A Novel Laryngoscope with an Adjustable Distal Tip
Adam Honeybrook, MBBS*
Walter Lee, MD*
Seth M. Cohen, MD, MPH
Durham, NC

Introduction: Various laryngoscopes are currently available for both laryngeal and proximal esophageal exposure, yet, none allow for articulation of the laryngoscope distal tip. We sought to create a new laryngoscope to improve anatomical exposure.

Methods: 3D printed plastic/titanium prototype designs were created using Solidworks™. Validation testing was performed in a cadaveric model. Optimal exposure of the cadaveric larynx was determined by ensuring the tip endoscope was exactly 3.5cm from the level of the vocal cords. The prototype exposure (22cm adjustable tip laryngoscope) was compared to the Weerda® (18cm distending laryngoscope) and Dedo® (18cm operating laryngoscope) laryngoscope exposures. Anteroposterior (AP) and lateral (L) exposure measurements were obtained from analysis of endoscopic images. Objective millimeter quantification was performed by pixel calibration to the known width of the vocal cord (Bersoft®).

Results: The prototype provided 77.3mm anteroposterior and 40.6mm lateral exposure of the cadaveric larynx and supraglottis. These measurements were then compared to the exposure provided by the Weerda (49.9mm AP, 40.4mm L) and Dedo (15.7mm AP, 18.6mm L) laryngoscopes. The investigators found the prototype had similar handling characteristics to the Weerda laryngoscope and laryngeal instrumentation was enhanced due to a wider distal field of view.

Conclusion: The prototype laryngoscope provided superior laryngeal exposure when compared to the Weerda and Dedo laryngoscopes in a cadaveric model. As this laryngoscope has the advantage of distal tip adjustability, we anticipate it will be particularly useful for performing endoscopic Zenker’s diverticulostomy procedures. Further clinical testing is required to ensure safety and validate its effectiveness in proximal esophageal procedures.
A Novel Silk Based Vocal Fold Augmentation Material:  
6-Month Evaluation in a Canine Model

Thomas J. Carroll, MD  
Christopher P. Gulka, PhD*  
Joseph E. Brown, PhD*  
Jodie E. M. Giordano, PhD*  
Jennifer E. Hickey, BS*  
Maria P. Montero, BS*  
Anh Hoang, PhD*  

*Boston, MA/Cambridge, MA

Objectives: Ideal vocal fold augmentation materials should be safe, biocompatible, delivered through small gauge needle, available “off the shelf” and allow tissue integration for long term effect, if desired. This remains an unmet need, and a novel silk/hyaluronic acid (Silk/HA) material has been developed specifically for vocal fold augmentation. This paper presents the 6-month, pre-clinical findings of a canine vocal fold injection trial for Silk/HA.

Materials and Methods: In vivo canine study. Twenty-four 4-6-month-old beagle dogs were injected transorally in the lateral/deep aspect of their right thyroarytenoid muscles with 0.3 ml of the designated material. 12 were injected with Silk/HA and 12 with calcium hydroxylapaptite. Silk particles were delivered via a custom catheter and calcium hydroxylapatite was delivered through a commercially available 25 cm needle. All 24 dogs were briefly anesthetized at 3 months for photodocumentation and gross appearance. Six dogs from each material group will be sacrificed 6-months from injection date for evaluation of implant longevity, immune response, and collagen typing of deposited matrix within the implants.

Results: Acknowledging our data is incomplete at abstract review, we offer separate report of 2 spare dogs that were also injected per the same protocol but sacrificed at the 2-month time point. The implant did not elicit any adverse reaction or migration at that time. Grossly, at 3 months, both materials were present and exhibited no gross inflammation.

Conclusions: The 6-month time point is December 2017. Tissue response, migration, and collagen ingrowth typing to differentiate scar vs. healthy collagen will be reported.
A Simple Hybrid Technique for Difficult Intubations: Combining Video Laryngoscopy with Flexible Fiberoptic Intubation

Casey Hay, MD*
Michelle Fincham, MD*
Joseph Mucarella, DO*

Buffalo, NY/Manhattan, NY

Introduction: The incidence of difficult intubation in the operating room ranges from approximately 1-4% and results in failed attempts at intubation in up to 0.35% of the time. We will discuss the combined use of video laryngoscopy and flexible fiberoptic intubation to quickly and safely secure the airway in patients with presumed difficult airways.

Methods: The video laryngoscope is obtained and an endotracheal tube is placed into position over a flexible endoscope. The video laryngoscope is used by one provider to obtain the best possible view of the glottic opening and then the endoscope is used by a second provider as a flexible stylet to access the trachea. The VL view is used to help guide the endoscope into the trachea; the endoscope camera feature is not utilized, but is available if necessary. Once inside the trachea, the ETT can be advanced and intubation is achieved.

Results: Anectodally, this technique has been performed at least 100 times over the past 10 years and there has been no associated morbidity or mortality.

Conclusion: This technique is a simple and efficient technique that can convert a difficult airway case into a successful intubation within seconds. Knowledge of this technique could increase the success rate of noninvasive intubation of airways and decrease the number of surgical airways, which require much more post-procedure care and result in increased morbidity for the patient.
Aerodynamic Changes in Patients with Chronic Cough Treated with Cough Suppression Therapy

Jim Yang, BA*
Thomas Murry, PhD
Brianna Crawley MD
Priya Krishna, MD, MS
Loma Linda, CA

Objective: Voice therapy has been suggested as the choice of treatment for patients with chronic cough. However, the voice aerodynamic parameters that may account for improvement in cough symptoms have not been well studied. The purpose of this study was to determine the changes in the aerodynamic parameters of phonation and self-ratings of cough severity following cough suppression therapy.

Methods: Chart review was conducted for 14 patients with long term chronic cough (>6 months) refractory to various medical treatments, who received from 2 to 4 visits of cough suppression therapy over a 5 month period. Sessions consisted of breathing modification exercises such as reported in the literature1. Aerodynamic parameters including mean peak estimated subglottal air pressure, mean airflow during voicing, aerodynamic resistance, and maximum phonation time (MPT) were obtained before and after therapy. Patients also completed the Cough Severity Index (CSI).

Results: Fourteen patients (M:F=3:11), mean age 62 (range=28-78) had significant CSI improvement from 18.1 to 9.7 (p=0.0003) after cough suppression therapy. Mean estimated subglottic air pressure decreased significantly from 8.02 to 6.61 cmH2O (p<0.05). MPT increased significantly from 12.7s to 19.8s (p<0.05). Laryngeal airway resistance decreased from 64.4 to 46.6 cmH2O/cc/sec though not statistically significant.

Conclusion: This investigation provides evidence that reduced mean estimated subglottic air pressure and MPT are associated with symptomatic improvement in chronic cough. These objective changes in aerodynamic measures support the use of cough suppression therapy for chronic cough patients, especially those refractory to other treatments. Key words: chronic cough, behavioral treatment, cough severity index
Application of Thulium Laser as an Office Procedure for the Treatment of Vocal Cord Polyps

Elie Khalifee, MD*
Abdul-Latif Hamdan, MD, EMBA, MPH

Beirut, LEBANON

Introduction: This is a retrospective chart review reporting voice outcome measures following the application of Thulium laser as an office based procedure in the treatment of vocal fold polyps.

Material and Method: Demographic data includes age, gender, smoking, and alcohol intake. Both subjective and objective voice outcome measures are reported. Subjective measures include Voice Handicap Index-10 and perceptual evaluation using GRBAS system. Objective measures include extent of disease regression and laryngeal video stroboscopic findings, namely glottic closure and extent of mucosal waves.

Results: A total of 20 patients with vocal fold polyps who underwent unsedated office based laser therapy using Thulium laser (Power 3.5-4.5W pulsed mode) were included. All patients had subjective improvement in voice quality associated with partial or complete regression of their lesions on endoscopy.

Conclusion: Thulium laser can be used as an office procedure for the treatment of vocal fold polyps.
Aspiration Prevention and Swallowing Evaluation before and after Injection Medialization Laryngoplasty for Acute Vocal Fold Immobility – Our Experience and Suggested Protocol

Sara Abu-Ghanem, MD, MMedSc*
Shu Wei Tsai, MD*
Liang-Chun Shih, MD*
Shannon Rudy, MD*
Edward J. Damrose, MD
C. Kwang Sung, MD, MS*
*Stanford, CA

Introduction: The morbidity of glottic insufficiency resulting from unilateral vocal fold immobility (UVFI) may significantly compromise postoperative recovery in patients with decreased pulmonary reserve or inability to protect their airway. Early recognition allows earlier intervention by means such as vocal fold (VF) medialization or speech pathology maneuvers to improve the voice and lower rates of swallowing dysfunction and potential pneumonia. There is limited literature and no accepted protocol for swallowing evaluation before and after VF medialization.

Methods: Retrospective review of patients undergoing injection medialization laryngoplasty for acute UVFI (<30 days) at a tertiary academic center. Records were reviewed for demographics, clinical characteristics, procedural details, and short-term outcome measures of oral intake. Only patients who had instrumental swallowing studies both before and after the procedure were included. An extensive literature review was done.

Results: A total of 285 patients with documented UVFI, swallow evaluation, and VF injection were identified. Only 18 patients met the inclusion criteria and had data on swallowing studies before and after injection. Seventy percent were found with safe swallowing study following the injection and had their diet advanced to adequate oral intake. No complications were noted, and all patients were able to tolerate awake, bedside injection.

Conclusions: Acute UVFI following surgery requires immediate diagnosis and therapeutic strategy to minimize postoperative complications and to overcome impairments in the voice, swallow, and cough. An interdisciplinary assessment protocol is suggested based on our experience and extensive literature review. Further research is needed on the immediate outcomes of bedside medialization injection.
Association of Pepsin and Inflammatory Mediators in Patients with Clinically Suspected Laryngopharyngeal Reflux
Karen M. Kost, MD
Nicole Li-Jessen, PhD*
Hao Fu, MEng*
Xiyu Liu, PhD*
Westmount, Quebec, CANADA/Toronto, Ontario, CANADA

Introduction: Laryngopharyngeal reflux (LPR) affects as much as 40% of population in North America. The nonacid gastric content, notably pepsin, is the major agent causing symptoms of LPR. In addition to pepsin, proinflammatory cytokines are implicated in the inflammation of esophageal mucosa related to reflux. Pepsin has been shown to enhance the expression of proinflammatory cytokines in pharyngeal epithelial cell cultures. However, the association of pepsin and proinflammatory cytokines in LPR has not been prospectively studied in humans.

Purpose of the Study: This study was to investigate the association of pepsin and two inflammatory cytokines (interleukin [IL] 1-beta and tumor necrosis factor [TNF]-alpha) in laryngeal surface secretions from individuals with clinically suspected LPR and asymptomatic controls.

Methods: Nine clinically suspected LPR patients and nine asymptomatic individuals were recruited to this study. The diagnosis of suspected LPR was based on the Reflux Symptom Index (RSI) greater than 13 and clinical symptoms associated with LPR. Laryngeal surface secretions were sampled and subjected to enzyme-linked immunosorbent assays for protein quantification of pepsin, IL-1β and TNF-α.

Results: Concentrations of pepsin were significantly higher in LPR group compared to controls (t = -2.52; p < 0.05). Levels of IL-1β and TNF-α were not statistically different between the two groups. Correlations among these three biomarkers were statistically insignificant in the LPR group as well.

Conclusion: Pepsin appears to be the strongest biomarker to differentiate LPR and controls. However, the presence of pepsin might not indicate detectable laryngeal inflammation in patients with clinically suspected LPR.
Automated Indentation Mapping of Vocal Fold Structure and Cover Properties Across Species

Gregory R. Dion, MD*
Jean-Francoi Lavoie, PhD*
Paulo Coelho, DDS, PhD*
Milan R. Amin, MD*
Ryan C. Branski, PhD

Ft. Sam Houston, TX/New York, NY

Objectives/Hypothesis: Various animal models have been employed to investigate vocal fold (VF) and phonatory function. However, biomechanical testing techniques to characterize vocal fold structural properties vary and have not compared critical properties across species. We adapted a non-destructive, automated indentation mapping technique to simultaneously quantify VF structural properties (VF cover layer and intact VF) in commonly used species based on the hypothesis that VF biomechanical properties are largely preserved across species.

Study Design: Ex vivo Methods. Canine, leporine, and swine larynges (n=4 each) were sagittally bisected, measured, and subjected to normal indentation mapping (indentation at 0.3mm; 1.2mm/s) with a 2mm spherical indenter to quantify normal force along the VF cover layer, structural stiffness, and displacement at 0.8mN; 2-D maps of the free VF edge through the conus elasticus were created for these characterizations.

Results: Structural stiffness was 76.34mN/mm (1.47-730.59) for leporine, 24.30mN/mm (1.96-409.15) for canine, and 14.21mN/mm (5.49-44.69) for swine. For each species, the lowest values were along the free VF edge (mean ± SD; leporine: 3.90±2.08mN/mm, canine: 11.15±4.83mN/mm, swine: 8.72±2.79mN/mm). Similar results were obtained for the cover layer normal force at 0.3mm. On the free VF edge, mean (SD) displacement at 0.8mN was 0.24mm (0.05) in leporine, 0.12mm (0.05) in canine, and 0.13mm (0.03) in swine.

Conclusions: Automated indentation mapping yielded reproducible biomechanical property measurement of the VF cover and intact VF. Divergent VF structural properties across canine, swine, and leporine species were observed.
Classification of Voice Disorders using Deep Learning Models

Shintaro Fujimura, MD*
Tsuyoshi Kojima, MD, PhD*
Ryusuke Hori, MD, PhD*
Yusuke Okanoue, MD*
Seiji Oyagi, MD*
Hiroki Kagoshima, MD*
Kazuhiko Shoji, MD, PhD*

Nara, JAPAN

Introduction: Auditory-perceptual voice analysis is the gold standard for the quantification of overall voice quality, but perceptual ratings are based on subjectivity and there remains the issue of rating variation by examiner. Many acoustic parameters have been studied to evaluate severity of dysphonia objectively. However, because the interpretation of acoustic parameters measured in each individual case is difficult, the technique is not widely used by clinicians. Furthermore, level of excellence as an objective index of hoarseness is paradoxically measured by correlation with subjective evaluation. The aim of this study was to establish standardized methods to discriminate GRBAS (Grade, Roughness, Breathiness, Asthenia, Strain) scale of voice samples directly using deep neural network.

Method: We used voice waveforms or time-frequency frames as the input to the model, and investigate convolutional neural network (CNN) models with some different designs of convolution filters or network structures. Sustained vowel phonation samples recorded through voice acoustic analysis of voice disorder patients were rated using GRBAS scale by otolaryngologists. They were preprocessed appropriately according to respective models, then used to train neural network and to evaluate model performance by cross validation.

Results: The classification accuracy of the currently available best model is 73.5% with our test data.

Conclusion: We think the test results are acceptable. We are continuing this research to make the problem clearer of this method and aim for better outcomes sufficient to use this method as the replacement of human judgment in clinical or research use.
Clinical Implications of Reinke’s Edema
Raluca Tavaluc, MD*
Howie Herman, MS*
Paul Bryson, MD
Michael S. Benninger, MD
Juan Lin, PhD*
Melin Tan, MD

Bronx, NY/Cleveland, OH

Introduction: Reinke’s edema (RE) is a benign disease of the vocal folds with a wide spectrum of clinical severity. Clinical implications of RE grading have not yet been elucidated. We aim firstly to evaluate the clinical impact of RE and secondly to determine if RE grade correlates with severity of dysplasia and tobacco exposure.

Methods: Patients diagnosed with isolated RE between December 2010 and December 2014 were retrospectively reviewed. RE grade was determined from archived laryngeal videostroboscopy (LVS) exams. Grade of dysplasia and tobacco history were extracted from medical records.

Results: Of 120 lesions, 49 (33%) lesions were grade 1, 35 lesions (29%) were grade 2, and 18 (15%) were grade 3 and 9 (7.5%) were grade 4. Those patients with RE grade 3 or higher proceeded to surgery 82% of the time. Patients with smaller lesions as determined by RE grade underwent surgery 35% of the time. Of those undergoing surgery, 62% of specimens had no dysplasia on pathologic evaluation. No statistical correlation was identified between RE grade and severity of dysplasia. Furthermore, no statistical correlation was seen between tobacco exposure and severity of dysplasia or RE grade.

Conclusions: Treatment for RE has classically been indicated for dysphonia; however, our study population reveals that patients are more likely to proceed to surgical intervention when the size of the lesion is larger and potentially obstructive. Severity of dysplasia neither correlates with RE grade nor tobacco exposure.
CNS Multiple Myeloma Presenting as Isolated Bilateral Vagal Palsy: An Unusual Case of Dysphonia and Dysphagia
Amit A. Patel, MD
Long Branch, NJ

Introduction: Involvement of the CNS in multiple myeloma (MM) is very uncommon; it has been observed in approximately 1% of MM patients. We present a case of CNS MM presenting as bilateral vagal palsy leading to dysphonia and dysphagia.

Methods: Case Report/Literature Review Case Report: A 62 F who was diagnosed with MM 3 years ago was treated with autologous SCT followed by maintenance chemotherapy. She then developed acute onset breathy dysphonia, hypernasal speech, and dysphagia. Laryngoscopy revealed symmetric palate weakness and bilateral vocal fold immobility with aspiration, suggestive of a bilateral vagal palsy. CSF analysis revealed plasma cells, diagnostic of CNS multiple myeloma. No mass lesions or leptomeningeal enhancement were seen on imaging. The patient was treated with intrathecal chemotherapy with near complete resolution of symptoms. PET/CT was clear. When last examined, the soft palate weakness had resolved, she was tolerating an oral diet without aspiration, and exam showed a trace left vocal fold paresis with good compensation.

Discussion: To our knowledge, this is the first case report of CNS MM presenting as bilateral vagal nerve palsy, and without CNS plasmacytoma, mass, or leptomeningeal enhancement. Other reports have shown CNS MM presenting with other cranial nerve palsies, such as III, IV, and VI palsies causing ocular symptoms, however, some of these cases were also associated with CNS plasmacytoma causing the issue, which was not the case with our patient. Treatment options include intrathecal chemotherapy, systemic chemotherapy, cranial irradiation or a combination.
Common Practices in Botulinum Toxin Injection for the Treatment of Spasmodic Dysphonia: A National Survey

Hagit Shoffel-Havakuk, MD*
David E. Rosow, MD
Christian X. Lava
Edie R. Hapner, PhD
Michael M. Johns III, MD

Petah Tikva, ISRAEL/Miami, FL/Los Angeles, CA

Introduction: Protocols in the treatment of spasmodic dysphonia (SD) vary among physicians. Previously published work comes from relatively few centers.

Methods: An online 58 item survey was sent to all Otolaryngologists who self-identify as Laryngologists on the AAO-HNSF website. Items surveyed included Botulinum toxin injection technique, laterality and dosage.

Results: An 80% response rate was achieved (70 completed the survey). Participants collectively reported treating over 4000 patients with SD in the past year (mean 71±68 patients/laryngologist). 87% perform injections exclusively in the office, the remainder both in the office and OR. For ADSD injections, 88% use EMG guidance alone via cricothyroid approach. The remainder use anatomical landmarks alone (9%) or EMG with endoscopic guidance (3%). Sitting is the preferred patient position (70%; supine: 30%). A substantial majority (87%) starts with bilateral injections (starting dosage, mode: 1.25U/side). For ABSD injections, 67% use EMG guidance alone and 31% use endoscopic guidance with or without EMG. Sitting is the preferred patient position (84%; supine: 16%). Preferred approach is anterior-translaryngeal (51%) followed by lateral-retrolaryngeal with rotation (34%). A considerable majority (79%) starts with unilateral injections (starting dosage, mode: 5U). When deciding on initial dosage, the most influential factor was balancing effect/side effects, followed by patient’s frailty and risk of aspiration. The typical planned interval between injections is 3-4 months.

Conclusions: Laryngologists follow fairly uniform protocols in the treatment of SD with some important and previously unpublished differences. This study documents areas of agreement and discordance among Laryngologists in the US for the treatment of SD.
Comparing the Utility of 3-Day vs 10-Day Voice Rest following Type 1 Thyroplasty

Neel K. Bhatt, MD*
Andrea M. Park, MD*
Joseph P. Bradley, MD
Archie Harmon, PhD, CCC-SLP*
Dorina Kallogieri, MD, MPH*
Randal C. Paniello, MD, PhD

St. Louis, MO

Introduction: Post-operative voice rest is often prescribed to patients following laryngeal surgery. Voice rest has significant social and economic impacts, and the optimal duration of voice rest is unknown. This pilot study compared vocal fold edema and restoration of mucosal wave between two postoperative voice rest regimens.

Study Design: Randomized control trial

Methods: Twenty patients were randomly prescribed 3-days (n=10) or 10-days (n=10) complete post-operative voice rest following type 1 thyroplasty. Video stroboscopy was recorded on day 3, day 10, and 6 weeks following surgery, and mucosal wave and vocal fold edema were rated by expert reviewers at these time points. Patients were instructed to wear vocal activity monitor during the voice rest period. Vocal activity was recorded and compared.

Results: There was no significant difference in either mucosal wave or edema ratings between the two groups at any of the time points. Average use of vocal activity monitor was 2.6 hours/day (range 0.3 – 6.8 hours/day) in the 3-day voice rest group compared to 1.5 hours/day (range 0.8 – 6.6 hours/day) in the 10-day voice rest group. The average percentage of time with vocal activity above threshold (unacceptable voice use) was 6% (range 0-11%) for the 3-day voice rest group and 4% (range 0-14%) for the 10-day voice rest group.

Conclusion: Mucosal wave and vocal fold edema were not significantly different between patients prescribed 3-day and 10-day voice rest. The vocal activity monitor did not detect a significant difference in voice rest compliance between the two groups.
Correlation between Voice Therapy Compliance and Response to Voice Handicap Index Questions

Hannah Kavookjian, MD*
Andrew J. Holcomb, MD*
Thomas Irwin, MM*
James D. Garnett, MD
Shannon Kraft, MD*

Kansas City, KS

Introduction: Voice therapy (VT) is a helpful tool in the management of many voice disorders. Despite this, many patients are non-compliant and approximately 2/3 drop out before completion. In this study we examine whether responses to specific items on the voice handicap index (VHI) can be used to predict VT compliance.

Methods: This is an IRB-approved retrospective cohort study. All patients presented to a tertiary care center between January 2011 and June 2016 with chief complaint of dysphonia and were referred for VT. Patients were excluded if they were seen by SLP only for pre-operative assessment or if completion of therapy was unknown. Data collected included survey data from the first visit, as well as demographic and clinical information. Statistical analysis was performed using SPSS.

Results: Of 489 patients, 36.2% were recommended VT but did not attend, 36% partially completed VT, and 27% completed VT. Patients who partially completed VT were younger compared to the other groups (p=0.017). Patients who completed or partially completed voice therapy were more likely to use their voice for work (p=0.015). There were statistically significant differences among the groups for five individual VHI questions. Patients who were recommended voice therapy but did not attend had a statistically significant lower VHI-total score, VHI-10 score, and lower scores in each of the VHI sub-categories (“functional,” “physical,” “emotional”).

Conclusions: Patient responses to specific VHI items may indicate which patients will attend recommended VT.
**Decreased Calcium Hydroxyapatite Reabsorption in a Rat Model of Osteoporosis**

Derrick R. Randall, MD, MSC
Nogah Nativ, PhD*
Daniel J. Cates, MD*
Steve P. Tinling, PhD*
Peter C. Belafsky, MD, PhD, MPH

*Calgary, AB, CANADA/Sacramento, CA*

Objective: Calcium hydroxyapatite (CaHA) is a common material for vocal fold injection augmentation. Durability is variable, and factors involved in implant longevity are not understood. Animal models of osteoporosis show decreased bone density and increased mineral liberation, suggesting CaHA retention may be altered in these conditions.

Study design: Prospective murine investigation

Methods: Fourteen skeletally mature, 10-month-old female Sprague-Dewley rats were treated by one of three interventions: oophorectomy, laparotomy without oophorectomy (sham), or monthly risedronate injection (90 μg/kg, subcutaneous). CaHA was implanted into the right lateral thigh muscle in all animals at the time of procedure or first risedronate injection. After 17 weeks, all rats were sacrificed and the residual CaHA isolated from excised lateral thigh muscle through incubation in a 900°C calcinator for 9 hours.

Results: Mean CaHA mass remaining in the oophorectomy group was 65.9 (SD±16.1) mg, compared to 44.4±10.0 mg CaHA in the risedronate group and 48.6±7.5 mg in the sham group. One way analysis of variance found a statistically significant difference between the oophorectomy and risedronate groups, but not between the sham and other groups, F(2,11)=4.404, p=0.039.

Conclusion: Persistent estrogen deficiency in a murine model of osteoporosis demonstrated decreased rate of CaHA reabsorption. This suggests that hormone alterations associated with osteoporosis may alter the longevity of CaHA implant resorption through an uncertain mechanism.
Defining a Phonometric Surgical Learning Curve using Motion Metrics in Novices
Adriana Chou, BA*
Liyu Lin, PhD*
Allison Pulverm cher, BS*
David Piotrowski, BS*
Seth Dailey, MD
Jack J. Jiang, MD, PhD
Madison, WI

Objective: Motion metrics objectively describe surgical dexterity, but are not yet widely applied to phonosurgical training. The Video-based Phonometric Surgical Instrument Tracking System (V-PITS) successfully measures changes in motion metrics in novice subjects after repeating a phonometric surgical simulation. We aim to define the learning curve of novices, using each of the motion metrics captured by V-PITS as dependent variables and number of repetitions on a simulator as an independent variable.

Methods: In a prospective cohort study, 20 participants (11 females) without prior surgical experience completed 15 sessions with a validated vocal fold polypectomy simulation. At each session, participants operated on each hemifold in randomized order. Microforceps, microknife, and microscissors movements were used to compute: path length, depth perception, motion smoothness on 3 independent axes, net motion smoothness, and net orientation smoothness. The average metrics for each session were fit to a power function according to Wright’s Cumulative Average Model: Y=aX^b.

Results: For left-sided lesions, the depth perception data fit a power function for all 3 microinstruments (microforceps p=0.03; microknife p<0.01; microscissors p=0.01), as did path length data for the microforceps (p=0.04) and microknife (p<0.01). For right-sided lesions, path length and depth perception fit a power function for microforceps (p<0.01 for both). Bilateral path length (microforceps p<0.01; microknife p=0.01; microscissors p<0.01) and depth perception (microforceps p<0.01; microknife p=0.02; microscissors p=0.03) fit a power model for all 3 instruments.

Conclusion: In a novice population performing a simulated phonometric surgical task, a learning curve can be defined in terms of path length and depth perception as measured by V-PITS.
Endoscopic Excision of a Large Combined Laryngocele: A Case Report and Review of the Literature

Adam R. Szymanowski, MD*
Linnea Fechtner, MD*
Joseph Muscarella, DO*
Buffalo, NY

Introduction: A laryngocele is an abnormal, air-filled cavity originating from the laryngeal saccule that can present with a variety of symptoms ranging from a benign neck mass to significant respiratory distress. The majority of patients are treated surgically using an open transcervical approach; however, complete transoral excision can significantly reduce surgical morbidity. Objectives: (1) Present a case of a laryngocele with a large external component excised endoscopically using a CO2-laser and microsurgical instruments. (2) Review new, minimally invasive techniques to excise laryngoceles.

Methods: A case of complete endoscopic laryngocele excision, including capsule, is presented. Subsequently, a PubMed literature review of minimally invasive, endoscopic laryngocele excision was completed.

Results: Large laryngoceles, including their capsule, can be excised through an entirely transoral approach using microsurgical instruments and a CO2-laser. This technique minimizes operative morbidity compared with a transcervical approach, and has good patient outcomes. A small pool of case reports and case series employing similar techniques support transoral excision of laryngoceles.

Discussion: Our case report and literature review demonstrate that complete endoscopic excision of laryngoceles, regardless of size, is safe and efficacious. A transoral approach minimizes patient morbidity, allowing for prompt hospital discharge and limited wound care. While a notable gap in the literature remains, our case report lends further support to endoscopic excision of laryngoceles.
Endoscopic Findings in Prepubertal Boychoir Singers

David R. Lee, MD*
Barbara Weinrich, PhD, CCC-SLP*
Meredith Tabangin, MPH*
Wendy LeBorgne, PhD, CCC-SLP*
Stephanie Zacharias, PhD*
Janet Beckmeyer, MA*
Christopher Eanes
Alessandro deAlarcon, MD, MPH

Cincinnati, OH

Objective: The male singing voice through puberty undergoes many changes that present challenges for the singer and choral director. The purpose of this study is to discuss the endoscopic findings seen in pre-pubescent Boychoir singers. Study Design: Single-institution prospective study.

Methods: All subjects were recruited from the local Boychoir, and were described as Cooksey Stage unchanged or mid-voice I. History was obtained via questionnaire at the initial visit. Subjects with known laryngeal pathologies were excluded. All endoscopic laryngeal examinations were performed using videoendoscopy. During examination, each subject sang four discrete frequencies. The findings of the endoscopic exam were judged by a pediatric otolaryngologist and two speech pathologists focusing on voice disorders.

Results: We evaluated 28 subjects prior to vocal maturation. Their age range was 8 - 13 years old (Mean=10.2±1.2). All 28 were self-described as soprano. The subjects had a mean of 1.7±1.1 years in the Boychoir (0-5 years). None reported history of vocal issues or voice problems in the past; 7 (25%) subjects had bilateral vocal cord lesions seen at one or more frequencies; 26 (93%) subjects had a posterior gap at one or more frequencies.

Conclusions: Our study aimed to describe the laryngeal examination of dedicated Boychoir singers prior to undergoing pubertal development and vocal maturation. Interestingly, 7 subjects were found to have laryngeal pathology that was previously unknown and that was asymptomatic. This suggests that asymptomatic lesions are not uncommon in Boychoir singers and may suggest that this can also be seen in the general population.
Examining the Safety and Efficacy of Awake, Bilateral Injection Medialization Laryngoplasty in the Management of Bilateral Vocal Fold Atrophy

Zachary Kelly, BA*
Anju Patel, MD*
Adam Klein, MD
Atlanta, GA

Introduction: Office-based injection laryngoplasty (IL) has emerged as a useful procedure for Otolaryngologists to correct glottic insufficiency while avoiding the costs and risks of general anesthesia. This is the first study focused on addressing the safety and efficacy of this particular procedure solely for bilateral vocal fold (VF) atrophy, an important morbidity associated with the aging voice.

Methods: Patient records were reviewed from Emory University Hospital Midtown during the period of 2005-2017. Patients who underwent awake, bilateral transthyrohyoid, transroral, transcricothyroid, or transthyroid cartilage IL for bilateral VF atrophy were analyzed. Complication rate was used to evaluate safety. Before and after Voice Related Quality of Life (VRQOL) scores were recorded to determine efficacy.

Results: 240 patients met inclusion criteria. There were seven complications, yielding a complication rate of 2.9%. Complications included aborted cases for difficult anatomy or poor patient tolerance, injection material not absorbing, and a VF hematoma. No patients required admission to the hospital or evaluation in the emergency room. VRQOL scores were obtained from 133 patients. The average decrease in score was 8.1, correlating to an overall improvement in vocal quality (p<.0001).

Conclusions: This study illustrates a low complication rate for awake IL in treating bilateral VF atrophy. Complications were associated with patient tolerance, unique anatomy, and in one case, anticoagulant medication. The improvement in VRQOL scores and low complication rate support the conclusion that not only is bilateral medialization IL laryngoplasty safe in the awake setting, but it is also efficacious for patients with bilateral VF atrophy.
Gender-Based Outcomes in Type I Thyroplasty for Non-Paralytic Glottic Incompetence

Zainab Farzal, MD*
Lewis Overton, MD*
Douglas R. Farquhar, MD, MPH*
Elizabeth D. Stephenson, BA*
Rupali N. Shah, MD
Robert A. Buckmire, MD
Chapel Hill, NC

Introduction: Clinical outcomes for Type I Gore-Tex thyroplasty (GTP) for non-paralytic glottic incompetence (GI) have been reported in the literature. Given differences in male and female laryngeal anatomy, gender-based outcomes should also be evaluated. We endeavored to evaluate gender-specific post-GTP voice outcomes.

Methods: We performed a retrospective review of patients undergoing GTP for non-paralytic GI. Multidimensional voice outcome measures including Voice-Related Quality of Life (VRQOL), Glottal Function Index (GFI), and Grade/Roughness/Breathiness/Asthenia/Strain (GRBAS) were analyzed at post-operative time frames: 0-3 months, 3-9 months, 9-18 months, 18-36 months, and 3-5 years, and 5-10 years.

Results: 89 subjects (46 females, 43 males) with average age 52.2 undergoing GTP for non-paralytic GI from 2005 to 2017 met inclusion criteria. Etiologies included vocal fold hypomobility (N=37, 41.6%), paresis (N=19, 21.3%), vocal fold atrophy (N=17, 19.1%), and scarring (N=16, 18.0%). Females had significantly greater improvement on VRQOL at 0-3 months and 9-18 months timeframes compared to males with mean change in VRQOL: 38.9 vs 22.3 (p=0.001) and 41.7 vs 20.4 (p=0.002), respectively. Similarly, women had significantly greater improvement in GFI at 0-3 months follow-up (mean difference -10.3 vs -5.0, respectively, p=0.0004). There was no statistically significant gender difference in GRBAS at any follow-up interval.

Conclusions: Following GTP, females report greater improvement in patient-reported voice quality in the early post-operative period. No significant difference between genders was seen in perceptual measures (GRBAS). Gender-specific outcomes should be evaluated for clinical interventions to improve specificity of pre-operative counseling.
Glucocorticoids Regulate Smad Signaling Via Phosphorylation of the Glucocorticoid Receptor in Human Vocal Fold Fibroblasts

Shigeyuki Mukudai, MD, PhD*
Renjie Bing, MD*
Michael Garabedian, PhD*
Ryan C. Branski, PhD

New York, NY

Objectives. Direct glucocorticoid (GC) injection for vocal fold scar has evolved as a therapeutic strategy, but the mechanisms underlying the anti-fibrotic effects remain unclear. GCs act via glucocorticoid receptor (GR), which is phosphorylated at multiple serine residues in a hormone-dependent manner to affect bioactivity. We hypothesize that GCs regulate Smad signaling via GR phosphorylation in vocal fold fibroblasts (VFFs). We sought to quantify the effects of dexamethasone (DM) on Ser211 and Ser203 phosphorylation and regulation of TGF-β1 signaling.

Methods. Immortalized human VFFs were treated with DM (10⁻⁵-10⁻⁷M) +/- TGF-β1 (10ng/ml). The GR antagonist (RU486, 10⁻⁶M) was employed to isolate the regulatory effects of GR. Expression of total GR, Ser211, and Ser203 phosphorylation was examined via SDS-PAGE and immunocytochemistry. Quantitative polymerase chain reaction was employed to determine GR-mediated effects of DM on SMAD3, SMAD7, COL1A1 and ACTA2 expression.

Results. Total GR and Ser211 phosphorylation was observed predominantly in the nucleus 1 hour after DM administration. Whereas DM decreased total GR expression, Ser203 and Ser211 phosphorylation increased. RU486 limited the effects of DM. SMAD3 and SMAD7 mRNA expression significantly decreased 4 hours after DM administration (p<0.05); this response was negated by RU486. COL1A1 remained unchanged and ACTA2 significantly increased following 24 hours of DM treatment (p<0.05).

Conclusions. DM regulated TGF-β1 signaling via altered SMAD3 and SMAD7 expression. This response is associated with changes in GR phosphorylation. These findings provide insight into the mechanisms of steroidal effects on vocal fold injury, with the goal of enhanced therapeutic strategies for these challenging patients.
Incidence and Treatment Outcomes of Vocal Fold Mobility Impairment after Total Arch Replacement

Tanner M. Fullmer, MD*
David C. Wang, BS*
Matt Darwin Price, MS*
Scott A. LeMaire, MD*
Joseph S. Caselli, MD*
Donald T. Donovan, MD
Julie Ongkasuwan, MD

Houston, TX

Background: Vocal fold mobility impairment (VFMI) secondary to neuronal injury is a known risk factor after aortic surgery. Total arch repair is technically challenging and the incidence of recurrent laryngeal nerve injury is unknown. This study examines the incidence of VFMI after total arch replacement and inpatient medialization outcomes.

Study Design: Retrospective Cohort Study

Methods: All patients who underwent total arch replacement at our tertiary care center from 2006-2017 were identified through an institutional database. A total of 358 patients were reviewed. End points included evidence of vocal fold immobility on flexible laryngoscopy, time to diagnosis, time to treatment, performance on pre-and postoperative swallow studies, ICU and hospital length of stay.

Results: Nineteen percent of patients who underwent total arch replacement were diagnosed with VFMI during their initial inpatient stay. Seventy-eight percent of those injuries involved the left vocal fold, 16% were on the right and 6% were bilateral. The majority of patients (61%) received inpatient vocal fold medialization (VCM), 66% of those received injection laryngoplasty and 33% had a type 1 thyroplasty. Those with vocal fold paralysis had significantly longer stays in the intensive care unit (8.6 and 5.7 days, p=.03) and in the hospital (20.4 and 16.0 days, p=.04). Patients with VFMI, who received VCM trended toward shorter ICU (p=.08), and hospital stays (p=.5), though it was not significant.

Conclusions: Incidence of VFMI following total arch replacement is similar to those receiving other aortic arch surgeries. Prospective studies and standardization is needed to evaluate treatment outcomes.
Interesting Case of Delayed Gore-Tex Extrusion following Medialization Laryngoplasty: Case Report and Literature Review

Diana Kirke, BSc, MBBS, MPhil*
Andrew Blitzer, MD, DDS
New York, NY

Objective: To report a complicated case of late onset Gore-Tex extrusion six years after initial medialization laryngoplasty (ML).

Methods: Case report and literature review.

Results: A 65-year-old female presented with a foreign body sensation following an asthmatic attack, associated with severe coughing. The patient had had a right ML six years prior, which was complicated by a small tear (2mm) in the right ventricle, however the decision was made to proceed with Gore-Tex implantation. One year later the patient developed Gore-Tex extrusion and granuloma formation at the site of the previous tear, but after discussion the patient elected to partially remove the Gore-Tex in order to maintain quality of voice. Healing was complete with no issues until five years later, where on examination she had evidence of further Gore-Tex extrusion through the right ventricle, sitting above the laryngeal introitus. Attempts to remove this in office were unsuccessful and thus she had definitive removal of the implant via microlaryngoscopy in the OR.

Conclusion: Implant extrusion is a recognized complication of medialization laryngoplasty. This case demonstrates several important surgical steps. Firstly implantation should not proceed if there is a surgical defect in the ventricle. If however there is reason to still proceed, then the tear should be repaired with mucosa or allograft and reinforced with periosteum. Finally complete explanation should be performed at the time of the initial extrusion event.
Ipratropium Bromide: A Novel Treatment for Paradoxical Vocal Fold Motion
Karuna Dewan, MD
Elizabeth Direnzo, PhD, CCC-SLP*
Stanford, CA

Purpose: To establish the efficacy of inhaled ipratropium bromide in the treatment of paradoxical vocal fold movement (PVFM), and to compare its efficacy to that of respiratory retraining therapy.

Methods: In this prospective cohort study in a tertiary care laryngology practice, patients at the time of PVFM diagnosis, are asked to complete four validated surveys: Reflux Symptom Index, Voice Handicap Index-10, Cough Severity Index and Dyspnea Index. They are asked about the frequency of shortness of breath, duration of these attacks and the number of times they presented to an Emergency room in the past month. One group of patients are treated with ipratropium bromide only for one month, while another group of patients are treated with only respiratory retraining therapy for one month. During this timeframe neither is treated for reflux. After one month, the same questionnaires are administered to both groups. Results will be compared before and after treatment. Outcome measures from the ipratropium bromide group will be compared to those of the respiratory retraining group after one month.

Results: Anecdotally, patients with PVFM, treated with inhaled ipratropium bromide report symptom improvement. This is an ongoing treatment regimen and results will be analyzed upon patient return.

Conclusions: PVFM is a difficult to treat condition. It causes significant patient discomfort resulting in a notable decrease in quality of life. Ipratropium Bromide inhalation anecdotally has provided some patients with relief. Its efficacy is worthy of formal investigation.
Kinetic Energy Laser in the Larynx: A Preliminary Canine Study
Michael S. Benninger, MD
Anh N. Diep, VMD*
Seth Kaplan, MD*
Cleveland, OH/San Francisco, CA/New York, NY

Introduction: The application of laser energy in the larynx has relied on thermal injury while there has been ongoing attempts to reduce the impact on the tissues adjacent to the laser. A new technology (by Precise Light Surgical - PLS) utilizes kinetic energy through Pressure Induced Tissue Resection (PITR) to cut tissues, theoretically eliminating injury to the adjacent tissue. The purpose of this study was to evaluate the PSL in canine vocal folds.

Methods: 4 dogs underwent PITR incisions (4mJ pulses at 200Hz) on the vocal folds, through the mucosa into the muscle. The animals were sacrificed at days 0, 3, 7 and 21 days post-surgery, their larynges were harvested and histology was performed with H&E, Masson's trichrome, and Verhoeff-van Giessen.

Results: At day 0 focal denudation of the epithelium and coagulation necrosis in the lamina propria and adjacent connective tissue is noted. On day 3 and 7 an inflammatory infiltrate consisting of neutrophils is seen within the lamina propria and surrounding connective tissue with minimal edema and an early deposition of collagen. At day 21, the mucosa is completely regenerated with the area of previous ablation into the muscle replaced with thick bundles of collagen.

Conclusion: The unique PITR characteristics of the PLS system offer a potentially unique cutting technology for laryngeal microsurgery. The current canine study suggests appropriate and rapid healing. With refinements of the tip size of the prober and adjustment of energy the PSL will likely be an appropriate alternate to traditional lasers in laryngeal surgery.
Laryngeal Cryptococcoma Resulting in Airway Compromise in Immunocompetent Patient- A Case Report

Justin Moore, MD*
Alexander Gelbard, MD
Nashville, TN

Objectives: To report a case of laryngeal cryptococcoma resulting in airway obstruction in an immunocompetent patient and its management.

Methods: Cryptococcus neoformans is a yeast that can result in isolated pulmonary infections or disseminate and infect the central nervous system or soft tissues, classically associated with immunocompromise. This case report describes an immunocompetent patient presenting with airway obstruction secondary to laryngeal cryptococcoma, mimicking a laryngeal malignancy, and describes associated management.

Results: A 68-year-old immunocompetent female with COPD, history of colon cancer, and new PET avid laryngeal lesion was transferred from an outside hospital intubated after acute respiratory decompensation. The patient was taken to the operating room for direct laryngoscopy, and bronchoscopy. Airway evaluation revealed diffuse mucosal changes in the supraglottis with irregular waxy-appearing bilateral true vocal folds with significant loss of normal native tissue architecture. The subglottis demonstrated mucosal inflammation and exudative change throughout. The patient was successfully extubated. Results from operative biopsy confirmed subglottic infection of cryptococcal neoformans. The patient was treated with extended course fluconazole with resolution of airway obstruction and restoration of normal phonation.

Conclusion: Laryngeal cryptococcal infection is a rare entity sparsely described in the literature. This case reinforces characteristic physical and histologic findings described for laryngeal cryptococcal infection. To our knowledge, this is the first described case of subglottic cryptococcoma contributing to airway compromise. Extended course oral fluconazole is a successful treatment regimen for this infection.
Objective: Chemoradiation (CRT) for head and neck cancer (HNC) has been associated with toxicity leading to functional sequelae. The literature on post-CRT voice and swallowing function lacks long-term follow-up and focuses on laryngeal cancers, especially when it comes to voice. The purpose of this study was to examine the voice and swallowing function from the patient’s perspective at least 5 years after completion of CRT.

Methods: Twenty-eight patients with a history of non-laryngeal HNC who underwent CRT with or without surgery at least 5 years ago (Mean 10.5, SD 5.2 years) were surveyed utilizing a survey instrument based on previously validated questionnaires (PPSFQ, EAT-10, VHI-10, V-RQOL).

Results: Ten of the surveyed patients (36%) scored in the categories of “poor to fair” or “poor” voice perception on the V-RQOL questionnaire. VHI-10 scores were abnormal in fourteen patients (50%) indicating residual post-treatment voice dysfunction (VHI-10 scores≥20 in ten (36%) patients). The patient perception of swallowing function scores on PPSFQ questionnaire were abnormal in all but one patient, with eighteen patients (64%) reporting scores of 30 or higher. Seventeen patients (61%) had EAT-10 scores indicating presence of residual swallowing dysfunction (ten (36%) patients with EAT-10 score≥20).

Conclusion: Post-treatment voice and swallowing dysfunction following surgery and CRT for non-laryngeal HNC can persist or worsen beyond 5 years. This study shows that patients may have residual treatment sequelae affecting their voice and swallowing function after traditional post-treatment 5-year follow-up. More research is needed to investigate the long-term effects of CRT on voice and swallowing function.
Multipotency of the Cells in the Macula Flava of the Human Vocal Fold

Fumihiko Sato, MD*
Shun-ichi Chitose, MD*
Kiminori Sato, MD, PhD
Takashi Kurita, MD*
Kiminobu Sato, MD*
Hirohita Umeno, MD*
Hirohisa Yano, MD*

Kurume, JAPAN

Objectives: The latest research shows, there is growing evidence to suggest that the cells in the macula flava (MF) are tissue stem cells or progenitor cells of the human vocal fold mucosa (HVFM), and that the MFe are a candidate for a stem cell niche. The purpose of this study is to investigate the multipotency and stemness of the cells in the MFe of the HVFM.

Methods: Four normal human adult vocal folds from surgical specimens were used. After extraction of the anterior MFe under microscope, the MFe were minced, cultured and proliferated in mesenchymal stem cell growth medium and morphological features including immunohistochemistry were assessed. Cell differentiation into adipogenic, chondrogenic and osteogenic lineages was performed. Cell surface markers were detected using a flow cytometry. Pluripotency was assessed using a human pluripotent stem cell functional identification kit.

Results: Subcultured cells formed a colony-forming unit. Subcultured cells expressed CD105, CD73 and CD90, and lacked expression of CD 45, CD34, CD11b, CD19 or HLA-DR. They differentiated into adipogenic, chondrogenic and osteogenic lineages. Consequently, the cell features in the MFe meet the minimal criteria defining human mesenchymal stem cells. In addition, subcultured cells expressed stage-specific embryonic antigen 3 (SSEA-3, human pluripotent stem cell marker) and they differentiated into endoderm, ectoderm and mesoderm.

Conclusion: The results of this study are consistent with the hypothesis that the cells in the maculae flavae are tissue stem cells and the MFe are a candidate for a stem cell niche in the HVFM.
Novel Anesthetic Management for Thyroplasty Performed under Monitored Anesthesia Care using Simultaneous Infusions of Dexmedetomidine, Remifentanil and Propofol

Megan Hamre, MD*
Kathryn Handlogten, MD*
Dale Ekbom, MD
Toby Weingarten, MD*
Troy Seelhammer, MD*

Rochester, MN

Introduction: Thyroplasty type I, or medialization thyroplasty (MT), is an operation for voice reconstruction performed for correction of unilateral vocal cord paralysis. We present a retrospective case series of 75 consecutive thyroplasties performed under a multimodal analgesic and sedation combination using simultaneous infusions of remifentanil and dexmedetomidine with or without propofol.

Methods: Using the institution’s electronic medical record, patient records from June 2015 through June 2017 were compiled for patients who underwent thyroplasty with or without arytenoid adduction.

Results: All patients received dexmedetomidine and remifentanil infusions while 74 patients (98.7 %) received continuous propofol infusions. Eighteen patients (24%) experienced transient hypopnea events, all treated conservatively with supplemental oxygen delivery. Three patients (4%) experienced bradycardia (heart rate less than 50 beats per minute) requiring pharmacologic intervention. There were no adverse respiratory or cardiovascular events including intensive care unit admissions, requirement for blood product transfusion, adverse medication reaction or mortality during the hospital stay. One patient required surgical re-exploration due to post-surgical bleeding after initial hospital discharge.

Conclusions: Despite being amongst the most commonly utilized anesthetic agents in the setting of monitored anesthesia care, the novel simultaneous combination of remifentanil, dexmedetomidine and propofol has not previously been described in the literature. Co-administration of dexmedetomidine and remifentanil has previously been reported to result in optimization of analgesia, onset of appropriate level of sedation, speed of emergence and surgeon satisfaction. The concurrent, balanced infusions of dexmedetomidine, remifentanil and propofol safely facilitate medialization thyroplasty with or without arytenoid adduction while minimizing perioperative adverse events.
Oncologic Efficacy and Voice Outcomes after Potassium Titanyl Phosphate (KTP) Laser Therapy for Early Stage Glottic Carcinoma: A Retrospective Review

Matthew Ward, MD*
Robert L. Eller, MD
Brentley Lindsey, BS*

San Antonio, TX/Greenville, SC

Introduction: Radiation therapy and carbon dioxide laser excision are the mainstays of treatment for early stage glottic carcinoma. While oncologically effective at treating these early-stage lesions, these modalities can have a damaging effect on long-term voice outcomes. Over the past decade, potassium titanyl phosphate (KTP) laser ablation has emerged as a new treatment modality that may offer similar oncologic efficacy while achieving superior voice outcomes. This study adds to the growing body of evidence supporting use of KTP laser to achieve oncologic success while improving voice outcomes.

Method: We retrospectively reviewed 5 patients with low-grade (CIS, T1a) glottic lesions treated with KTP laser. Metrics utilized to evaluate effectiveness of therapy included disease recurrence, and pre- and post-procedure Voice Handicap Index-10 (VHI-10) scores and Voice-Related Quality of Life (V-RQOL) scores, when available.

Results: At the time of this study, none of the 5 patients showed evidence of disease recurrence, with a mean post-procedure follow-up period of 28 months. Of the 5 patients, 2 patients with complete pre/post-procedure data showed a >66% decrease in VHI-10 and/or V-RQOL scores with post-procedure VHI-10 scores ranging from 0-3/40 and a post-procedure V-RQOL of 0/50. The remaining 3 patients had only post-procedure scores available, with documented VHI-10 and V-RQOL scores ranging from 0-2.

Conclusions: In this small case series, we found that utilization of KTP laser therapy for early stage glottic lesions provides local disease control with excellent voice outcomes post-operatively.
Osteoradionecrosis of the Sternoclavicular Joint after Laryngopharyngeal Radiation
Rachel T. Irizarry, MD
Deborah R. Shatzkes, MD*
Stephanie Teng, MD*
Nikita Kohli, MD*
Gady Har-El, MD
New York, NY

Introduction: Adequate treatment of laryngopharyngeal malignancy often incorporates radiation therapy. Structures around laryngopharynx exposed to traditional radiation doses are susceptible to post-treatment toxicity. Amongst poorly understood sequelae is the rare manifestation of sternoclavicular joint (SCJ) osteoradionecrosis (ORN).

Methods: Three institutional encounters prompted a comprehensive literature search, generating three published case reports. Systematic extraction and analysis (n=6) of demographics, cancer history, comorbidities, ORN presentation, imaging, and management established the largest series to investigate this pathology.

Results: Patients were males (6), 54–70 years old, smokers (4), with HTN/DLD (5), MI/CAD (2), second primary (2), DM (1), and myelofibrosis (1). Four underwent total laryngectomy, one primary, three as salvage. Five patients had concurrent chemoradiation (>70Gy). All patients presented with swollen, tender neck wounds concerning for persistent/recurrent malignancy. CT demonstrated bone erosion (5/5) and increased bone scan uptake (2/2). All responded to surgical exploration with drainage alone (1), sequestrectomy (2), or bone resection with synovectomy (3). Complete healing took two months to three years. One unrelated patient death occurred before control of ORN was achieved.

Discussion: Given varied patient characteristics, synergistic risk factors exist which alter bone radiation threshold resulting in irreversible damage and osteonecrosis. Vascular susceptibility and inability to repair may regulate that threshold. Understanding this relationship will facilitate early detection and intervention.

Conclusion: Integrating cases of sternoclavicular joint ORN promotes awareness of atypical laryngopharyngeal radiation complications, elucidates contributing factors, educates physicians on presentation and management, and provides a platform for prospective investigation.
Patient Pain Perception during Flexible Laryngoscopy, Assessment with a Validated Pain Questionnaire

Javier J. M. Howard, MPH*
John Paul Gilberto, MD*

Cincinnati, OH

Objectives: Flexible laryngoscopy is performed many times daily in otolaryngology clinics worldwide. Patients typically ask ‘will it hurt?’ Some studies have provided ratings for this procedure on ordinal scales and visual analog scales (VAS). With no publication that has yet assessed pain perception during laryngoscopy with a validated assessment tool, our prospective study uses the Short Form McGill Pain Questionnaire (SF-MPQ) to score our patients’ perceptions.

Methods: In our tertiary academic medical center, 81 adults completed the SF-MPQ immediately after undergoing flexible laryngoscopy/stroboscopy and 6 patients did not complete the survey (i.e., reasons related to English literacy).

Results: Of the 81 (93%) patients who completed the survey, there were 46 (57%) women and 35 (43%) men (mean age 51.4 and 52.7 years, respectively). Notably 95% of our patients rated the procedure less painful than expected, and commonly described the procedure as tender (36%) and fearful (31%). Mean scores for sensory, affective, and total pain were 1.7/33, 0.8/12, and 2.4/45, respectively. Mean scores for present pain intensity and VAS were 0.68/5 and 7.1/100 mm, respectively. Compared to historical values, laryngoscopy was rated less painful than chronic sinusitis, labor pain, carpal tunnel syndrome, among others (table).

Conclusions: Our patients who underwent flexible laryngoscopy/stroboscopy rated low pain scores on all domains of the SF-MPQ. These findings may serve as a reference for future quantification of pain during in-office procedures. Potentially, these scores will also reassure patients, given the nearly 1/3 who reported feeling fearful and 95% expected more pain than actually experienced.
Patients’ Attitudes Regarding Treatment for Vocal Fold Atrophy
VyVy Young, MD
San Francisco, CA

Introduction: Up to one-third of the elderly population have voice disorders, but few pursue treatment. A common but unproven assumption is that patients only want reassurance about lack of malignancy. This study aims to understand factors affecting decision-making about treatment for vocal fold atrophy and to identify potentially correctable systematic impediments to appropriate treatment.

Methods: Prospective study of 34 consecutive patients with primary diagnosis of vocal fold atrophy. Participants answered an anonymous, single-page questionnaire at end of clinic visit following development of treatment plan.

Results: 19 patients (56%) wanted to pursue treatment (e.g. voice therapy or surgery) and 15 patients (44%) did not. Most common reasons for pursuing treatment included desire for better voice (100%), aggravation by voice symptoms (84%) and decreased functionality of voice (63%). Most common reasons to forego treatment included feeling reassured by the lack of malignant findings (67% and 40% of those not wanting surgery and voice therapy, respectively) and the lack of a significant degree of symptomatology (80% and 53%, respectively). No patients cited insurance or transportation concerns, and few (13 and 27%, respectively) indicated other health issues taking priority.

Conclusions: This pilot study represents an important first step in understanding patients’ motivations in pursuing or declining treatment, which will help clinicians better counsel and guide patients to make appropriate treatment choices. It is imperative that clinicians develop better understanding about treatment outcomes as symptomatology and functionality are primary driving factors in the treatment-seeking population. Improved methods to assess candidacy for appropriate treatment are needed.
Background: Epithelial lesions including leukoplakia, CIS, and papilloma are generally treated by phonomicrosurgery, in which type I cordectomy or resection of the epithelium is performed. Excessive resection causes postoperative dysphonia due to scar formation, and should be avoided. Peeling is basically performed as cosmetic skin procedure to remove the stratum corneum, the superficial portion of the epithelium of skin. Peeling of the vocal fold should be minimally invasive for epithelial lesions which can maximally preserve the vibratory function.

Case series: Case 1 was 72-year-old tenor singer. Leukoplakia on the surface of the vocal fold was revealed as CIS by biopsy. The lesion was located from upper lip down to lower lip of the vocal fold free edge. Careful exploration of dissection layer of the vocal fold during phonomicrosurgery enabled intraepithelial resection (peeling). Postoperative recovery of vibratory function was quick, and voice was improved.

Case 2: 64-year-old female jazz singer. Papilloma was found on the left vocal fold membranous portion. Angiolytic laser was used for dissection of the lesion under phonomicrosurgery. The lesion was detached from the underlying epithelium, and was removed preserving the epithelium.

Conclusion: Peeling can be applied for selected cases with very superficial epithelial lesions. Angiolytic laser is useful for peeling of papilloma because of the coagulation effects of tumor vessels.
Predictive Value of Globus Pharyngeus in Patients with Functional Dysphonia vs. Organic Dysphonia

Elie Khalifee, MD*
Anthony Ghanem, MD*
Abdul-Latif Hamdan, MD, EMBA, MPH
Beirut, LEBANON

Introduction - This is a retrospective study investigating the prevalence of globus pharyngeus in patients with dysphonia.

Material and Method - A retrospective chart review looking at the prevalence of globus pharyngeus in patients presenting with history of dysphonia at the Voice Center American University of Beirut Medical Center was performed. The etiology of dysphonia was categorized as organic in the presence of laryngeal pathology vs. functional in the absence of any laryngeal pathology on laryngeal videostroboscopic examination. Functional dysphonia was further stratified as muscle tension dysphonia and non-muscle tension dysphonia based on the presence or absence of supraglottic muscle tension patterns.

Results - The medical records of 300 patients were reviewed. Total prevalence of globus pharyngeus was 14.33%. There was a significant difference in the prevalence of globus pharyngeus between patients with organic dysphonia and patients with functional dysphonia (p value <0.001). Out of 43 patients with globus, 41.86% had organic voice disorders vs 58.14% had functional voice disorders. Among those with functional voice disorders, globus pharyngeus was more prevalent in patients with MTD vs non-MTD (p-value = 0.19). Out of 25 patients with functional voice disorders and globus, 72% had MTD vs. 28% had no MTD (p-value=0.19).

Conclusion - Globus pharyngeus is significantly more prevalent in patients with functional dysphonia vs. patients with organic dysphonia. More so, in patients with functional dysphonia, the prevalence of globus was higher in those with MTD despite not reaching statistical significance. Globus pharyngeus may be either the cause or the result of laryngeal aberrant functional behavior.
Prevalence and Characteristics of Dysphagia in Patients with Unilateral Vocal Fold Immobility: A Systematic Review

Dimin Zhou, MS, MD*
Moshin Jafri, BS*
Inna Husain, MD*

*Chicago, IL

Objective: To identify the prevalence and characteristics of dysphagia in patients with unilateral vocal fold immobility (UVFI) through a systematic review of current literature.

Methods: A review of four electronic databases (Embase, PubMed, ScienceDirect, Wiley Online Library) was completed based on preferred reporting items for systematic reviews and meta-analysis statement (PRISMA) criteria. Inclusion criteria were that: the major theme examined dysphagia in UVFI patients; subjects were 18 years or older; and the article was an original study. Non-English language publications and case reports were excluded. Qualified articles were analyzed independently by two researchers.

Results: Of 445 studies discovered through the literature search, 17 satisfied eligibility criteria. The prevalence of dysphagia in patients with UVFI ranged from 40 to 76%. Left-sided UVFI predominated. The most common cause of UVFI was iatrogenic, followed by thoracic and mediastinal malignancy, idiopathic, neurologic disease, and trauma. Videofluoroscopic swallowing study (VFSS) examining aspiration and penetration was the most common method for evaluating dysphagia. Primary findings were impaired airway protection due to incomplete laryngeal elevation and abnormal epiglottis mobility as well as prolonged bolus transit due to delayed triggering of pharyngeal swallow and impaired pharyngeal squeeze. Patients were more likely to aspirate on thin liquids than on purées and solids. Benefits of medialization thyroplasty for dysphagia symptoms were equivocal.

Conclusion: A significant portion of patients with UVFI present with dysphagia. Methodological heterogeneity and small sample sizes in the reviewed studies may have compromised the reliability of summarized data, calling for large-scale studies with standardized diagnostic techniques.
Prevalence and Characterization of Dysphonia in U.S. Marine Corps Drill Instructors

Joseph Spellman, MD, LCDR*
Christopher M. Johnson, MD, LCDR*
Carole R. Roth, PhD*
Michael J. Coulter, MD, LT*

San Diego, CA

Introduction: Prior studies have evaluated populations at increased risk of voice overuse and dysphonia, however, little work has been done for drill instructors. The purpose of this study was to determine the prevalence of subjective and objective dysphonia in drill instructors and evaluate factors associated with dysphonia.

Methods: A cross-sectional analysis of 151 active military drill instructors was undertaken investigating demographics, validated subjective measures of dysphonia, and questions related to impact on function. Acoustic and cepstral-spectral analyses were also performed. Multiple linear regression and ANOVA were used to evaluate associations of voice use with measures of dysphonia. Predictors of dysphonia were compared by univariate analysis.

Results: Subjective dysphonia was present in 47.7% by the Voice Handicap Index-10 (VHI-10). 47% and 11.9% of subjects reported voice problems limiting to function for at least 1 day and at least 1 week, respectively, in the month prior to being surveyed. The mean Cepstral-Spectral Index of Dysphonia (CSID) and Rainbow Passage CSID were abnormal in 95.8% and 100%, respectively. There was no progression of dysphonia as the number of completed training cycles increased. However, there was significant improvement based on time elapsed since the last training cycle.

Conclusions: There is a strikingly high prevalence of dysphonia in drill instructors. The VHI-10 may underestimate impairment in this population based on comparison to CSID. Dysphonia develops shortly after the initiation of recruit training. There was no evidence of progression of dysphonia over time, however, there was a relationship between rest and improvement.
Objective: Dehydrated vocal folds are inefficient sound generators. While systemic dehydration of the body is believed to induce vocal fold dehydration, this causative relationship has not been demonstrated in vivo. Here we investigate the feasibility of using in vivo proton density (PD) weighted magnetic resonance imaging (MRI) to demonstrate hydration changes in vocal fold tissue following systemic dehydration in rats.

Method: Sprague Dawley rats (n=10) were imaged at baseline and following a 10% reduction in body weight secondary to withholding water. In vivo, high-field (7T), PD-weighted MRI was used to successfully resolve vocal fold and salivary gland tissue structures.

Results: Normalized signal intensities within the vocal fold decreased post-dehydration by an average of 11.38 ± 3.95% (mean ± S.E.M, p=0.0098) as compared to pre-dehydration levels. The salivary glands experienced a similar decrease in normalized signal intensity by an average of 10.74 ± 4.14% (mean ± S.E.M, p=0.0195) following dehydration. The correlation coefficient (percent change from dehydration) between vocal folds and salivary glands was 0.7145 (p=0.0202).

Conclusion: 10% systemic dehydration induced vocal fold dehydration as assessed by PD-weighted MRI. Changes in the hydration state of vocal fold tissue were highly correlated with that of the salivary glands in dehydrated rats in vivo. These preliminary findings demonstrate the feasibility of using PD-weighted MRI to quantify hydration states of the vocal folds and lay the foundation for further studies that explore more routine and realistic magnitudes of systemic dehydration and rehydration. This paper has been accepted for publication in The Laryngoscope.
Safety and Feasibility of Outpatient Medialization Thyroplasty

Christine M. Kim, MD*
Andrew M. Vahabzadeh-Hagh, MD*
Steven Chau, MD*
Sunil Verma, MD
Dinesh Chhetri, MD

Los Angeles, CA/Orange, CA

Objectives: To evaluate the safety of outpatient medialization thyroplasty in adult patients with unilateral vocal fold paralysis.

Introduction: Type I medialization thyroplasty (MT) is a commonly performed procedure for dysphonia secondary to unilateral vocal fold paralysis. The safety of this procedure performed in the outpatient setting has not been previously established. The purpose of the study was to assess the incidence and timing of post-operative complications in patients undergoing MT in two different tertiary care medical centers.

Methods: Retrospective review of charts for patients who had undergone MT at two tertiary care academic medical centers from 2011 to present was performed. Patients undergoing bilateral medialization thyroplasties or those patients undergoing additional laryngeal framework procedures were excluded. Patient demographics, operative details and complications were evaluated and compared between those patients who underwent inpatient versus outpatient MT. Postoperative airway edema, hemorrhage, emergency room visits, readmissions, and any postoperative complications documented in subsequent clinic visits were recorded.

Results: 161 total procedures met inclusion criteria. 10 were performed as 23-hour stays, and 151 were performed as outpatient surgeries. Silastic or Gore-Tex implants were used in all patients, and all were discharged home on a regular diet. There were no post operative airway complications.

Conclusions: The incidence of adverse events after unilateral type I thyroplasty is very low. These data justify performance of the operation in the outpatient setting.
Silastic Vocal Implant Complications: A Case Series and Literature Review

Tyler Mingo, MD*
Benjamin Rubinstein, MD*
John Sinacori, MD*
Norfolk, VA

Introduction: Medialization thyroplasty is a commonly performed procedure for glottic insufficiency. Silastic is a preferred prosthetic, in part due to its low tissue-reactivity. Despite this, infection and extrusion are known complications with rates quoted at 0.8%-8%. Two interesting presentations of silastic infection and extrusion prompted a review of the literature.

Methods: The cases presented represent those encountered by an academic laryngologist at a tertiary referral center. A PubMed search was performed with the terms “medialization,” “thyroplasty,” “complication,” and “extrusion.” Case reports, case series, review articles were analyzed.

Results: A 73 year old female with sarcoidosis presented with a painful, enlarging paramedian neck mass concerning for chondrosarcoma on imaging. She had undergone a Silastic medialization thyroplasty eight years prior. In the operating room, an extruding Silastic implant within granulation and purulence was identified without mucosal violation. A 70 year old male with previous silastic medialization was seen in clinic for hoarseness. Laryngoscopy revealed an anteriorly located, over-sized implant. He refused intervention, and later coughed up a foreign body with further voice deterioration. This was brought to clinic, and it was identified as his silastic implant. The largest review of laryngeal framework procedures demonstrated a 0.8% rate of extrusion, however it did not sub-divide based on prosthesis type. Smaller reviews limited to silastic implants demonstrated rates of 0% (n=116), 1.5% (n=194), and 8.6% (n=56).

Conclusion: Extrusion and infection after silastic medialization thyroplasty is a known, rare complication. Familiarity with the rates and varied clinical presentations allows for patient counseling and appropriate diagnosis.
Subglottic Stenosis: An Evaluation of an Elderly Treatment-Seeking Population

Alissa Collins, MD*
Kevin Chorath, BS*
C. Blake Simpson, MD

San Antonio, TX

Objective/Hypothesis: To evaluate the demographics, etiology, intraoperative findings and treatment outcomes of patients with subglottic stenosis, comparing those patients less than 65 years of age to an elderly population (age >65).

Study Design: Retrospective review.

Methods: Nine-year review of patients with subglottic stenosis comparing patients less than 65 years of age to an elderly population (age >65).

Results: Forty-three adults presented for evaluation and treatment of subglottic stenosis between 2008 and 2017. At the time of treatment, 35 were younger than age 65 (27 female, 8 male) and 8 (6 female and 2 male) were older than age 65. Comparing age younger than 65 to older than 65 groups, the etiology was idiopathic in 32% vs 50% (n=11 vs n=4), intubation in 35% vs 37.5% (n=12 vs n=3) and GPA (granulomatosis with polyangiitis) in 33% vs 12.5% (n=11 vs n=1). No statistically significant difference was noted in the two groups when comparing the demographics, etiology and intraoperative findings. The age greater than 65 group was noted to have a shorter interval between surgeries than those younger than 65 (310 ± 246 days vs 651 ± 452 days, p=0.0373).

Conclusion: Patients with subglottic stenosis treated after age 65 have a shorter interval between surgical interventions.
**Subjective and Objective Swallowing Outcomes Do Not Correlate in Head and Neck Cancer Patients Treated with Radiation**

Elliana Kirsh, BM, BS*
Matthew Neinheim, MD, MBA*
Allison Holman, MS, CCC-SLP*
Rachel Kammer, MS, CCC-SLP*
Mark A. Varvares, MD
Tessa Goldsmith, MA, CCC-SLP*

*Boston, MA*

**INTRODUCTION:** Dysphagia is a known toxicity after chemoradiation for head and neck cancers (HNC), but the correlation of subjective patient-reported outcomes and objective measure of swallowing function is not well characterized. The primary objective of this project was to retrospectively investigate the relationship between subjective and objective swallowing measures after chemoradiation therapy.

**METHODS:** Adult patients who underwent chemoradiation therapy for HNC from 2005-2017 and presented for modified barium swallow (MBS) were reviewed retrospectively. Surgically treated patients were excluded. Patient-reported swallowing function was assessed via the MD Anderson Dysphagia Inventory (MDADI). Objective measure of swallow function was assessed with the Dynamic Imaging Grade of Swallowing Toxicity (DIGEST) scale, divided into safety (DIGEST-S - penetration/aspiration) and efficiency (DIGEST-E - residue) scores. Statistical analysis for correlation coefficients was performed.

**RESULTS:** 30 patients met the inclusion criteria. The oropharynx was the most commonly affected site (70.0%), followed by the larynx (16.7%). The median radiation dose was 72Gy (range: 66-72Gy). The DIGEST-E and DIGEST-S scores were correlated (Pearson r=0.59, p<0.001), but there was no correlation between the MDADI and either the DIGEST-E (r=0.06, p=0.765) or DIGEST-S score (r=-0.14, p=0.443). MDADI scores did not change significantly with increasing time since radiation (p=0.375), whereas both DIGEST-E and DIGEST-S scores worsened over time (p=0.001 and p=0.007, respectively).

**CONCLUSIONS:** Objective assessment of swallowing function worsened after radiation therapy, but this did not correlate with patient-reported quality-of-life measures. Reduced patient awareness of swallow dysfunction years after completion of chemoradiation has implications for management of dysphagia in the face of physiologic decline.
Objective: Evaluate the effect of time dose of raised intensity phonation on vocal fold vibratory function in an in-vivo rabbit phonation model.

Design: Prospective animal study

Methods: Adult male New Zealand white breeder rabbits underwent an in vivo phonation procedure. Phonation was achieved through the simultaneous delivery of electrical stimulation to the cricothyroid muscles and membrane via custom hooked electrodes and airflow directed through the glottis via a cuffed endotracheal tube placed in the upper segment of a tracheostomy. Rabbits in the experimental group were phonated at raised intensity for 120 minutes, and only received stimulation for data capture. Rabbits in the control group received continuous airflow without stimulation for 120 minutes. Vocal fold vibratory function was captured via monochrome high-speed videoendoscopy (HSV) at 8000 frames per second. Data was collected at baseline, 30 minutes, 60 minutes, 90 minutes, and 120 minutes. For both groups, data was collected at normal intensity phonation. Following phonation, HSV image sequences were analyzed for amplitude and left-right phase asymmetry.

Results: Preliminary results indicate increased variability of amplitude and left-right phase asymmetry after 60 minutes of phonation, followed by reduced amplitude of vibration, and increased left-right phase asymmetry after 120 minutes of phonation compared to controls.

Conclusion: Exposure to 120 minutes of raised intensity phonation results in altered amplitude and phase asymmetry compared to controls. Analysis of findings from interim data points will be discussed.
The Expression and Distribution of Claudins in the Vocal Fold Epithelium

Ryo Suzuki, MD*
Tatsuya Katsuno, PhD*
Yo Kishimoto, MD, PhD*
Masanobu Mizuta, MD, PhD*
Atsushi Suehiro, MD, PhD*
Masaru Yamashita, MD, PhD*
Koichi Omori, MD, PhD
*Sakyo-ku, Kyoto, JAPAN

Objective: Previous study indicated the localization of occludin and ZO-1 in the vocal fold stratified squamous epithelium (SSE). However, the expression of claudins (cldns), the essential integral membrane proteins constituting TJs, remains unknown. The aim of this study was to clarify the gene expression pattern and the distribution of cldn subtypes in the vocal fold epithelium.

Methods: The normal and injured vocal folds of Sprague-Dawley rats were used. Reverse transcription polymerase chain reaction was performed to determine mRNA expression profile of cldn-1 to -23 in the vocal fold tissue. Immunohistochemistry was performed to clarify the localization of cldn subtypes in the vocal fold SSE.

Results: Gene expression of cldn-1, -3, -4, -5, -6, -7, -8, -10, -11, -12, -17, -22, -23 was identified in the vocal fold tissue. Of these, cldn-3 signals were localized to the cell-cell junction at the most luminal epithelium, and cldn-3, -4, -7, -8 signals were also localized between deeper cells of SSE. The distribution of each cldn subtypes was slightly different in the vocal fold epithelium at 5 and 14 days postinjury.

Conclusions: It was suggested that cldn-3 is a main component of TJ strands existing at the junctional region of the outermost layer of SSE, and is responsible for the paracellular diffusion barrier against small molecules. Although the role of cldns in SSE remains controversial, improved understanding of cldns expression in the vocal fold epithelium may offer new insight into the elucidation of the physiology and various pathogenesis of the vocal folds.
The Incidence of Idiopathic Vocal Fold Paralysis: A Population-Based Study
Farzad Masroor, MD*
Debbie Pan, BS*
Julia Wei, MPH*
Nancy Jiang, MD*
Oakland, CA

Introduction: The incidence and rate of spontaneous recovery of idiopathic vocal fold paralysis (IVFP) is unknown.

Methods: A retrospective analysis of the Kaiser Permanente Northern California electronic healthcare record system was done to identify patients with idiopathic vocal fold paralysis and paresis between 2008 and 2014. The incidence, rate of spontaneous recovery, and their relation to demographic variables and steroid use were determined.

Results: 183 patients with idiopathic vocal fold paralysis and 81 patients with idiopathic vocal fold paresis were identified, yielding a total cohort of 264 patients. 96.0% of these cases were unilateral, and 89.8% were over the age of 45. The incidence was 1.04 per 100,000 per year. This was highest for Caucasians (1.60), lowest for Asians (0.63), and similar for gender (1.02 for males and 1.05 for females). 15 (5.7%) patients were treated with steroids, 74 (28%) with speech therapy, 34 (12.9%) with vocal cord injection, and 13 (4.9%) with thyroplasty. The rate of spontaneous recovery was 28.8%, where 20.8% had endoscopic evidence of resolution and 8.0% had clinical improvement in their voice without endoscopic confirmation. The median time to symptom resolution was 4 months and the mean time was 11.4 months. Age, steroid use, and speech therapy were not predictive of spontaneous recovery on multiple logistic regression analysis.

Conclusion: The incidence of IVFP is 1.04 cases per 100,000 per year. 28.8% of patients experience spontaneous recovery.
The Prototype Device for Real-Time Light-Guided Vocal Fold Injection

Wonjae Cha, MD, PhD*
Jung Hoon Ro, PhD*
Chang Jun Choi, PhD*
Sun Choel Yang, PhD*
Il-young Cho, MD*
Min-gyu Jo, MD*
Hyoseok Seo, MD*

Seo-Gu, Busan, SOUTH KOREA

Introduction: Vocal fold injection (VFI) is a minimally invasive technique for vocal fold pathologies. Among various approaches, the trans-cricothyroid (CT) membrane approach is a good option for office-based VFI. However, due to invisibility of the needle tip during injection with CT approach, accurate localization requires a high level of experience and there is a steep learning curve involved in mastering this approach. To overcome the current limitations, we conceptualized a novel technique; real-time light-guided vocal fold injection (RL-VFI), which enables simultaneous injection under precise needle localization by visualization of a lighted needle tip. In this study, we developed the prototype device for RL-VFI and applied it in ex vivo canine larynx.

Methods: The device comprised the three parts of light source, controller, and injector. The light source had laser diode modules of two wavelength (red and green). An ex vivo canine larynx model was used to validate the device in high-resolution flexible videolaryngoscopy system.

Results: The location of the needle tip was accurately indicated by light, and the depth from the mucosa could be estimated by brightness and size of the light. The needle routes from various insertion points could be identified by light. Precise and simultaneous injection could be easily performed on the intended location under the guidance of light.

Conclusions: RL-VFI might be a feasible and promising technique to treat vocal fold pathologies. It is expected that the technique can improve precision of VFI and expand its indication in laryngology.
The Repeatability of Vocal Outcomes across Serial Botulinum Toxin Injections – Using a Novel Method for Real-Time Patient Reported (Vocal) Outcomes

A. Morgan Selleck, MD*
Rupali Shah, MD
James Howard, MD*
Douglas Farqujar, MD, MPH*
Katherine Adam, BS*
Robert A. Buckmire, MD
Chapel Hill, NC

Introduction: The precise location, and consequently, the effect of intra-laryngeal botulinum toxin deposition within the laryngeal musculature is subject to subtle variability from injection to injection. We employed a novel, real-time method of obtaining patient reported vocal outcomes to investigate subtle temporal variations between voice parameters across serial botulinum toxin injections.

Methods: 13 patients with adductor spasmodic dysphonia receiving stable doses of intralaryngeal botulinum toxin were recruited. The Remind Application (a freeware application) permits real-time patient queries via the patient’s preferred method of communication (email, text etc.). Patients were queried in real-time about perceived breathiness, global voice quality and vocal spasms on post-injections days 0, 3, and, weekly throughout at least two consecutive injection cycles.

Results: 13 subjects were included in the study with a total of 30 injections analyzed. The response rate was 93.8%. No statistically significant difference was found between the first and second injection for each of the individual subjects or averaged group response for each parameter. Weekly point to point measures for all parameters were within 9% of one another.

Conclusions: Despite the known variability of toxin depositions during intralaryngeal injections, serial injections by a consistent injector produced repeatable voice results (within 10%), across consecutive injections. The Remind application provides a novel way to improve the collection of patient reported data, in real-time, with a significantly improved response rate in comparison to traditional data collection methods.
Objective: To report our ongoing institutional experience with metformin, an oral antihyperglycemic drug, as a possible agent to halt the progression of dysplastic lesions to carcinoma, in those with previously treated laryngeal squamous cell carcinoma (SCC).

Methods: Case series with longitudinal follow up.

Results: There were three patients included who had laryngeal dysplasia (age 66.67 ± 7.09; range 68 – 73 years; 3 male). Follow up time ranged between 12 to 32 months and the average metformin dose was 500mg twice daily. Only one patient experienced a side effect, that being light-headedness and dizziness, but required no change in dose. Two patients showed complete or partial regression of the laryngeal dysplastic mucosa and have not yet required any additional surgeries. The third patient demonstrated a worsening of his dysplastic change after he halted treatment for six weeks, but has since been restarted on metformin and undergoes close surveillance.

Conclusion: This longitudinal case series continues to demonstrate metformin’s potential to treat dysplastic change in non-diabetic patients. This effect is thought to possibly occur at the cellular level through the activation of adenosine monophosphate activated protein (AMP) kinase, inducing apoptosis and therefore halting tumour progression. Given that metformin is safe, inexpensive, easy to administer and has minimal side effects it may be a therapeutic candidate to potentially prevent the progression of dysplasia to carcinoma.
The Trach Talk: Improving Knowledge and Confidence of ICU Trainees to Optimize Patient Care

Yael Bensoussan, MD*
Jennifer Anderson, MD, MSc*
Molly Zirkle, MD, MSc*
Allan Bescan, MS, MSc*
Melissa Roy, MD, MSc*
Tanya Beranjee, MD*

Toronto, Ontario, CANADA

Introduction: Patients living with temporary or permanent tracheostomies will be cared for by multiple health care professionals throughout their lives. There remain many educational gaps and misconceptions about their care within the healthcare community, which can unfortunately lead to avoidable morbidity and mortality for these patients. The literature provides evidence that formal training about tracheostomy technique, care and emergencies increases the confidence of the junior doctors and their effectiveness in treating airway emergencies resulting in reduced complication rates for patients. However, there is no formal cross discipline tracheostomy education at our institution.

Objective: To assess the impact of a 1-hour interactive seminar on tracheostomy and tracheotomised patient care on the knowledge and confidence level of intensive care trainees in two Level 1 trauma tertiary hospitals in Toronto, Canada.

Methods: Quality improvement prospective study. A 1-hour interactive seminar was developed by a multidisciplinary team and given to intensive care trainees of 2 Level 1 trauma centers in Toronto. A questionnaire including basic knowledge and emergency management was completed by the trainees before, immediately after and 1 month after the seminar. Primary outcome was competency improvement measured by pre- and post-questionnaires. Secondary outcomes were retention of information measured by the 1-month follow-up questionnaire as well as confidence level measured by Likert scales within the questionnaires.

Results: Primary and secondary outcomes for 45 medical trainees will be discussed. Improvement in post questionnaire scores and confidence levels was observed.
Objective: This study aims to determine the rate and natural time course of iatrogenic vocal fold paralysis (IaVFP) recovery.

Methods: Records of 294 patients with IaVFP treated between 2006 and 2017 were reviewed. Patients seen >1 year after onset (27), lost to follow up (70) or with framework surgery <1 year from onset (76) were excluded. Patient demographics, disease onset, recovery and treatment details, including timing and type of injection augmentation and surgery were recorded. Recovery was defined as return of normal vocal quality.

Results: 121 patients (76F:45M, age 58±13.9, 82 L:32 R:7 Bilateral) were included in the study. 55 patients did not undergo injection augmentation; time course could be assessed in 42 patients who recovered (31F:11M, age 55±14.4). Overall, they recovered in a mean of 175±109 days. Mean time to recovery of R-sided paralysis was 222±115.6 days; L-sided paralysis was 166±104.8 days (p-value=0.091). Patients were stratified by anatomic site of surgery. Mean time to recovery was 180±124 days after neck (20F:4M, age 53±13.8), 144±80 days after thoracic (2F:3M, age 46±15.0), 171±116 days after skull-base (3F:1M, age 56±9.0), 135±40 days after intubation (4F:1M, age 61±10.7), and 239±100 days after carotid (2F:2M, age 75±8.2). ANOVA testing demonstrated a p-value of 0.67. The overall probability of recovery was 71% at 3 months, 59% at 6 months, 40% at 9 months, and 20% at 12 months.

Conclusion: Recovery time of IaVFP is not defined by injury site or laterality. Recovery rates at time from injury may be better guides for determining intervention.
Introduction: For a subset of patients with chronic cough, pharmacological intervention does not provide adequate symptom relief. This study explored the feasibility of using transcutaneous electrical nerve stimulation (TENS) as an adjunct or alternative to standard pharmacologic therapy. TENS is a form of electroanalgesia commonly used to treat an array of pain disorders, including neuropathic pain disorders, which may be physiologically similar to "neuropathic" or refractory chronic cough.

Methods: Laryngeal TENS therapy was administered to three subjects with refractory chronic cough. TENS electrodes were placed on the left neck over the lateral thyrohyoid membrane, approximating the location of the superior laryngeal nerve, and the cricothyroid space. A high frequency current of 120 Hz was applied for 30 minutes. Pre-treatment cough severity index (CSI) and Newcastle Laryngeal Hypersensitivity Questionnaire (NLHQ) data were collected and subjects rated symptoms pre-, during, and post-TENS treatment using a 5-point Likert scale. Flexible laryngoscopy was performed to evaluate for laryngeal muscle contraction during TENS application.

Results: Laryngeal TENS was well-tolerated by all subjects. Adverse effects included brief neck discomfort when increasing TENS intensity and one report of mild post-treatment hoarseness. No abnormal laryngeal muscle contraction was noted on laryngoscopy during stimulation. The self-reported Likert scores showed a trend toward reduction in symptom severity during and after treatment.

Conclusions: In light of this promising paradigm, future research is suggested to investigate the efficacy of TENS as a novel non-pharmacologic intervention for patients suffering from chronic cough or symptoms of laryngeal irritability.
Transoral Rigid 70 Degree Laryngeal Stroboscopy in a Pediatric Voice Clinic

Jennifer Yan, MD*
Julina Ongkasuwan, MD
Houston, TX

Objective: Complaints of dysphonia and dysphagia frequently require rigid or flexible laryngeal stroboscopy in the office to aid in diagnosis. Transoral rigid 70° stroboscopy allows for higher quality, magnified views of lesions and vibratory patterns compared to flexible stroboscopy. For young children, flexible stroboscopy can be uncomfortable and often requires multiple adults to restrain the child. Rigid stroboscopy does not result in tears but does require patient cooperation; thus it is used primarily in adults. This project describes our experience using rigid stroboscopy in a pediatric cohort.

Methods: This was a retrospective chart review of patients at a Pediatric Voice Clinic who underwent stroboscopy from December 2011 through March 2017. Data analysis is via student t-test and descriptive analysis.

Results: 311 patients were identified with 423 unique stroboscopy exams, of which 212 were flexible and 210 were rigid. One patient did not tolerate either rigid or flexible exam. There was a statistically significant difference in age between children diagnosed via rigid mean 10.92 years (range 2.39-19.14 years) vs. flexible mean 6.51 years (range 0.41-19.29 years), p ≤ 0.01. Of the 44 children under 3 years, flexible stroboscopy was used almost exclusively, with 43/44 (97.7%) flexible scope exams. Rigid stroboscopy was performed on 24/115 (20.9%) children ages 3-5, 26/40 (65%) 6-year-olds, and 159/223 (71.3%) aged 7 and older.

Conclusion: Transoral 70° rigid stroboscopy can be used in select children down to 3 years. This modality allows for improved visualization of lesions with greater comfort for patients.
Objectives: (1) Characterize the US general population ≥age 65 with self-reported voice problems, (2) describe characteristics of voice treatment in this group, and (3) identify factors associated with self-reported voice improvement.

Methods: We identified a cohort of adults aged ≥65 years in the US from the National Health Interview Survey, a population-based cross-sectional national survey data. Descriptive and multivariable regression analyses were performed.

Results: The prevalence of self-reported voice problems in this cohort was 10%. The strongest predictor of reporting voice improvement was receipt of voice treatment (OR 3.18 [95% CI 1.36, 7.42]). Eleven percent of those reporting voice problems reported receiving voice treatment. Female gender was significantly associated with reporting treatment (OR 2.5 [95% CI 1.13, 5.56]). Among those who received voice treatment, 38% reported “better,” 33% “same,” and 29% “worse” voice symptoms over the past year, compared to 17%, 67%, and 16%, respectively, among those who did not receive treatment. Among those who reported treatment, we observed differences related to gender, race, age, and education associated with report of “better,” “same,” or “worse” voice symptoms.

Conclusions: A significant portion of the US population ≥age 65 reported voice problems. A small minority reported receiving voice treatment. Vocal improvement was associated with treatment. Further investigation is needed to clarify patient and treatment characteristics most associated with vocal improvement.
Trends in Editorial Board Membership over the Past 20 Years
Elizabeth H. Wick, MD*
Mark E. Whipple, MD, MS*
Julie Goldman, MD*
Jamie Litvack, MD, MS*

St. Louis, MO

Objectives: 1. Determine the proportion of female representation on a cross-section of general and subspecialty-specific otolaryngology editorial boards over the past 20 years 2. Measure relative rate of advancement between male and female cohorts over duration of service

Methods: This is an observational study reviewing female representation across nine otolaryngology journals from 1997-2017. Journals were selected based on impact factor and subspecialty coverage using the 2015 Scimago Journal & Country Rank for initial screening. Female representation was evaluated at the following levels of leadership: editorial board member, associate and/or section editor, and editor-in-chief. Advancement criteria and member demographics were obtained via direct communication and public records.

Results: In 2017, 20% of all editorial board members, and 22% of all associate or section editors were women. However, there was huge variability between journals with the proportion of female editorial board members ranging from 11 to 39% and the proportion of female associate editors ranging from 5 to 40% per journal. No editor-in-chief was female. One journal demonstrated a significantly higher proportion of female associate editors and was observed to have more transparency regarding advancement criteria.

Conclusion: The proportion of female editorial board members and associate or section editors is comparable to the proportion of women in otolaryngology practice. However, there is still large variability in the gender makeup of journal editorial boards. Transparency with regard to advancement criteria may explain part of this variability. Disparity at the highest level of advancement still exists: none of the nine journals has a female editor-in-chief.
Trigger Reduction Prior to Drugs for Neurogenic Chronic Cough
Craig H. Zalvan, MD
Craig Berzofsky, MD*
Jan Geliebter, PhD*
Valhalla, NY

Introduction: Neurogenic chronic cough (NCC) typically presents as a post-viral chronic cough spasms, preceded by a tickle sensation with multiple triggers and often recalcitrant to multiple treatments. Current treatment has focused on the use of neuromodulating agents with moderate success. Post nasal drainage and laryngopharyngeal reflux (LPR) can be a trigger for these coughing events in the setting of laryngopharyngeal hypersensitivity. Treatment with a trigger reduction approach using nasal toilet and a dietary regimen for LPR will be presented.

Methods: This is a retrospective chart review of new patients with cough (R05.0) from the past year excluding those found to have asthma, sinus disease, or pulmonary causes. Cough symptom index (CSI) and Reflux symptom index (RSI) were evaluated at initial presentation and again at 6 weeks after treatment with a trigger reduction approach.

Results: Of 119 patients, 29 met criteria. This cohort of 29 patients exhibited a statistically significant reduction (p<0.0001) in mean RSI from 21.2 (95% CI; 17.6 – 24.76) at baseline to a 6 wk mean of 11.2 (95% CI; 7.4 – 15.0). Twenty one of these 29 patients experienced a clinically significant 6-point reduction in RSI. Concomitant with this decrease in RSI was a statistically and clinically significant reduction (p<0.0001) in mean CSI from 17.9 (95% CI; 14.6 – 21.3) at baseline to a 6 wk mean of 7.02 (95% CI; 3.7 – 10.4).

Conclusion: Based on this review, it is reasonable to initiate a trigger reduction approach in patients with NCC prior to the initiation of neuromodulating medications.
Type I Thyroplasty Using Gore-Tex and Silastic Implant: A Safe Outpatient Procedure

Attapon Junlapan, MD*
C. Kwang Sung, MD*
Edward J. Damrose, MD

Muang, Phitsanulok, THAILAND/Stanford, CA

Objective: Overnight hospitalization is routinely advocated following type I thyroplasty (TP) because of concerns for airway compromise. Hospitalization increases cost and patient inconvenience, and may not necessarily be appropriate. This study evaluated complications following surgery and identified predictors for same in order to assess which patients benefit most from hospitalization.

Methods: A retrospective chart review was conducted on patients who underwent TP with or without arytenoid repositioning procedures, between June 2008 and March 2017. The demographic data of the subjects, characteristics, etiology of glottic insufficiency, interventions performed, and subsequent complications were evaluated.

Results: Of 147 patients reviewed, 100 underwent TP alone, 41 underwent TP with arytenoid adduction (AA) and 6 patients underwent TP with adduction arytenopexy (AP). Iatrogenic vocal fold paralysis was the most common indication. Major complications, which included transient airway compromise and hematoma requiring reoperation, occurred in 7% of patients. Revision surgery and thyroplasty combined with repositioning maneuvers were associated with increased risk of major complications.

Conclusions: In general type 1 thyroplasty is a safe procedure, with a major complication rate that is lower than that of outpatient thyroidectomy. Overnight hospitalization should be considered in patients undergoing revision surgery and in those requiring concurrent arytenoid reposition procedures.
Wrapping Airway Cart Instruments: Limitations to Access without the Intended Safety Benefits

Skyler Nielsen, DO*
Jayne Stevens, MD*
Gregory Stevens, MD*
Jagatkumar Patel, BS*
Robert Eller, MD

San Antonio, TX/Greenville, SC

Introduction: A few case studies have shown improper sterilization or contamination of equipment from Anesthesia carts can lead to transmission of disease and even death. Citing this literature, national accrediting agencies recently mandated that all instruments in the Otolaryngology airway carts at San Antonio Military Medical Center be packaged to prevent contamination. This study sought to determine the safety and efficiency of a packaged instrument airway cart.

Methods: A retrospective review of upper aerodigestive tract procedures, some of which penetrated mucosa, was performed by analyzing 100 consecutive patient records during the unpackaged period and 100 during the packaged period. A comparison of infections, deaths, and length of stay in the hospital was included in the analysis. Additionally, a timed simulation to setup instruments for an emergency airway situation from both the unpackaged and packaged airway carts was performed using a total of 11 surgical technologists and nurses.

Results: Each group had a total of 4 airway infections and neither had any deaths. The average length of hospital stay was 0.36 days for the unpackaged period and 0.44 days from the packaged period. None of these variables reached statistical significance. The average time to find and set out the correct instruments for the two groups was 46.6 and 95.5 seconds for the unpackaged and packaged airway carts, respectively (p-value = 0.004).

Conclusion: This study suggests individually packaging of instruments used for emergency airway cases may put lives at risk when time matters and fails to decrease the risk of infection.