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ORIGINAL ARTICLE

Interventional Sialendoscopy with Endoscopic Sialolith Removal Without Fragmentation

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Abstract We performed a retrospective analysis to review the results and complications of sialendoscopy and to identify the overall success rate of mechanical stone retrieval without fragmentation in our patients with sialolithiasis. Between 2009 and 2011, 33 patients with sialolithiasis underwent interventional sialendoscopy. Patients with sialoliths larger than 7 mm in the Wharton's duct and 5 mm in the Stensen's duct or intraparenchymal stones were not included in this study. Grasping forceps, wire baskets and graspers was used for stone removal. The mean age at presentation was 41.7 (range, 29–62) years with a male to female ratio of approximately 1:2. The average size of the stones ranged from 2 to 6 mm. The overall success rate for endoscopic stone retrieval was 78 % (26 of 33) and three patients required a combined approach with intraoral incisions for stone removal. The major complication rate was 3 % (1 of 33) caused by submandibular duct perforation. The endoscopic retrieval of salivary stones is a safe and effective technique in selected cases. As instruments for stone fragmentation are expensive and not available everywhere, selecting patients with small and medium sized stones could lead to successful results in majority of cases.

Keywords Sialolithiasis · Salivary duct · Sialadenitis · Sialendoscopy · Complications

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Introduction

The classical methods of treating sialolithiasis are medical treatment with antibiotics and anti-inflammatory drugs or surgical excision of the involved salivary gland. Because of the morbidity of salivary gland surgeries, both the surgeons and patients are unwilling to proceed to operation. However, delaying the surgery may lead to stone enlargement and fibrosis and therefore increase the risks [1].

There has been rapid development of nonsurgical and minimally invasive techniques for diagnosing and treating salivary gland duct obstructions in last few years. Extracorporeal lithotripsy, sialendoscopy, mini instruments, and related surgical techniques and approaches all have become focused on salivary duct and gland pathologies. Sialendoscopy is a minimally invasive method that allows endoscopic visualization of the salivary ductal system. It can be used as a diagnostic or interventional tool for inflammatory and obstructive pathology of the ductal system, thus providing an alternative to open surgery and its related complications [2].

The aim of this retrospective review was to validate the safety of sialendoscopy and to review its results and complications in our patient population. We also aimed to identify the overall success rate of endoscopic mechanical retrieval without fragmentation in treatment of sialolithiasis.

Material and Method

This is a retrospective analysis of all sialendoscopic procedures for sialolithiasis performed between 2009 and 2011. Patients underwent sialendoscopy at Amiralam hospital, Tehran University of medical sciences. Diagnosis of sialolithiasis had been made by clinical examination, plain

radiographs or CT scans but all patients were subjected to ultrasonographic study before the operation.

All of the procedures were carried out in operating room under general anesthesia. The endoscopic system used in this study was Marshal compact modular semirigid interventional sialendoscope (Karl Storz, Tuttlingen, Germany). We used grasping forceps, wire baskets and graspers for stone removal.

Institutional approval was obtained from the otolaryngology research center ethics board, Tehran University of medical sciences before the beginning of the study. For all patients epidemiologic and clinical data including age, sex, physical examination and ultrasonographic findings, intraoperative findings and problems and complications were documented. All the procedures were performed by the senior author who was trained using the porcine model at the European Sialendoscopy Training Center, Geneva, Switzerland.

Preoperatively, we discussed with all patients about the possibility of switching to open or combined approach during the procedure and relevant informed consent was obtained.

The sialendoscopic approach for endoscopic removal of sialoliths was undertaken when the calculus diameter did not exceed 7 mm in the Wharton's duct and 5 mm in the Stensen's duct. We excluded patients with larger stones or intraparenchymal stones because of the lack of appropriate instruments for stone fragmentation.

For introducing the endoscope into the ductal lumen, dilation of the papilla was accomplished with salivary dilators and conical probe (Karl Storz, Tuttlingen, Germany). When finding the duct papilla was not possible with this technique, a small papillotomy incision was carried out.

A 50 ml syringe filled with isotonic saline was used for continues irrigation. The irrigation maintains duct dilation and is necessary for adequate visibility.

Sialoliths were removed with baskets or miniforceps in one piece. Occasionally we were able to crush a large stone into small pieces and remove them piece by piece by forceps or basket or wash them out by irrigation.

We didn't use any stent after the procedure except in combined approach patients in such cases a stent was maintained in place for a period of 2–4 weeks. Postoperatively patients were asked to massage the affected gland and use sialagogue frequently to stimulate saliva secretion. Post-operative examination was performed 2 weeks and 1 month after the procedure.

Results

During the study period, we performed interventional sialendoscopy on 39 glands in 38 patients. Thirty three of our patients had sialolithiasis and their data were included in this study.

Table 1 The range of stones size in submandibular and parotid glands

	Successful removal	Unsuccessful removal
Parotid gland	2–5 mm	3–5 mm
Submandibular gland	2–6 mm	4–6 mm

Thirteen of our patients were male and 20 were female and their mean age was 41.7 (range, 29–62) years. 23 patients had sialolithiasis of submandibular gland and 10 patients had parotid gland sialolithiasis. Thirty cases were performed endoscopically whereas in three patients a combined approach was used to remove the salivary gland stones.

The average size of the stones ranged from 2 to 6 mm with a mean size of 4.6 and 3.8 mm for submandibular and parotid stones respectively. The largest size of stones that were removed endoscopically was 6 mm for submandibular and 5 mm for parotid stones (Table 1). Multiple stones were found in eight patients, five patients had two stones and three patients had three or more stones in the same duct. Twenty seven patients had stones in the main duct while in six patients sialolith location was in the hilum of the gland. In two patients stones were fragmented during instrumentation but in other patients we were able to remove the stones in 1 piece. A small papillotomy incision was necessary in five patients (15 %).

The overall success rate for endoscopic stone removal was 78 % (26 of 33 cases). Endoscopic retrieval was not successful in seven patients (Table 2). These failures occurred because of inability to introduce the endoscope into the lumen in one patient and submandibular duct perforation in another one. In two cases we were unable to navigate the endoscope through the ductal system and visualize the stone. In three other patients despite the stone visualization, endoscopic removal failed. In these patients the stones were removed through incisions in oral mucosa under the guidance of endoscope transillumination. During endoscopic visualization of the stone, a mucosal incision was made over the transilluminated area and with blunt dissection the stone was identified and removed. An angiocatheter was then advanced through the duct and sutured in place.

With regard to complications, 15 patients experienced temporary postoperative gland swelling that subsided within 24–48 h without any sequel. One patient had lingual nerve paresthesia that improved within 1 week. In patient with ductal perforation, extravasation of irrigation fluid resulted in severe swelling of the floor of the mouth. The patient was extubated at the end of the procedure, observed

Table 2 Summary of unsuccessful endoscopic stone retrieval cases

Reason of failure	Gland	Stone size (mm)	Stone location	Approach
Inability to introduce the endoscope	Submandibular	4	Main duct	Open
Duct perforation	Submandibular	5	Main duct	Open
Inability to navigate the endoscope	Parotid–submandibular	3–5	Main duct–hilum	Open
Inability to retrieve the stone	Parotid–submandibular	4–6	Main duct	Combined

overnight and discharged the next day without any further complication. This patient underwent submandibular gland excision a few weeks later. No other complications were noted during the follow up period.

Discussion

Sialendoscopy entered the salivary gland field in 1988 and now is an established method for diagnosis and treatment of salivary ductal disorders [3]. Because of its innovations, it is possible to do more complicated procedures without major surgery and with less morbidity assuming the return of the gland to function.

Sialolithiasis represents the most frequent etiology of obstructive sialadenitis. In postmortem studies, calculi can be found in 1.2 % of the population [4]. It usually affects the patients in the age range of 40–50 years [5].

Traditionally open surgical approaches are used for treatment of sialolithiasis but a number of complications may be associated with these techniques. Neurologic damage following open surgeries is of primary concern. Other complications include sialocoeles, salivary fistula, facial scarring and Frey syndrome that may also contribute to the morbidity of the traditional approaches [6].

Detailed patient history is the first step in confirming the diagnosis of sialolithiasis. However, imaging has become a standard part of the diagnostic process [3]. The advent of sialendoscopy for salivary gland disorders makes unique challenges in imaging. Sialography, CT scan or MR sialography all may be used in preoperative assessment of salivary ductal system. All of these imaging modalities are sensitive to calculi and can demonstrate sialoliths with high accuracy. In a review of 185 patients with salivary gland calculi, ultrasonography identified and localized the calculi correctly in 94 % of patients [7]. Because of ease of access, reliability and lack of morbidity, ultrasonography is the first line imaging modality in most clinical situations [8].

Sialendoscopy can be used as a diagnostic as well as a therapeutic tool in patients with obstructive salivary gland disorders. The chief diagnostic indications include suspicion of obstruction in the salivary ductal system [3]. Apart from using as a diagnostic tool, in recent years because of the popularization of the minimally invasive surgeries and advances in instruments and technology, sialendoscopy has become the primary method in surgical treatment of obstructive disorders of the salivary glands [9]. Therapeutic indications include treatment of sialolithiasis, dilation of strictures and management of recurrent juvenile sialadenitis [3]. Sialendoscopy also can be used for treatment of radioiodine induced sialadenitis [10] and intraductal masses [2]. The only contraindication for sialendoscopy is acute sialadenitis [11].

Sialolithiasis is the most frequent indication for sialendoscopy. The purpose of treatment is to completely remove the stone. Previous studies suggest that the stone diameter should not be more than 5 mm for Stensen duct and 7 mm for Wharton duct if it is to be removed in one piece without fragmentation [11, 12]. Sometimes it is possible to remove even larger stones without fragmentation if they have smoothly ellipsoid configuration [3]. On the other hand, the chances for stone removal are reduced if the stone is impacted inside the duct or if the stone location is deep in duct branches smaller than the diameter of the endoscope [13].

In addition to stone size, stone location and stone mobility also have a significant effect on treatment success. In a study by Nahlieli et al. [14], endoscopic stone removal failed in 13 % of the patients because of intraparenchymal stone location, anatomic strictures or severe duct angles.

In mechanical retrieval, sialoliths may be removed by a basket, miniforceps, grasper or balloon. The key factors in choosing an instrument are sialolith mobility and its connection to the ductal wall and the ability to bypass the stone with an instrument [11]. For free floating calculi, endoscopic removal is most commonly performed with the use of a basket. Balloons also are suitable tools for the removal of small mobile calculi. In cases in which the sialolith cannot be bypassed, a miniforceps or a grasper can be used to remove the stone.

For larger stones a variety of fragmentation techniques should be used prior to extraction. These include external or internal lithotripsy, laser fragmentation or microdrill [15, 16]. The success rate for endoscopic sialolithotomy of larger stones without fragmentation was as low as 35 % [4, 12]. Furthermore complications like ductal tear or avulsion may occur if these large stones approached endoscopically [2].

However fragmentation techniques need expensive instruments that are not always accessible or available to surgeons. It adds considerable cost to the overall price of sialendoscopy equipments that are expensive by themselves. Additionally there is no consensus on the maximum diameter of stones that could be removed without fragmentation. This size varies between 3 and 7 mm in different studies [11–13].

Some patients with large, impacted or hard stones cannot be managed effectively by endoscopic approach alone. The recommended combined approach involves localization of the stone in the ductal system by means of transillumination as an aid to external approaches [17, 18].

In addition to intraoperative failures in which surgeons are unable to accomplish endoscopic stone retrieval, on occasion it may be difficult or not feasible to enter the papilla or to pass the sialendoscope along the entire ductal system, a situation that classified as immediate failure by Nahlieli et al. [14]. It may result from active inflammation around the papilla, ductal stenosis, or because of the presence of an acute bend of Stenson's duct around the masseter muscle making navigation of the scope difficult [2].

Overall, sialendoscopy is considered to be a safe procedure but several types of complications may occur. Reported side effects and complications include ductal strictures, temporary swelling caused by irrigation, perforations, ranula, and lingual nerve paresthesia [3, 6]. Strictures are one of the main complications following sialendoscopy that may occur in 0.3–3.5 % of patients [3]. Ductal wall perforation can happen at the orifice of the duct during endoscope insertion or intraductally during mechanical procedures like stone removal or dilation of strictures [6].

The overall major complication rate for our cohort of patients was 3 % caused by submandibular duct perforation during an attempt to introduce the endoscope into the lumen. Complications such as facial nerve injury, severe hemorrhage, postoperative infection or bleeding and ductal strictures, as described in other series, were not seen in our patients [14]. This may be attributed to small sample size and lack of long-term follow-up in our study.

Sialendoscopy has been confirmed as a successful technique in several studies. In a retrospective study of 236 patients who were endoscopically treated for suspected salivary gland obstructive disease, Nahlieli and Baruchin [15] reported 83 % success rate. Marchal [18] attempted interventional sialendoscopy in 110 cases of submandibular sialolithiasis with a success rate of 82 %. Serbetci and Sengor [9] analyzed the results of sialendoscopy in 38 glands with sialolithiasis. In 27 of these patients (71.1 %) endoscopic removal was successful; however in another five cases fragmentation was necessary for stone removal. Thus 81.6 % of cases were considered successful for endoscopic sialolith removal.

In a review of 62 patients with sialolithiasis, Papadaki et al. [13] reported removal of stones in one piece using basket or grasper in 34 cases. In 23 patients stones were fragmented before endoscopic retrieval. The overall success rate of mechanical retrieval or fragmentation was 85 %. In 55 cases with parotid sialoliths, Marshal et al. [12] found that interventional sialendoscopy was successful in 85 % of cases. The average size of sialoliths was 3.2 ± 1.3 mm and sialolithiasis fragmentation was required in 10 % of cases with a success rate of 70 %.

Using size criteria, we achieved a success rate of 78 % without fragmentation that was similar to other series.

The field of sialendoscopy is rapidly expanding as it provides a minimally invasive way of diagnosing and treating a variety of conditions in salivary gland disorders. Mechanical retrieval of stones is a suitable technique for use in selected cases. As instruments for stone fragmentation are expensive, not available everywhere and the protracted anesthesia needed for fragmentation may have additional risks, selecting patients with small and medium sized stones could lead to successful results in majority of cases.

Conflict of interest None.

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