No sponsorships or competing interests have been disclosed for this article.

Abstract

Objectives. Analyze the characteristics of patients undergoing interventional sialendoscopy for sialolithiasis whose stones were not visualized intraoperatively.

Study Design. Case series with chart review.

Setting. Tertiary care hospital.

Subjects and Methods. Patients (n = 276) undergoing sialendoscopy between June 2008 and December 2014 were reviewed for patient characteristics, imaging characteristics, and outcomes. Nonvisualization was defined as a sialolith that was documented on imaging preoperatively but not visualized intraoperatively during sialendoscopy, despite successful ductal cannulation and evaluation.

Results. A total of 337 sialendoscopy procedures were performed. Preoperative imaging documented a sialolith in 203 (60%) cases. Nonvisualization occurred in 31 (15%) cases with sialolith. The parotid gland was involved in 58% (18 of 31) of nonvisualization cases, as opposed to 21% (43 of 203) of all sialolith cases. The submandibular gland was involved in 42% (13 of 31) of nonvisualization cases, as compared with 79% (160 of 203) of all sialolith cases. Nonvisualization occurred in 42% (18 of 43) of parotid cases versus 8% (13 of 160) of submandibular cases, a statistically significant difference (P < .001). Parotid stones located posterior to the plane of insertion of the posterolateral edge of the masseter were significantly more likely to experience nonvisualization (73%) than those along and anterior to the masseter (25% and 0%, respectively; P = .009).

Conclusions. Intraoperative nonvisualization of a sialolith is more likely to occur in the parotid gland. Proximal stone location may predict nonvisualization. These factors should be considered during treatment planning and counseling for patients with sialolithiasis.

Keywords

sialolith, sialolithiasis, sialendoscopy, sialadenitis

Sialolithiasis is one of the most common disorders of the salivary glands, frequently presenting with recurrent pain and/or swelling.1 Sialolithiasis has a reported lifetime symptomatic incidence of 1 per 10,000 to 30,000 individuals.2 Sialolithiasis more frequently originates from the submandibular gland (76%-95%), as opposed to the parotid gland (5%-24%).3,4 This submandibular predominance has been attributed to the more steep trajectory of Wharton’s duct, a varied secretion composition (less serous), and an increase in sequestered calcium, as compared with the parotid gland.5,6

Over the last decade, there has been a fundamental shift in the treatment method for sialolithiasis, as sialendoscopy has carved out an important role as an effective, minimally invasive, low-morbidity treatment for sialolithiasis.3,4,7-10 Sialolith removal by sialendoscopy has been reported as having a success rate between 80% and 98%, depending on the source.4,7-9,11,12 Thus, while sialendoscopy is highly effective, there is a proportion of the patient population that does not receive therapeutic benefit from the procedure. These reports of removal rate vary greatly in terms of sample size, population, preoperative sialolith documentation, and therapeutic approach (eg, the concurrent use of extracorporeal shock wave lithotripsy and/or laser lithotripsy). In a meta-analysis by Atienza and López-Cedrún, the success rate for salivary obstruction resolution was 76%.13

Given this variation in reported success rate, we sought to define the endoscopic nonvisualization rate for patients with a preoperatively image-documented sialolith. Furthermore, this study aimed to investigate the characteristics of patients undergoing interventional sialendoscopy for sialolithiasis whose stones were not visualized intraoperatively and to contrast these characteristics with patients who had successful sialolith visualization and extraction. In particular, we aimed to define any characteristics to allow preoperative prediction of an increased likelihood for nonvisualization.

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This article was presented at the 2015 AAO-HNSF Annual Meeting & OTO EXPO; September 27-30, 2015; Dallas, Texas.

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Methods

After approval was obtained from the institutional review board (Thomas Jefferson University Division of Human Subjects Protection), we retrospectively reviewed 337 consecutive sialendoscopy procedures performed at Thomas Jefferson University Hospital occurring from June 2008 through December 2014.

Clinical data collected included patient age, sex, gland type, imaging findings, surgical procedure, outcome, and complications. All data were kept within a secure online database (REDCap). Nonvisualization was deemed to have occurred when a sialolith was documented on imaging preoperatively but not visualized intraoperatively during sialendoscopy, despite successful ductal cannulation and evaluation.

Categorical data were compared between the nonvisualization and visualization groups with a Pearson’s chi-squared test. Numeric data were compared with a Student’s t test for 2 independent means.

In the parotid gland subanalysis, stone location on imaging was divided into 3 categories (anterior to the masseter, along the masseter, and posterior to the masseter) relative to a plane along the angle of insertion of the masseter into the mandible, as demonstrated in Figure 1. Categorization of parotid stone location was performed upon imaging review, with the examining physician blinded to the outcome of the procedure. For sialoliths visible within multiple imaging planes, the plane in which the stone was the largest was used for classification.

Results

A total of 337 sialendoscopy procedures were performed at our institution. Preoperative imaging documented a sialolith in 203 (60%) cases. Sialoliths were documented in 43 parotid glands (21%) and 160 submandibular glands (79%). These 203 cases were further reviewed for outcome and characteristics.

Nonvisualization occurred in 31 (15%) cases with a preoperatively documented sialolith. The mean age of nonvisualization patients was 52 years (range, 40-72). This group contained 11 women and 20 men (65% male). The submandibular gland was involved in 42% (13 of 31) of nonvisualization cases, while the parotid gland was involved in 58% (18 of 31) of nonvisualization cases.

Visualization occurred in 85% (172 of 203) of cases with a preoperatively documented sialolith. The mean age of visualization patients was 50 years (range, 12-87). This group contained 85 females and 87 males (51% male). The submandibular gland was involved in 85% (147 of 172) of visualization cases, while the parotid gland was involved in 15% (25 of 172) of visualization cases.

Relative values and statistical significance of the above characteristics are displayed in Table 1. Notably, the parotid gland was involved in nonvisualization cases at an increased frequency compared to visualization cases (58% vs 15%) to a significant degree ($P < .001$). Sex and age were not statistically significant variables. Nonvisualization occurred in 42% (18 of 43) of parotid cases versus 8% (13 of 160) of submandibular cases ($P < .001$).

Given this statistical significance and increased rate of parotid gland nonvisualization, all parotid sialolith cases were retrospectively reviewed for detailed imaging characteristics. A total of 43 parotid glands with sialolithiasis were instrumented. Of these, 33 cases had computed tomography or magnetic resonance image films currently available for review. Distribution of these sialoliths relative to the insertions of the masseter is presented in Table 2. The frequency of nonvisualization posterior to the masseter (73%) was increased as compared with that along and anterior to the masseter (25% and 0%, respectively), to a statistically significant degree ($P = .009$).

Discussion

In patients with preoperatively documented sialoliths, sialendoscopy is an effective treatment for sialolithiasis, but our results illustrate a decreased success rate for parotid gland sialolithiasis, especially if the sialolith is proximal in location.

The overall successful visualization rate was 85%, while the visualization rate for parotid sialoliths posterior to the masseter edge was 27%. It is important to recognize the

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**Figure 1.** Parotid sialolith location relative to masseter insertion plane: (A) anterior to masseter insertion plane, (B) along masseter, (C) posterior to masseter insertion plane. Note the sialolith located within this region.
Table 1. Comparison of Visualization and Nonvisualization Patient Characteristics.

<table>
<thead>
<tr>
<th>Category</th>
<th>Visualization</th>
<th>Nonvisualization</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, % (n)</td>
<td>51 (87 of 172)</td>
<td>65 (20 of 31)</td>
<td>.153</td>
</tr>
<tr>
<td>Age, y, mean (range)</td>
<td>50 (12-87)</td>
<td>52 (40-72)</td>
<td>.323</td>
</tr>
<tr>
<td>Parotid gland, % (n)</td>
<td>15 (25 of 172)</td>
<td>58 (18 of 31)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Table 2. Parotid Gland Sialolith Locations Relative to Outcome.

<table>
<thead>
<tr>
<th>Stone Location</th>
<th>Visualization</th>
<th>Nonvisualization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
<td>3 (100)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Along masseter</td>
<td>6 (75)</td>
<td>2 (25)</td>
</tr>
<tr>
<td>Posterior</td>
<td>6 (27)</td>
<td>16 (73)</td>
</tr>
</tbody>
</table>

*Values presented as n (%). Stone location is defined relative to the plane of the posterolateral edge of the masseter muscle (P = .009).

fundamental difference between this successful visualization rate and the rate of successful removal of a visualized stone used in other literature.8

During analysis of parotid stone location, in contrast to previous literature, we defined location relative to the plane of the posterolateral edge of the masseter and its angle of insertion into the mandible, as demonstrated in Figure 1.5 This plane was chosen because it represents the anatomic division between the parenchyma of the parotid gland and the masster. This clarification between the posterolateral edge of the masster and a perpendicular line at the posterior-most edge of the masster is slight but important for outcome prediction, as 30% of all parotid sialoliths were located within the anterior most aspect of the parotid gland (as illustrated by the sialolith observed in Figure 1).

Involved gland and stone location were the only statistically significant variables between nonvisualization and visualization patients. Notably, stone size was intentionally omitted from this analysis, as it has been described as an important factor in successful stone retrieval7,11 and a secondary factor to the inherent difficulty in determining stone size—namely, measurement of stone size from preoperative imaging, intarret variability in measurement of small objects, variation in image quality from different radiology centers with different thickness-of-axial cuts affecting location of cross-sectional visualization, and dental artifact obscuring findings.

While the large patient pool undergoing sialendoscopy at our institution is a strength, this study’s subanalysis is limited by the small number of parotid gland sialolithiasis patients with imaging available for review. Patients without available preoperative imaging for re-review could have swayed the outcomes. A prospective study would be of interest in the future to overcome this limitation, as well as to provide a higher level of evidence. Another limitation of this study is that it does not take into account the documented physician learning curve for sialendoscopy outcomes.13 Note, however, that the majority of parotid patients with imaging available for review today did come from later years in our experience when computer technology advanced to more easily allow the uploading of outside studies onto our image archiving and communication system.

While the rate of nonvisualization is higher within the parotid gland, our institution continues to favor sialendoscopy prior to gland excision due to the low morbidity of sialendoscopy and increased risk of parotidectomy in patients with chronic parotitis. We recommend discussion of the increased likelihood of nonvisualization with proximal sialolith parotid patients prior to the procedure to guide patient expectations.

Conclusion

Intraoperative nonvisualization of a sialolith is more likely to occur in the parotid gland. Proximal location of stone, specifically posterior to the insertion of the masster, is correlated with nonvisualization in the parotid gland. These factors should be considered during treatment planning and patient counseling for cases of parotid sialolithiasis.

Author Contributions

Lauren Galinat, study design, data analysis and interpretation, drafting and revision; Joseph Curry, study design, data interpretation, revisions; Adam Luginbuhl, study design, data interpretation, revisions; David Rosen, study design, data interpretation, revisions; David M. Cognetti, study design, data interpretation, drafting, and revisions.

Disclosures

Competing interests: None.
Sponsorships: None.
Funding source: None.

References


