Operative Techniques in Otolaryngology (2015) 26, 143–149

Operative Techniques in
Otolaryngology

Open surgical management of sialolithiasis

Sam J. Daniel, MD, MSc, FRCSC, Alyssa Kanaan, MD

From the Department of Otolaryngology—Head & Neck Surgery, Montreal Children's Hospital, McGill University Health Center, Montreal, Quebec, Canada

KEYWORDS
sialolithiasis;
salivary glands;
open surgery;
Wharton's duct;
Stenson's duct

Sialolithiasis should be considered in the differential diagnosis of any patient with persitent or recurring salivary gland swelling or inflammation. It occurs most frequently in the Wharton duct followed by the Stensen duct, and rarely in the sublingual glands. Sialolithiasis typically presents with pain and swelling of the involved gland and is aggravated by eating. In the acute setting, patients with sialadenitis secondary to calculi are treated conservatively with antibiotics, and stones less than 2 mm may pass spontaneously. Sialendoscopy is now well established as a novel minimally invasive diagnostic and therapeutic modality for salivary gland stones. Sialoendoscopes can also be used in combination with several open surgical approaches to guide the extraction of large calculi. This article highlights the open surgical interventions that are frequently used in sialolithiasis management, when sialoendoscopy is not the most appropriate option, has failed, or is not available. They range from minimally invasive to open techniques. Mastering the anatomy of the salivary ducts and surrounding structures is of exquisite importance. The management of sialolithiasis should aim for gland-sparing procedures before considering gland excision.

Introduction

Sialolithiasis is the most common etiology of obstructive sialadenitis, followed by stenosis and sialodochitis.[1] Stone formation is more frequent in areas where the duct is narrow or compressed. Overall, 60%-80% of sialoliths occur in the submandibular ducts (the Wharton duct), and the rest are found mostly in the parotid ducts (the Stensen duct). Only 1% of sialoliths occur in the sublingual glands, and they are extremely uncommon in the minor salivary glands.[2,3]

Management of sialoliths depends on the stone size, location, number of stones, and the extent of ductal obstruction. Surgical management ranges from minimally invasive to open surgical techniques. The introduction of sialoendoscopes has revolutionized the management of sialolithiasis and allowed for a more accurate diagnosis and localization of the obstruction.[1] Sialoendoscopes are also valuable in the management of small sialoliths and can be used in combination with open techniques in cases with large stones.[1] This article focuses on open surgical techniques for the management of sialolithiasis.

Etiology and pathophysiology

Sialoliths are composed of both organic and inorganic substances. They are thought to originate from secretory inactivity of the salivary gland, leading to creation and accumulation of sialomicroliths. These in turn become colonized with bacteria, leading to duct inflammation with cellular exudate and fibrosis.

Once a large duct is compressed or obstructed, stagnation of calcium-rich material leads to the formation of a sialolith nidus that further obstructs the duct, leading to a vicious

Address reprint requests and correspondence: Sam J. Daniel, MD, MSc, FRCSC, Department of Otolaryngology—Head and Neck Surgery, Montreal Children's Hospital, McGill University Health Center, 2300 Tupper Ave, Room B-240, Montreal, Quebec, Canada H3H-1P3.
E-mail address: sam.daniel@mcgill.ca

http://dx.doi.org/10.1016/j.otot.2015.06.008
1043-1810/

cycle.[4] Stones are more likely to form when the water content of saliva is low. Risk factors include dehydration; certain medications such as diuretics, anticholinergics, and antihistamines; certain autoimmune conditions; systematic abnormalities with calcium metabolism; and altered salivary pH.[5]

Symptoms and signs

Most patients present with an acute painful swelling of their submandibular or parotid gland or with a history of recurrent swelling. The swelling and discomfort can be exacerbated during meals, particularly when the patient eats sour or acidic food. Symptom duration and severity can vary depending on the degree of ductal obstruction.

Calculi can occasionally pass spontaneously; however, when impacted, removal is the optimal management strategy. Complete ductal obstruction can potentiate a bacterial infection, resulting in sialadenitis. Physical findings include an enlarged tender gland, with occasional edema and erythema of the overlying soft tissue, purulent secretions from the duct, and cervical lymphadenitis. Some patients experience fever and malaise. Severe infection secondary to submandibular duct obstruction with marked cellulitis can lead to airway obstruction, as the swelling may extend into the floor of the mouth. Some patients, particularly those with immune deficiency, may develop an abscess requiring drainage.

Diagnostic testing

The diagnosis can often be made on history and physical examination including a thorough bimanual palpation of the affected gland and its excretory duct.

Oral examination may reveal a stone at the orifice or along the ductal system.

Plain x-rays can be used for a quick confirmation in the presence of radiopaque stones. However, up to 80% of parotid and 20% of submandibular stones are radiolucent, leading to false-negative results. In addition, other calcifications such as phleboliths, calcified nodes, and atherosclerosis of the lingual artery can make the interpretation of plain radiographs more difficult.

Traditional sialography consisting of injection of contrast material into the Stensen duct or the Wharton duct was previously used extensively to detect duct stricture, stenosis, or sialoliths. It has fallen out of favor because of associated patient discomfort, technical challenge, and its contraindication in the acute inflammatory setting. Ultrasonography with a high-frequency linear transducer is very reliable in cases of silolithiasis. Salivary calculi measuring more than 2 mm are identified accurately in more than 90% of the cases.[6,7] Computed tomography (CT) is beneficial when the diagnosis is uncertain, especially for identification of calculi within the parotid duct. CT scan with soft tissue and bone algorithm allows the detection of an associated abscess or ranula. CT imaging is usually performed both with and without contrast enhancement to differentiate calculi from vascular structures. Magnetic resonance imaging is very valuable to identify smaller stones and to differentiate acute from chronic obstruction.[8] A noninvasive diagnostic method—sialo–magnetic resonance imaging—produces sialographic images without using any contrast vehicle and without ionizing radiation, a disadvantage of both CT and contrast sialography.[9] This technique may be performed even in the presence of acute inflammation. It also allows for precise morphologic evaluation of the salivary ducts, up to second- and third-order branches, without the need for duct cannulation.[10,11]

Sialoendoscopy is a relatively new minimally invasive method that allows endoscopic transluminal visualization of salivary gland ducts. It permits an accurate diagnosis of salivary gland ductal pathology (inflammation, stenosis, and stricture), as well as the diagnosis and treatment of sialolithiasis.[12,13] Advances in instrumentation have allowed the use of this to remove stones that are beyond the reach of traditional transoral procedures. Endoscopy may also find stones that have gone undetected by other imaging techniques.[14] The authors believe that this innovative method will become the gold standard for the investigation and treatment of sialolithiasis in the near future. The size of the stone, its location, and the condition of the duct (angle, stenosis, and scaring) may dictate an intraoral open approach or a combined approach. Sialoendoscopes are extremely fragile and are not available in all institutions.

Relevant anatomy

The parotid is the largest of the salivary glands and is the first to develop in utero (Figure 1).[15] It lies between the external auditory canal, the ramus of the mandible, and the mastoid tip. The Stensen duct arises from the anterior border of the parotid gland, courses superficial to the masseter muscle in a direction parallel and inferior to the zygoma, and then turns sharply and pierces the buccinator, entering the oral cavity opposite the second upper molar. The parotid duct changes direction twice; a proximal bend is noted as it joins the hilum, and a more distal bend is noted as it curves around the masseter muscle.[16] The average length of the duct is 4-7 cm and its mean diameter ranges between 0.5 and 1.4 mm, with narrowing at the middle of the duct.[17]

The submandibular gland rests between the anterior and posterior digastric tendons just below the body of the mandible. The Wharton duct arises from the medial surface of the submandibular gland. Its average length is 5 cm and its mean diameter ranges between 0.5 and 1.5 mm.[17] It opens in the floor of the mouth through a papilla lateral to the tongue frenulum. It has an important relation with the lingual nerve, as depicted in the caption in Figure 1. The lingual nerve forms a near-complete loop around the duct. It crosses above the duct as the latter exits the gland. As the duct continues distally, the lingual nerve passes below the duct and crosses it medially.