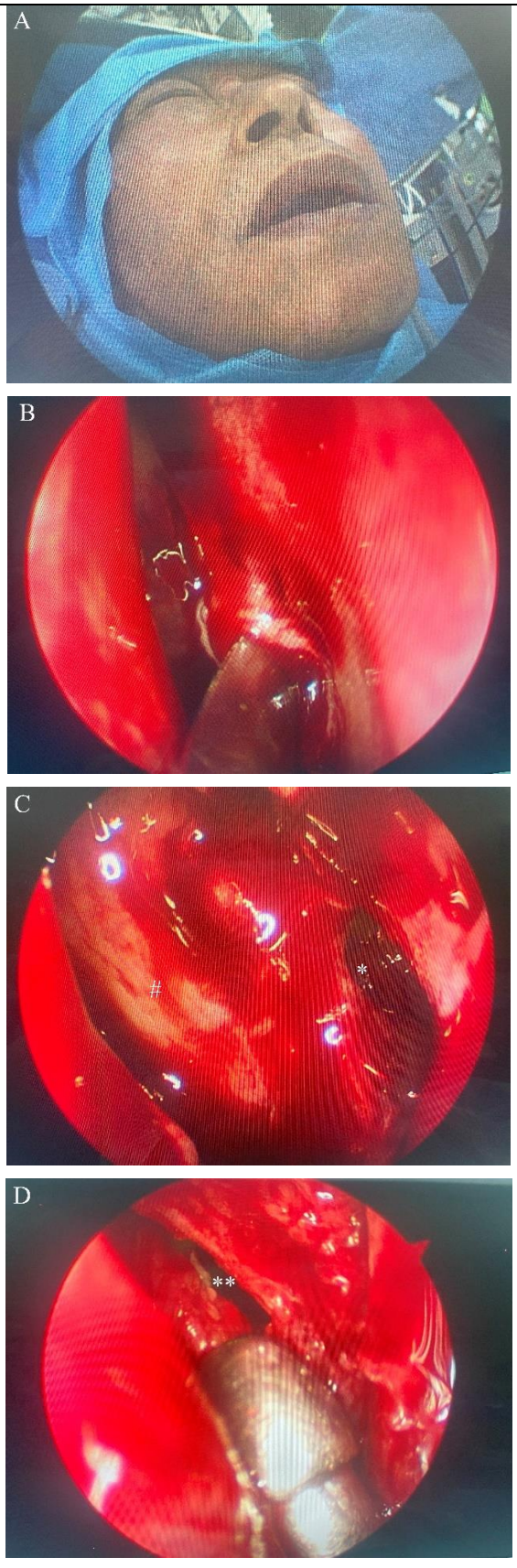

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Figure 5: Intraoperative setting and endoscopic images. A. Preoperative operation field preparation for local infiltrative anesthesia. B. mucopurulent discharge (Whitish pus through maxillary sinus ostium) of left maxillary sinus was confirmed using the curved freer. C. Middle meatal antrostomy of left maxillary sinus was done. The asterisk presents the opening site of left maxillary sinus. The sharp shows left middle turbinate. D. Left sphenoid sinus ostium was confirmed. Suction device removed mucoid discharge of left sphenoid sinus. The double asterisk presents the left sphenoid sinus ostium. E. Postoperative bleeding control.

Discussion

Sphenoid sinus is a developmental growth of the sphenoid bone in the posterosuperior segment of the sphenoid recess **[5]**. According to the recent literatures, the most common cause of sphenoid sinus lesions is inflammation, as found in up to 65%-72% of cases, followed secondly by neoplasms, which account for 18% (in benign) and less than 11% (in malignant) of the cases, respectively **[6]**. Because of its deep-seated anatomy, this sinus does not usually present with nasal symptoms such as nasal obstruction or rhinorrhea. The most common symptom is headache, which is prevalent in about 98% of inflammatory lesions **[7]**. In the majority of cases, symptoms do not arise in the early stages of the disease or are non-specific, and some cases may subsequently be referred to the otolaryngology department after significant progression of the diseases **[8]**. So, isolated sphenoid sinusitis and partially continuous sphenoid sinusitis (sphenoid-maxillary or sphenoid-frontal) are uncommon disease, relatively.

The sphenoid sinus can be confirmed through sphenoid sinus ostium using endoscopic system. Different types of sphenoid sinus are known; a simple way to classify it is using the conchal (small to no pneumatization), presellar (pneumatization anterior to the sella), and sellar (pneumatization beyond the sella) classification **(Figure 6)**. A more specific way to classify the sphenoid sinus is using the Wang classification, which takes into consideration coronal, sagittal, and axial view details the extension anterior to the sphenoid crest **[9]**. The ICA lateral to the sella turcica and optic nerve superior to ICA form the groove called the Optic-Carotid Recesses (OCR). The planum sphenoidale, tuberculum sellae and the prechiasmatic sulcus are superior to the sella **[10]**. Medial to the parasellar ICA, the middle clinoid process can be identified as a bony depression, which marks the delimitation of the roof of the Cavernous Sinus (CS) and the parasellar ICA **[10,11]**.

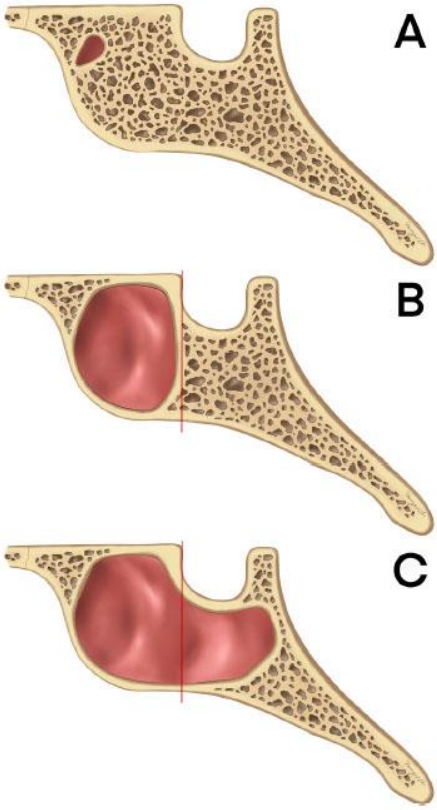

Figure 6: Illustration of different types of pneumatization of the sphenoid sinus. (A. Conchal. B. Presellar. C. Sellar.) the illustration is referenced by V.R. Chavez-Herrera et al.

Pathological mechanism of sphenoid sinusitis is not fully exposed. According to recent papers, the main pathological causes of sphenoid sinusitis are dysregulated immune response, persistent inflammation and interactions with microorganisms, which together cause epithelial barrier dysfunction/tissue remodeling **[12]**. Also, the blockage of the mucociliary movement to sphenoid sinus ostium is an additional cause. Bacterial colonization, along with impaired mucociliary clearance, plays a significant role in initiating or sustaining the inflammatory process in chronic rhinosinusitis (CRS) **[12]**. *Prevotella*, *Fusobacterium*, and *Streptococcus* were responsible for mucin degradation and the degradation of mucin by these genera enhanced the growth of *S. aureus* strains **[13].**

Occurrence mechanism of FB in the paranasal sinus is still not certain. Recent papers reported that FB is formed by malfunction of the paranasal sinus ventilation. Sphenoid sinus FB is relatively rare, isolated FB only to sphenoid sinus and the FB spreading mechanism from frontal sinus/maxillary sinus to the sphenoid sinus is not proved. It has been hypothesized that ostial closure creates an anaerobic environment favorable for growth of Aspergillus, or that chronic sinusitis predisposes to the development of FB **[5]**. Environmental and hormonal factors may be involved in the pathogenesis of FBs **[1,2,14-16]**. Clinically, sphenoid sinus FB is generally found incidentally and characterized by nonspecific symptoms such as headache which is the most common symptom; it can be bilateral or more often unilateral (fronto-orbital, fronto-temporal, retro-orbital, or occipital) **[2,16-19]**. Other common symptoms of sphenoid sinus FB are purulent anterior rhinorrhea, post nasal drip, nocturnal cough, and nasal obstruction. Ocular disorders, such as diplopia and visual disturbance are not uncommon **[18-21]**. In the cases of sphenoid sinusitis and sphenoid sinus FB, there are secretions in the spheno-ethmoidal

recess, a congested surrounding mucosa which often impedes visualization of the sphenoid sinus ostium and bulging mucosa of sphenoid sinus through the nasal endoscopic examination. For diagnosis of sphenoid sinus disease, CT scan is the definitive radiological method. Typically, sphenoid sinusitis finding is showed as heterogenous soft tissue density and sphenoid sinus FB is usually presented as heterogenous soft tissue density with calcification. And spontaneous hyper-densities often appear within the sinus opacity, due to the content of the FB in iron, calcium, and manganese. Some cases may demonstrate radio-opaque ("metallic") densities within the sinus opacity which represent microcalcifications or dense hyphae **[1,2,20,22,24]**. The pathological composition of isolated and partial-composed sphenoid sinus disease varied greatly in different regions **[25]**. According to statistics in published studies, inflammatory diseases accounted for 75%, tumors accounted for 18.9%, and malignant tumors accounted for less than 7% **[26]**.

The gold standard for sphenoid sinus lesions is surgical treatment. The surgical treatment is usually done by two approaches, trans-nasal approach and trans-ethmoidal approach. The trans-nasal approach has the merit to spare the ethmoid sinus mucosa. Trans-ethmoid approach is considered to treat combined the maxillary, ethmoid sinus and frontal sinus lesions with sphenoid sinus lesion. In both approaches, Sphenoid sinus lesion requires a wide opening of the sphenoid sinus to achieve complete removal of the disease. Postoperative bone regeneration may be due to the reduced negative effect of inflammation on osteogenesis **[1]**. Traditional sphenoidotomy is recommended to expand the natural ostium of the sphenoid sinus from the olfactory cleft or the posterior ethmoid sinus **[26]**. For avoidance of the dangerous area of the skull base and lateral wall of the sphenoid sinus, most of the surgeons perform the sphenoidotomy, expanding the sphenoid sinus downward. During the downward-approach, the author usually performs this procedure carefully, to avoid the injury of posterior lateral nasal branch of sphenopalatine artery. Duan et al. reports that the bone at the medial and bottom wall of the sphenoid sinus ostium is exposed, which is susceptible to scarring. And sphenoid sinus inflammatory disease is usually accompanied by mucosal and bone inflammation, more severe scarring, and even bone hyperplasia **[25]**. Electrocauterization is usually considered to postoperative bleeding control, but excessive electrocauterization leads to sphenoid ostium stenosis. The sphenoid stenosis derived postoperative bleeding control is one of causes of re-operation of the sphenoid sinusitis. In the case of sphenoid sinus ostium atresia, the surgical reconstruction with posterior septal flap could be considered. Insertion of packing material to paranasal sinus cavity is another method of postoperative bleeding control. The packing material is divided into absorbable packing material and non-absorbable packing material. Absorbable packing material is more flexible and more patient-friendly than non-absorbable packing material due to the good characteristic of taking up the nasal cavity fluid and blood. But, non-absorbable packing material is preferred to absorbable packing material because non-absorbable packing material slides out nasal cavity smoothly removing the material and keep the contour the volume well. According to the preference of operators, the packing material was selected. The author usually selects the materials considering the anatomical structure and the entity of secretion. Due to major structures around the sphenoid sinus include the optic nerve and ICA, the operator should scrutinize the sphenoid sinus anatomy, variation, and the critical structures surrounding the sinus. Also, because the damage to these structures can have fatal complications, meticulous surgical procedure should be taken to avoid damnifying them **[5]**. Commonly, the surgeon does the surgical treatment under general anesthesia to obtain good performance with stability. But, in the condition of the patient's uncontrolled systemic diseases and the social crisis derived the Intern/Resident/Faculty/Doctor strike, the surgery under local infiltrative anesthesia with nice cooperation of the

patient and the expert could be more effective to treat the pathologic lesions, for example, sphenoid sinus lesion.

Conclusion

The representative treatment of sphenoid sinusitis is the surgical approach. Preoperative nasal endoscopic examination and CT scan are the standard tools for diagnosis. The injury of critical structures adjacent to sphenoid sinus may lead to serious long-term complications. Surgical treatment of the sphenoid sinus could be successfully performed under local infiltrative anesthesia if preoperative imaging scrutiny/a meticulous surgical strategy precede the treatment. Also, surgical approach under local infiltrative anesthesia might be the freedom in the restricted circumstance.

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