Rates of Sialoendoscopy and Sialoadenectomy in 5,111 Adults With Private Insurance

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Objective: To determine frequencies and trends in sialoendoscopy and sialoadenectomy for the treatment of obstructive, nonneoplastic submandibular gland disease in the United States.

Methods: Epidemiologic study of insurance claims from 2006 to 2013 in a large, private insurance claims database. Rates were calculated for patients undergoing one or both index procedures.

Results: A total of 5,111 adults with sialadenitis who underwent sialoendoscopy or submandibular gland excision were included. Mean age was 47.6 years, and patients undergoing sialoendoscopy were less likely to be male (relative risk [RR] = 0.84; 95% confidence interval [CI], 0.78–0.89), more likely to have sialadenitis without stones (RR = 1.60; 95% CI, 1.53–1.66), and had a similar number of comorbidities (RR = 1.00; 95% CI, 0.91–1.06) compared to patients undergoing sialoadenectomy. The most common complication after sialoadenectomy was surgical site infection (1.4%; 95% CI, 1.1–1.8%), and complications after sialoendoscopy were rare. From 2007 to 2013, use of sialoendoscopy increased from 0.13 (95% CI, 0.08–0.18) to 0.42 (95% CI, 0.40–0.45) per 100 thousand people, and sialoadenectomy decreased from 2.41 (95% CI, 2.39–2.42) to 1.43 (95% CI, 1.40–1.44) per 100 thousand. The highest mean rate of sialoadenectomy was seen in the south (2.15 per 100,000; 95% CI, 2.13–2.16), the lowest was in the west (1.6 per 100,000; 95% CI, 1.57–1.62), and it decreased in all regions over time.

Conclusion: Utilization of sialoendoscopy has increased over time, and the overall rate of sialoadenectomy is decreasing. Both procedures are safe for treatment of patients with sialadenitis and sialolithiasis. Future research should examine whether availability of sialoendoscopy leads to a decreased rate of sialoadenectomy in patients with salivary gland disease.

Key Words: Sialoendoscopy, sialendoscopy, sialadenitis, salivary gland diseases, epidemiology, health services research.

Level of Evidence: 2C

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INTRODUCTION

Introduced in 1990 and inspired by the treatment of kidney and gall bladder stones, sialoendoscopy has since been shown to be a safe and effective procedure for treatment of obstructive salivary gland disease.2,3 This minimally invasive method improves functional recovery of the salivary gland and may decrease the need for sialadenectomy.4 The reported cure rates for sialolithiasis with sialoendoscopy range from 60% to 80% for stones of all sizes, and the success rate is higher with smaller stones, with one study showing 100% retrieval rate in stones less than 3 mm.5,6

Sialoendoscopy may be an improvement in the standard of care for patients with obstructive sialadenitis by potentially allowing patients to avoid sialoadenectomy and improve salivary gland function. Barriers to adopting this technology include equipment cost as well as the learning curve of a new technique.7–9 However, the rate of adoption of this technology is not well documented.

Our hypothesis is that as sialoendoscopy rates increase, sialoadenectomy rates will decrease in patients with non-neoplastic obstructive sialadenitis. This hypothesis is supported by a large registry-based study from Denmark, which found a consistent decrease in the rate of submandibular gland removal with a corresponding increase in sialoendoscopy for benign, non-neoplastic salivary gland disease.10 In addition, sialoendoscopy volume, or simply availability of sialoendoscopy at a healthcare facility, may potentially be used as a quality measure for the care of patients with salivary duct disease if this hypothesis proves true across a larger, more heterogeneous population. The goal of this study was to examine the rates of sialoendoscopy and sialoadenectomy in a large population, describe trends, and identify regional differences in the United States.

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MATERIALS AND METHODS

We performed a retrospective observational study of privately insured persons who underwent sialoadenectomy or sia-
loendoscopy in the Truven Health MarketScan Commercial Database (Truven Health Analytics, IBM Watson Health, Ann Arbor, MI) from 2006 to 2013. MarketScan (Truven Health Analytics) contains de-identified longitudinal medical and pre-
scription drug claims for a large number of privately insured patients in the United States, including inpatient hospitaliz-
tions, emergency department, outpatient physician, and facility encounters. The database includes claims obtained primarily
from large employers. The dataset was stored and managed by
the Washington University Center for Administrative Data Research (St. Louis, MO). This study was considered exempt by
the Washington University Human Research Protection Office.

Inclusion and Exclusion Criteria

Patients eligible for inclusion were adults aged 18 to 64 years
with International Classification of Diseases, 9th Revision, Clini-
cal Modification (ICD-9-CM) procedure or Current Procedural
Terminology (CPT) codes for sialoadenectomy (ICD-9-CM codes
26.30–26.32 or CPT codes 42410, 42415, 42420, 42425, 42440) or
sialoendoscopy (ICD-9-CM 26.99 or CPT 42699) during an inpa-
tient hospitalization or ambulatory or encounter from July 1, 2006,
to November 30, 2013, with at least 180 days prior continuous
health insurance enrollment. We required a diagnosis of sial-
lithiasis (ICD-9-CM diagnosis code 527.5) or sialoadenitis (527.2)
within 180 days before the procedure to ensure appropriate
capture of patients undergoing sialoendoscopy for obstructive
salivary gland disease because the CPT code typically used for
sialoendoscopy is unlisted (42699 = Other Procedures on the Sal-
vary Gland and Ducts). This requirement was also applied to sia-
loadenectomies to avoid inclusion of patients undergoing
surgery for neoplastic disease. In addition, to exclude patients
undergoing procedures for cancer, we excluded patients undergo-
ing either sialoendoscopy or sialoadenectomy for neoplasm (ICD-
9-CM diagnosis code 235.0, 142.0–142.9, and 210.2 coded on the
day of surgery).

Identifying Patients Undergoing Salivary Gland Procedures

We developed an algorithm to determine the most likely
procedures dates, due to instances of repeated coding in the Mar-
ketScan (Truven Health Analytics) database. We prioritized pro-
cedure dates with matching facility and provider claims for
operation. If sialoadenectomy or sialoendoscopy were coded by a
provider or a facility only, additional information was used to
increase the likelihood that the procedure was performed, includ-
ing Uniform Billing (UB-04) coding for operating room services
(0360, 0361, 0490) and CPT codes for anesthesia for salivary gland,
introral, or head and neck procedures (00100, 00170,
00300, 00320). In addition, if there were both provider and facil-
ity coding for the procedures but the dates did not match, the
dates were compared to UB-04 operating room services and anes-
thesia dates, if available, to determine the most likely date of
procedure. Procedures coded on a single line by a facility or pro-
vider with no other services coded on that date were excluded.

Baseline clinical characteristics were identified using ICD-
9-CM diagnosis, CPT, and Healthcare Common Procedure Coding
System (HCPCS) codes within 180 days through the date of opera-
tion, including oral cancer (ICD-9-CM codes 145.0, 145.6, 145.8, and
145.9), radioactive iodine exposure (CPT 79005, HCPCS A8517,
A8530), history of radiotherapy (V58.0), Sjögren syndrome (ICD-
9-CM 710.2), thyroid cancer (ICD-9-CM 193, V10.87), and clotting

disorder (ICD-9-CM 286.9). Comorbidities were identified as
defined by Elixhauser, using ICD-9-CM diagnosis codes on claims
during the 180 days before the first sialoadenectomy or sia-
loendoscopy date.11,12 The algorithm to identify the Elixhauser comor-
bidity was performed as described by Klabunde et al., requiring
either coding on one inpatient facility claim or at least two outpa-
tient/provider claims spaced at least 30 days apart.11

Postoperative complications were identified within 30 days
of operation by ICD-9-CM diagnosis codes, including hematoma
(958.12), facial nerve injury (951.4), xerostomia (527.7), and surgi-
cal site infection (998.5, 998.51, 998.59). Because patients could
have more than one procedure, we identified all unique codes
coded for sialoadenectomy or sialoendoscopy. The observation
time for complications was censored at the time of a subsequent
procedure that occurred within 30 days of the prior procedure.

Statistical Analysis

We used descriptive statistics to describe the study popula-

tion as well as the distribution of demographic and clinical char-
acteristics. Denominators were obtained by using the entire
population adults aged 18 to 64 years in the MarketScan data-
base (Truven Health Analytics), with at least 6 months of continu-
ous health insurance enrollment to calculate the rates of
procedures over time and in regions of the United States.

Because data from 2006 were only available for the latter half of
the year, only rates from 2007 to 2013 were examined for trend
analysis. Ninety-five percent CIs were calculated to display preci-

sion of the data. Risk ratios were used to estimate relative risk
NC) was used to perform the analysis.

RESULTS

We identified 5,111 patients with a diagnosis of siala-
denitis, sialolithiasis, or both, who underwent either sia-
loendoscopy or sialoadenectomy from July 1, 2006, to
November 30, 2013. The mean age of all patients was
47.6 years, and patients undergoing sialoendoscopy were
less likely to be male (RR = 0.84; 95% CI, 0.78–0.89), more
likely to have a diagnosis of sialolithiasis (RR = 1.60; 95% CI,
1.53–1.66), and had a similar number of comorbidities
(RR = 1.00; 95% CI, 0.89–1.09) compared to patients
undergoing sialoadenectomy. In addition, patients under-
going sialoendoscopy were more likely to have had prior
thyroid cancer (RR = 4.8; 95% CI, 4.8–5.1) or Sjögren
syndrome (RR = 3.2; 95% CI, 2.5–3.5) (Table I). Of the
641 patients who first underwent a sialoendoscopy, 106
(16.5%) were converted to a sialoadenectomy on the same
visit, and an additional 23 (3.6%) subsequently underwent
a sialoadenectomy at a later date. In total, 129 patients
(20.1%) who had an initial sialoendoscopy subsequently
had a sialoadenectomy.

We identified 105 total complications in 5,111 patients
(2.1%); 102 of 105 complications (97.1%) occurred after sia-
loadenectomy. The most common complication after sia-
loendoscopy was surgical site infection (1.4%; 95% CI,
0.8%; 95% CI, 0.5–1.0%) (Table II).

The rate of sialoendoscopy increased over time, rising
from 0.13 (95% CI, 0.08–0.18) per 100 thousand people in
2007 to 0.42 (95% CI, 0.40–0.45) per 100 thousand in 2013.
In parallel, the rate of sialoadenectomy decreased in the

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same time period from 2.41 (95% CI, 2.39–2.42) per 100 thousand in 2007 to 1.43 (95% CI, 1.40–1.44) per 100 thousand in 2013 (Fig. 1). The highest mean rate of sialoadenectomy over this time period occurred in the southern region of the United States (2.15 per 100,000; 95% CI, 2.13–2.16); and the lowest was in the western region (1.59 per 100,000; 95% CI, 1.57–1.62), although the rate decreased in all regions throughout the study period (Fig. 2).

DISCUSSION

In this epidemiologic study of over 5 thousand adults in a U.S. private insurance claims database, we found that the rates of sialoendoscopy remain low, although utilization has increased slightly over time. The rates of sialoendoscopy and sialoadenectomy varied throughout regions of the country but trended in the same direction. Patients who underwent sialoendoscopy were more likely to be female, were more likely to have the procedure as an outpatient, and had a similar number of comorbidities as compared to patients who underwent sialoadenectomy. In addition, patients undergoing sialoendoscopy were more likely to have a diagnosis of Sjögren syndrome or thyroid cancer as compared to patients undergoing sialoadenectomy. Patients with a diagnosis of sialolithiasis were more likely to undergo sialoendoscopy as compared to patients with sialadenitis, as we had expected. The most common complication was surgical site infection after sialoadenectomy, with an overall complication rate less than 2%, consistent with other recent studies.5,8,14,15 Complications of sialoendoscopy were too rare to report.

We were unable to provide evidence for or against our main hypothesis that rates of sialoadenectomy and other secondary outcomes decrease when sialoendoscopy rates increase. The hypothesized trend is consistent with prior work, however, showing that the use of sialoendoscopy may prevent subsequent sialoadenectomy. In Denmark, the increasing use of sialoendoscopy is believed to have directly led to a decreased rate of sialoadenectomy.4,10 Rasmussen et al. also noted regional variation among rates of sialoadenectomy in Denmark.10

TABLE I.
Baseline Characteristics of Patients Undergoing Sialoendoscopy or Sialoadenectomy.

<table>
<thead>
<tr>
<th></th>
<th>All Patients N = 5,111 patients</th>
<th>Sialoadenectomy* N = 4,470 patients</th>
<th>Sialoendoscopy* N = 641 patients</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age, yrs</td>
<td>47.6 (47.3–47.9)</td>
<td>47.9 (47.6–48.3)</td>
<td>45.5 (44.6–46.5)</td>
<td>0.95</td>
</tr>
<tr>
<td>Male sex</td>
<td>2,295 (44.9)</td>
<td>2,048 (45.8)</td>
<td>247 (38.6)</td>
<td>0.84</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sialadenitis</td>
<td>4,149 (81.2)</td>
<td>3,729 (83.4)</td>
<td>420 (65.5)</td>
<td>0.79</td>
</tr>
<tr>
<td>Sialolithiasis</td>
<td>1,459 (28.5)</td>
<td>1,187 (26.6)</td>
<td>272 (42.4)</td>
<td>1.60</td>
</tr>
<tr>
<td>Both</td>
<td>497 (9.7)</td>
<td>446 (10.0)</td>
<td>51 (8.0)</td>
<td>0.80</td>
</tr>
<tr>
<td>Prior existing diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sjögren syndrome</td>
<td>82 (1.6)</td>
<td>56 (1.3)</td>
<td>26 (4.1)</td>
<td>3.2</td>
</tr>
<tr>
<td>Thyroid cancer</td>
<td>105 (2.1)</td>
<td>62 (1.4)</td>
<td>43 (6.7)</td>
<td>4.8</td>
</tr>
<tr>
<td>Oral cancer</td>
<td>7 (0.1)</td>
<td>7 (0.2)</td>
<td>0 (0.0)</td>
<td>–</td>
</tr>
<tr>
<td>Elixhauser comorbidities, mean</td>
<td>0.47 (0.45–0.49)</td>
<td>0.47 (0.45–0.50)</td>
<td>0.47 (0.41–0.53)</td>
<td>1.00</td>
</tr>
<tr>
<td>Procedure setting†</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outpatient</td>
<td>4,739 (92.7)</td>
<td>4,106 (91.7)</td>
<td>633 (98.8)</td>
<td>1.08</td>
</tr>
</tbody>
</table>

*As index procedure.
†Patients with more than one procedure with at least one inpatient procedure were counted as inpatient.
CI = confidence interval; RR = relative risk.

TABLE II.
Complications From Sialoendoscopy and Sialoadenectomy Procedures in Adults From 2006–2013.

<table>
<thead>
<tr>
<th></th>
<th>Sialoendoscopy (n = 641)</th>
<th>Sialoadenectomy* (n = 4,469)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complications</td>
<td>n % 95% CI</td>
<td>n % 95% CI</td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>1 0.2 0.0–0.5</td>
<td>64 1.4 1.1–1.6</td>
</tr>
<tr>
<td>Hematoma</td>
<td>1 0.2 0.0–0.5</td>
<td>35 0.8 0.5–1.0</td>
</tr>
<tr>
<td>Facial weakness</td>
<td>1 0.2 0.0–0.5</td>
<td>3 0.1 0.0–0.1</td>
</tr>
</tbody>
</table>

*Sialoendoscopy converted to sialoadenectomy or sialoendoscopy-assisted sialoadenectomy counted as sialoadenectomy.
CI = confidence interval.
Limitations

A limitation of our study is that the data source consists of administrative claims, which are not designed for research purposes. Thus, we were limited to the data fields supplied for billing purposes. Because of this, we are not able to determine other events that were not coded as complications and clinical details, including, for example, how often endoscopy was aborted due to failure to cannulate the duct and how many stones were identified but unable to be removed endoscopically. In other studies, reported rates of unsuccessful cannulation ranged from 6% to 10%, and inability to extract visualized stones ranged from 3% to 5%. It is also possible that certain complications were underreported, including facial weakness due to injury to the marginal mandibular nerve. However, we believe that these data allow for an accurate representation of the usage of sialoendoscopy in this patient population due to the need for appropriate reimbursement to the physician and facility. In the situation when a sialoendoscopy may not be expected to be successful, the patient should be counseled that endoscopy may be attempted, followed by a sialoadenectomy if unsuccessful.

Another limitation of this study is that sialoendoscopy has an unlisted CPT code in the United States, identifying procedures was not straightforward. Due to the fragmented nature of healthcare delivery in the United States, use of claims data is the only feasible way to look at utilization of procedures from a population perspective. We identified unlisted procedures within 180 days of a diagnosis of sialadenitis, sialolithiasis, or both, which likely represented sialoendoscopies. We used a complex algorithm including coding for operating room services; administration of anesthesia for salivary gland, oral, or head and neck procedures; and matched coding from facilities and providers to increase the accuracy of identification of sialoendoscopy and sialoadenectomy. Given the lack of clinical detail, we were unable to definitively verify the procedure type. However, our rates are consistent with other published literature describing the use of sialoendoscopy and sialadenectomy at other academic centers.

Future Research

Future studies could examine whether availability of sialoendoscopy could be utilized as a quality measure for the treatment of patients with salivary gland disorders because having the option to perform a sialoendoscopy may allow gland preservation by obviating the need for sialoadenectomy. In addition, barriers to incorporating sialoendoscopy into practice should be examined because the procedure is a safe, low-risk intervention.

CONCLUSION

Utilization of sialoendoscopy has increased over time, and the overall rate of sialoadenectomy is decreasing in the United States. Both procedures are safe for the treatment of patients with sialadenitis and sialolithiasis. Future research should examine whether the availability of sialoendoscopy leads to a decrease in the rate of sialoadenectomy in patients with salivary gland disease.

BIBLIOGRAPHY


