Surgical Ciliated Cyst Following Maxillary Sinus Floor Augmentation: A Case Report

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Maxillary sinus floor augmentation is considered to play a critical role in dental implant treatment. Although many complications, such as maxillary sinusitis and infection, are well known, few reports are available on the risk of surgical ciliated cyst following the procedure. Here, we report a case of surgical ciliated cyst following maxillary sinus floor augmentation. A 55-year-old Japanese woman was referred to our hospital because of alveolar bone atrophy in the bilateral maxilla. We performed bilateral maxillary sinus floor augmentation by the lateral window technique without covering the window. The Schneiderian membrane did not perforate during the operation. She returned to our hospital after 9 years due to swelling of the left buccal region. Computerized tomography revealed a well-defined radiolucent area with radiodense border intraosseously localized in the left maxilla. We performed enucleation of the cyst with the patient under general anesthesia. Histological examination of the specimen showed a surgical ciliated cyst. In conclusion, the course of this patient has 2 important implications. First, the sinus membrane entrapped in the grafted bone without visible perforation and or tearing can develop into a surgical ciliated cyst. Second, there is a possibility that covering the lateral window tightly might prevent the development of a surgical ciliated cyst.

Key Words: surgical ciliated cyst, sinus floor augmentation, maxilla, complication

INTRODUCTION

Previous reports have shown that surgical ciliated cyst is a frequent complication of radical maxillary sinus surgery for chronic sinusitis. There are few reports of the development of a surgical ciliated cyst as a complication of maxillary sinus floor augmentation. The difficulty with this cyst is that it takes several years to develop, and in a case, the removal of the implant fixtures is required. In all previous reports of the cyst as a complication of maxillary sinus floor augmentation, no information was available concerning the possible problems encountered during Schneiderian membrane elevation. However, our patient developed a surgical ciliated cyst following maxillary sinus floor augmentation, which was performed without visible Schneiderian membrane perforation 9 years ago. Thus, we should be aware of the possibility of a surgical ciliated cyst developing a long time after maxillary sinus floor augmentation. We also discuss the pathogenesis of the cyst and a preventive measure.

CASE REPORT

A 55-year-old Japanese woman was referred to our hospital because of alveolar bone atrophy in the bilateral maxilla in January 2007. She hoped for dental rehabilitation supported by dental implants, and computerized tomography (CT) revealed slight edema of the left sinus membrane and no cystic lesions (Figure 1). Therefore, we performed bilateral maxillary sinus floor augmentation by the lateral window technique. After creation of the lateral window, the Schneiderian membrane was detached from the surface of the maxillary sinus and elevated. The empty compartment created by elevating the membrane was filled with a mixture of OSferion (beta-tricalcium phosphate, Olympus, Tokyo, Japan), Ceratite (tricalcium phosphate and hydroxyapatite, Japan Medical Next, Tokyo, Japan), and autogenous bone from the mandibular ramus as the bone substitute material. The Schneiderian membrane did not perforate or tear during the operation, and there was no evidence of postoperative complications, such as infection. Four implants were placed in her edentulous maxilla for implant supported over denture after 6 months at another dental clinic.

Nine years later, in July 2016, she returned to our hospital with a chief complaint of swelling and tenderness of the left buccal region. There was no gross facial swelling on examination. Intraoral examination showed mild swelling and tenderness at the left upper gingivobuccal fold accompanied by decubitus ulcer and erythrogenic of the mucosal surface.
Panorama XP showed well-defined unilocular radiolucency in the left upper dentoalveolar region below the maxillary sinus, and CT showed a bilocular, well-defined radiolucent area with a radiodense border intraosseously localized between the left upper implant fixtures (Figures 3, 4a and b). The scan showed no perforation of the medial cortex and no communication with the maxillary sinus and nasal cavity. Hydroxyapatite granules had migrated toward the buccal side through the lateral window, not only toward the diseased side but also the healthy side. We performed a biopsy through an incision in the labial sulcus with the patient under local anesthesia. Yellowish mucinous fluid (1 mL) was withdrawn by aspiration, and histological examination of the specimen showed that the cystic wall was composed of squamous epithelium (Figure 5). With a clinical diagnosis of maxillary cyst, we performed enucleation of the cyst with the patient under general anesthesia in August 2016. The cyst was exposed after a mucoperiosteal flap was raised, and the cyst was enucleated in total (Figure 6a and b). Although the cystic cavity was partially contiguous with the implant fixtures, the implant fixtures were stable, and the cavity was completely separated from the maxillary sinus by bone. The wound was closed primarily without any graft. Pathological findings of the surgical specimen revealed that the cyst was lined by pseudostratified ciliated epithelium and focally by squamous epithelium (Figure 7a and b). The cyst was finally diagnosed as a surgical ciliated cyst, taking consideration of the medical history of sinus floor augmentation. There was no recurrence at the left maxilla at 8 months postoperatively (Figure 8a and b).

**DISCUSSION**

To our knowledge, this is the fourth report to describe a case of a surgical ciliated cyst following sinus floor augmentation1–3 and the first to describe the possibility that the surgical ciliated cyst developed without visible perforation and or transplantation of the Schneiderian membrane. The course of the present patient has 2 important implications.

First, the Schneiderian membrane entrapped in grafted bone without visible perforation and or tearing can develop into a surgical ciliated cyst. The surgical ciliated cyst is a locally aggressive lesion, usually developing as a delayed complication many years after radical maxillary sinus surgery for chronic sinusitis.4–7 The widely accepted theory is that iatrogenically implanted respiratory epithelium from the sinus surgery (eg, by the Caldwell–Luc procedure or LeFort I osteotomy) contaminates the maxillary wound, proliferates, and undergoes cystic changes and enlargement.5–8 Furthermore, there are many reports of the cyst developing following midface orthognathic surgery5,9 and simultaneous mandibular surgery.4,8,10,11 The development of the cyst in the mandible may be attributed to entrapment of the Schneiderian membrane by surgical instruments, such as saw blades.10 There have been three previous reports on the development of surgical ciliated cysts following maxillary sinus augmentation at 6 months, 3 years, and 10 years after the initial surgery (Table 1).1–3 In these reports, another surgeon performed the initial sinus floor augmentation, and no information is available concerning possible problems encountered during Schneiderian membrane elevation. In all previous reports of surgical ciliated cysts following Caldwell–Luc, LeFort I osteotomy, genioplasty, or sinus floor augmentation, the cysts developed after perforation or transplantation of the Schneiderian membrane. We performed both the sinus floor augmentation and the cyst enucleation surgery. According to our operation records, there was no visible perforation of the Schneiderian membrane at the initial surgery but the cyst developed in the patient’s maxilla 9 years later. This course strongly suggests that the development of a surgical ciliated cyst is not necessarily preceded by visible perforation and or tearing of the Schneiderian membrane.

Second, there is a possibility that tightly covering the lateral window prevents the development of a surgical ciliated cyst. In general, sinus floor augmentation is a proven and reliable technique because of the low observed rate of postoperative complications and the high success rate of implants placed into the grafted area.2,12–14 However, Nosaka et al15 reported temporary strong postoperative swelling of the Schneiderian membrane. A complication of this postoperative swelling was migration of the bone substitute materials and dislocation of the trap door. When the pressure was toward the lateral window, the bone substitute materials migrated toward the buccal side of the alveolar bone through the lateral window. In
In the present case, we conjecture that there was temporary strong swelling after sinus floor augmentation from the CT findings that hydroxyapatite granules had migrated toward the buccal side through the lateral window not only on the left but also on the right side. Our hypothesis is that the events happened in the following sequence: first, the bone substitute materials migrated to the lateral window as a result of the temporary strong postoperative swelling of the Schneiderian membrane; second, the migration of the materials left a loose space in the remaining materials; third, the membrane was trapped in the space accidentally at the timing of swelling diminished; and finally, the cyst developed in the space. Nosaka et al.\textsuperscript{15} recommended that the lateral window be covered tightly with a titanium mesh plate and screws to avoid the migration of bone substitute materials through the lateral window. Titanium mesh is widely used in oral and maxillofacial surgery and acts as a barrier and physical support of the soft tissue over the bone graft.\textsuperscript{16,17} Although a disadvantage of this material is a tendency to become exposed during the healing phase, the risk of infection is very low.\textsuperscript{18} In addition to maintaining the formation of grafted bone, titanium mesh may play an important role in preventing the development of a surgical ciliated cyst after sinus floor augmentation.

In the present case, according to our operation records, there was no visible damage to the Schneiderian membrane during the sinus floor augmentation procedure; however, there may have been invisible damage to the membrane at the time. As a limitation of this case report, we cannot completely rule out the possibility that perforation or tearing of the Schneiderian membrane occurred at the time of temporary postoperative swelling of the membrane. Thus, further study on cases of surgical ciliated cyst following sinus floor augmentation is necessary.

**FIGURES 2–5.** Figure 2. Intraoral view when the patient returned to our hospital shows mild swelling and tenderness at the left upper gingivobuccal fold accompanied by decubitus ulcer and erythrogenic of the mucosal surface (black arrowhead). Figure 3. Panorama XP when the patient returned to our hospital shows well-defined unilocular radiolucency in the left upper dentoalveolar region below the maxillary sinus (white arrowhead). Figure 4. (a) Coronal computerized tomography (CT) plane. (b) Axial CT plane. CT shows a bilocular, well-defined radiolucent area with radiodense border intraosseously localized between the left upper implant fixtures. Hydroxyapatite granules have migrated toward the buccal side through the lateral window, not only toward the diseased side (red circle) but also toward the healthy side (yellow circle). Figure 5. Biopsy specimen reveals that the cystic wall consists of squamous epithelium.
required to determine whether the cyst can develop without visible perforation and or transplantation of the membrane.

In conclusion, the course of this patient has 2 important implications. First, sinus membrane entrapped in the grafted bone without visible perforation and or tearing can develop into a surgical ciliated cyst. Second, there is a possibility that covering the lateral window tightly may prevent the development of a surgical ciliated cyst. Therefore, when sinus floor augmentation is required, details about the risks and complications, including surgical ciliated cyst, should be discussed with the patient. Furthermore, we should consider the use of titanium mesh as a preventive measure against the development of a surgical ciliated cyst.

**ABBREVIATION**

CT: computerized tomography

**NOTE**

The authors declare there is no conflict of interest.
REFERENCES


TABLE 1
Summary of the reported cases of surgical ciliated cyst following maxillary sinus augmentation*

<table>
<thead>
<tr>
<th>No.</th>
<th>Source</th>
<th>Age/Sex</th>
<th>Histopathological Findings</th>
<th>Squamous Metaplasia</th>
<th>Content Fluid</th>
<th>Duration</th>
<th>Treatment</th>
<th>Implant Removal</th>
<th>Graft to Cyst Cavity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Misch et al.</td>
<td>76/F</td>
<td>CCE</td>
<td>+</td>
<td>Yellowish mucinous</td>
<td>3 years</td>
<td>enucleation</td>
<td>Required</td>
<td>Bio-Oss/autogenous bone</td>
</tr>
<tr>
<td>2</td>
<td>Lockhart et al.</td>
<td>41/F</td>
<td>CCE</td>
<td>–</td>
<td>NA</td>
<td>6 months</td>
<td>enucleation</td>
<td>Before implantation</td>
<td>Iliac bone</td>
</tr>
<tr>
<td>3</td>
<td>Kim et al.</td>
<td>60/M</td>
<td>CCE</td>
<td>+</td>
<td>NA</td>
<td>10 years</td>
<td>enucleation</td>
<td>Not required</td>
<td>Demineralized freeze-dried bone/ resorbable calcium phosphate</td>
</tr>
<tr>
<td>4</td>
<td>Present case</td>
<td>64/F</td>
<td>CCE</td>
<td>+</td>
<td>Yellowish mucinous</td>
<td>9 years</td>
<td>enucleation</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>

*NA indicates not available; CCE, ciliated columnar epithelium.