Parotid Stones

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Key Points

1. Stones are more common in the submandibular gland than the parotid and represent 50% of all obstructive pathology.
2. Stones may start as microliths or be secondary to trauma, bacteria, or foreign bodies.
3. Ultrasound and CT are most commonly used to evaluate for stones.
4. Salivary endoscopy can address most small stones in a minimally invasive way. Larger stones may require other modalities combined with endoscopy.

Epidemiology

The incidence of parotid stones is reported to be approximately 1 in 20,000, with some reports of stones in autopsy material of up to 1% [1]. In the parotid gland, it is the second most common reason for salivary swelling after mumps. The etiology of salivary stones has not been completely determined. Research by Dr. John Harrison and others has concentrated on the formation of microliths. These can be found in normal glands and then serve as the nidus for the formation of sialoiths. In animal models, the incidence of microliths increases when salivary flow is obstructed [2]. Another theory is that trauma, bacteria, or foreign bodies act as the initial nidus.

Clinical Presentation

Patients with parotid stones primarily present with intermittent mealtime symptoms. When salivary demand increases, the stones which are usually in the duct over or anterior to the masseter at presentation cause obstruction of flow, swelling, and discomfort [3]. Stones are therefore symptomatic when they reach a point that they block a significant portion of the ductal lumen where they reside. The parotid duct has been estimated to be about 1.5 mm in diameter at its widest part [4]. Patient's stones may reach significant size with few symptoms and then present with an acute more dramatic infection. Intermittent obstruction leads to infection and stricture formation as well. One theory of stone formation suggests that recurrent bouts of salivary gland inflammation lead to the formation of inflammatory microliths that coalesce into symptomatic stones (Fig. 5.1).

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Fig. 5.1 This is a stent from a patient who was lost to follow-up and had it retained for many months. It is covered with new mini stones, demonstrating the principle of microlith formation from a foreign body nidus

Testing

History is the most important feature of salivary inflammatory disease. For stone patients, 80% of them are in the submandibular gland (see Chap. 7). The choice as to what radiographic investigation is best varies among practitioners.

Ultrasound (US)

The noninvasive, readily available, and inexpensive nature of this technique has led to US becoming a major investigative tool in patients with salivary complaints. Increasingly, surgeons have these devices in their offices and can use them as a natural extension of their physical examination. In Europe, residency training in US is becoming a requirement for certification, and it is reasonable to assume that US will shortly become an integral part of residency training in the United States as well.

Fig. 5.2 Ultrasound image of right proximal parotid stone (5.2 mm); stone casts a typical distal acoustic shadowing

Terraz found the overall sensitivity, specificity, accuracy, and positive and negative predictive values of sonography in the detection of calculi were 77, 95, 85, 94, and 78%, respectively. Most importantly, false-negative sonographic findings were associated with calculi with a diameter less than 3 mm in non-dilated salivary ducts; most calculi with a diameter of 3 mm or greater were correctly identified. False-positive findings were caused by ductal stenosis with wall fibrosis, which was erroneously interpreted as lithiasis [5]. If US shows a stone, it is likely to be there with a high positive predictive value (94%) (Fig. 5.2). The absence of a stone might be because it is small. In that case the authors of the paper suggest proceeding with an MR sialogram if the likely suspicion for a stone is low and a conventional sialography if the likelihood of a stone is felt to be high. Our institutional preference is to obtain a non-contrast CT scan in these situations instead.

Computerized Tomography (CT)

CT scan is superior at detecting salivary stones but relatively poor at looking at ductal dilatation. It is able to detect stones as small as 1 mm, and below this size, they are rarely symptomatic (Fig. 5.3). It has as a disadvantage the exposure to radiation. Cone beam CT has also been used, and it is less expensive with less radiation exposure.

Fig. 5.3 Computerized tomography demonstrating dense stone with significant parotid inflammatory changes in the left parotid gland

MRI Sialography

This technique is not universally available, but it has been well described in the literature.

The sensitivity, specificity, and positive and negative predictive values of MR sialography to detect calculi were 91, 94–97, 93–97, and 91% [6].

Conventional Sialography

Although the technique is not as popular as it once was, it does have a role in the management of small parotid stones and other salivary pathologies. An excellent resource to understand the role and technique of sialography for the diagnosis and management of nonneoplastic salivary gland disorders is the Iowa Head and Neck Protocol, an effort spearheaded by Dr. Henry T. Hoffman. https://iowaheadneck-protocols.oto.uiowa.edu/display/protocols/Sialograms+and+Sialography

Nonsurgical Therapy

Lithotripsy has a long history in the treatment of salivary stones. Its main advantages is that it is noninvasive and outpatient, requires no anesthesia, and has relatively few complications. The technique is NOT currently FDA approved in the United States. Iro et al. reported on minimally invasive treatment of salivary stones in five centers in 4691 patients. Only 78 patients had parotid stones treated in this manner. Since multiple centers were involved, they used more than one manufacturer's technology. The duration of each session was usually 1 h. The number of shock waves delivered during each session varied between 3000 and 5000. The outcome was assessed clinically and by ultrasound or sialographic evaluation, or both, 3–6 months after completion of treatment. Parotid stones were successfully treated in 70% and partially successful in 25% with <5% requiring gland removal. Submandibular cases had a lower rate of complete success. Long-term reports of lithotripsy have placed permanent complete response to treatment at 40% [7].

Surgical Therapy/Results/Complications

Sialolithotomy

Direct sialolithotomy has traditionally been done for stones presenting at the papilla. Large palpable stones that are too large for simple endoscopy can be addressed by a transoral approach as well. The stone must be palpable. It is possible that long-standing stones with proximal dilation can fall back toward the hilum of the parotid gland during this manipulation making transoral removal difficult. A papilla sparing approach can also be used to facilitate removal of stones either proximal to the papilla or distal to the anterior border of the masseter muscle. This procedure involves making a curvilinear incision or circular incision around the papilla and accessing the duct in the buccal space (Fig. 5.4). The stone is identified within the duct in the buccal space and

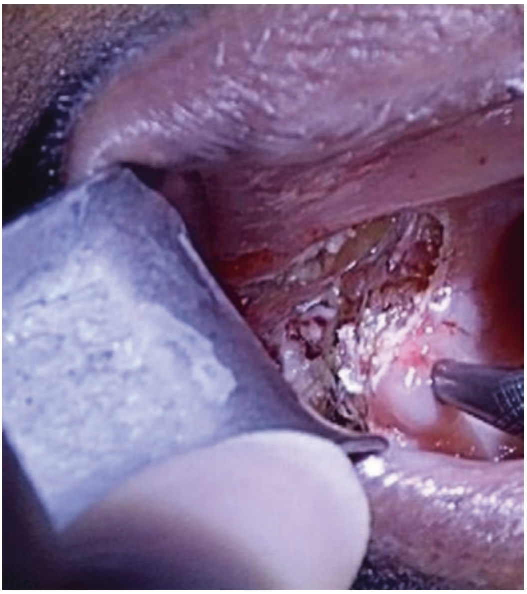

Fig. 5.4 Transoral approach to salivary stone in right parotid not amenable to simple endoscopic removal. Curved incision allows exposure of the duct in the buccal space

delivered via a longitudinal sialolithotomy. After stone removal, a salivary endoscopy to check for complete stone removal and facilitate stent placement and repair of the duct is performed (Fig. 5.5). The major potential complication is stenosis related to the surgical incision which may be reduced by stenting the repaired duct (Fig. 5.6).

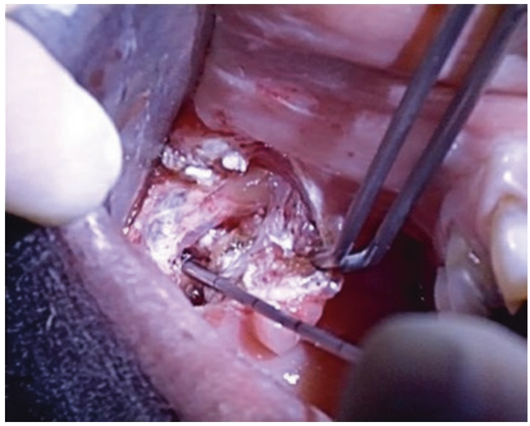

Fig. 5.5 Passage of salivary endoscope through an opening in distal Stensen's duct

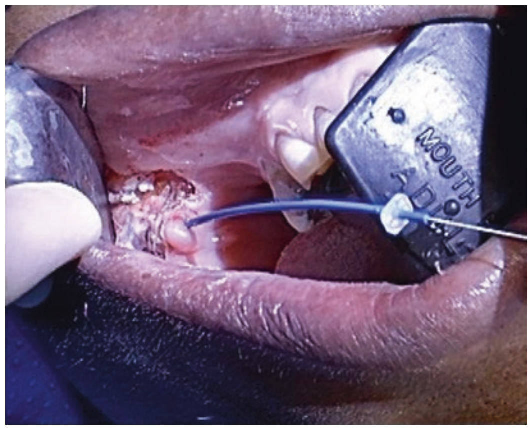

Fig. 5.6 Placement of a stent over a guidewire into Stensen's duct. Many surgeons have found that stent placement for 1–2 weeks reduces the probability of a ductal stenosis

Salivary Endoscopy

Salivary endoscopy has emerged as a minimally invasive approach for stones of the parotid and submandibular gland. It can be performed purely under local anesthesia where local anesthetic is administered intraluminally via the salivary endoscope after initial dilation of the papilla that often requires no anesthesia or just a topical anesthetic; alternatively, it can also be performed under monitored anesthesia care. More complex cases lend themselves to general anesthetics in an operating room setting. A decision to perform local, monitored anesthesia or general anesthesia rests upon several factors such as patient comfort, surgeon experience and comfort, office-based infrastructure, patient factors (such as age, comorbidities, previous salivary surgery), and indication for the procedure. The ideal case is a mobile, small stone that can be captured in a stone basket and delivered with no incision or a small papillotomy (Fig. 5.7). The size of the stone is not an absolute when building an algorithm for stone removal [8]. Walvekar et al. found that small, round stones could be more difficult to remove with stone baskets than larger more oblong stones. Each scope has only certain baskets that will fit in the working channel. In order to deploy the best

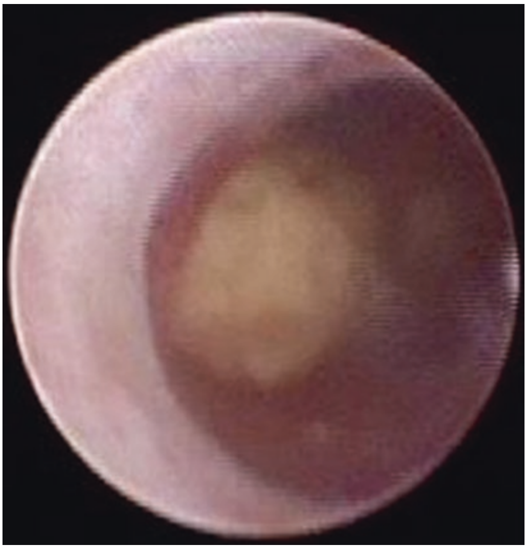

Fig. 5.7 A mobile stone as visualized on salivary endoscopy is usually amendable to endoscopic basket removal

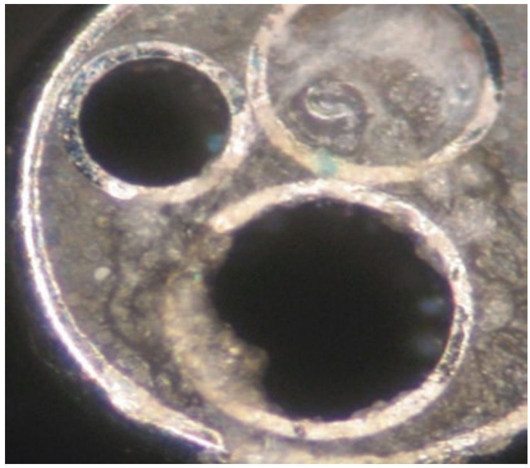

Fig. 5.8 View of salivary scope tip that was damaged by laser use. This changed the scope optics and deformed the working channel

basket, it is necessary to know the basket to scope options and to have an array of scopes available to perform the case. Potential complications include duct rupture, duct avulsion, traumatic stenosis, failure to remove a stone, and stone recurrence (about 5%).

Medium-sized round stones (4–7 mm) will most commonly require fragmentation to allow extraction. The only option in the United States is the holmium laser which is similar to what is in use in urologic stone surgery [9]. Small fibers fit easily through the working channels. It is imperative to be trained in the use of the laser and to exercise caution. The holmium laser is used primarily since it is a contact laser; however, it is still possible to injure or perforate the duct wall with the laser energy. The cases sometimes need to be staged as irrigation and laser energy will lead to duct swelling and make the procedure less safe. Stones are of a variety of densities requiring different power setting, but in general, one can start at 5 Hz and 0.5 J per pulse and increase it as necessary. A greater power setting allows more rapid fragmentation but is associated with faster onset of ductal edema due to thermal damage. Lower setting allows a more controlled stone fragmentation but increases operative time.

Tremendous care and constant irrigation are required to prevent the duct wall from being injured. In addition, the fragile and expensive scopes can be injured by the stony material that is generated by the laser energy. In order to avoid scope damage, the scope should be kept back as far as possible but with a continued good view. This damage can be either to the optics of the scope or can accumulate in the working channel and prohibit instruments from passing through the tip of the scope (Fig. 5.8).

Salivary Endoscopy with Combined Approach

Stones with size and shape not amenable to laser excision are removed with a hybrid or combined approach. These larger parotid stones can still be managed without parotidectomy. The stone is first localized with a traditional salivary endoscopy. The stone is trapped in a basket if possible to allow for the stone to be fixed in its location. Trapping the stone may also allow the surgeon to "place" the stone in a part of the duct with the easiest external accessibility, generally distal to the gland over the masseter muscle. If it is not possible to deploy a basket because the stone fills the ductal lumen and the basket cannot be deployed, the scope is left in the duct, and the palpability of the scope and the light facilitate the external ductal incision.

Once the stone is identified, a face-lift parotid incision is generally used. some cases have been done with a SMALL TRANSFACIAL Incision. The flap is raised as for parotid surgery. A U-shaped flap of SMAS is created lateral to the duct as determined by palpation and/or scope light transillumination. A small incision over the stone with an 11 blade is accomplished and enlarged as necessary with very fine scissors. Care is taken after creation of the SMAS flap to avoid the buccal branch of the facial nerve that travels with the duct. Although this author does not use a nerve monitor, several of the book's editors do this case with a nerve monitor. Success in the parotid gland is over 75% [10, 11]. Complications include stone recurrence, sialocele, facial nerve weakness, numbness, scar, and failure to remove the stone.

Gland Excision

Some patients still require gland excision for salivary stones. These make up <10% of all inflammatory parotid patients. For stone patients they are made up of the following groups:

1. Stones down side channels not accessible to salivary endoscopy
2. Proximal intraglandular stones not amenable to removal with scope
3. Recurrent stones that are multiple and inaccessible
4. Stones with dense stenosis distal to them
5. Surgical failures because of technical issues

Conclusions

Salivary stones are a relatively common cause of obstructive salivary symptoms. Stones larger than 3 mm can be accurately diagnosed with US. Smaller stone patients with a strong history and negative US should be investigated with CT or sialography.

Stone size and shape determine the best method of stone removal. Small stones will come out directly with endoscopy. Medium-sized stone requires external or laser lithotripsy and fragmentation to allow extraction.

Larger stones can be treated successfully with combined or hybrid approaches. Failure of all techniques will result in a small number of cases that need to have a conventional parotidectomy as definitive therapy. The goal, however, is always to try to take care of the problem with gland preservation in the most minimally invasive way possible.

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