Unsedated Office-Based Laryngeal Surgery

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Grand Rounds Presentation
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Overview

- Historical Perspective
- Patient Selection
- Topical Anesthesia
- Patient Tolerance
- Specific UOLS
- Complications
- Cost Analysis
- Advantages
History

• 1807: Bozzini develops indirect mirror laryngoscopy
• 1852: Green describes first direct laryngoscopy and visually controlled endoscopic resection of laryngeal neoplasm
• c1872: Jacob Solis Cohen
• Performed office-based mirror-guided surgery at his home in Philadelphia

History

- 1884: Koller introduces cocaine-induced mucosal anesthesia
- 1884: Koller and Jelinek give a live demonstration of the use of cocaine as local anesthetic for mirror-guided endolaryngeal surgery.
History

- 1897: Kirstein performs in-office direct laryngoscopy with an assistant using an electric headlight.

History

• 1900s: Chevalier Jackson introduces the rigid esophagoscopy and perfects supine direct laryngoscopy

History

• 1960s: Operating microscope utilized for laryngeal surgery
  • Rigid laryngoscopes
  • Microlaryngeal instruments
  • Optical telescopes
  • CO2 laser with micromanipulator
  • General anesthesia (jet ventilation)
History

• 1970s: Flexible fiberoptic scopes allow examination of awake, unsedated patients in the office
• 1999: Distal-chip camera for flexible aerodigestive tract endoscopy (TNE, 5.1 mm diameter)
  • Brilliant illumination
  • High resolution
  • Working channel (2 mm)
    • Air insufflation
    • Suction
    • Flexible foceps and laser fibers
  • 4.1 mm diameter flexible laryngoscope
• Integration of lasers
Slide-On Sheath

- Vision Sciences
- Fits over standard flexible nasolaryngoscope

"Figure 2. This sheath fits over a flexible endoscope and is equipped with side channels that can be used to pass a biopsy forceps or to topically apply a local anesthetic."

- Amin et al. Office evaluation of the tracheobronchial tree. Ear Nose Thr 2004; 83:10-12.
Transoral

- Sataloff set of office-based instruments

Figure 5. Illustration depicts a variety of instruments (Sataloff set; Medtronic Xomed) that have become available for use in office-based laryngeal procedures.

- Simpson et al. Office-based procedures for the voice. Ear Nose Thr J 2004; 83:6-9
Patient Selection

- **Informed Consent**
  - Patients must be cooperative
  - Gag reflex
  - Anxiety
  - Pain tolerance
- **Comorbidities**
  - Cardiopulmonary disease
  - Movement disorders
  - Anticoagulation
- **Anatomy**
  - Nasal patency
  - Adequate oral opening (at least 2 cm interincisor distance) for transoral instrumentation
Topical Anesthesia

- Sensory innervation to larynx, trachea and esophagus is from vagus nerve
  - Internal branch of SLN innervates glottic and supraglottic structures
  - RLN innervates subglottis
  - Trachea and esophagus are directly innervated from branches of vagus nerve distally
Topical Anesthesia

- Simpson et al. 2004 (EBM D)
- Topical anesthesia of the airway and esophagus
- Step 1
  - Topical 2% oxymetazoline/tetracaine spray into nasal cavities
- Step 2
  - Topical benzocaine/tetracaine spray on the palate and posterior pharynx
- Step 3
  - Drip 3-5 mL of 4% lidocaine onto the tongue base and larynx under fiberoptic guidance
  - Several 0.5-1 mL aliquots
  - “Laryngeal gargle”
- NPO for 45-60 minute following procedure
<table>
<thead>
<tr>
<th>Anesthetic</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine 4% (40 mg/ml)</td>
<td>7 to 8 ml (or 4.5 mg/kg; ~300 mg for a 70-kg patient)</td>
</tr>
<tr>
<td>Tetracaine 2% (20 mg/ml)</td>
<td>0.9 ml*</td>
</tr>
<tr>
<td>Benzocaine/tetracaine spray</td>
<td>2-sec spray</td>
</tr>
<tr>
<td>Benzonatate</td>
<td>200 mg</td>
</tr>
</tbody>
</table>

*When tetracaine is administered via an atomizer for nasal anesthesia, only 0.1 to 0.2 ml is typically used.

- Simpson et al. Topical anesthesia of the airway and esophagus. Ear Nose Thr J 2004; 83:2-5.
Topical Anesthesia

- Zeitels et al. 2004 (EBM C-4), MEEI
- Office-based treatment of glottal dysplasia and papillomatosis with the 585-nm pulsed dye laser and local anesthesia
- Topical nebulized solution of 2% lidocaine and 0.125% phenylephrine intranasally
- Nebulized 4% lidocaine to lower pharynx and larynx
- +/- Direct application of lidocaine
  - Through working channel of scope
  - Direct application with angled rigid cotton holder
- +/- Local nerve block
Topical Anesthesia

- Adverse Reactions are very rare
  - Thorough history
  - Must adhere to maximal dosing guidelines
  - Systemic toxicity
    - Cardiovascular depression/cardiac arrest
    - Convulsions
    - Respiratory arrest
  - Toxicity may be potentiated in patients with renal, hepatic, and cardiac conditions
  - Allergic reactions to lidocaine are uncommon
    - Urticaria and rash
    - Anaphylaxis is rare
    - Methemoglobinemia, “chocolate cyanosis”
      - 1-2 mg/kg intravenous methylene blue
    - Reactions may be more prevalent with topical esters, tetracaine and benzocaine
  - Vasovagal syncope
    - Prodromal nausea, diaphoresis, lightheadedness, parasthesias
Patient Tolerance

- Rees et al. 2006 (EBM C-4), WFU
- Patient tolerance of in-office pulsed dye laser treatments to the upper aerodigestive tract
- 328 office-based procedures in 131 patients
  - 54 patients had a previous procedure for UADT disease under GA
- 5.1 mm transnasal esophagoscope
  - TNE KayPentax Model VE-1530
- Topical anesthesia
  - 1:1 solution of 0.05% oxymetazoline and 4% lidocaine spray intranasally
  - Cotton pledgets soaked in same solution packed for 5-10 min
  - +/- 20% benzocaine spray to oropharynx, Tessalon perles
  - 4% lidocaine spray (4-8 mL) to lesion through working channel
- PDL (Photogenica SV) used to treat lesion until it blanched white

<table>
<thead>
<tr>
<th>Type of lesion</th>
<th>Number of cases (%)</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papillomas</td>
<td>172 (52%)</td>
<td>55</td>
</tr>
<tr>
<td>Leukoplakia</td>
<td>62 (19%)</td>
<td>22</td>
</tr>
<tr>
<td>Granuloma</td>
<td>27 (8%)</td>
<td>18</td>
</tr>
<tr>
<td>Barrett’s esophagus</td>
<td>20 (6%)</td>
<td>8</td>
</tr>
<tr>
<td>Vocal fold lesion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(unspecified)</td>
<td>21 (6%)</td>
<td>12</td>
</tr>
<tr>
<td>Vocal fold polyp</td>
<td>8 (2.4%)</td>
<td>5</td>
</tr>
<tr>
<td>Reinke’s edema</td>
<td>6 (2%)</td>
<td>4</td>
</tr>
<tr>
<td>Laryngeal amyloidosis</td>
<td>5 (2%)</td>
<td>1</td>
</tr>
<tr>
<td>Glottic web</td>
<td>2 (&lt;1%)</td>
<td>1</td>
</tr>
<tr>
<td>Nasopharynx mass</td>
<td>1 (&lt;1%)</td>
<td>1</td>
</tr>
<tr>
<td>Tracheal stenosis</td>
<td>1 (&lt;1%)</td>
<td>1</td>
</tr>
<tr>
<td>Bronchial mass</td>
<td>1 (&lt;1%)</td>
<td>1</td>
</tr>
<tr>
<td>Tracheal tumor</td>
<td>1 (&lt;1%)</td>
<td>1</td>
</tr>
<tr>
<td>Subglottic web</td>
<td>1 (&lt;1%)</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>328 cases</td>
<td>131 patients</td>
</tr>
</tbody>
</table>
Patient Tolerance


<table>
<thead>
<tr>
<th>Survey item</th>
<th>Results (1 = worst pain, 10 = no pain)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain during procedure</td>
<td>7.4 ± 2.49</td>
</tr>
<tr>
<td>Pain in nose</td>
<td>9.4 ± 2.53</td>
</tr>
<tr>
<td>Pain in throat</td>
<td>7.6 ± 1.52</td>
</tr>
<tr>
<td>Gagging</td>
<td>No 50 (56%)</td>
</tr>
<tr>
<td>Pain after PDL</td>
<td>8.3 ± 2.11</td>
</tr>
<tr>
<td>Pain medicines</td>
<td>No 75 (84%)</td>
</tr>
<tr>
<td>Previous surgery in OR for</td>
<td>Yes 54 (61%)</td>
</tr>
<tr>
<td>same pathology</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Unsedated PDL versus general anesthesia procedure (n = 54)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain PDL vs OR</td>
<td>%</td>
</tr>
<tr>
<td>Less with PDL</td>
<td>83%</td>
</tr>
<tr>
<td>Same PDL versus OR</td>
<td>6%</td>
</tr>
<tr>
<td>More with PDL</td>
<td>11%</td>
</tr>
</tbody>
</table>
Vocal Fold Injection

- Simpson et al. 2004 (EBM D)
- Office-based procedures for the voice
- Augmentation injection laryngoplasty
  - Unilateral paralysis
  - Vocal fold bowing
    - Muscular atrophy
    - Paresis
    - Presbylaryngis
  - Transoral approach
  - Injection into substance of thyroarytenoid muscle at the level of the free edge of the vocal fold
    - Avoid injection into SLP
    - Posterior VF injection followed by mid-VF
Table 1. Laryngeal injectables

<table>
<thead>
<tr>
<th>Material</th>
<th>Length of effect</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Needle gauge*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gelfoam</td>
<td>6 wk</td>
<td>Long track record; minimal tissue reactivity; can be used as a “diagnostic test” in questionable cases of glottal insufficiency.</td>
<td>Short duration; some preparation time is required (to mix with saline).</td>
<td>18 or 19</td>
</tr>
<tr>
<td>Bovine collagen (Zyplast)</td>
<td>4 to 6 mo</td>
<td>Small-gauge needle can be used.</td>
<td>Allergy test required (1 mo delay).</td>
<td>27</td>
</tr>
<tr>
<td>Autologous collagen (Autologen)</td>
<td>4 to 6 mo</td>
<td>No allergy test required (patient’s own tissue).</td>
<td>Must harvest donor skin (4- to 6-wk processing).</td>
<td>27</td>
</tr>
<tr>
<td>Micronized AlloDerm (Cymetra)</td>
<td>2 to 6 mo</td>
<td>No allergy test required.</td>
<td>Unpredictable length of effect.</td>
<td>26 or 27</td>
</tr>
<tr>
<td>Teflon</td>
<td>Permanent</td>
<td>Long lasting.</td>
<td>Irreversible; may cause vocal fold stiffness; risk of granuloma formation.</td>
<td>18 or 19</td>
</tr>
<tr>
<td>Calcium hydroxyapatite (Radiance FN)</td>
<td>2 to 5 yr (?)</td>
<td>Long lasting; FDA approved.</td>
<td>Limited track record; long-term effects unknown.</td>
<td>25</td>
</tr>
</tbody>
</table>

*Simpson et al. Office-based procedures for the voice. Ear Nose Thr J 2004; 83:6-9*
Vocal fold injection with collagen

Simpson et al. Office-based procedures for the voice. Ear Nose Thr J 2004; 83:6-9)
Scar Reduction

• Woo P. 2006
• UOLS may be used following operative resection of tumors to address postoperative synechiae
• Transoral instrumentation with telescope or transnasal flexible scope may be used
• Mitomycin topical application is amenable in clinic setting
  • Mitomycin 0.4 mg/mL, 2 mL
Scar Reduction

Fig. 4. Before office lysis of scar.

Fig. 5. Post scar lysis and mitomycin application.

Steroid Injection

- Woo P. 2006
- Advantages
  - Reduce granulation and promote primary healing
  - Reduce hypertrophic scar and soften scar
  - Reduce acute and chronic inflammation
- Treatment for recurrent granulomas of the vocal process, fibrovascular lesions, phonotrauma
  - Depo-Medrol 40 mg/mL, 0.1-0.2 mL
  - Kenelog 40, Kenelog 80
  - Injection around lesion including arytenoid near the vocal process followed by removal of exophytic granulation
- Hypertrophic scar: unilateral stiffness with hyperemia
- Vocal scar: fusiform polyps, acute hemorrhagic polyps
  - Injection into vocal ligament and flap of mucosa superficial to vocal ligament
- Vocal fold edge edema, vocal fold nodules, and polypoid corditis
  - Injection into SLP
- May be repeated in 6-12 wk intervals
Steroid Injection

Lasers

- **PDL**
  - 585 nm wavelength
  - Angiolytic
  - Preferentially absorbed by hemoglobin
    - Microvascular specific property
  - Relative tissue-sparing (SLP)

- **CO2**
  - 10,500 nm wavelength, colorless
  - Absorbed by water
  - Soft tissue cellular vaporization

- **Thulium:YAG**
  - 2,000 nm wavelength
  - Intermediate properties between PDL and CO2
  - Greater thermal penetration than PDL

- **Pulsed KTP**
  - 532 nm wavelength
  - Angiolytic and hemostatic
  - Preferentially absorbed by oxyhemoglobin
    - Greater affinity than PDL

- **ALWAYS PRACTICE LASER SAFETY!**
Zeitels et al. 2004 (EBM C-4), MEEI
Office-based treatment of glottal dysplasia and papillomatosis with the 585-nm pulsed dye laser and local anesthesia
51 patients underwent 82 procedures
All had previously undergone microlaryngeal biopsies
Pentax FNL-15RP3: 5 mm diam, 2 mm working channel
  • Fiberoptic scope
Pentax VNL-153OT: 5.1 mm diam, 2 mm working channel
  • Distal chip
Photogenica V 585-nm PDL
  • 450 microsec pulse width
  • 2.0 J per pulse max output
  • 2 Hz repetition rate
  • 0.6 mm fiber through 1 mm aluminum channel
  • 1 – 2 mm spot size
Zeitels 2004

- Procedure
  - Anesthetic: topical or block
  - Silica fiber placed through working channel until it was flush with distal lumen
  - Scope then passed through nose until larynx and disease visualized
  - Fiber then advanced several mm until it was in visual field
    - Distance to tissue about 2 mm
    - Direct contact for medial surface and anterior commissure lesions

Entire lesion and approx 5 mm around visible margins were treated (600-800 mJ/pulse)

Zeitels 2004

- Disease regression
  - Assessment at 4-8 weeks posttreatment
  - 4 level grading scheme based on degree of resolution
    - 0% - 50%
    - 51% - 70%
    - 71% - 99%
    - 100%
    - Favorable outcome defined as greater than 50% resolution
  - Self-assessment of vocal quality by patients
    - Better, same, slightly worse, substantially worse
Zeitels 2004

• Results
  • 77 of 82 cases were successful
  • 5 cases aborted
    • 2 with inadequate exposure
    • 3 with discomfort
  • 68/77 (88%) had favorable outcome
  • 12% had 25-50% regression
  • 34/77 had an improved voice
  • 39/77 had no change in voice
  • 4/77 had slightly worsened voice
  • 2 mild episodes of epistaxis managed with pressure
PDL does not alter the natural history of recurrence for RRP and dysplasia
  - Biopsy

Influences on disease resolution
  - Separation between epithelial basement membrane and underlying SLP without injury to SLP
    - Photothermal and/or photoacoustic denaturing of BM linking proteins
  - Tissue ablation when fiber is in extremely close proximity or contacts tissue

Limitations
  - Moving target
  - Unable to obtain a specimen
  - Difficult to quantify energy delivery and real-time tissue effects
  - Tangential vectors for visualization and laser delivery cannot be overcome with retraction

Contraindications
  - Bulky papillomatosis
  - Difficult to reach locations: ventricle

Surgical fee for UOLS 50% that of OR-based procedure
Hospitalization/clinical fee 10% of typical fees
PDL

- Franco R 2007 (EMB D), MEEI
- In office laryngeal surgery with the 585-nm pulsed dye laser
- Non-bulky RRP
  - Non-direct contact
  - Safe to use at anterior commissure
- Leukoplakia
  - Safe to use at anterior commissure
  - Cleavage plane facilitated removal of superficial epithelium while minimizing injury to SLP
- Recalcitrant keratosis using PDL-activated topical aminolevulinic acid
  - Aminolevulinic acid is converted to porphyrin IX which has a peak absorption at 585 nm
Thulium

- Zeitels et al. 2006 (EBM C-4), MEEI
- Office-based and microlaryngeal application of a fiber-based thulium laser
- 74 cases
  - 32 with topical anesthesia through flexible scope
    - Papillomas 20
    - Microinvasive Ca 6
    - Benign supraglottic lesions 3
    - Edema 2
    - Granuloma 1
  - 42 with microlaryngeal surgery in OR
    - 27 partial laryngeal resections
      - SCCA
      - Amyloid
      - Sarcoma
      - Hemangioma
      - Papillomas
      - Reinke edema
- Thulium 2,012 nm laser (Revolix, LISA)
- Pentax VNL-1530T scope, 5.1 mm diameter, 2 mm working channel
Thulium was designed to function similarly to CO2 laser, however, with delivery possible through a glass fiber (0.365 – 0.55 mm).

Diode-pumped solid-state laser with a thulium-doped yttrium-aluminum-garnet laser rod.

Wavelength 2,013.

Chromophore is water.

Zeitels 2006

- RRP

Thulium laser was effective at tissue ablation when distance to tissue was increased to several mm in noncontact mode
  • In contact mode, thulium provided hemostatic cutting
  • Power less than 4 W was less effective cutting than over 4 W

Hemostatic property judged to be better than CO2 laser
  • Thermal damage zone adjacent to cut was greater with thulium

Thulium allowed some tangential cutting with fiber

Thulium laser was deemed more effective and easier to use than CO2 during extensive endolaryngeal resections
Laser Surgery

- Koufman et al. 2007 (EBM C-4), WFU
- Office-based laryngeal surgery: a review of 443 cases using three wavelengths
  - 5.1 mm Pentax TNE with 2.0 mm working channel
  - 406 pulsed dye laser
  - 10 CO2 laser
  - 27 thulium: yttrium-aluminum-garnet laser
Koufman 2007

- 406 procedures with PDL in 151 patients


<table>
<thead>
<tr>
<th>Indication</th>
<th>Number of procedures (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RRP</td>
<td>212 (52.2%)</td>
</tr>
<tr>
<td>Glottal dysplasia</td>
<td>79 (19.5%)</td>
</tr>
<tr>
<td>Granuloma</td>
<td>40 (9.9%)</td>
</tr>
<tr>
<td>Vocal fold lesion, unspecified</td>
<td>26 (6.4%)</td>
</tr>
<tr>
<td>Barrett esophagus</td>
<td>19 (4.7%)</td>
</tr>
<tr>
<td>Reinke edema</td>
<td>18 (4.4%)</td>
</tr>
<tr>
<td>Laryngeal amyloidosis</td>
<td>6 (1.5%)</td>
</tr>
<tr>
<td>Glottal web</td>
<td>3 (0.7%)</td>
</tr>
<tr>
<td>Tracheobronchial mass</td>
<td>2 (0.5%)</td>
</tr>
<tr>
<td>Tracheal stenosis</td>
<td>1 (0.2%)</td>
</tr>
</tbody>
</table>
• RRP
  • 3.6 procedures (1-15 procedures/pt)
  • 1.0 J power (0.5 – 2.0 J)
  • Topical anesthesia 61%
  • Nebulized lidocaine 37%
  • Nerve block 1.4%
  • 15% underwent subsequent OR procedure
  • F/U 17 mo (1-45 mo)
Glottal leukoplakia and dysplasia

- 3.2 procedures (1-9)
- All had biopsies of dysplasia prior to UOLS
- 1.0 J power (0.75 – 1.5 J)
- Nebulized lidocaine 76%
- Topical lidocaine 24%
- F/U 16 mo (3 – 44 mo)
- 1 patient went on to develop vocal fold carcinoma
Granulomas

1.6 procedures (1 – 5)
All treated with antireflux therapy
1.0 J power (0.75 – 1.7 J)
Topical anesthesia 72.5%
Nebulized lidocaine 27.5%
F/U 12 mo (1 – 30 mo)
1 had laser tip break off but was retrieved
• Reinke edema
  • 1.8 procedures (1 – 3)
  • All were counseled to stop smoking and placed on antireflux therapy
  • Topical anesthesia only
  • 1.0 J power (0.75 – 1.5 J)
  • F/U 7.3 mo (1 – 13 mo)
  • 2 had vocal fold hemorrhages that resolved

Figure 1  Treatment of Reinke edema with PDL. (A) Preoperative. (B) Four-week status post-PDL to left vocal fold. The right vocal fold is treated at this visit. (C) Five-week status post-PDL to right vocal fold. (D) Four-month status post-treatment initiation.
Koufman 2007

- Flexible CO2 laser (through hollow bore glass filament)
  - 2 patients had 10 procedures
    - Severe RRP
    - Both had previous PDL treatments
- Hollow-core photonic bandgap optical fibers
- 7 and 3 procedures
- 8 – 17 W power
Koufman 2007

- Thulium: YAG laser (LISA)
  - 27 procedures in 17 patients
  - F/U 5.6 mo

<table>
<thead>
<tr>
<th>Indication</th>
<th>Number of procedures (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RRP</td>
<td>9 (33%)</td>
</tr>
<tr>
<td>Granuloma</td>
<td>7 (26%)</td>
</tr>
<tr>
<td>Amyloid</td>
<td>4 (15%)</td>
</tr>
<tr>
<td>Vocal fold lesion</td>
<td>3 (11%)</td>
</tr>
<tr>
<td>Dystonia</td>
<td>3 (11%)</td>
</tr>
<tr>
<td>Glottal web</td>
<td>1 (4%)</td>
</tr>
</tbody>
</table>

YAG, Yttrium-aluminum-garnet; UOLS, unsedated office-based laser surgery; RRP, recurrent respiratory papilloma.

Koufman 2007

- 10 RRP patients followed long term > 5y
  - Interval between procedures was shorter for UOLS
    - 3.5 mo UOLS vs. 6.5 mo OR
    - Returned sooner for vocal changes
    - Less time lost from work
    - Less expenses
Bulky nonvascular lesions: CO2 or Tm:YAG laser
  - Exophytic papilloma
  - Supraglottic cysts
If hemostasis is a concern: Tm:YAG
  - Large inflamed vocal process granulomas
Leukoplakia, Reinke edema, non-bulky papillomas and anterior commissure papillomas: PDL
Complication rate 0.9%
  - Vasovagal episode (1)
  - Vocal fold hemorrhages (2)
  - PDL fiber tip breakage (1)
Pulsed KTP

- Zeitels et al. 2007 (EBM D), MEEI
- Office-based laryngeal laser surgery with the 532-nm pulsed-potassium-titanyl-phosphate laser
- Pulsing the laser takes advantage of the fact that energy delivery time is shorter than the thermal relaxation time of tissue
  - Minimizes collateral extravascular thermal soft tissue trauma compared to continuous mode
- Pentax VNL-1530T fiberoptic scope, 5 mm diameter, 2 mm working channel
- Laserscope 532 nm pulsed KTP laser
- Topical anesthesia
- Like the PDL, real-time effects are not as easily detected as CO2 laser
Zeitels 2007

- **PDL 585 nm**
  - Very expensive
  - Required frequent repair (not solid-state laser)
  - Short pulse-width that could not be adjusted past 0.5 ms
    - Contributes to vessel wall rupture
    - Blood on epithelial surface inadvertently absorbs energy
  - PDL on hemorrhagic polyp will destabilize overlying normal epithelium
  - Treatment of varices and ectasias is susceptible to extravasation of blood into SLP due to vessel wall rupture

- **Pulsed KTP 532 nm**
  - Less expensive
  - More reliable (solid-state laser)
  - Pulse-width 10 – 50 ms (15 ms)
    - Better coagulation property as laser energy delivered over a time period is 30 times longer than PDL
    - Minimizes photothermal injury to SLP
  - More strongly absorbed by oxyhemoglobin
  - Smaller glass fiber (0.3-0.4 mm diameter) compared to PDL (0.6 mm)
    - Greater working channel area for suctioning
  - Does not require recalibration if power setting is changed
Zeitels 2007

Figure 3 The distal flexible laryngoscope revealing the 2-mm working channel with laser fibers and sheaths.

Note that the 0.4-mm potassium-titanyl-phosphate laser fiber (left) with its sheath allows for substantially more area to suction secretions and blood than the 0.6-mm pulsed-dye laser fiber (right) with sheath.

Zeitels 2007

• Limitations of pulsed-KTP
  • Unable to obtain biopsy with laser
  • Moving target
  • Office-based operations are generally less effective as compared with OR procedures
  • Threshold for office-based intervention is decreased commensurate with decreased morbidity and improved patient tolerance

• Routine use of UOLS not supported for management of polyps, ectasias, and varices unless GA is contraindicated
  • Multiple staged procedures required in office-based setting compared to typically single operation in OR

• Mass lesions arising in SLP should be resected with bimanual phonomicrosurgical techniques
Complications

• Postma et al. 2005 (EBM C-4), WFU
  • Transnasal esophagoscopy: revisited (over 700 consecutive cases)
    • 611 patients
  • 5.1 mm transnasal esophagoscope
    • TNE KayPentax Model VE-1530
  • Topical anesthesia
    • 1:1 0.05% oxymetazoline and 4% lidocaine spray
    • 20% benzocaine spray
  • 3% cases aborted due to tight nasal vault
  • 2 cases aborted for mild vasovagal reactions
  • No cases of epistaxis required packing

• Potential complications
  • Epistaxis
  • Vasovagal episodes
  • Anesthetic toxicity
  • Pneumothorax
  • Breakage of fiber tip
Why The Office?

- Patients
  - Convenient
  - Comfort
  - Less invasive, only topical anesthesia
  - Less time: preop, procedural, recovery, work/family
  - Direct feedback
  - Less cost

- Surgeon
  - Minimal complications
  - Allows for biopsies
  - Excellent outcomes
  - Low complication rate
  - Time is minimal compared to OR setting
  - Skill may be developed
  - Global cost savings

- Insurance companies/Medicare/Medicaid
  - Less cost
Advantages

<table>
<thead>
<tr>
<th>Table 1 Advantages of unsedated office-based laryngeal laser surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsedated: no intravenous or other medication</td>
</tr>
<tr>
<td>Patient requires no postoperative recovery</td>
</tr>
<tr>
<td>Only topical anesthesia (4% xylocaine spray)</td>
</tr>
<tr>
<td>Biopsies may be obtained for cytology or histology</td>
</tr>
<tr>
<td>Fewer complications (e.g. dental injury, airway)</td>
</tr>
<tr>
<td>Actual operating time is usually minimized</td>
</tr>
<tr>
<td>Many procedures are technically easier</td>
</tr>
<tr>
<td>Global time and cost savings</td>
</tr>
<tr>
<td>Increased patient satisfaction because of:</td>
</tr>
<tr>
<td>Patient comfort</td>
</tr>
<tr>
<td>Safety (few complications)</td>
</tr>
<tr>
<td>Excellent (improved) outcomes</td>
</tr>
<tr>
<td>Less lost time from work/family</td>
</tr>
<tr>
<td>Fewer out-of-pocket expenses</td>
</tr>
</tbody>
</table>

Cost Savings

- Rees et al. 2007, WFU
- Cost savings of unsedated office-based laser surgery for laryngeal papillomas
- CPT codes
- 6 CO2 laser for RRP in OR
- 7 UOLS with PDL for RRP

<table>
<thead>
<tr>
<th>Charge Category</th>
<th>Subject 7</th>
<th>Subject 8</th>
<th>Subject 9</th>
<th>Subject 10</th>
<th>Subject 11</th>
<th>Subject 12</th>
<th>Subject 13</th>
<th>Average for Category</th>
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<tbody>
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<td>N/A</td>
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</table>

N/A — not applicable.
Rees 2007

- PDL $80,000
- TNE $18,900
- PDL fibers $147/each
- Dye kit $900/20,000 pulses (6 months)
- OR avg $7,808
- UOLS avg $2,081
  - Reimbursement rate $260 - $434 for Medicaid, Medicare and major local insurances
- Savings $5,727
- Lost days of work not included (OR)
- Comparative symptom-free and pathology-free intervals have not been evaluated
- Anecdotal data suggest that UOLS may be needed more frequently than OR procedures
Comparison

Operating Room
- Personnel
  - Surgeon
  - Anesthesiologist
  - Nurse
  - Surgical Tech
- Anesthesia
  - General
  - Cardiopulmonary monitor
- Equipment
  - Rigid laryngoscope
  - Microscope
  - Laser
  - Endoscopic instruments
  - Video Monitor
- Time
  - Preop Anesthesia clearance
  - Induction/Intubation
  - Procedure
  - Recovery

Office Setting
- Personnel
  - Surgeon
  - Assistant/Nurse
- Anesthesia
  - Topical
  - +/- Pulse oximetry
- Equipment
  - Flexible laryngoscope
  - Flexible endoscopic instruments
  - Laser
  - Video Monitor
- Time
  - +/-Sedation
  - Procedure
Conclusions

• As population demographics change and patients demand preservation or restoration of vocal function, office-based laryngeal surgery will continue to grow.
• Technologic integration of smaller devices and use of different therapeutic drugs will broaden the scope of UOLS.
• As training in endoscopic procedures improves, surgeons may perform procedures that would be technically difficult in the OR setting.
• UOLS cuts unnecessary costs and become more widely accepted and be reimbursed sufficiently.
• A thorough understanding of the capabilities and limitations of UOLS must be achieved in order to optimize patient care.
Sources

• Simpson et al. Topical anesthesia of the airway and esophagus. Ear Nose Thr J 2004; 83:2-5.
• Amin et al. Office evaluation of the tracheobronchial tree. Ear Nose Thr J 2004; 83:10-12.