No Disclosures.
What's wrong with the old way?

“I will apply, for the benefit of the sick, all measures that are required avoiding those twin traps of overtreatment and therapeutic nihilism.”

- Hippocratic Oath

Parotidectomy rarely done for non-neoplastic disease

SMG excision: 9-18% marg weakness (2-12% permanent)

Scar
Conservative Treatment

Massage
Sialogogues (sour, chewing, etc.)
Warm Compress
Hydration
Antibiotics
Steroids
Sialendoscopy - why bother?

Compared to excision:
- 90-95% symptom resolution without gland excision
- Less pain
- Shorter recovery
- Valuable diagnostic tool
- Less risk of scarring
Why save the gland?

- Salivary tissue has significant, inducible regenerative capacity
- Histologic studies routinely show normal gland after treatment
- Scintigraphy shows function after treatment
- Outcome/function inversely related to age and size of sialolith
Gland Preservation is not for everyone.

- Patient must accept the potential for recurrent symptoms.
- Longterm outcome is not known in some cases.
  - Laser lithotripsy
  - Ductal stenosis
  - Transoral sialolithotomy for stone near SMG hilum

Sialadenectomy should be included in the discussion.
Objectives

• Review basic salivary anatomy and physiology

• Review clinical presentation and evaluation of suspected obstructive salivary disease

• Discuss algorithms for treatment of various pathologic findings in obstructive salivary disease
Anatomy of the Parotid Duct

Described by Nicolas Steno (Neils Stensen) in 1660 at age 22

Stensen’s Duct (Ductus stenonianus)

Father of geology and stratigraphy

Catholic Priest and Bishop

Beatified by Pope John Paul II in
January 11, 2012
Nicolas Steno’s 374th Birthday
Parotid Duct

<1.5mm diameter, ~5-6cm length

Along line from lobule attachment to corner of mouth

Passes over masseter, pierces buccinator m. (sharp posterior angulation)

Opens opposite 2\textsuperscript{nd} upper molar

Sphincterlike mechanism located more posteriorly than in Wharton’s

Ductal diameter generally preserved in branches

Parotid duct

0.5mm

1.2mm

1.4mm
Anatomy of the Submandibular Duct

Wharton’s duct

Described by Thomas Wharton in 1656
Submandibular Duct

~2mm diameter, 6-7cm length

Runs between hyoglossus m. and mylohyoid m.

24-178° bend at posterior border of mylohyoid

anterior: superficial to lingual n. posterior: deep to lingual n.

Sphincterlike mechanism near papilla
Anatomy of the Sublingual Duct

Bartholin’s duct

Described by Casparus Bartholinus in 1690

Drains into Wharton’s duct
~5mm posterior to papilla

8-20 small ducts of Rivinus open on the plica sublingualaris
Salivary Production

Both parasympathetic and sympathetic stimulate saliva production (parotid and SMG only).

Chewing, food in mouth, sour, and nausea stimulate.

Salivary production is not dependent on age.

<table>
<thead>
<tr>
<th></th>
<th>Stimulated (Prandial)</th>
<th>Unstimulated (Basal)</th>
<th>Overall (~1.5L/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parotid (serous)</td>
<td>64%</td>
<td>24%</td>
<td>20%</td>
</tr>
<tr>
<td>Submandibular</td>
<td>25%</td>
<td>66%</td>
<td>70%</td>
</tr>
<tr>
<td>(mixed)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sublingual</td>
<td>4%</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>(mucous)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor salivary</td>
<td>7-8%</td>
<td>7-8%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Clinical Manifestations of Obstructive Salivary Disease

- Recurrent swelling
- Gland pain
- Facial pain
- Otalgia
- Purulent drainage
- Abscess
- +/- Aggravated by food intake
Differential Diagnosis of Salivary Complaints

- **Ductal**
  - Sialolithiasis
  - Stenosis
  - Atresia
- Anatomic Variation
  - Tortuous ducts
  - Kinks
- Foreign body
- Radioiodine sialadenitis
- Juvenile recurrent parotitis
- Allergic/eosinophilic parotitis
Sialolithiasis

• Rauch 1959, 1200 patients: 1/300,000
  • ~80% submandibular gland (20% radiolucent)
  • ~10% parotid (40% radiolucent)
  • ~7% sublingual
• McGurk 1999 1/15,000 - 1/30,000
• Peak age 20-40 yrs
• M:F 2:1
• Established stone estimated to grow 1mm/yr
Salivary Duct Stenosis

- Unknown incidence - likely underdiagnosed
- More common in parotid
- Females > Males
- Usually age 40-50
Diagnostic Evaluation

• History & Physical
• CT
• Ultrasound
• MR sialography
• Sialography
• Sialendoscopy
Ultrasound

- Test of choice in Europe and Asia
  - inexpensive
  - non-invasive
  - no radiation
- Less common in U.S.
- Real-time study (must trust U/S tech and radiologist)
  - Will likely increase in U.S. as surgeons increasingly perform U/S in office
Ultrasound

- Useful in stenosis and sialolithiasis
- Stenosis appears as a hypoechoic band
- Sialoliths appear as hyperechoic structures with distal acoustic shadowing
- Rarely misses stones (caution if <1.5mm or ‘soft’ stones)
- Often dilation of proximal ducts
MR Sialography

- MR hydrography: long TR and TE times, fat suppression
  - highlight fluid
  - suppress other signals
- Non-invasive
- Requires no contrast
MR Sialography
CAUTION:

MRI does not equal MR sialography.
Sialography

- Iodinated contrast agents
- Oil-based gives sharper image but persists longer
- 2 views and digital subtraction
- Can see:
  - Dilated duct
  - Calcified stone
  - Filling defect
  - Stricture
Sialography

**Pro’s**

- Interventions possible
- Benefits in treatment of stenosis
- Not limited by tortuous anatomy
- Provides ‘aerial’ view
Sialography

Con’s

• Need radiologist who is willing/able (or do yourself)

• Radiation exposure

• Interventions more limited than in sialendoscopy

• ENT is a scope specialty
Sialography
Sialography
Sialendoscopy

• Scopes commercially available since 2000
• Early pioneers:
  • Marchal (Geneva, Switzerland)
  • Nahleili (Ashkelon, Israel)
  • Iro, Zenk, Koch (Erlangen, Germany)
  • McGurk (London, England)
  • Schaitken (Pittsburg, PA)
Erlangen Salivary Endoscope

- 0.8mm, 1.1mm, 1.6mm
- semi-rigid fiberscope
- nitinol shaft
- 10cm working length
- remote eyepiece
- 0.25mm irrigation channel +/- working channel
  - 0.45mm for 1.1mm scope
  - 0.85mm for 1.6mm scope

Karl Storz
Marchal Endoscopes

- 0.8mm, 1.1mm, **1.3mm**, 1.6mm
- semi-rigid fiberscope
- **5°** tip angulation
- 12cm working length
- remote eyepiece
- 0.20-0.25mm irrigation channel +/- working channel
  - 0.45mm for 1.1mm scope
  - **0.65mm** for 1.3mm scope
  - 0.80mm for 1.6mm scope

Karl Storz
Indications for Sialendoscopy

Recurrent or chronic sialadenitis
Sialolithiasis
Unexplained salivary swelling
Unexplained salivary pain

*only ‘contraindication’ is acute sialadenitis*
Every time I eat my face swells up big as West Texas!

“ONLY IN TEXAS”
So what are our options?
Interventional Sialendoscopy

Wire basket
Holmium laser lithotripsy
Hand drill
Ballon dilation
Guidewire
Bougie dilation
Grasping forceps
Biopsy forceps
Interventional Treatment

Ductal dilation and irrigation
Intraoral sialolithotomy
Interventional sialendoscopy
  Wire Basket sialolithotomy
  Holmium laser lithotripsy
  Sialodochoplasty
Combined approaches
SMG excision (external vs. transoral)
Parotidectomy

*extracorporeal shockwave lithotripsy not FDA-approved in U.S.
Basic Sialendoscopy Technique

Local in-office vs. general anesthesia

Oral vs. nasal intubation

Identify and dilate ostia - most critical

Introduce scope with continuous irrigation

Systematic examination of duct system

Interventions
Normal Sialendoscopic Findings

Pale, pink epithelial lining
Blood vessels visible
Faint circular ridges
Sialodochitis

- thickened, whitish epithelium
- punctate epithelial hemorrhage
- loss of circular ridges
- fibrinous exudates
Treatment of Sialolithiasis
Treatment of Sialolithiasis

QuickTime™ and a decompressor are needed to see this picture.
## Holmium Laser Lithotripsy

<table>
<thead>
<tr>
<th></th>
<th>n=31</th>
<th>Laser (n=16)</th>
<th>Non-laser (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Glands</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 parotid, 11 SMG</td>
<td>5 parotid, 10 SMG</td>
<td></td>
</tr>
<tr>
<td><strong>Average Stone Size</strong></td>
<td>6.5mm, 6.1 mm</td>
<td>6.0mm, 5.7mm</td>
<td></td>
</tr>
<tr>
<td><strong>Surgical Success</strong></td>
<td>81%</td>
<td>93%</td>
<td></td>
</tr>
<tr>
<td><strong>Subjective Improvement</strong></td>
<td>95%</td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td><strong>Average Follow Up</strong></td>
<td>8.4 months</td>
<td>8.9 months</td>
<td></td>
</tr>
</tbody>
</table>
Holmium Laser Lithotripsy

• Complications
  • Laser
    • None
  • Non-laser
    • Stenosis requiring endoscopic dilation (n=2)
    • Salivary fistula (n=1)
Dilation of Stricture
Salivary Stents

• Use primarily if concerned about scarring at papilla/distal duct
• Suture to mucosa on 2 sides
• Leave for 2-3 weeks
• Often cause obstructive symptoms

*Stent falls out in 60-70% patients
Postoperative Care

Stenting
Corticosteroid infusion
 +/- Antibiotics
Hydration
Massage
Sialogogues
Morbidity and Complications

Salivary swelling expected for 2-3 hours

Duct perforation

Hematoma formation

Duct strictures

Ranula formation

Neural injury (lingual, facial)
Minimally Invasive Management of Sialolithiasis in 4,691 Patients

- 5 centers over 5 years, mean follow-up > 5 years
- mean stone size: 7.1mm SMG, 5.2mm parotid

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Nahleili 2006, Success Rates

**Endoscopic sialolithotomy***

- 86% parotid
- 89% submandibular

**Endoscopic dilation of stricture**

- 81% after single procedure
- 15% required revision procedure
- 4% treatment failure

* no ESWL available
Parotid Stricture

endoscopic dilation

steroid infusion

stenting

combined endoscopic/transfacial sialodochoplasty

combined endoscopic/transoral papilla resection/sialodochoplasty

combined endoscopic/transfacial resection/vein graft
SMG Sialolithiasis

<4mm

basket retrieval

4-7mm

basket retrieval +/- laser lithotripsy

>7mm

ESWL

combined endoscopic/transoral (duct splitting)
SMG Stricture

endoscopic dilation

steroid infusion
stenting

duct splitting
Learning Curve

• Improvement in operative time and performance after 10 patients and again after 30 patients
• Continued decrease in operative time and improvement in performance seen throughout, leveling off after 50 patients

Alpha-1 Blockers

- Well studied in obstructive urinary disease
- 2010 Guerre A. et al, retrospective study
  - 352 pts
  - 194 s/p ESWL
  - 69 stenosis
  - 89 allergic pseudo-parotitis

Alpha-1 Blockers

- Treated for 3-24 months
- Males: 2.5mg TID
- Females: 2.5mg BID
- Mean follow-up 33 months
- 80% reported significant symptom improvement
- 2% rate of orthostatic hypotension

Radioiodine Sialadenitis

- Sodium-iodine symporter absorbs RAI
- Serous glands predominantly affected
- Ductal mucosa affected by RAI and secondary inflammation
- 70% scintigraphic dysfunction
- 10-60% symptomatic
- Endoscopic findings: pale mucosa, mucous plugs, debris, stenosis
Radioiodine Sialadenitis

• Prendes BL et al. 2012 Arch Otolaryngol Head Neck Surg

• 11 pts s/p RAI and failed conservative management

• 90% significant improvement after single endoscopy

• 50% with sustained improvement at 18 months

• Few papers exist- endpoints are primarily resolution of pain and swelling

• Xerostomia is not improved
Radioiodine Sialadenitis

- Future Directions
  - Determining who will have more significant issues
  - Determining preventative/prophylactic options
Future Developments

• Better Balloons (OTW but through the scope)

• More lithotripsy options (extracorporeal vs intracorporeal)

• Improved stenting options
Conclusions

• Challenging diagnostic and therapeutic tool
• Technique requires patience
• Improvements in equipment will continue to expand what can be treated
• Allows treatment of patient subset who would otherwise be left untreated
THE ERLANGEN
SALIVARY GLAND PROJECT
PART I: SIALENDOSCOPY IN OBSTRUCTIVE DISEASES OF THE MAJOR SALIVARY GLANDS

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SIALENDOSCOPY
THE ENDOSCOPIC APPROACH TO SALIVARY GLAND DUCTAL PATHOLOGIES

INTRODUCING THE NEW SIALENDOSCOPES

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