THE PROGRAM OF
THE NINETY FIFTH ANNUAL MEETING OF

The American Broncho-Esophagological Association

WEDNESDAY AND THURSDAY
APRIL 22-23, 2015

SHERATON BOSTON
HYNES CONVENTION CENTER
BOSTON, MASSACHUSETTS
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Purpose
The purpose of this program is to provide Otolaryngologists-Head and Neck Surgeons, Pulmonologists, Gastroenterologists and other interested physicians, clinicians and scientists with an opportunity to update their knowledge of diseases involving the upper aerodigestive tract.

Educational Objectives

- The aim of these scientific sessions is to provide physicians with up-to-date information pertinent to the clinical evaluation and endoscopic management of laryngeal, tracheobronchial, and esophageal disorders.

- Advanced understanding of current issues regarding the diagnosis and management of complex swallowing disorders, voice disorders, airway disorders and operative procedures used in the management of disorders of the upper aerodigestive tract.

- Special focus will be placed on issues relevant to laryngology.

- Advanced knowledge and techniques enabling participants to compare and refine their medical and surgical skills to include best practice performance and optimize patient outcomes. Also introduce them to deficits in current knowledge and future research needs.
Disclosure

In compliance with ACCME Accreditation Criteria, the American College of Surgeons, as the accredited provider of this activity, must ensure that anyone in a position to control the content of the educational activity has disclosed all relevant financial relationships with any commercial interest. All reported conflicts are managed by a designated official to ensure a bias-free presentation. Please see the insert to this program for the complete disclosure list.

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This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education through the joint providership of the American College of Surgeons and the American Broncho-Esophagological Association. The American College Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

AMA PRA Category 1 Credits™

The American College of Surgeons designates this live activity for a maximum of 6.25 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.
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The ABEA is fortunate to count among its leadership those who have supported our science through the creation of the President’s Circle and Leadership Funds.

Here, we recognize those whose gifts will ensure the ABEA’s preeminent representation of advances in the science of laryngology and broncho-esophagology.

For further information on how you can also make a difference, please contact Michael Benninger, MD, at benninm@ccf.org

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### Wednesday, April 22, 2015

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Presidential Welcome

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Boston, MA
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1:40-1:45 PM

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President Keynote Address

A Brief History of Minimally Invasive Surgery of the Upper Digestive Tract

Steven Zeitels, MD

Boston, MA
SESSION I:

Broncho-Esophagology

Moderators:
Ellen M. Friedman, MD
Steven Zeitels, MD
MECHANICAL MODELING OF THE HUMAN CRICOID CARTILAGE USING COMPUTER-AIDED DESIGN: APPLICATIONS IN AIRWAY BALLOON DILATION RESEARCH

Authors: C. M. Johnson¹, J. Howell², D. Mettenburg¹, F. Rueggeberg¹, G. Postma¹, P. Weinberger¹

Institutions: ¹Georgia Regents University, ²No Academic Affiliation, Structural Engineer

Presenter: Christopher Johnson

Objectives: Among numerous therapeutic options for subglottic stenosis, endoscopic balloon dilation is the most commonly used treatment modality in the US. Some balloon dilation systems utilize a compliant balloon that can deform around rigid structures. Others use a non-compliant balloon that does not deform, allowing for dilation of more rigid stenoses. We hypothesized that subglottic dilation with a non-compliant balloon increases the likelihood of fracture of the cricoid when compared to a compliant balloon.

Methods: Three fresh human cricoid cartilages were placed in a universal testing system (UTS) to determine the expansile force necessary for cricoid fracture. Using this data, a 3D printer was used to construct a synthetic cricoid model possessing near-identical physical characteristics to the human cricoid. This was verified using the UTS. Simulated dilation was then performed on the cricoid model using a 16mm non-compliant balloon and a 15-18mm compliant balloon. The line pressure on the manufacturer’s pressure gauge at the time of cricoid fracture was recorded.

Results: Both the compliant and the non-compliant balloons fractured the cricoid model in every replicate experiment. Mean balloon internal pressure at fracture was 7.67ATM (SD=1.21) for the compliant balloon and 11.34ATM (SD=1.29) for the non-compliant balloon.

Conclusions: These data show that fracture of the cricoid is a valid concern in balloon dilation procedures. Furthermore, the compliant balloon system fractured the cricoid model at a lower internal pressure than the non-compliant system, questioning if the compliant balloon actually functions in a compliant manner in this particular application.
Steven D. Gray Resident Award Recipient

THE EFFECT OF STRUCTURAL DIFFERENCES IN COLLAGEN SPONGE SCAFFOLDS FOR TRACHEAL EPITHELIUM REGENERATION

Authors: Y. Nakaegawa\textsuperscript{1}, R. Nakamura\textsuperscript{1}, T. Nakamura\textsuperscript{2}, K. Omori\textsuperscript{1}

Institutions: \textsuperscript{1}Fukushima Medical University, \textsuperscript{2}Kyoto University

Presenter: Yuta Nakaegawa

Objective: We prepared an in situ regeneration-inducible artificial trachea, which is composed of porcine collagen sponge and polypropylene framework, and have used is clinically for tracheal reconstruction. Collagen sponges with different structures were prepared from various concentrations of collagen solutions. The effect of collagen sponge structure on the regeneration of tracheal epithelium was examined.

Method: Collagen sponges were prepared from various concentrations of type I and III collagen solutions. Structures of the sponges were observed under a scanning electron microscope (SEM). Artificial tracheae, which were equipped with the collagen sponges with different structures, were transplanted into rabbit, and regeneration of tracheal epithelium on the artificial tracheae was evaluated by SEM analysis and histological examinations.

Results: SEM analysis showed that collagen sponges prepared from less than or equal to 1.0% collagen solutions had porous structure which was constructed with collagen membranes with dynamic framework. However, the sponges prepared from over 1.0% collagen solutions had unporous structure, which was constructed with collagen membranes arranged in parallel, and inter-membrane spaces were small. Two weeks after transplantation of the artificial trachea prepared from 0.5% collagen solution, its luminal surface was free from granulation tissue, and entirely covered with epithelium. Moreover, many ciliated cells were observed in the epithelium. However, epithelial reorganization was late on an artificial trachea with a sponge prepared from 1.5% collagen solution.

Conclusion: Collagen sponges with porous structure were suggested to be proper for regeneration of tracheal epithelium.
RISK FACTORS FOR POSTERIOR GLOTTIC STENOSIS: A MULTI-INSTITUTIONAL CASE-CONTROL STUDY

Authors: A. T. Hillel¹, S. Karatayli-Ozgursoy¹, I. Samad¹, S. Best¹, L. M. Akst¹, L. Giraldez², J. Gross², A. Gelbard³, M. Johns²

Institutions: ¹Johns Hopkins University School of Medicine, ²Emory University School of Medicine, ³Vanderbilt University Medical Center

Presenter: Alexander Hillel

Objective: Both extrinsic factors related to endotracheal tube (ETT) size and intrinsic patient factors such as poor tissue perfusion and wound healing are associated with posterior glottic stenosis (PGS), but not well studied. This study’s purpose is to assess ETT size, length of intubation, gender, and other comorbidities as risk factors in the development of PGS in intubated patients.

Method: PGS patients diagnosed between September 2012 – May 2014 at 3 tertiary-care university hospitals were included. Patient demographics, comorbidities, duration of intubation, ETT size, and indication for intubation were recorded. PGS patients were controlled with like patients intubated in intensive care units during the period from 11/15/2013 to 1/1/2014.

Results: 28 PGS patients (14 male, 14 female) and 112 (65 male, 47 female) controls were included. Mean length of intubation was 13.2 days for PGS patients and 6.5 days for controls (p<0.01). Multivariate analysis demonstrated obstructive sleep apnea (OSA, p=0.01), coronary artery disease (p=0.04), poor tissue perfusion (p=0.02), hypertension (p=0.01), and diabetes (p<0.01) were significant risk factors for the development of PGS. 14/14 (100%) men with PGS in this study to be intubated by size 8 or larger ETT compared to 47/65 (72.3%) male controls (p<0.05).

Conclusion: Duration of intubation, ischemia risk factors, OSA, and large ETT size (8 or greater) in men were significant risk factors for the development of PGS. Reducing the use of size 8 ETTs and earlier planned tracheostomy in high-risk patients should reduce the incidence of PGS.
IL-1 RECEPTOR ANTAGONIST INHIBITS EARLY GRANULATION

Authors: E. A. Nicolli¹, A. Ghosh¹, S. Haft², S. Singhal³, N. Cohen¹, N. Mirza¹

Institutions: ¹University of Pennsylvania, ²University of California - San Diego

Presenter: Elizabeth Nicolli

Objective: Using a functional model of airway granulation tissue in subglottic stenosis, we investigated changes in histopathology and inflammatory markers within granulation tissue in response to intraperitoneal IL-1 Receptor Antagonist (IL1RA) injections. Changes in inflammatory markers will allow us to further delineate the immune response to wound healing and to potentially identify treatment targets.

Method: Laryngotracheal complexes (LTCs) of donor mice underwent direct airway injury. LTCs were transplanted into subcutaneous tissue of recipient mice in two groups: IL1RA-treated and untreated. The IL1RA-treated arm received daily intraperitoneal injection of IL1RA for three weeks. LTCs were then harvested. Granulation formation was measured. The mRNA expression of TGF-β1 and IL-1 was quantified using RT-PCR with SYBR Green Assay.

Results: At 3 weeks post-transplantation, there were statistically significant differences in observable lamina propria thickness. There were no statistically significant changes in mRNA expression of TGF-β1 and IL-1β within the IL-1 Receptor Antagonist treated arm as compared to the untreated arm.

Conclusion: Using a previously described novel murine model, we begin to delineate inflammatory markers that can be targeted for potential therapy. While the lamina propria thickness shows that the effect of IL-1 has been inhibited, the levels of inflammatory markers do not change. This verifies that early use of the IL1RA will inhibit the efficacy of IL-1 in the inflammatory cascade and can prevent early granulation formation, but does not affect the levels of inflammatory markers expressed in tissue.
SESSION II:

Head and Neck

Moderators:
James Burns, MD
Lucian Sulica, MD
GOLD LASER UTILITY IN LARYNGOLOGY PROCEDURES

Authors: J. E. Allen¹,², J. J. Johnston²

Institutions: ¹University of Auckland, ²North Shore Hospital

Presenter: Jacqui Allen

Objective: Evaluate the range of procedures that can be performed in the head and neck utilizing the Gold Laser (980nm).

Method: A retrospective audit of patients who underwent procedures that utilized the fibre-based Gold laser between August 2010 and May 2014 was performed. Demographic data, indication for procedure, procedure type and outcomes were recorded. Qualitative data analysis was undertaken.

Results: A total of 31 procedures were performed on 22 patients during the study period. Mean age was 56 years (+/- 14.8 yr SD). Three patients underwent more than one procedure (range 2-4). Symptoms pre-operatively included dysphagia (n=13, 59%), dysphonia (n=13, 59%), and dyspnoea (n=3, 15%). Procedures performed were resection of vocal fold carcinoma, buccal pouch carcinoma, supraglottic masses (pyolaryngocoele), and right vocal fold leukoplakia, supraglottic/glottic scar division, excision/marsupialization of valleculae cysts, cordotomy, partial arytenoidectomy, and cricopharyngeal myotomy. Mean follow up from most recent surgery was 5 months (range 1-18 months). Ten patients demonstrated complete resolution and were discharged. 21/22 patients noted significant symptomatic improvement following surgery. One posterior glottic scar division could not be achieved secondary to difficult endoscopic access with lack of improvement in dyspnoea. No major complications occurred and no device or fibre failure was noted.

Conclusion: The Gold Laser is an effective and versatile tool in the treatment of pharyngeal and laryngeal lesions and may be applied in a wide range of procedures in the head and neck. Due to its tuneable fluence, fibre delivery system and small size it may be utilized in diverse situations.
LOCAL SYNTHESIS OF PEPsin IN BARRETT’S ESOPHAGUS AND THE ROLE OF PEPsin IN ESOPHAGEAL ADENOCARCINOMA

Authors: T. Samuels¹, C. Hoekzema¹, J. Gould¹, M. Goldblatt¹, M. Frelich¹, S. Lee², N. Johnston¹

Institutions: ¹Medical College of Wisconsin, ²Sungkyunkwan University School of Medicine

Presenter: Tina Samuels

Objective: Despite widespread use of proton pump inhibitors (PPIs), the incidence of esophageal adenocarcinoma (EAC) continues to rise at an alarming rate. PPIs reduce the acidity of reflux, but only transiently inactivate gastric enzymes such as pepsin. Recent evidence suggests that nonacid reflux, specifically nonacid pepsin, contributes to carcinogenesis in the larynx. Given the carcinogenic potential of pepsin and ineffectiveness of PPIs to combat the rise in EAC, the presence and effect of pepsin in the esophagus should be investigated.

Method: Normal and Barrett’s mucosa biopsies from eight Barrett’s esophagus patients were collected for pepsin analysis via Western blot and RT-PCR. Het1A esophageal epithelial cells were treated with pepsin (0.01-1mg/ml; 1 and 20 hours), acid (pH4; 5 minutes), or acid and pepsin (5 minutes); cell migration and invasion assays and real-time RT-PCR and ELISA were performed.

Results: Pepsin protein was detected in all eight Barrett’s specimens tested and in four of eight adjacent normal specimens. Pepsin mRNA was observed in two Barrett’s specimens but not in normal adjacent samples. Pepsin increased Het1A cell migration and invasion, PTSG2 gene expression and IL1B protein expression in vitro.

Conclusion: This study confirms that pepsin may be synthesized by metaplastic esophageal tissue in patients afflicted with the reflux-associated disease, Barrett’s esophagus, and that nonacid pepsin increases metrics of tumorigenicity in esophageal epithelial cells in vitro. These findings implicate refluxed and locally synthesized pepsin in development and progression of EAC and may in part explain the ineffectiveness of PPIs as chemotherapeutics for EAC.
PROGNOSTIC FACTORS IN T4 THYROID CANCER INfiltrATING THE AIRWAY TREATED BY TRACHEAL OR CRICO-TRACHEAL RESECTION AND ANASTOMOSIS

Authors: C. Piazza¹, F. Del Bon¹, D. Barbieri¹, P. Grazioli¹, P. Perotti¹, A. Paderno¹, D. Lombardi¹, P. Nicolai¹, G. Peretti²

Institutions: ¹University of Brescia, ²University of Genoa

Presenter: Cesare Piazza

Objective: To evaluate prognostic factors influencing survival in patients affected by T4 thyroid cancer infiltrating the airway submitted to tracheal (TRA) or crico-tracheal resection and anastomosis (CTRA).

Method: Retrospective charts review of 27 patients affected by T4 thyroid malignancies involving the airway treated by TRA or CTRA from 1999 to 2013 in a single academic institution. Kaplan-Meier curves were used to evaluate 5-year overall (OS), disease specific (DSS), and disease free (DFS) survivals. Impact on survival of age, comorbidities, previous radiotherapy (RT), types of TRA/CTRA, degree of airway involvement according to the Shin classification (stages II, III, IV), grading (well- vs. poorly-differentiated), and length of airway resected were evaluated.

Results: At the last follow up (July 2014), 11 (41%) patients were alive and well, 1 (4%) alive with disease (pulmonary metastasis), and 15 (56%) died for disease (15% of whom for loco-regional relapse). Five-year OS, DSS, DFS were all 59.3%. Lesions requiring CTRA with resection of the cricoid arch and plate, and poor differentiation statistically affected survival (p=0.0015 and p=0.0002, respectively). Poor differentiation significantly impacted also on local relapse (p=0.0211). Age, comorbidities, previous RT, degree of airway involvement, and length of airway resection did not statistically impact on survival.

Conclusion: Grading is the most important factor in determining oncologic prognosis and outcomes in T4 thyroid cancer infiltrating the airway. On the other hand, except for advanced poorly differentiated thyroid cancer, TRA/CTRA allow adequate local control even in advanced tumors.
GLOTTIC CANCER: A METAMORPHOSING DISEASE

Author: S. M. Zeitels¹, ²

Institutions: ¹Massachusetts General Hospital, ²Harvard Medical School

Presenter: Steven Zeitels

Objective: Vocal-cord cancer is generally considered to be a smoking-induced disease. The increased incidence of glottic cancer over the past century has been inextricably linked to the popularity of mass-produced cigarettes. Today, conventional wisdom is that the overwhelming majority of glottic-cancer patients have a smoking history. However, in recent years anecdotal observations suggested that an increasing number of patients presenting with glottic cancer were not smokers. Therefore, an investigation was done examining the incidence of having a smoking history in a recent cohort of glottic-cancer patients.

Method: Retrospective review of the last 100 patients with glottic cancer to determine those having reported to not smoke.

Results: Thirty-one of 100 patients reported not having a smoking history. Clinical observations of those cases revealed that the morphology of the disease tended to be exophytic, papillary and very vascular often resembling recurrent respiratory papillomatosis (RRP). Remarkably, 2/31 were initially treated elsewhere assuming they had RRP and each underwent 5 cidofovir injections. Review of their prior video-laryngoscopic examinations revealed that in both cases cancer growth accelerated with the injections. Both patients ultimately required a partial laryngectomy and radiotherapy to control the cancer.

Conclusion: Observations herein provide insights that glottic cancer is an evolving disease in which smoking is becoming less exclusive not unlike HPV-induced pharynx cancer. Similar to RRP, the angiogenic papillary disease morphology is well suited for voice-preserving angiolytic KTP laser treatment. Given the resemblance of some glottic cancers to RRP, great care should be taken when using cidofovir for papillary glottic neoplasms.
GLOTTIC CANCER: A METAMORPHOSING DISEASE
BREAK
PANEL I:

Common Yet Challenging Conditions

Moderator:
Frederik Dikkers, MD

Panelists:
Suzy Duflo, MD
Gaelyn Garrett, MD
Markus Hess, MD
Peak Woo, MD
Foreign Body Case Presentations:

Moderator:
Gresham Richter, MD
Foreign Body Case Presentation #1

POSITIVE PRESSURE BRONCHOSCOPY TECHNIQUE: CASE REPORT

Authors: M. Hall\textsuperscript{1,2}, D. Johnston\textsuperscript{1,2}, P. Barth\textsuperscript{2}

Institutions: \textsuperscript{1} Thomas Jefferson University, \textsuperscript{2}Nemours - Alfred I. DuPont Hospital For Children

Presenter: Michael Hall

Objective: Foreign body aspiration into the tracheobronchial tree continues to be a challenging problem for Otolaryngologists. This is especially true in patients with poor pulmonary reserve.

Method: We describe a novel technique in which a cuffed endotracheal tube is sheathed over a bronchoscope as a means to provide positive pressure ventilation simultaneously during foreign body extraction. Two cases are described and photodocumentation is provided.

Results: This new technique afforded the bronchoscopist more time during retrieval of the foreign body where previous conventional attempts were limited by rapid desaturations and the overall nature of the foreign body.

Conclusion: The endotracheal sheathed bronchoscope is a safe and efficacious technique for challenging airway foreign bodies complicated by a patient’s limited pulmonary reserve.
Foreign Body Case Presentation #2

ENDOSCOPIC REMOVAL OF A METALLIC SPRING FROM THE ESOPHAGUS OF A CHILD: A CASE REPORT

Authors: Q. Zhong, D. Carvalho, S. Pransky

Institution: University Of California - San Diego

Presenter: Qiu Zhong

Objective: Foreign body ingestion is common in the pediatric population, and often requires endoscopic removal. The vast majority of these cases are accomplished in a routine fashion. The goal of this case report is to describe the successful endoscopic removal of an unusual foreign body (metallic spring) from the proximal esophagus of a child, using a two surgeon-four hands technique and the novel usage of laryngeal instruments.

Method: We present the case of an 8-month-old boy who presented to our pediatric hospital after an episode of choking and vomiting and subsequent refusal to feed.

Results: X-rays revealed a large spring-like metallic foreign body in the esophagus at the thoracic inlet. Esophagoscopy showed a metallic spring lodged horizontally at the cricopharyngeus with prongs extending into the lateral esophageal walls. Removal was quite challenging due to the size and irregular shape of the object. After the failure of standard endoscopic removal techniques, a novel approach was utilized that included suspension, two surgeon-four hands, optical forceps, and the novel usage of laryngeal instruments to successfully remove the spring endoscopically. The object was a 1.5 by 2 cm metallic spring from a clothespin. The case was complicated by a small pharyngeal tear without perforation.

Conclusion: Our case was very challenging due to the large size and shape of the object. Such cases often require open surgical removal. We were able to avoid such an outcome and the associated higher morbidity by successful endoscopic removal involving two surgeons and the novel usage of laryngeal instruments.
Ellen M. Friedman
Foreign Body Award and Case Presentation
USE OF A HAND-HELD METAL DETECTOR FOR EARLY IDENTIFICATION OF ESOPHAGEAL BUTTON BATTERIES IN YOUNG PEDIATRIC PATIENTS: A FEASIBILITY STUDY

Authors: P. Chaffin¹, I. N. Jacobs², K. R. Jatana¹

Institutions: ¹ Nationwide Children’s Hospital and Wexner Medical Center At Ohio State University, ² Children’s Hospital Of Philadelphia

Presenter: Phillip Chaffin

Objective: The Button Battery Task Force was created within the ABEA to help mitigate injury in children at a national level. A hand-held metal detector (HHMD) for universal screening of young children, presenting with non-specific symptoms, could help with early identification of an esophageal button battery (BB).

Method: A retrospective study of lateral x-rays and operative reports in 62 children, 0-6 years of age, with metallic esophageal foreign bodies surgically removed was performed. A bench-top study was done to measure the distance that a single commercially available HHMD (SuperWand, Garrett, Inc.) could detect 31 commercially available BB.

Results: The corrected x-ray distances from skin to known metallic esophageal foreign bodies were: proximal (mean=2.89 cm, max=4.99 cm), mid (mean=5.79 cm, max= 8.14 cm), distal (mean=7.52 cm, max=8.46 cm). Using a HHMD, 17 BB <2 cm diameter were detected between 1.75-3.5 cm, while 14 BB ≥2 cm diameter had a greater detectable range, 4 cm-6.5 cm. Using the lowest 4 cm detection distance for BB ≥2 cm, identification in this young cohort of pediatric patients could have occurred in 90% proximal, 14.3% mid, and 0% distal locations.

Conclusion: Based on distances alone, this study demonstrates the utility of a HHMD to identify at least 90% of ≥2 cm BB within the proximal esophagus but much less likely in the mid or distal esophagus. The use of a HHMD in an urgent care/ED triage or primary care settings could expedite diagnosis and treatment, decreasing BB-related morbidity and mortality in young children.
SESSION III:

Voice Disorders

Moderators:
Albert Merati, MD
Cara Stepp, PhD
MICROARRAY ANALYSIS GENE EXPRESSION PROFILES IN LARYNGEAL MUSCLE AFTER RECURRENT LARYNGEAL NERVE INJURY

Authors: K. Blum¹, K. Bijangi-Vishehsaraei², H. Zhang², S. Halum¹

Institutions: ¹Purdue University, ²Indiana University School of Medicine

Presenter: Kevin Blum

Objective: The pathophysiology of recurrent laryngeal nerve (RLN) injury is rare in that it is characteristically followed by a high degree of spontaneous reinnervation, with reinnervation of the laryngeal adductor complex (AC) preceding that of the abducting posterior cricoarytenoid (PCA) muscle. It is believed that denervation-induced myogenic changes in gene expression may be at least partially responsible for the spontaneous reinnervation that ensues after RLN injury. Here, we aim to elucidate the differentially expressed myogenic factors following RLN injury.

Methods: F344 male rats underwent RLN injury or sham surgery (n=12). One week after RLN injury, larynges were harvested following euthanasia. mRNA was extracted from PCA and AC muscles bilaterally, and microarray analysis was performed using a full rat genome array.

Results: Microarray analysis identified 21 individual probes that had differential expression between the denervated AC and sham AC muscles, and 219 individual probes that had differential expression between the denervated PCA and sham PCA muscles. Denervated AC and PCA muscles demonstrated dramatic differences in gene expression profiles, with 205 individual probes that were differentially expressed between the denervated AC and denervated PCA muscles, and only 14 genes with similar patterns of expression.

Conclusions: The differential expression patterns of the AC and PCA suggest different mechanisms of reinnervation between the two groups. The PCA showed the gene patterns of Wallerian degeneration, while the AC expressed the gene pattern of reinnervation by adjacent axonal sprouting. This finding may reveal important therapeutic targets applicable to RLN and other peripheral nerve injuries.
EARLY CELLULAR RESPONSES TO IONIZING RADIATION IN HUMAN VOCAL FOLD FIBROBLASTS

Authors: E. Erickson-DiRenzo1, G. Enos2, S. L. Thibeault2

Institutions: 1Stanford University, 2University of Wisconsin

Presenter: Elizabeth Erickson-DiRenzo

Objective: Radiation-induced fibrosis of healthy vocal fold tissue is one of the most common adverse side effects of ionizing radiation therapy for the treatment of laryngeal carcinoma. Progressive fibrosis leads to long-term and often intractable reductions in voice quality. However, the early vocal fold cellular responses to ionizing radiation are not well characterized. Fibroblasts are the primary cell population of the vocal fold lamina propria and responsible for the maintenance and turnover of the extracellular matrix. The objective of this study was to evaluate the early response of healthy human vocal fold fibroblasts to two different delivery schemes of ionizing radiation.

Method: A primary human vocal fold fibroblast cell line was irradiated with two different delivery schemes: 1 dose x 3Gy and a fractionated scheme with 3 doses x 3Gy in intervals of 24 hours. Following 24 hours, the effect of irradiation on inflammatory cytokine and extracellular matrix gene transcription and fibroblast morphology, viability, and proliferation was evaluated. Unirradiated fibroblasts served as controls. All in vitro experiments were replicated in quadruplicate.

Results: Both 1 x 3Gy and 3 x 3Gy irradiation delivery schemes significantly reduced vocal fold fibroblast proliferation. No significant changes in cytokine or extracellular matrix gene transcription, morphology, or viability were observed.

Conclusion: Cellular responses to irradiation such as reduced fibroblast proliferation may be an early mechanism underlying radiation-induced fibrosis of the vocal folds. These findings contribute to a growing body of literature seeking to identify novel prevention and treatment targets for vocal fold fibrosis secondary to ionizing radiation.
OUTCOMES OF LARYNGEAL REINNERRVATION FOR UNILATERAL VOCAL FOLD PARALYSIS IN CHILDREN: ASSOCIATIONS WITH AGE AND TIME SINCE INJURY

Authors: M. E. Smith, D. Houtz
Institution: University of Utah
Presenter: Marshall Smith

Objective: Laryngeal reinnervation of the injured recurrent laryngeal nerve (RLN) with ansa-cervicalis has been reported to treat dysphonia from unilateral vocal fold paralysis. However, the criteria for surgical candidates are not well specified. Some studies have suggested that outcomes may be influenced by age of the patient, and time interval between surgical injury of the RLN and reinnervation, suggesting less favorable outcomes in older patients and greater than 2 year time interval after injury. This study examines these questions in the pediatric population with laryngeal paralysis.

Method: Review of prospectively collected data set of 29 children and adolescents (1 through 21 years) who underwent ansa-RLN laryngeal reinnervation for unilateral vocal fold paralysis.

Results: The time from nerve injury to reinnervation averaged 5.0 years (range 1 to 21 years). No correlation was found between age at reinnervation (r=0.1), time between nerve injury and reinnervation (r=-0.2) and patient or parent reported global percent voice outcome, or perceptual ratings. Pre-operative EMG also was not predictive of post-operative result. The postoperative voice self/surrogate global percent rating average was 80% (range - 50 to 100), and perceptual rating GRBAS sum score was 2.6 (range - 0 to 6.5).

Conclusion: This study did not find a correlation between age at surgery, length of time between injury and reinnervation, and postoperative results. This suggests that children and adolescents who present with dysphonia from unilateral vocal fold paralysis are favorable candidates for ansa-RLN reinnervation regardless of the length of time since injury and should be offered the procedure.
Broyles Maloney Award Recipient

**THYROARYTENOID MUSCLE STIMULATION DECREASES OPEN QUOTIENT IN AN EX-VIVO PERFUSED HUMAN LARYNX MODEL**

**Authors:** A. H. Mendelsohn, Z. Zhang, G. Luegmair, M. Orestes, G. S. Berke

**Institution:** University of California - Los Angeles

**Presenter:** Abie H. Mendelsohn

**Objective:** Current understanding of human phonation is derived from indirect investigations including animal models, cadaveric tissue study, or computational modeling, and thus requires validation in human larynx modes. The ex-vivo perfused human model as previously described allows such systematical investigation in virtually living human larynges with parametric laryngeal muscle stimulation. In this study, the relationship between adductor muscle group stimulation and the open quotient (OQ) of vocal fold vibration was investigated using this perfused human model.

**Method:** Human larynges were recovered from research-consented organ donors. Following re-perfusion with whole human blood in a pulsatile fashion, phonation was achieved by providing subglottal airflow under neuromuscular electrical stimulation. The produced vibratory characteristics were recorded through high-speed imaging and the OQ was derived through digital kymography and glottal area waveform analysis.

**Results:** Results showed that while maintaining constant experimental variables increases in adductor muscle group stimulation decreased OQ. The OQ values reached a lower limit of 0.42 which were unchanged with further increase in stimulation.

**Conclusion:** For the first time, we report on a direct relationship between adductor muscle group stimulation and OQ during phonation in the human larynx. Further study with the ex-vivo phonatory model will investigate additional vocal control mechanisms in the human larynx.
AVERAGE AMBULATORY MEASURES OF SOUND PRESSURE LEVEL AND VOCAL DOSE DO NOT DIFFER BETWEEN ADULT FEMALES WITH PHONOTRAUMATIC LESIONS AND MATCHED CONTROL SUBJECTS

Authors: J. H. Van Stan¹, ², D. D. Mehta¹, ², ³, S. M. Zeitels¹, ³, J. A. Burns¹, ³, A. M. Barbu¹, ³, R. E. Hillman¹, ², ³

Institution: ¹Massachusetts General Hospital, ²MGH Institute of Health Professions, ³Harvard School of Medicine

Presenter: Jarrad Van Stan

Objective: Clinical management of phonotraumatic vocal fold lesions (nodules and polyps) is based largely on assumptions that abnormalities in habitual levels of sound pressure level, fundamental frequency, and/or amount of voice use play a major role in lesion development and chronic persistence. This study used new voice ambulatory monitoring technology to determine if there are significant differences between patients with phonotraumatic lesions and normal matched controls in terms of average daily voice use and vocal function.

Method: Subjects were 70 adult females: 35 diagnosed with vocal fold nodules or polyps and 35 age-, sex-, and occupation-matched individuals with no history of voice disorders. Anterior neck surface vibration was recorded using an accelerometer-based ambulatory voice monitor implemented on a smartphone. Weeklong summary statistics were computed from estimates of sound pressure level, fundamental frequency, vocal dose measures, and voicing/voice rest periods.

Results: Paired t-tests and Kolmogorov-Smirnov tests resulted in no statistically significant differences between patient and matched-control groups in terms of average statistics of sound pressure level, vocal dose measures, and voicing/voice rest periods. Only paired t-tests comparing fundamental frequency variation and maxima between the two groups resulted in statistically significant differences (moderate effect sizes).

Conclusion: Individuals with phonotraumatic lesions did not exhibit differences in average ambulatory measures of vocal behavior (e.g., talking too much or too loudly) when compared with individuals without voice disorders. More refined characterizations of vocal behavior/function and environmental factors are warranted to better understand the risk factors associated with phonotraumatic vocal fold lesions.
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<td>7:00-8:00 am</td>
<td>ABEA Business Meeting</td>
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<td>Presentation of New Members (Members Only)</td>
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<td>8:00 - 8:05 am</td>
<td>Presidential Welcome</td>
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<td>Presentation of Poster Awards</td>
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<td>Break with Exhibitors</td>
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<td>10:40-11:10 am</td>
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<td>11:10-11:40 am</td>
<td>Session VI: Swallowing Disorders</td>
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<td>Presidential Close</td>
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SESSION IV:
Sleep Surgery

Moderators:
Seth Cohen, MD
Phillip Song, MD
THE STUPA PROCEDURE - A MUCOSAL SPARING UVULOPALATOPHARYNGOPLASTY (UPPP) PROCEDURE

Authors: J. Toman, M. Bianchi

Institution: Yale University School of Medicine

Presenter: Julia Toman

Objective: To present a modification to the traditional uvulopalatopharyngoplasty (UPPP) procedure.

Method: A review of the literature regarding obstructive sleep apnea and surgical management was conducted. This included a review of the various proposed modifications as well as the reported long terms results and various complications of uvulopalatopharyngoplasty (UPPP) procedure. Finally, a new mucosal sparing uvulopalatopharyngoplasty (UPPP) procedure is presented.

Results: The modification of the uvulopalatopharyngoplasty (UPPP) procedure makes two important modifications. It is mucosal sparing and involves minimal dissection of the soft palate along with tangential incisions leading to favorable scar contraction, minimizes risk of velopharyngeal insufficiency, favors optimal positioning a physiology of the soft palate, and lead to decreased risk of stenosis.

Conclusion: This modification to the uvulopalatopharyngoplasty (UPPP) procedure has the potential to address many of the pitfalls of traditional UPPP procedure with reduced scaring and subsequent stenosis. Such a modification avoids not only velopharyngeal insufficiency, but also recurrence of obstruction as a result of the surgical procedure.
SLEEP SURGERY IN SYNDROMIC AND NEUROLOGICALLY IMPAIRED CHILDREN

Authors: J. Alyono¹, A. Kumar¹, H. Cheng², P. Koltai¹

Institutions: ¹Stanford University, ²Shenzhen People’s Hospital

Presenter: Jennifer Alyono

Objective: To assess surgery performed for obstructive sleep apnea (OSA) in children with syndromic or neurologic comorbidities.

Method: Medical records of 375 children with OSA were retrospectively reviewed. 142 patients with trisomy 21, 105 with cerebral palsy, 53 with muscular dystrophy, 32 with spinal muscular atrophy, 18 with mucopolysaccharidoses, 14 with achondroplasia, and 11 with Prader-Willi were included. Patients with laryngeal, subglottic, or tracheal stenosis were excluded. Procedures included sleep endoscopy, direct laryngoscopy, bronchoscopy, tonsillectomy, adenoidectomy, turbinate reduction, pharyngoplasty, lingual tonsillectomy, epiglottopexy, and supraglottoplasty. Main outcome measures included apnea-hypopnea index (AHI), complications, length of postoperative stay, and endoscopic findings.

Results: 219 patients received 490 surgical interventions, with the remainder undergoing observation or positive pressure ventilation. Adenoidectomy was the most common procedure performed (93.9% of patients), followed by tonsillectomy (92.4%). Of the 165 patients who had tonsillectomy performed at this institution, 11% were discharged the same day, 85% were discharged postoperative day (POD) 1, and 9.1% were discharged after POD 1. Five patients experienced post-tonsillectomy hemorrhage. AHI significantly improved following tonsillectomy, from 14.6 to 8.5 (p = 0.0001). The most common sleep endoscopy finding was the tongue base causing epiglottic retroflexion. Lingual tonsillectomy alone resulted in an insignificant decrease in the AHI.

Conclusion: Adenotonsillectomy, when there is hypertrophy, remains the mainstay of management of disabled children with OSA. However, additional interventions are often required, due to incomplete resolution of the OSA. Sleep endoscopy is valuable in identifying remaining sites of obstruction and guiding future management.
NATIONAL TRENDS IN PEDIATRIC INPATIENT POLYSOMNOGRAPHY: AN ANALYSIS OF THE KIDS’ INPATIENT DATABASE

Authors: K. O. Tawfik, A. R. Sedaghat, S. L. Ishman

Institutions: 1Cincinnati Children’s Hospital Medical Center, 2University of Cincinnati, 3Massachusets Eye And Ear Infirmary, 4Harvard Medical School

Presenter: Stacey Ishman

Objective: It has been suggested that male and/or black children are more likely to have obstructive sleep apnea. We sought to characterize trends in inpatient polysomnogram (PSG) utilization over the past decade.

Method: Retrospective analysis of the Kids’ Inpatient Database from 2003 to 2012. Patients ≤21 years who underwent PSG were included. Weighted chi-square and t-tests were used to compare categorical and ordinal/continuous variables, respectively.

Results: Inpatient PSG procedures decreased from 1266 in 2003 to 829 in 2012. Children undergoing PSG were more likely to be male than the overall hospitalized population (55.3-57.7% versus 47.2-47.9%, p<0.001) at all-time points. Mean age decreased from 3.9±5.1 years in 2003 to 3.1±5.2 years in 2012 (p=0.001) and at all-time points was significantly younger than the overall pediatric inpatient population (p<0.001). Racial composition also differed, as Hispanic and Black children made up a greater proportion of those undergoing PSG over time (p<0.001). Children were more likely to have comorbid conditions in 2012, including hypertension (OR=3.1, p<0.001), cardiac conduction disease/dysrhythmia (OR=3.0, p<0.001), and nervous system disease (OR=1.9, p<0.001). Moreover, central sleep apnea (CSA) was diagnosed 2.3 times more often in 2012 (11.5% versus 26.1%, p<0.001). The primary payer was more likely to be Medicaid in 2012 than 2003 (33.7% versus 60.1%, p<0.001).

Conclusion: Children who underwent inpatient PSG were younger and more likely to be Black or Hispanic than the overall inpatient pediatric population. They also had more comorbid cardiac and neurologic diagnoses over time. CSA was also more likely to be an indication for testing over time.
Chevalier Jackson Award 2015:

Steven Zeitels, MD

Chevalier Jackson Award Recipients

1959-2015

1959  Louis H. Clerf, MD
1960  (no award)
1961  Herman J. Moersch, MD
1962  Paul H. Holinger, MD
1963  Edwin N. Broyles, MD
1964  Leroy A. Schall, MD
1965  Herbert W. Schmidt, MD
1966  Paul G. Bunker, MD
1967  Joel Pressman, MD
1968  Verling K. Hart, MD
1969  Joseph P. Atkins, MD
1970  Anderson C. Hilding, MD
1971  Robert M. Lukens, MD
1972  Charles M. Norris, MD
1973  Arthur M. Olsen, MD
1974  Charles F. Ferguson, MD
1975  Shigeto Ikeda, MD
1976  Blair W. Fearon, MD
1977  Francis W. Davidson, MD
1978  Seymour R. Cohen, MD
1979  M. Stuart Strong, MD
1980  DeGraff Woodman, MD
1981  Albert H. Andrews Jr., MD
1982  Gabriel F. Tucker, Jr., MD
1983  Howard A. Andersen, MD
1984  Paul H. Ward, MD
1985  Bruce N. Benjamin, MD
1986  Loring W. Pratt, MD
1987  Robert S. Fontana, MD
1988  Charles W. Cummins, MD
1989  Bernard R. Marsh, MD
1990  David R. Sanderson, MD
1991  William W. Montgomery, MD
1992  John A. Tucker, MD
1993  Gerald B. Healy, MD
1994  Vincent J. Hyams, MD
1995  Lauren D. Holinger, MD
1996  Stanley M. Shapshay, MD
1997  Robert H. Ossoff, MD
1998  John Frederickson, MD
1999  Eiji Yanagisawa, MD
2000  William W. Montgomery, MD
2002  Jack L. Gluckman, MD
2003  Ellen M. Friedman, M.D.
2004  Robin T. Cotton, M.D.
2005  Charles W. Vaughn, MD
2006  Andrew Blitzer, MD, DDS
2007  Gayle E. Woodson, MD
2008  Robert J. Toohill, MD
2009  Peter Koltai, MD
2010  Clarence T. Sasaki, MD
2011  Peak Woo, MD
2012  W. Frederick McGuirt, Sr., MD
2013  Seth Pransky, MD
2014  Michael Rothschild, MD
2015  Steven Zeitels, MD
CHEVALIER JACKSON LECTURE:

Into the Future of Minimally Invasive Surgery via Lessons Learned from the TORS Story

Bert O’Malley, MD

Philadelphia, PA
PANEL II:

Difficult Airway Cases
Panel Supported by the Voice Health Institute Endowment

Moderator:
Reza Rahbar, MD

Panelists:
Robert Buckmire, MD
Michael Rutter, MD
Stanley Shapshay, MD
Dana Thompson, MD, FACS
BREAK WITH EXHIBITORS
SESSION V:
Patient Safety

Moderators:
Paul Flint, MD
Markus Hess, MD
Objective: A major challenge faced by otolaryngologists in emergent or urgent consult situations is quickly obtaining the appropriate equipment and medications needed to perform the indicated intervention. The objective of this study was to develop an Otolaryngology consult cart system to ensure prompt delivery to the bedside of all the unique equipment and medications required for emergent and urgent Otolaryngology consults including obstructed airways and bronchoesophageal foreign bodies.

Method: An Otolaryngology practice responsible for emergency room and hospital consult coverage sought to create a cart containing all equipment, medications, and supplies for Otolaryngology consults. Meetings with hospital administration, emergency room staff, nursing, pharmacy, central processing, and operating room staff were held to develop a system for the emergent delivery of the cart to the needed location, sterilization of equipment between uses, appropriate billing of supplies and the maintenance of stock items.

Results: Approximately two months were required from conception to implementation. All equipment was purchased new from the manufacturer, including flexible scopes and headlights. The cart is sterilized, restocked, and maintained by central processing after each use. The equipment is available to handle all airway emergencies as well as all common Otolaryngology consults and is delivered bedside in less than five minutes.

Conclusion: The development of a novel, self-contained otolaryngology consult cart requires coordination with a wide variety of hospital departments. While upfront monetary and time investment are required, the much improved expediency of necessary equipment and medications for life-threatening otolaryngology emergencies and improvement in consult efficiency justifies the investment.
COMPREHENSIVE EMERGENCY AIRWAY RESPONSE TEAM (EART) TRAINING AND EDUCATION: IMPACT ON TEAM EFFECTIVENESS, PERSONNEL KNOWLEDGE, AND PATIENT SAFETY AND OUTCOMES


Institution: Boston Medical Center

Presenter: Angela Tsai

Objective: To evaluate the efficacy and usefulness of simulation of an Emergency Airway Response Team (EART) simulation based training program aimed at improving patient safety and outcomes. Primary outcomes included change in team dynamic, personal confidence, and EART program knowledge

Method: This was a descriptive, quantitative performance improvement study. From October 1, 2012 to September 30, 2013, 177 members of the EART from Anesthesia, Otolaryngology, Trauma Surgery/Critical Care, Emergency Medicine, ICU Nursing and Respiratory Therapy participated in 12 emergency airway simulations at a tertiary care hospital simulation center. Confidence and knowledge of EART were assessed using pre- and post-simulation questionnaires.

Results: All participants regardless of their role, experience in the medical field, or any prior exposure to a difficult airway showed improvement in self-rated confidence and objective knowledge regarding EART after undergoing simulation. The average pre-simulation score confidence score was 3.8 out of 5 based on a Likert-type scale and post-simulation score was 4.5. Participants scored an average of 70.6% on their pre-simulation knowledge assessment and 90.9% post-simulation.

Conclusion: Our study highlights the efficacy and usefulness of simulation in assessing personnel confidence levels and knowledge of emergency airway scenarios. It is clear that practitioners in all fields and level of experience benefit from EART training and simulation. This data will lay the foundation for a subsequent study that will determine the impact of this simulation on patient morbidity and mortality.
MONITORING HYPOPHARYNGEAL PH IN PATIENTS UNDERGOING GENERAL ENDOTRACHEAL TUBE ANESTHESIA: A PILOT STUDY?

**Authors:** E. Regenbogen, S. P. Oleszak, T. Corrado, A. L. Shroyer, E. A. Vanner, J. Goldstein, M. L. Pearl

**Institution:** Stony Brook University Medical Center

**Presenter:** Elliot Regenbogen

**Objectives:** Laryngeal injuries are important and not infrequent following both short and extended endotracheal tube exposure. Available data regarding hypopharyngeal pH during endotracheal tube anesthesia is limited. The objective of this pilot study was to document hypopharyngeal pH values in patients undergoing surgery performed under general endotracheal tube anesthesia.

**Methods:** Twenty volunteers were continuously monitored intra-operatively using a commercially available pH monitoring system. Demographics, pre- and postoperative voice and reflux self-reported survey data were also collected.

**Results:** No complications associated with the Restech Dx-pH monitoring system occurred. Median pH was 6.54 (5.98-7.01); median recorded time in minutes was 183.9 (130.7 – 323.5). 13/20 patients had pH>5.0≤5.5 events, for up to 113 minutes of monitored time; 2/20 patients had pH>4.0≤5.0 events, for up to 8 minutes of monitored time; 2/20 patients had pH≤4.0 events, for up to 61 minutes of monitored time.

**Conclusions:** The Restech Dx-pH test was used successfully to intra-operatively record pharyngeal pH variations. Extended pharyngeal exposures to low pH environments were commonly documented but not associated with patient survey score changes. Future research appears warranted to expand this study, identify “at-risk” populations and to rigorously evaluate an expanded set of voice-related and lower airway clinical outcomes.
THE EFFICACY AND SAFETY OF THE FLEXIBLE FIBER CO2 LASER DELIVERY SYSTEM IN THE ENDOSCOPIC MANAGEMENT OF PEDIATRIC AIRWAY PROBLEMS: OUR LONG TERM EXPERIENCE

Authors: G. Lee¹,², R. Rahbar¹,²

Institutions: ¹Boston Children’s Hospital, ²Harvard Medical School

Presenter: Gi Soo Lee

Objective: To report the use of the flexible fiber CO2 laser delivery system in the endoscopic management of pediatric airway cases.

Method: Retrospective review conducted at a tertiary pediatric hospital of patients who underwent CO2 laser-assisted airway procedures between September 2007 and January 2014.

Results: A total of 68 patients with airway pathology underwent 76 procedures utilizing the flexible fiber CO2 laser under endoscopic or microscopic visualization. Procedures included supraglottoplasty (N=32), laryngeal cleft repair (type I [N=10], type II [N=7], type III [N=5]), excision of suprastomal granulation/granuloma (N=6), cordotomy (N=4), excision of laryngeal neurofibroma (N=3), excision of laryngeal granulomatous mass (N=1), excision/incision of subglottic stenosis (N=4), division of glottic web (N=3), and biopsy of supraglottis (N=1). Ages ranged from 8 days to 21 years (median age 11 months). No intraoperative or postoperative complications related to the use of laser were noted.

Conclusions: The flexible fiber CO2 laser delivery system can be safely and effectively used to address a variety of pediatric airway lesions. Previously, the use of CO2 laser in minimally invasive airway surgery has been limited due to the articulating arm carrier, absence of a handpiece, and the direct line-of-sight view required when using the microscope attachment. The fiber allows the cutting beam to be directed at the site of the lesion and bypasses the limitations posed by other laser systems.
SESSION VI:
Swallowing Disorders

Moderators:
Mark Courey, MD
Suzy Duflo, MD
HOW ACCURATELY DO PATIENTS WITH CERVICAL DYSPHAGIA LOCALIZE THE SOURCE OF THEIR COMPLAINT?

Authors: B. Cervanka, P. Belafsky, M. Kuhn

Institution: University of California - Davis

Presenter: Brian Cervanka

Objective: Dysphagia is a common symptom. Previous observations suggest that swallowing complaints arising above the clavicles are often the result of distal (esophageal) pathology. We sought to assess the frequency with which cervical dysphagia is a manifestation of esophageal pathology as well as patients’ accuracy in localizing dysphagia symptoms.

Method: We retrospectively evaluated consecutive patients presenting for fluoroscopic swallow study or esophagram. Patients who identified a site of solid food or pill dysphagia were included. Excluded were patients who had been diagnosed or treated for head and neck cancer, experienced neck trauma or referred for follow-up evaluation of previously diagnosed pathology. Etiologies of dysphagia were classified as esophageal, oropharyngeal, combined or undetermined and were identified by fluoroscopic study, endoscopy, manometry or pH testing.

Results: 139 fluoroscopic studies were reviewed and 80 patients met inclusion criteria. Fifty-two percent were female. Included patients had a mean age of 60 (SD 14) years and EAT-10 score of 18.4 (SD 10.6). Eighty-three percent (n=66) complained of supra-sternal dysphagia. Of this group, 33% (n=22) had an esophageal etiology and 54% (n=35) had an esophageal or combined etiology. Forty-six percent (n=31) correctly localized a cervical etiology for dysphagia. Seventeen percent (n=14) reported dysphagia symptoms arising below the sternal notch. Of this group, 79% (n=11) had an identified esophageal etiology.

Conclusion: More than half of patients reporting suprasternal dysphagia have esophageal pathology. These results underscore the importance of routine esophageal evaluation in the workup of cervical or generalized dysphagia.
OBJECTIVE MEASURES OF SWALLOWING DEFICITS IN PATIENTS WITH PARKINSON’S DISEASE

Authors: J. K. Ellerston, A. Heller, D. R. Houtz, K. A. Kendall

Institution: University of Utah

Presenter: Julia Ellerston

Objective: Dysphagia and associated aspiration pneumonia is a sequela of Parkinson’s disease (PD), the latter being the most common cause of death in this patient population. Previous studies of swallowing in patients with PD have described longer bolus pharyngeal transit time, delayed onset of bolus pharyngeal transit, cricopharyngeal (CP) achalasia, slowed pharyngeal constriction and slowed hyolaryngeal elevation. These studies were completed using inconsistent swallowing methodology and reliance on qualitative analysis without comparison to age-matched controls, resulting in concerns with regard to their diagnostic precision. The purpose of this study was to investigate swallowing function in patients with PD using a norm-referenced, quantitative approach.

Methods: The present retrospective study includes 29 patients with a diagnosis of PD referred to a multi-disciplinary voice and swallowing clinic. Modified barium swallow studies were performed and objective measures of bolus pharyngeal transit time, hyoid displacement, CP sphincter opening, area of the pharynx at maximal constriction and timing of laryngeal vestibule closure relative to bolus arrival in the CP sphincter were made.

Results: Contrary to the results of previous studies, prolongation of pharyngeal transit, poor hyoid elevation and CP achalasia were rare. Weak pharyngeal constriction was found in 35% and a delay in airway closure relative to arrival of the bolus at the CP sphincter was the most common abnormality, present in 62% of patients.

Conclusions: Based on quantitative analysis of swallowing function, therapy regimens in PD patients should focus on improving the timing of airway closure and the strength of pharyngeal constriction.
APPROACH TO ZENKER’S DIVERTICULA NOT AMENDABLE TO ENDOSCOPIC STAPLER

Authors: A.G. Spinner, H. H. Chang, R.C. Chang

Institution: University of Nevada

Presenter: Alycia Spinner

Objective: Most Zenker’s diverticula are treated with endoscopic stapling. Occasionally, the traditional laryngoscope cannot be used due to patient anatomy and open repair must be performed. We sought to determine if patients with unfavorable anatomy for the endoscopic stapler could be successfully treated using a cervical esophagoscopy (CE) and an Enseal device, which has a slimmer profile than the stapler, rather than being converted to a more morbid open procedure.

Method: Four patients unable to safely undergo typical endoscopic stapling with a Weerda laryngoscope secondary to their anatomy were visualized with CE and treated with the Enseal G2 Tissue Sealer (Ethicon). Complications, patient complaints, hospital stay and recurrence rates were collected.

Results: All four patients had successful treatment of their Zenker’s diverticula with the Enseal device using a CE for visualization. No complications were encountered; however, these patients did have more complaints of pain when compared to the stapled group. Every patient had resolution of symptoms at up to 3 years of follow up.

Conclusion: Due to higher complaints of pain and slightly slower return to normal diet, we would not recommend use of Enseal tissue sealing device as a first line treatment for Zenker’s diverticulum. However, we believe that it is a fantastic option for patients with challenging anatomy that precludes use of the Weerda laryngoscope and endoscopic stapler. In these patients, the CE with Enseal is a safe and easy device that can be used to perform cricopharyngeal myotomy without necessitating conversion to a highly morbid open procedure.
OBJECTIVE MEASURES OF SWALLOWING FUNCTION APPLIED TO THE DYSPHAGIA POPULATION: A ONE YEAR EXPERIENCE

Authors: K. Kendall, J. Ellerston, A. Heller, D. R. Houtz, A. Presson, C. Zhang

Institution: University of Utah

Presenter: Katherine Kendall, MD

Introduction: Modified barium swallow studies (MBSS) evaluate swallowing physiology but are generally interpreted subjectively, leading to a lack of precision and reliability. Although objective, reliable measures of swallowing physiology can be made from an MBSS, these have not been previously employed to study large dysphagic patient populations.

Methods: The present retrospective study of 141 consecutive patients with dysphagia seen in a university tertiary voice and swallowing clinic sought to use objective measures of swallowing physiology to 1) quantify the most prevalent deficits seen in the patient population, 2) identify commonly associated diagnoses and describe the most prevalent swallowing deficits and 3) determine any correlation between objective deficits and Eating Assessment Tool (EAT-10) scores.

Results: Poor pharyngeal constriction (35%) and airway protection deficits (34%) were the most common swallowing abnormalities. Reflux-related dysphagia (36%), nonspecific pharyngeal dysphagia (24%), Parkinson disease (16%), esophageal abnormality (13%) and brain insult (11%) were the most common diagnoses. Poor pharyngeal constriction was significantly associated with patients who demonstrated an esophageal abnormality (p=0.01). In general, dysphagia symptoms as determined by the EAT-10 did not correlate with swallowing function abnormalities. A negative correlation was found between coordination of airway protection and the EAT-10 (p=0.01) indicating that patients with poor airway protection had fewer swallowing complaints.

Conclusions: This preliminary study indicates that reflux disease may contribute to general dysphagia, that associated esophageal abnormalities are common in the dysphagic population and may be associated with specific pharyngeal swallowing abnormalities. However, symptom scores from the EAT-10 did not correspond to swallowing pathophysiology.
Introduction of New President
The American Broncho-Esophagological Association

Broyles-Maloney Award Recipients

The Broyles-Maloney Award was established to encourage advancement of the art and science of bronchoesophagology and closely related subjects. Competition for the award is limited to persons whose abstracts are submitted for inclusion in the Annual Scientific Program. The award is given for outstanding manuscript, thesis or accomplishments in bronchoesophagology, laryngology or related science.

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The Ellen M. Friedman Foreign Body Award is given to an accepted abstract in recognition of excellence in innovation, skill and education in the management of aero-digestive foreign bodies. It is intended to encourage continued leadership in the art of endoscopic foreign body management.

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1984  Judson R. Belmont, MD
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2012  (no award)

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2008  J. Matthew Dickson, MD  
2009  Wataru Okano, MD  
2010  None  
2011  Richard Turley, MD  
2012  Koshi Otsuki, MD  
2013  Mitsuyoshi Imaizumi, MD  
2014  None  
2015  Yuta Nakaegawa, MD
Rules Concerning the Presentation of Papers At The Annual Meeting

- The reading of any paper shall not extend beyond the time allotted by the Program Committee. The exact time for presentation will be allotted by the Program Committee. This shall include presentation of slides, pictures and video demonstrations.

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- Only original and unpublished papers may be submitted for consideration. The same or similar abstract should not be submitted simultaneously to any other meeting or publication.
SCIENTIFIC POSTER SESSION

All registrants and guests are invited. Scientific Posters will be attended by authors.

Abstracts of ABEA submissions to the Combined Scientific Poster Session appear on pages (74-140) of this program booklet.
UPPER AIRWAY ANOMALIES IN CONGENITAL TRACHEOESOPHAGEAL FISTULA AND ESOPHAGEAL ATRESIA PATIENTS

Authors: A. Hseu, T. Recko, R. Jennings

Institution: Children's Hospital Boston

Presenter: Anne Hseu

Objective: To examine the prevalence of upper airway anomalies in patients diagnosed with congenital tracheoesophageal fistula and esophageal atresia (TEF/EA).

Method: A retrospective review was conducted of all TEF/EA patients seen at a tertiary pediatric hospital between January 2008 and December 2013. Inclusion criteria included evaluation by the otolaryngology service. Exclusion criteria included age > 18 years, acquired TEF/EA, subsequent rule out of TEF/EA, and otolaryngology evaluation for reasons not pertaining to the airway. Data including demographics, co-morbidities, presenting symptoms, surgical interventions, laryngoscopic and bronchoscopic examinations, and subsequent medical and surgical management were collected and analyzed.

Results: 139 children were included in the analysis. 56.1% (n=78) male, 43.9% (n=61) female. All patients underwent either flexible laryngoscopy or direct laryngoscopy and bronchoscopy. 4.3% patients (n=6) were diagnosed with laryngomalacia. 21.6% (n=30) were found to have vocal fold paresis or immobility. Laryngeal cleft was diagnosed in 25.9% (n = 36). 18 patients or 12.9% were diagnosed with subglottic stenosis. Tracheomalacia was not uncommon, diagnosed in 37.4% (n=52) patients.

Conclusion: Patients diagnosed with congenital TEF/EA have a high rate of secondary upper airway anomalies. Consideration should be given to perform a complete airway evaluation in all of these patients.
The American Broncho-Esophagological Association

A-002

DEXMEDETOMIDINE ANESTHESIA DURING SUPRAGLOTToplasty IN INFANTS WITH LARYNGOMALACIA

Authors: C. E. DeMason¹ ², S. Verghese¹, G. Zalzal¹, D. Preciado¹

Institutions: ¹Children’s National Medical Center, ²Georgetown University Medical Center

Presenter: Christine DeMason

Objective: Managing the ventilatory status of young infants during supraglottoplasty presents a significant peri-operative anesthesia challenge. Currently, there is no accepted consensus on the most appropriate anesthetic approach for these procedures. Dexmedetomidine (dex) is an intravenous anesthetic associated with minimal respiratory depression and as such we hypothesized its use would reduce peri-operative respiratory events relative to other intravenous anesthetics. The aim of this study is to compare the primary use of dex vs. other intravenous anesthetics used during supraglottoplasty, while analyzing the rate of early complications.

Methods: A retrospective chart review was done of children who underwent supraglottoplasty in the past 3 years at a large tertiary pediatric hospital. Data collected included: age, ASA class, anesthetic agents, and complications. Patients who were left electively intubated after surgery were excluded.

Results: Of 92 supraglottoplasties performed, 19 patients received dex as a primary anesthetic agent. There was no difference in mean age, laryngomalacia severity, co-morbidities, mean ASA category, or length of stay between the two groups. However, there were significantly less episodes of early post-operative respiratory distress events (laryngospasms, hypoxic events or need for racemic epinephrine) in the dex group (5.26%) compared to the non-dex group (31.5%) (p=0.02).

Conclusion: The use of intra-operative dexmedetomidine appears to reduce early respiratory complications in infants undergoing supraglottoplasty and may provide an improvement in the anesthetic management of these cases.
COSTAL CARTILAGE LARYNGOTRACHEAL RECONSTRUCTION IN ADULTS 60-80 YEARS OLD

Authors: J. R. Bekeny, C. T. Wootten

Institution: Vanderbilt University Medical Center

Presenter: James Bekeny

Objective: Examine the feasibility and pitfalls of airway reconstruction in patients with laryngotracheal stenosis 60-80 years old.

Method: A series of nine patients, aged 60-80 years who underwent complex open or endoscopic laryngotracheal reconstruction by a single surgeon between 2010-2013 was identified. Medical record review included history and treatment course, nature of post-reconstruction interventions, decannulation, time to decannulation, and complications.

Results: The median patient age was 62 years (mean 67). One of 9 had an unexpected cardiac death within the post-operative period. Of the remaining 8 patients, 4 had a preoperative tracheotomy. Two patients underwent tracheal resection, 2 had an endoscopically placed posterior cricoid cartilage graft, two had extended cricotracheal resection with a posterior cricoid cartilage graft, two had open anterior and posterior cricoid cartilage grafts, and one had an open posterior cricoid cartilage graft. Seven patients had stents placed at the time of surgery. Mean stent duration was 36 days (range 14-59). Following stent removal, a median of 3 additional procedures was performed (range 1-5). Interventions included removal of granulation, steroid injection, incision and dilation, stent placement, and application of mitomycin-C. Seven of the 8 patients achieved decannulation. The average length to decannulation was 117 days (range 58-203).

Conclusion: Airway reconstruction in adults 60-80 years old with laryngotracheal stenosis is feasible with a high decannulation rate. Preoperative evaluation and careful patient selection is paramount. Vigilant post-reconstruction endoscopy and intervention is essential to guide airway healing.
A-004

UTILITY OF PEAK INSPIRATORY FLOW IN EVALUATING UPPER AIRWAY OBSTRUCTION

Authors: S. Bayan, K. Tasche, H. Hoffman

Institution: University of Iowa

Presenter: Semirra Bayan

Objective: To identify the utility of the pulmonary function metric peak inspiratory flow (PIF) in the assessment and management of subglottic stenosis and other forms of upper airway obstruction through correlation of signs, symptoms and interventions with PIF values.

Method: A retrospective chart review was performed from 2002-2014 on all patients with upper airway obstruction who underwent pulmonary function testing. The clinical course of each patient was reviewed along with the best effort peak inspiratory flow (PIF) and peak expiratory flow (PEF) measurements. The presence or absence of shortness of breath and the presence or absence of stridor were evaluated.

Results: 102 patients were retrospectively reviewed. Diagnoses evaluated included subglottic stenosis (n=70), vocal cord paralysis (n=15), glottic stenosis (n=9), subglottic and laryngeal amyloidosis (n=4), tracheal stenosis (n=3), and pharyngeal stenosis (n=1). Among all patients, there was a statistically significant correlation between PIF of < 2 with patient reported shortness of breath (p<0.001) and clinician documented stridor (p<0.001). Patients with the diagnosis of subglottic stenosis had a statistically significant correlation between PIF values of < 2 with patient reported shortness of breath (p<0.001) and clinician documented stridor (p<0.001). Patients who had operative intervention within seven days had a statistically significant correlation with PIF values < 2 (p=0.013).

Conclusion: This study demonstrates the correlation between peak inspiratory flow (PIF) measurements and the severity of clinical symptoms. This objective marker can help direct intervention and monitor treatment success and outcomes in individuals with subglottic stenosis, as well as other forms of upper airway obstruction.
A-005

PEDiatric Multidisciplinary Aerodigestive Clinic: Presenting Complaints, Diagnoses, Management, and outcome

Authors: N. Bauman, G. Krakovsky, S. Sehgal, C. Noelke, M. Collins, F. Ogunlesi, D. Pillai

Institution: Children’s National Medical Center

Presenter: Nancy Bauman

Objective: To determine the value of a pediatric multidisciplinary aerodigestive clinic (ADC) for patients with complicated, recalcitrant aerodigestive conditions.

Methods: Review of a 12 month ADC experience beginning August, 2013 to determine most frequent presenting complaint, diagnostic evaluation, diagnosis and outcome.

Results: 54 patients were seen by all ADC members (otolaryngologist, gastroenterologist, pulmonologist, speech pathologist and nurse practitioner). All patients had recalcitrant, aerodigestive complaints despite multiple evaluations by their pediatrician and at least one specialist. Mean age was 4.25 years (0.5–19). Cough was the most common primary complaint (24) followed by dyspnea (7), dysphagia (6), chronic congestion (6), reflux disease (3), poorly-controlled asthma (3), vomiting (2), aspiration (1), recurrent croup (1), and vocal cord dysfunction (1). Flexible laryngoscopy was completed in 35% and pulmonary function testing in 75%. Subsequent operative endoscopy (bronchoscopy, esophagoduodenoscopy and/or laryngoscopy) was warranted in 32/54, immune evaluation in 5, cilia biopsy in 4 and intraluminal impedance testing in 7 patients. Combined clinic and operative endoscopy provided highest diagnostic yield detecting vocal cord dysfunction (4), laryngeal cleft (4), adenoid hypertrophy (3), reflux disease (3) tracheomalacia (1), celiac disease (1), H. pylori (1), duodenal web (1) cilia abnormality (1), and infection (3). Following medical or surgical management, 15 of 17 responding patients reported resolved or markedly improved symptoms and 2 reported minimal improvement.

Conclusions: The multidisciplinary approach of an ADC provides high diagnostic yield and successful management of difficult, recalcitrant aerodigestive conditions particularly with combined endoscopy. Strategies for conducting a successful ADC clinic are reviewed.
A-006

HOARSENESS AND DYSPHAGIA FOLLOWING ANTERIOR CERVICAL DISK FUSION SURGERY: DOES PATIENT BMI PLAY A ROLE?

Authors: J. D. DePietro, T. Anderson

Institution: Lahey Clinic

Presenter: Joseph DePietro

Objective: To evaluate the rates of temporary and permanent dysphagia and hoarseness in patients undergoing Anterior Cervical Disk Fusion (ACDF). We will assess whether Body Mass Index (BMI) has any effect on these outcomes.

Method: Retrospective review of patients undergoing ACDF by 3 separate neurosurgeons was performed. We collected data from 290 patients who were operated on from 2007-2010.

Results: 16 patients had temporary hoarseness (5.5%) and 2 patients had hoarseness that persisted one year following the operation (0.7%). 57 patients had temporary dysphagia (19.7%) and 16 patients had dysphagia that was still present one year following their operation (5.5%). These outcomes did not show any significant association between mean BMI and outcome status for any of the four outcomes. However, when BMI was categorized as underweight, normal, overweight and obese; there was a significant difference in BMI category distribution in patients with and without temporary hoarseness.

Conclusion: BMI does not have an obvious effect on the rates of permanent hoarseness and dysphagia in the set of patients we studied. When BMI was assessed in categories, however, we were able to show an increase in rates of temporary hoarseness in the overweight and obese patients. In order to further assess the effect of BMI on post-operative complications of ACDF, further studies are necessary.
HIGH PRESSURE BALLOON DILATION OF THE PEDIATRIC AIRWAY: A CASE SERIES AND LESSONS LEARNED

Authors: A. Rameau, H. Cheng, A. Messner, P. Koltai

Institution: Stanford University

Presenter: Anais Rameau

Objective: To report experience with endoscopic high-pressure balloon dilation (HPBD) of the pediatric airway, validate its use based on existing guidelines for airway dilation, describe possible novel applications, as well as limitations and complications.

Method: We reviewed the charts of all patients who had HPBD at our institution between 2008 and 2014. Recorded data included demographics, diagnosis with stenosis grade and length, co-morbidities, indications, balloon size and pressure, number of dilations, dilation outcomes, adjunctive medications and complications.

Results: 34 children had HPBD for airway stenosis. 52% were female. The mean age was 5 years old (STD 5.9). 32 (94%) had two or more comorbidities. 91 dilations were performed, with 2.8 dilation per patient (STD 2.1). Twenty-three (67%) children had HPBD for airway stenosis in an effort to avoid tracheotomy or laryngotracheal reconstruction (LTR), with a success rate of 86%. Six (18%) children had HPBD in order to expand the lumen in high grade stenoses prior to LTR and 67% of these children were successfully decannulated following LTR. Four (12%) children had HPBD following slide tracheoplasty for distal tracheal stenosis, and 33% of these patients avoided tracheostomy. Two (6%) patients had complications, including a child with cricoid rupture and another with tracheal rupture. Both experienced extended ICU stay and persistence of the stenosis.

Conclusion: HPBD appears to be equally safe and effective to more traditional methods of airway dilation, although a significantly more expensive one. Indications for HPBD appear consistent with existent guidelines for other dilation methods.
A-008

DECANNULATION IN CHILDREN WITH A TRACHEOTOMY: EVALUATION OF A STANDARDIZED PROTOCOL

Authors: A. M. Landry¹, C. K. Hart¹, M. E. Tabangin¹, J. Gentile¹, E. A. Gantwerker³, K. E. Johnson², M. J. Rutter¹, A. De Alarcon¹

Institutions: ¹Cincinnati Children’s Hospital Medical Center, ²Seattle Children’s Hospital, ³Children’s Hospital Boston

Presenter: April Landry

Objective: There are very few studies or reports of a standardized protocol for decannulation of children with long-term tracheostomy. To describe the experience and success of a capping and decannulation protocol for children with tracheotomy at a single tertiary airway center.

Methods: Retrospective review of 34 children undergoing a standardized protocol for decannulation at a single academic tertiary care center between 2006 and 2013. Children were admitted for an initial capping trial of 24-48 hours. Subjects who successfully completed a capping trial would proceed to a decannulation trial for an additional 24-48 hours during the same admission or at a separate admission determined by the treating physician. Results: 34 children were identified that underwent the protocol. 29 subjects were successfully decannulated.

Demographics: Median age 4.1 years; 20 (58.8%) male; 23 (67.6%) premature; 27 (79.4%) pulmonary comorbidity; 20 (58.8%) neurologic comorbidity; 44 capping trials were performed: 28 single, 10 second, 2 third, 2 fourth, 2 fifth. 35/44 (79.5%) trials were deemed successful. 10/44 (32.7%) underwent decannulation trial during the same admission. Subjects who underwent decannulation trials capped for <72 hours (n=4), 1-4 weeks (n=3), 1-3 months (n=7), >3 months (n=17). 31 decannulation trials were performed. 29/31 subjects passed the decannulation trial (93.5%).

Conclusion: Our study is the first study to evaluate a protocol for decannulation of children with a tracheotomy. We found that a small percentage of children will fail capping or decannulation. Proper selection of patients for decannulation is central and establishing a standardized protocol is important in the decannulation process.
Authors: M. R. Sakamoto, J. C. Groblewski, M. A. Vecchiotti, A. R. Scott

Institution: Tufts Medical Center

Presenter: Mandy Sakamoto

Objective: To assess the efficacy of office video laryngoscopy (OVL) for detecting subglottic stenosis (SGS) in infants and children and to determine the accuracy of estimating SGS severity using OVL.

Methods: Children who underwent both operative laryngoscopy/bronchoscopy and OVL were identified retrospectively using a departmental database. Patients included were those under 5 years who had an operative laryngoscopy/bronchoscopy within 4 months of OVL. Videos were randomized and independently reviewed by 3, blinded pediatric otolaryngologists during a single session. When SGS was suspected, the Cotton-Myer grade was estimated. Operative bronchoscopy and OVL findings were compared, using operative findings as the gold standard. Sensitivity, specificity, and positive and negative predictive values were calculated. To evaluate intra-rater and inter-rater reliability, 30 randomly selected exam videos were reviewed 3 times by each reviewer.

Results: During the 3 year study period (April 2011-April 2014) 102 children with 129 OVLs met inclusion criteria; 100 OVLs (77.5%) afforded an adequate view of the subglottis. There were 47 opportunities to detect SGS. Sensitivity for detecting stenosis was 35.5% (grade I), 75.0% (grade II) and 100% (grade III). Sensitivity for detecting clinically significant stenosis (grades II-IV) was 81.2%. Consistently accurate estimations of SGS severity were only seen in high grade lesions.

Conclusion: While operative laryngoscopy/bronchoscopy is necessary for accurate detection of low grade SGS, OVL may detect clinically relevant subglottic narrowing (grades II-IV) in over 80% of cases when a view of the subglottis can be obtained. Reliable estimation of SGS severity using OVL is subject to inter-rater variability.
MAXIMIZING ENDOSCOPIC EXPOSURE FOR ZENKER’S DIVERTICULOTOMY

Authors: M. I. Orestes¹, N. Jamal², V. Nabili¹, K. Blackwell¹, L. Holly¹, D. K. Chhetri¹

Institutions: ¹University of California - Los Angeles, ²Temple University

Presenter: Nausheen Jamal

Objective: To describe early diagnosis of hypopharyngeal and esophageal perforations from cervical spine hardware using office transnasaleosophagoscopy, and to present a multidisciplinary approach to its definitive management.

Methods: Five cases were reviewed; diagnosis and definitive repair were performed by the same multi-disciplinary team including a head and neck surgeon, a reconstructive surgeon and a neurosurgeon. Diagnostic techniques, surgical repair and degree of dysphagia were evaluated. Swallowing outcomes were rated using Functional Outcomes of Swallowing Scale (FOSS).

Results: All of the patients reported severe dysphagia as their main symptom at presentation requiring gastrostomy tube placement. Two had associated vocal fold paralysis. All were diagnosed as having exposed spinal hardware based on office-based trans-nasal esophagoscopy. All patients underwent neck exploration, primary repair of the esophagus, removal of cervical hardware and coverage of the area with a regional advancement flap. Six months after surgery all had improvement in dysphagia following surgery and were able to take all nutrition by mouth. Mean pre- and post-op FOSS scores were 4.8 and 1.6.

Conclusion: A high degree of clinical suspicion for hypopharyngeal and esophageal perforation is required for patients presenting with dysphagiawho have cervical spine hardware. Office trans-nasal esophagoscopy allows early diagnosis of perforations prior to development of significant life threatening complications. Early repair, removal of hardware, and coverage with a regional flap is optimal management of the perforation and for return of swallowing function.
A-011

MANAGEMENT OF SUBGLOTTIC STENOSIS

Authors: R. Meacham, J. Schindler

Institution: Oregon Health and Science University

Presenter: Ryan Meacham

Objectives: Identify and compare the differences in presentation and management of subglottic stenosis (SGS) of those with an origin of prolonged intubation or trauma, autoimmune disease, or idiopathic. Design: Retrospective analysis Setting: Tertiary academic hospital

Methods: CPT code 31528 was used to identify all those that had undergone laryngoscopy with dilation for SGS. Patients were included if age was greater than 18. Subjects were excluded if they had a diagnosis of cancer.

Results: 133 patients were identified undergoing 256 procedures. 93 patients were idiopathic, 26 had prolonged intubation or trauma, and 14 had autoimmune disease. Mean number of dilations were 1.7, 1.7, and 3.7 for the above groups, respectively. When multiple dilations were required, there was a mean of 15.1 months between dilations for the idiopathic group, 10.5 months for the intubation group, and 13.3 months for the autoimmune group. Comparison of techniques showed that average months between dilations was 16.9 months for the balloon dilation group, 14.8 months for laser excision of stenosis with balloon dilation, and 9.4 months with steel dilators with microdebrider excision of stenosis. Open procedures were performed in 9% of those with idiopathic SGS, 19% of those with SGS from prolonged intubation, and 7% in SGS from autoimmune disease.

Conclusions: There is a longer time between debridements for the idiopathic SGS than the trauma or autoimmune disease subgroups. There is a higher number of patients undergoing open airway procedures for SGS due to prolonged intubation or trauma.
A-012

STANDARDIZING LARYNGEAL CLEFT EVALUATIONS: FEASIBILITY OF THE INTER-ARYTENOID REGION ASSESSMENT PROTOCOL

Authors: K. E. Johnson¹, D. J. Dudley¹, A. F. Inglis¹, S. R. Parikh¹, K. DeMarre, CCC-SLP¹

Institutions: ¹Seattle Children’s Hospital, ²University Of Washington School Of Medicine

Presenter: Kaalan Johnson

Objectives: The Benjamin-Inglis classification is widely used for laryngeal cleft assessments. This classification system, however, does not clearly identify an anatomic superior boundary for type 1 laryngeal clefts, or describe the range of normal inter-arytenoid anatomy. Our proposed inter-arytenoid region assessment (IARA) protocol was developed with the goal of providing standardized, efficient, and comprehensive evaluations of the interarytenoid region. This study seeks to establish the feasibility of the IARA protocol in an academic practice.

Methods: The proposed steps of the IARA protocol are 1: suspend the laryngoscope, 2: insert and suspend vocal cord spreaders, 3: palpate post-cricoid and inter-arytenoid musculature with right angle hook, 4: assess depth of inter-arytenoid region using anatomic reference and measurement of cranio-caudal distance from inter-arytenoid mucosa to cricoid in millimeters. Videos of protocol attempts were analyzed to determine successfully completed steps.

Results: Twenty-four videos were reviewed. Completion rates for each step ranged from 96-100%. Step 4 was further analyzed to show 96% completion of the anatomic reference technique, and 37.5% completion of the cranio-caudal measurement technique (which required use of the limited resource laryngeal measuring devices). Mean time to completion was 71 seconds when using the anatomic reference technique and 145 seconds when using the measurement technique.

Conclusions: The proposed IARA protocol for laryngeal cleft evaluation was utilized efficiently in an academic practice. Further study is ongoing to validate the reliability of this protocol, to gather normative anatomic data to refine the definitions of minor laryngeal clefts, and to more clearly define our outcomes in pediatric dysphagia research.
A-013

DIAGNOSIS OF PEDIATRIC FOREIGN BODY INGESTION: CLINICAL PRESENTATION, PHYSICAL EXAMINATION, AND RADIOLOGIC FINDINGS

Authors: J. R. Sink, D. J. Kitsko, D. K. Mehta, M. W. Georg, J. P. Simons

Institution: Children’s Hospital of Pittsburgh

Presenter: Jacquelyn Sink

Objectives: 1) To describe clinical and radiologic findings in patients with esophageal foreign bodies. 2) To examine the predictive value of history, physical examination, and radiologic studies in children with suspected foreign body ingestion.

Methods: A retrospective cohort study was performed, evaluating all children who underwent esophagoscopy for suspected foreign body ingestion at our tertiary-care children’s hospital from 2007-2013. Data collected included symptoms, physical examination, radiologic, and endoscopic findings, and complications.

Results: 543 patients were included (54% male). Average age was 4.7 years (sd=4.1 years). Foreign bodies were identified on esophagoscopy in 497 cases (92%). Ingestion was witnessed in 23%. Most common presenting symptoms were choking/gagging (49%), vomiting (47%), dysphagia/odynophagia (42%), cough (40%), and drooling (40%). Most patients with foreign bodies had normal physical examinations (76%). Most foreign bodies were radiopaque (83%); coins were the most common items identified (70%). In 59% of patients with normal chest radiographs, a foreign body was present. The sensitivity and specificity of one or more findings on history, physical examination, and imaging were 98% and 0%, 22% and 74%, 89% and 100%, respectively. For non-radiopaque foreign bodies, sensitivity and specificity of history and exam combined were 99% and 0%, respectively. Specificity increased with increased number of combined positive findings.

Conclusion: Most patients with esophageal foreign bodies are symptomatic. Although many patients will have a normal physical examination, an abnormal exam should increase suspicion for a foreign body. Most esophageal foreign bodies are radiopaque, but a normal chest radiograph cannot rule out a foreign body.
A-014

CHRONIC STRIDOR IN A NINE-MONTH OLD - CONSIDER ESOPHAGEAL FOREIGN BODY

Authors: B. B. Roby¹, L. M. Zapapas¹, L. Z. Fenton¹, J. M. Arganbright³, N. R. Friedman², J. D. Prager²

Institutions: ¹Children’s Hospitals and Clinics of Minnesota, ²Children’s Hospital Of Colorado, ³Children’s Mercy Hospital

Presenter: Brianne Roby

Objective: Chronic foreign body impaction can cause numerous airway and gastrointestinal complications. We present the case of a 9-month-old female with seven weeks of stridor.

Method: A single case report from an academic children’s hospital was reviewed. Results: A 9-month-old female was evaluated for worsening stridor over seven weeks. Initial lateral neck radiograph showed widening of the retropharyngeal space with significant mass effect displacing the cervical and upper thoracic trachea anteriorly with narrowing. Due to her airway symptoms, she was taken emergently by ENT to the operating room (OR) for intubation. As the radiograph showed tracheal compression extending below the clavicles, extracorporeal membranous oxygenation (ECMO) was on standby in case this patient could not be intubated. In the OR, flexible fiberoptic nasotracheal intubation was achieved with the patient sitting upright. Through multimodality imaging and several procedures, she was found to have ingested part of a Christmas ornament, which lodged in the esophagus, perforated the mucosa and caused a retropharyngeal phlegmon. The impacted foreign body and surrounding inflammation compressed the airway, leading to respiratory distress and stridor. She improved on intravenous antibiotics and the ornament was retrieved endoscopically.

Conclusion: Slowly worsening stridor should raise suspicion for a chronic esophageal foreign body.
AN UNUSUAL AIRWAY FOREIGN BODY - A COCKROACH IN THE TRACHEA

Authors: C. C. Liu$^{1,2}$, A. Sheyn$^{1,2}$, R. Johnson$^{1,2}$, G. B. Shah$^{1,2}$

Institution: $^1$Children’s Medical Center, $^2$University Of Texas Southwestern Medical Center

Presenter: Christopher Liu

Objective: To report the finding of an unusual foreign body in the airway of a child who was found unconscious after a choking episode.

Method: Case Report

Results: We present a case of airway obstruction by an unusual foreign body in a 10 month old male. The child was brought intubated to the emergency room after he was found unconscious and blue by his parents. His older sibling reported a choking episode after he placed a black object in his mouth. Chest x-ray on arrival demonstrated right-sided air trapping but no definite radio-opaque foreign body. Due to difficulty with ventilation and post-obstructive pulmonary edema on initial bronchoscopy, emergent extracorporeal membrane oxygenation (ECMO) was initiated to help stabilize the patient. Subsequent bronchoscopy demonstrated near total obstruction of the mid-trachea by an insect-like object. The object removed appeared to be a common American cockroach.

Conclusion: Airway foreign body retrieval is a common part of otolaryngology practice. Most of the time, these foreign bodies are food materials or other inanimate objects. Finding a cockroach in the airway is incredibly rare and only three cases have been reported in the literature. This case also illustrates that ECMO may be considered in a patient too unstable to tolerate temporary withdrawal of ventilatory support for endoscopy. Additionally, rapid diagnosis and treatment is important when caring for a child with suspected foreign body aspiration.
A-016

MANAGEMENT OF WIRE BRUSH BRISTLE INGESTION, REVIEW OF LITERATURE AND PRESENTATION OF AN ALGORITHM

Authors: S. Wong, C. Brook, G. A. Grillone

Institution: Boston University

Presenter: Stephanie Wong

Objective: To increase awareness of wire brush bristle ingestion, review the literature relating to wire brush bristle ingestion, and describe a management algorithm for wire brush bristle foreign bodies, as well as a technique for bedside removal.

Method: The authors present a case of an accidental wire bristle ingestion that was successfully treated with bedside removal, and describe a successful bedside technique for removal. For the literature review, the PubMed journal database was queried using the search terms “wire bristle”, “wire brush”, and “grill bristle”.

Results: 27 wire brush ingestions were identified in the medical literature since 2005. Bedside visualization was attempted in ten patients and successful in four. The foreign body was able to be removed at the bedside in three of these patients. Two patients were managed conservatively. The authors developed a management algorithm based on literature findings.

Conclusion: Wire brush bristle ingestion is increasingly common in the literature and a definitive algorithm does not exist for management. The authors present a management for algorithm and describe a technique for successful removal at the bedside.
TRICHOBEZOAR CAUSING A FOREIGN BODY IN THE UPPER AERODIGESTIVE TRACT: A HAIRY SITUATION

Authors: N. J. Scalzitti, G. Dion, S. Bowe

Institution: San Antonio Military Medical Center

Presenter: Nicholas Scalzitti

Objective: 1. Report the case of a 5-year-old female with history of trichotillomania and trichophagia with subsequent airway compromise from a trichobezoar during esophagogastroduodenoscopy. 2. Discuss the management of an unusual foreign body causing extubation and partial airway obstruction.

Method: Case report of a rare situation of airway compromise caused by a hairball.

Results: A 5-year-old patient underwent endoscopic retrieval of a gastric trichobezoar (hairball) by the gastroenterology service under general endotracheal anesthesia in the pediatric sedation unit. During removal, the hairball, due to its large size, dislodged the endotracheal tube, effectively extubating the patient. The bezoar became lodged at the cricopharyngeus muscle, and attempts to remove the bezoar or re-intubate were unsuccessful. The child was able to be mask ventilated while the otolaryngology service was called. Direct laryngoscopy revealed a hairball partially obstructing the view of the glottis from its position in the post-cricoid area. The hairball, still entrapped in the snare from the esophagoscope, was grasped with Magill forceps and slowly extracted. The patient was then re-intubated and the airway and esophagus were re-evaluated.

Conclusion: Trichobezoar, more commonly found in our feline counterparts, is an uncommon cause of airway foreign body. This case describes how airway compromise was avoided after inadvertent extubation in this hairy situation.
MISDIAGNOSED CHRONIC LARYNGEAL FOREIGN BODY

Authors: V. Smith-Bronstein, S. Cervantes, J. Schroeder

Institution: Lurie Children’s Hospital Northwestern

Presenter: Santino Cervantes

Objective: To present and discuss management of a chronic laryngeal foreign body.

Methods: Case report of a glottic foreign body that had been misdiagnosed for nine months.

Results: A healthy six year old female presented to the emergency room (ER) with worsening chronic stridor and increased work of breathing. She had persistent hoarseness and had been treated for five episodes of a croup like illness over the preceding 9 months. Despite multiple visits to physicians, ERs, and three courses of steroids she remained symptomatic and misdiagnosed until dedicated airway films revealed an airway foreign body consistent with a rubber band. Upon further questioning, she described choking on a rubber band prompting a trip to the ER 9 months prior. Microlaryngoscopy and bronchoscopy were performed. A two centimeter rubber band was found in the glottis, extending just above the vocal folds. The rubber band was engulfed in granulation tissue which both anchored the foreign body and narrowed the airway by 40%. Under endoscopic guidance the band was removed with alligator forceps. Obstructive granulation was then removed with optical cup forceps. 24 hours later the patients’ voice returned to baseline and she was completely asymptomatic.

Conclusion: A glottic foreign body is an airway emergency. A choking episode followed by hoarseness, stridor, and difficulty breathing are typical presenting symptoms. We present a case of misdiagnosis of a glottis foreign body in a child. This case highlights the importance of a thorough history, exam, and appropriate imaging when evaluating a child with stridor.
A-019

THE INCIDENCE OF RECURRENT RESPIRATORY PAPILLOMATOSIS HAS THREE PEAKS

Authors: M. R. San Giorgi, E. R. Van Den Heuvel, F. G. Dikkers

Institution: University of Groningen – Netherlands

Presenter: Michel San Giorgi

Objectives: Distribution of age of onset of Recurrent Respiratory Papillomatosis (RRP) is generally described to have a bimodal distribution, with peaks around 5 years and 30 years. There is no scientific substantiation for this assumption and authors often refer to an article which does not describe distribution. Knowledge on distribution of age of onset is important for virological and epidemiological comprehension. Objective of this study was analyzing the distribution of age of onset of RRP in a large cohort.

Methods: Sixteen hospitals from 11 countries were invited to provide information on date of birth and date of onset of all their RRP patients treated between 1998 and 2012. Centers which only treated juvenile onset or adult onset RRP patients, or were less accessible for one of these groups, were excluded. A mixture model was implemented to describe distribution of age of onset. On the basis of the Bayesian Information Criterion the best fitting model was selected.

Results: Six hundred and thirty-nine patients from 12 hospitals were included in the analysis. Age of onset was described best by a three component mixture distribution with log normally distributed components. RRP starts at three median ages: 7, 35 and 63 years. Risk of RRP at young age is twice as high in females.

Conclusions: Distribution of age of onset of Recurrent Respiratory Papillomatosis shows three peaks. In comparison with the already adopted idea of peaks around age 5 and 30, there seems to be an extra peak around the age of 60.
POST TRANSPLANT LYMPHOPROLIFERATIVE DISORDER (PTLD) OF THE LARYNX IN CHILDREN

Authors: D. R. Sidell¹, D. C. VonAllmen², C. K. Hart²

Institutions: ¹Stanford University, ²Cincinnati Children’s Hospital Medical Center

Presenter: Douglas Sidell

Objective: Posttransplant lymphoproliferative disorder (PTLD) involving the larynx has the potential to cause airway obstruction, and is likely underdiagnosed. We describe the clinical presentation, intraoperative characteristics, and management of two children with PTLD of the larynx.

Method: A detailed review of patient medical records was performed. A comprehensive literature review was completed using PubMed. The epidemiology, clinical characteristics and natural history of this disease are outlined. Intraoperative and radiologic images are presented. Treatment options and patient management concepts are discussed.

Results: Between July 2013 and July 2014, two patients presented with laryngeal PTLD. Patient 1 is a 16-month-old male who presented 7 months following liver transplantation with progressively worsening stridor and elevated Epstein-Barr virus (EBV) titers. Laryngoscopy demonstrated irregular thickening of the epiglottis, arytenoid mucosa, and aryepiglottic folds. Patient 2 is a 9-year-old female admitted 9 years following cardiac transplantation with progressive airway symptoms, reduced oral intake, and weight loss. Laryngoscopy demonstrated mucosal discoloration and thickening involving the posterior larynx. Both patients underwent intraoperative biopsy, confirming PTLD. Patient 1 received rituximab and immunosuppression was reduced in both which resulted in improvement of their symptoms.

Conclusion: To our knowledge, these cases represent two of the three documented cases of primary PTLD of the larynx in the literature. Albeit rare, laryngeal PTLD may have nonspecific clinical findings, and failure to recognize this entity may have airway consequences. Because biopsy is required for a definitive diagnosis, clinical suspicion is necessary so that appropriate treatment can be initiated.
HIGH-GRADENEOENDOCRINE CARCINOMA OF THE LARYNX - A SINGLE INSTITUTION’S EXPERIENCE

Authors: N. L. Deep¹, D. C. Ekbom², S. H. Patel¹, M. L. Hinni¹

Institutions: ¹Mayo Clinic - Arizona, ²Mayo Clinic – Rochester

Presenter: Nicholas Deep

Objective: To report a single institution’s series of high grade neuroendocrine carcinoma of the larynx (NCL), a very rare yet aggressive tumor. To review the literature of NCL and discuss historical trends, including clinical behavior, treatment outcome, and prognosis.

Method: A retrospective chart review of high grade laryngeal neuroendocrine carcinomas at a single institution.

Results: NCL is a rare diagnosis. We performed a retrospective chart review limited to high grade NCL, which includes small and large-cell neuroendocrine carcinomas. A total of 8 patients with high grade NCL were treated at our institution from 1992 to 2014. The median age at time of diagnosis 65.5 years (range, 43 - 80). Five patients were male. Two patients had a known smoking history. Primary tumor location was supraglottic in seven patients and glottic in one patient. Primary treatment consisted of surgery alone (3 patients), radiotherapy alone (1 patient), combination of chemotherapy and radiotherapy (1 patient), and surgery followed by post-operative chemoradiotherapy (3 patients). Locoregional recurrence followed by distant metastasis occurred in four patients. Five patients died of their disease, with average survival of 2.2 years after diagnosis.

Conclusion: High-grade NCL is a rare diagnosis. Compared to well- and moderately-differentiated NCL, high grade NCL’s have a far more aggressive clinical course and associated with a worse prognosis. To our knowledge, this is the largest series of patients with high grade NCL treated at a single institution. Prompt diagnosis and multimodality therapy including elective neck dissection may improve survival.
EXTERNAL BRANCH OF THE SUPERIOR LARYNGEAL NERVE MEDIATED GLOTTIC CLOSING FORCE IN THE PORCINE MODEL

Authors: B. Paskhover¹, D. Folk¹, M. Wadie², C. T. Sasaki¹

Institutions: ¹Yale University School of Medicine, ²Cairo University

Presenter: Boris Paskhover

Objectives: Based upon our Laboratory’s newly confirmed motor pathway for glottic closure, we measured the glottic closing force (GCF) during isolated stimulation of the external branch of the superior laryngeal nerve (eSLN) in the porcine model. Glottic closure is one of the primary mechanisms for prevention of aspiration during deglutition.

Methods: The recurrent laryngeal nerve (RLN) and eSLN were identified bilaterally in four porcine necks. Subsequently, we proceeded to bilaterally stimulate the distal ends of representative nerves in a staged manner using bipolar platinum-iridium electrodes. GCF was measured using a pressure transducer placed anteriorly between the vocal cords with direct visualization and repeated 6 times. The RLN mediated GCF was measured first, followed by isolated eSLN mediated GCF, followed by transection of the RLN and then repeat measurement of the eSLN GCF. Ultimately the cricothyroid (CT) muscle attachment was released as well and the GCF was measured once again.

Results: The measured GCF during isolated eSLN stimulation before and after RLN transection is approximately 89% of the RLN mediated GCF in each animal. The GCF after CT release is approximately 84% of the RLN perceived GCF in each animal. Transection of the RLN did not alter the eSLN observed GCF.

Conclusions: The GCF obtained during isolated eSLN stimulation is adequate for delivery of an appropriate laryngeal protective response and may be considered a target motor nerve for augmenting GCF in selected rehab settings.
A-023

MICROVASCULATURE OF THE SUBGLOTTIC LARYNX - A HUMAN CADAVERIC MICRO-CT STUDY

Authors: J. J. Romak, I. Lalich, J. Kasperbauer

Institution: Mayo Clinic

Presenter: Jonathan Romak

Objective: Knowledge of the anatomy of the subglottic larynx is essential for the understanding and treatment of diseases affecting this region. The microvascular anatomy of the subglottis has not been previously described in the literature. Delineating this anatomy may aid in understanding the pathophysiology of subglottic diseases and will be important for the future application of regenerative medicine and tissue engineering techniques in this area. This study demonstrates the feasibility of micro-CT for vascular studies of the subglottis and documents the unique microanatomy thereof.

Method: Bilateral dissection of fresh frozen human cadaver necks was performed to identify arterial and venous blood supply. The superior thyroid arteries were cannulated and all other vessels were ligated. Microfil radiopaque polymer was then injected. Larynx specimens were then removed and scanned in a micro-CT scanner.

Results: Filling of the subglottic vasculature was achieved via injection and visualized on micro-CT. The primary feeding vessels to the subglottis enter laterally through the cricothyroid membrane and form a submucosal plexus with greatest vessel density laterally and posteriorly.

Conclusion: Micro-CT analysis is a feasible, safe and effective technique for studying the vasculature and microvasculature of the subglottic larynx. Knowledge of the microvascular anatomy of the subglottis is germane to the understanding of disease processes affecting this unique region and their medical and surgical management.
A-024

CELL ORIGIN IN THE MACULA FLAVA OF THE HUMAN NEWBORN VOCAL FOLD

Authors: K. Sato, S. Chitose, T. Kurita, H. Umeno

Institution: Kurume University

Presenter: Kiminori Sato

Objective: There is growing evidence that cells in the maculae flavae are tissue stem cells or progenitor cells of the human vocal fold mucosa, and that the maculae flavae are a stem cell niche. Our electron microscopic investigations indicate that the cells in the human newborn maculae flavae (HNMF) are immature and possess some features of mesenchymal cells. Origin of the cells in the HNMF and the relationship with bone marrow derived cells were investigated.

Method: Three human newborn vocal fold mucosae were investigated. Immunoreactivity to antibodies directed to cytokeratin, desmin, GFAP (Glial fibrillary acidic protein), vimentin, CD34, CD45, collagen type I, telomerase reverse transcriptase and SSEA-3 (stage-specific embryonic antigen-3) was investigated.

Results: The cells in the HNMF expressed hematopoietic markers (CD34, CD45) and collagen type I, which are the major makers for bone marrow derived circulating fibrocyte. The cells in the HNMF expressed epithelium-associated, muscle-associated, neural-associated, and mesenchymal cell-associated proteins, indicating the cells in the HNMF are undifferentiated and express proteins of all three germ layers. The cells in the HNMF expressed SSEA-3 and telomerase reverse transcriptase.

Conclusion: The cells in the HNMF are undifferentiated cells which arise from the differentiation of bone marrow cells. The results of this study are consistent with the hypothesis that the cells in the HNMF are tissue stem cells or progenitor cells of the human vocal fold.
HUMAN AIRFLOW VELOCITY DISTRIBUTION CHANGES FROM THE GLOTTIS THROUGH PHARYNX DURING PHONATION

Authors: H. Kataoka, S. Arii, T. Fukuhara

Institution: Tottori University

Presenter: Hideyuki Kataoka

Objectives: Human voices originate from the vibration of vocal folds in the larynx. In most previous studies on voice generation, a planar sound source was assumed for a laryngeal sound source and the effects of airflow in a larynx were neglected. However, no direct in vivo measurement of human glottal velocity has been reported. Therefore, detailed study of this airflow is necessary to elucidate mechanisms of human phonation.

Methods: In the present study, airflow just above the glottis was experimentally analyzed to clarify the phonation mechanism and seek better modeling of vocal folds. This experiment focused on direct measurement of the airflow velocity by means of a tiny probe and simultaneous observation of vocal fold movement by means of a high-speed digital camera.

Results: Experimental results show that the velocity of the glottal airflow is very high at the front of the glottis as a pulsatile jet and includes the high frequency fluctuation as a turbulent flow. Glottal airflow reveals highest just above the glottis, gradually decreases and fade away in the pharynx.

Conclusions: The airflow velocity in the larynx has high frequency components. Glottal airflow reveals highest just above the glottis. This results provide crucial information to create better simulation models of the phonation mechanism.
PERIOPERATIVE EVENTS IN SURGICAL PATIENTS WITH OSA: RESULTS OF A NATIONAL SURVEY

Authors: M. J. Brenner¹, R. Stachler³, L. Davies⁴, R. Baugh⁵, J. L. Goldman²

Institutions: ¹University of Michigan, ²University Of Louisville, ³Henry Ford Health System, ⁴Dartmouth Medical School, ⁵University of Toledo Medical Center

Presenter: Michael Brenner

Objective: Although the long-term adverse effects of obstructive sleep apnea (OSA) are well known, the impact of OSA on perioperative risk is less clear. This study investigated perioperative events in otolaryngology patients with OSA to identify factors that may influence patients’ perioperative risk.

Method: A 50-question survey was distributed via the AAO-HNS electronic newsletter. Recipients were queried regarding adverse events in surgical patients with known OSA, capturing demographic data, risk factors, and detailed descriptions of events. Events were classified using a hierarchical taxonomy. Results: 389 respondents reported 107 instances of permanent harm, including 58 deaths and 8 anoxic brain injuries. Procedures were 58% general otolaryngology and 25% sleep surgery. Over half of patients were obese or morbidly obese. Of patients who had polysomnography (74% of the total), 56% had severe OSA (AHI>30 for adults and >10 for pediatrics). Events occurred most commonly within 24 hours (46%) or between 1 day and 1 week postoperatively (40%), and 45% of events occurred outside the hospital. Most patients had received some form of narcotic analgesic for pain control, and 10 had known obesity-hypoventilation syndrome. Complicating factors reported included narcosis or impaired respiratory drive, respiratory distress, hypercapnea, pulmonary edema, and bleeding.

Conclusion: This study illustrates the medical complexity that may occur in OSA patients undergoing surgery. An interaction may exist between medication, surgery, and perioperative setting in these patients. Further research is needed to identify optimal pain management and perioperative care practices.
FUNCTIONAL EVALUATION OF TUBED SUPRAGLOTTIC LARYNGOPLASTY IN A HUMAN CADAVERIC MODEL OF PROFOUND OROPHARYNGEAL DYSPHAGIA

Authors: D. J. Cates¹, N. N. Venkatesan¹, T. Siddiqui¹, C. M. Johnson², M. A. Kuhn¹, P. N. Gregory², P. C. Belafsky¹

Institutions: ¹University of California-Davis, ²Georgia Health Sciences University

Presenter: Daniel Cates

Objective: Profound aspiration is a devastating condition with significant morbidity and few treatment options. The purpose of this study is to evaluate the efficacy of tubed supraglottic laryngoplasty (TSL) in the prevention of aspiration utilizing a human cadaveric model of profound oropharyngeal dysphagia.

Method: The head and neck of a human cadaver were secured into lateral fluoroscopic view. Five trials of 20 mL of barium sulfate were delivered into the oropharynx under fluoroscopy to evaluate two different conditions – pre- and post-TSL. Outcome measures were the penetration aspiration scale (PAS) and the NIH swallow safety scale (NIH-SSS).

Results: Reproducibility in each test criterion was perfect (100%). Mean PAS and NIH-SSS improved from 8 (+/- 0.0) and 6 (+/- 0.0) pre-TSL to 1 (+/- 0.0) and 3 (+/- 0.0) post-TSL (p < 0.05), indicating improved swallow safety for both outcome measures.

Conclusion: Tubed supraglottic laryngoplasty significantly improves both PAS and NIH-SSS in a human cadaveric model of profound oropharyngeal dysphagia.
A-028

EFFICACY OF CHIN-DOWN MANEUVER FOLLOWING ESOPHAGECTOMY; QUANTITATIVE ANALYSIS

Authors: Y. Kumai, Y. Kamenosono, K. Matsubara, Y. Samejima, E. Yumoto

Institution: Kumamoto University Graduate School Of Medicine

Presenter: Yoshihiko Kumai

Objective: To quantitatively determine the efficacy of chin-down maneuver following esophagectomy with three-field lymph node dissection (3FL)

Method: Videofluoroscopic (VF) evaluations of 10 patients (mean age, 65.6±6.2y) who received esophagectomy with 3FL from May to August in 2014 were reviewed prospectively. The assessment parameters of VF examination were set as follows: amount of residue in the pyriform sinus (PS) and vallecula after the 1st swallow, pharyngeal constriction ratio (PCR), upper esophageal sphincter (UES) opening diameter (UESD), duration of UES opening (DUES) and laryngeal elevation delay time (LEDT) during the 1st swallow. These parameters were calculated in the VF still images of the lateral view and evaluated by three experienced raters in blinded manner. Inter-rater reliability of each parameter was examined using inter-rater correlation coefficient and each parameter was compared before and after chin-down.

Results: The inter-rater correlation coefficient of each parameter was r=0.63−0.87, (p<0.05), which demonstrated consistency in the evaluation. In comparison with before chin-down, PCR was significantly (p<0.05) smaller and UESD was significantly (p<0.05) larger after chin-down. Moreover, the amount of residue in PS and LEDT were relatively smaller (p=0.09 and p=0.06, respectively) after chin-down. However, the amount of residue in vallecula and DUES were not significantly different before and after chin-down (p=0.58 and p=0.13, respectively).

Conclusion: Chin-down maneuver after esophagectomy with 3FL might help expedite swallowing ability by strengthening pharyngeal constriction, widening the UES and enhancing laryngeal closure.
VECTOR ANALYSIS OF CRICOID CARTILAGE TRACTION STRATEGIES TO IMPROVE SWALLOWING

Authors: M. Ellis, S. Reyes, C. Johnson, G. Postma, W. Pearson

Institution: Georgia Regents University

Presenter: Mark Ellis

Objective: Cricoid cartilage traction addressing narrowing of the pharyngo-esophageal segment (PES) is previously described. Which vector of cricoid traction best facilitates swallowing is undetermined. In this study, multivariate morphometric analysis was used to evaluate swallowing biomechanics during traction of the cricoid.

Methods: This case study involved one HNC patient who developed severe dysphagia following CRT. A traction suture was placed at the cricoid cartilage and swallowing attempts were recorded via MBSS. Coordinates mapping 10 anatomical landmarks were collected from all image frames including 3 sequential swallows from 3 different vector conditions (no traction, anterior traction, and superior traction). Multivariate discriminant function analysis of swallowing coordinates was used to determine biomechanics associated with PES opening. Regression analysis was performed using discriminant function scores of PES opening as the criterion variable and cricoid traction as the predictor variable.

Results: Discriminant function analysis revealed significant differences in shape change in open vs. closed PES (Mahalanobis distance = 2.99, p < .0001) with eigenvectors showing increased laryngeal elevation and hyoid excursion to open the PES. Regression analysis of PES opening and cricoid pull revealed a $r = .41$ with superior traction and $r = .51$ with anterior traction.

Conclusion: In this case study, cricoid traction achieves swallowing shape changes associated with PES opening with the anterior pull being more predictive of PES opening. Multivariate morphometric analysis of MBS imaging provides an objective analysis of the biomechanics of swallowing resulting from surgical intervention and may play a role in patient selection and type of surgery recommended in dysphagic individuals.
ACUPUNCTURE FOR INTRACTABLE ESOPHAGEAL SPASM

Authors: C. G. Tang¹, B. A. Nuyen², M. H. Tang³, A. F. Jahn¹

Institutions: ¹New York Center for Voice and Swallowing Disorders, ²University Of California-San Diego, ³Columbia University

Presenter: Christopher Tang

Objective: To review a case of intractable esophageal spasm treated with acupuncture alone.

Case: A 22 year old Caucasian female presented to the head and neck surgery clinic with a 2 year history of dysphagia. Patient had difficulty swallowing solids and liquids and received an extensive work up including two upper gastrointestinal endoscopies with esophageal biopsies as well as a barium swallow. Biopsy results revealed no evidence of Crohn’s esophagitis or eosinophilic esophagitis on pathologic review, with only mild evidence of gastroesophageal reflux disease. A barium swallow showed diffuse moderate esophageal spasm. The patient was treated by the gastroenterologist with multiple modalities including anti-reflux medication, swallowing therapy, and endoscopic esophageal dilation without any benefit. Although the reflux was controlled, the dysphagia persisted.

Methods: The patient was evaluated by the senior author for diffuse esophageal spasm and treated with acupuncture alone. Acupuncture points included: the points for the esophagus and gastric antrum in the right (dominant) ear, the Shenmen point in the left ear, and Governor Vessel 20 (Dumai 20) on the scalp.

Results: The patient’s symptoms of dysphagia completely resolved within 24 hours. She is able to swallow both solids and liquids normally, without any further intervention. The patient returns to clinic every three months for repeat acupuncture.

Conclusion: Acupuncture may be a viable alternative for select patients who’ve failed conventional treatment for diffuse esophageal spasm.
A-031

INJECTION OF BOTULINUM TOXIN IN THE UPPER OESOPHAGEAL SPHINCTER UNDER ULTRASOUND GUIDANCE

Authors: K. Hammoudi, F. Marmouset, C. Bobillier, F. Patat, S. Moriniere

Institution: CHRU Tours - France

Presenter: Karim Hammoudi

Objective: To evaluate the efficacy of botulinum toxin injection in the UES under ultrasound guidance.

Methods: In this prospective study conducted from May 2012 to May 2013, 6 patients with UES hypertonia (4 who were treated with total laryngectomy for squamous cell carcinoma and 2 with a neurological disease), objectified clinically and by fluoroscopy, were enrolled and treated with botulinium toxin injection under ultrasound guidance. We administered 100 units of BOTOX® diluted in 2 cc of saline to each patient in one injection. Treatment efficacy was evaluated on improving food intake (confirmed by fluoroscopy) and tracheoesophageal voice for laryngectomy patients.

Results: it was objectified in all patients an improvement of food intake, with an increase in volume and consistency of the bolus swallowed. Two patients resumed a liquid diet while they were fed exclusively by gastrostomy, 3 resumed a grinded diet when they had a liquid diet for one and an exclusive enteral diet for the others. A patient has resumed a normal diet. Tracheoesophageal voice was significantly better in patients who underwent total laryngectomy. The treatment efficacy was observed on average 1 week after injection. Its effect was on average 5 months. 5 patients required reinjection.

Conclusion: The use of ultrasonography to control the botulinum toxin injection under local anaesthesia appears to be an effective method. Its simplicity and accessibility make it an attractive alternative to traditional techniques requiring general anaesthesia or performing concurrent electromyography.
FUNCTIONAL ENDOSCOPIC EVALUATION OF SWALLOW WITH SENSORY TESTING (FEESST) AND ITS UTILITY IN DIET ADVANCEMENT IN AN INPATIENT POPULATION

Authors: H. Born², C. M. Ivey¹

Institution: ¹Mount Sinai School Of Medicine, ²Columbia University

Presenter: Hayley Born

Objective: This study aims to evaluate whether the sensory testing (ST) component of functional endoscopic evaluation of swallow with sensory testing (FEESST) assisted in determining diet changes in an inpatient population with dysphagia.

Method: We retrospectively reviewed results of all FEESST examinations performed at a single institution from May 2009 through December 2010. Complete data sets included patient age, admitting diagnosis, tracheotomy status, pre-test diet status, sensory testing results, and post-test diet recommendation. Both descriptive analysis and statistical analysis using chi-square test for independence was performed with significance determined at p< 0.05.

Results: A total of 222 serial examinations were evaluated during the noted time period. Thirty-one (13.96%) exams did not have ST data for evaluation because the patient did not tolerate ST on either side. An additional 3 patients only tolerated ST on one side. 145 examinations displayed abnormal ST, 107 of which were bilateral deficits. Of these abnormal exams, 125 were severely abnormal (ST > 6.0) on at least one side and 20 were moderately abnormal (ST = 4.0-6.0). A change in diet was seen in 162 cases. Patients with abnormal ST were as likely to have a recommended diet advancement as those with normal ST (p= 0.62). Even ST in the severe range for at least one side failed to reach statistical significance (p= 0.12).

Conclusion: These results indicate that ST results in FEESST do not correlate with diet advancement recommendations. Thus, this portion of the test, as currently implemented, may not be clinically useful in an inpatient population.
OFFICE-BASED INJECTION PHARYNGOPLASTY: TECHNIQUE, INDICATIONS, AND INITIAL EXPERIENCE

Authors: P. C. Bryson, W. S. Tierney
Institution: Cleveland Clinic
Presenter: Paul Bryson

Objective: To describe the technique and initial experience with awake, unsedated injection pharyngoplasty.

Method: Case series

Results: Four adult patients with acquired velopharyngeal insufficiency with dysphagia, dysphonia, and nasopharyngeal regurgitation underwent office-based injection pharyngoplasty with calcium hydroxyapatite. Subjective swallowing function and direct nasopharyngoscopy was performed on all patients before and after injection. Objective swallowing function via modified barium swallow was reviewed if possible. Awake, unsedated injection pharyngoplasty was well tolerated in all patients without complication. There was subjective improvement in swallowing, voice and endoscopic improvement in velopharyngeal closure in all patients.

Conclusion: Awake unsedated injection pharyngoplasty is a safe procedure that can provide temporary improvement in voice and swallowing. It may be a reasonable alternative for patients undergoing treatment for other medical/surgical conditions, patients with prior radiation to the skull base, and patients not otherwise able to undergo formal pharyngoplasty techniques.
VALIDATION OF AN OVINE MODEL OF PROFOUND OROPHARYNGEAL DYSPHAGIA

Authors: P. C. Belafsky, D. Cates, T. Siddiqui, N. Venkatesan, C. Johnson, M. Kuhn, G. N. Postma

Institutions: ¹University of California-Davis, ²Georgia Health Sciences University

Presenter: Peter Belafsky

Objective: Profound oropharyngeal dysphagia is associated with a high degree of morbidity and mortality. The development of novel surgical treatments is limited by the absence of an appropriate research model. The purpose of this investigation was to evaluate the validity of an ovine model of profound oropharyngeal dysphagia.

Method: The head and neck of 2 dorper cross ewes and 1 human cadaver was secured to an apparatus in the lateral fluoroscopic view. To evaluate reproducibility of the model, 20cc of barium sulfate was delivered to the oropharynx of each specimen and 5 successive feeding trials were performed. The primary and secondary outcome measures were the penetration aspiration scale (PAS) and the NIH swallow safety scale (NIH-SSS). Intra- and inter-species reproducibility was evaluated. To evaluate criterion-based validity, five 20cc barium trials were administered pre and post laryngohyoid suspension.

Results: The mean PAS and NIH-SSS for both sheep and the human cadaver was 8 (+/- 0.0) and 6 (+/-0.0) respectively. Both intra- and inter-species reproducibility was perfect (100%). The mean PAS and NIH-SSS improved from 8 (+/- 0.0) and 6 (+/-0.0) pre- to 1 (+/- 0.0) and 2 (+/- 0.0) post-laryngohyoid suspension (p < 0.01) indicating excellent criterion-based validity.

Conclusion: The ovine model displayed perfect intra- and inter-species reliability for PAS and NIH-SSS. Criterion-based validity is excellent. The data support the utility of the model for surgical research of profound oropharyngeal dysphagia.
A-035

IMPROVEMENT IN THE REFLUX SYMPTOM INDEX FOLLOWING CRICOPHARYNGEAL MYOTMY, WITH OR WITHOUT ZENKER’S DIVERTICULECTOMY

Authors: N. Jiang, C. K. Sung, E. J. Damrose

Institution: Stanford University

Presenter: Nancy Jiang

Objective: Gastroesophageal reflux likely contributes to the development of cricopharyngeal dysfunction and Zenker’s diverticulum. It is postulated that if the upper esophageal sphincter is weakened by performing a cricopharyngeal myotomy, symptoms of laryngopharyngeal reflux (LPR) may worsen. If this is indeed the case, then it could be hypothesized that patients who undergo endoscopic partial myotomy would have less severe reflux symptoms post-operatively than patients who undergo an open complete myotomy.

Method: A retrospective chart review was performed. Inclusion criteria included all patients who underwent endoscopic or open cricopharyngeal myotomy, with or without Zenker’s diverticulectomy. Patients were excluded if they underwent revision surgery. The preoperative and postoperative reflux symptom index (RSI), voice handicap index (VHI-10), and eating assessment tool scores (EAT-10) were compared.

Results: A total of 30 patients were included in the study. Fourteen patients underwent an endoscopic procedure and 16 patients underwent an open procedure. The average follow up time was 212 days. The overall average pre- and postoperative RSI were 22.1 and 9.0, respectively (p < 0.001). The average pre- and postoperative RSI for the endoscopic group were 21.3 and 8.3, respectively (p < 0.001). The average pre- and postoperative RSI for the open group were 22.8 and 9.6 (p < 0.001). There was no significant difference in VHI-10 scores pre- and post-operatively. The EAT-10 scores were significantly improved in all groups.

Conclusion: Patients’ LPR symptoms significantly improved after cricopharyngeal myotomy. Concern for worsening of reflux symptoms following surgery does not appear to be clinically common.
DEVELOPMENT OF A REFLEX COUGH TEST EQUIPMENT

Authors: K. Fujiwara, T. Fukuhara, K. Kawamoto, H. Kitano
Institution: Tottori University – Japan
Presenter: Kazunori Fujiwara

Objective: The risk factors for aspiration pneumonia include silent aspiration caused by old age, cerebral stroke, and neuromuscular disorder. It has been reported that the reflex cough test is useful in the detection of silent aspiration. However, to assess the risk of aspiration pneumonia, the power of cough as well as the reflex cough test is required.

Method: We developed a new testing equipment that easily and simultaneously measured the time to the cough reflex and power of cough. This equipment comprises a special pipe with double lumen, an ultrasonic nebulizer, an electronic spirometer, and a mouthpiece. We used a 20% solution of prescription-grade L-tartaric acid to initiate the cough reflex. The solution was placed in the ultrasonic nebulizer and inhaled as a microaerosol. Further, subjects were asked to inhale using the mouthpiece. If the cough was induced, peak cough flow was measured using the spirometer.

Results: The average time to cough reflex is 1.0 s in healthy subjects (normal) and 24 s in subjects with a history of aspiration pneumonia for more than two times (abnormal). The average peak cough flow is 4.25 ml/s in normal and 0.37 ml/s in abnormal subjects. The time to cough reflex and peak cough flow showed a significant difference between the two groups.

Conclusion: This equipment can easily and simultaneously measure the cough reflex and power of involuntary cough, and assess the risk of aspiration pneumonia. This is the first system to measure the power of involuntary cough.
EARLY DIAGNOSIS AND MANAGEMENT OF HYPOPHARYNGEAL AND ESOPHAGEAL PERFORATIONS DUE TO CERVICAL SPINE HARDWARE

Authors: M. I. Orestes¹, N. Jamal², V. Nabili¹, K. Blackwell¹, L. Holly¹, D. K. Chhetri¹

Institutions: ¹University of California - Los Angeles, ²Temple University

Presenter: Michael Orestes

Objective: To describe early diagnosis of hypopharyngeal and esophageal perforations from cervical spine hardware using office transnasal esophagoscopy, and to present a multidisciplinary approach to its definitive management.

Methods: Five cases were reviewed; diagnosis and definitive repair were performed by the same multi-disciplinary team including a head and neck surgeon, a reconstructive surgeon and a neurosurgeon. Diagnostic techniques, surgical repair and degree of dysphagia were evaluated. Swallowing outcomes were rated using Functional Outcomes of Swallowing Scale (FOSS).

Results: All of the patients reported severe dysphagia as their main symptom at presentation requiring gastrostomy tube placement. Two had associated vocal fold paralysis. All were diagnosed as having exposed spinal hardware based on office-based trans-nasal esophagoscopy. All patients underwent neck exploration, primary repair of the esophagus, removal of cervical hardware and coverage of the area with a regional advancement flap. Six months after surgery all had improvement in dysphagia following surgery and were able to take all nutrition by mouth. Mean pre- and post-op FOSS scores were 4.8 and 1.6.

Conclusion: A high degree of clinical suspicion for hypopharyngeal and esophageal perforation is required for patients presenting with dysphagia who have cervical spine hardware. Office trans-nasal esophagoscopy allows early diagnosis of perforations prior to development of significant life threatening complications. Early repair, removal of hardware, and coverage with a regional flap is optimal management of the perforation and for return of swallowing function.
A-038

TREATMENT OF DYSPHAGIA SECONDARY TO ISOLATED CRICOPHARYNGEAL BAR: CRICOPHARYNGEAL MUSCLE MYOTOMY VERSUS ENDOSCOPIC ESOPHAGEAL DILATION

Authors: A. P. Marston, J. L. Kasperbauer, K. Ravi, D. C. Ekbom

Institution: Mayo Clinic

Presenter: Alexander Marston

Objective: This study aimed to compare functional swallow outcomes after cricopharyngeal dilation versus surgical myotomy in patients with dysphagia secondary to isolated cricopharyngeal bar.

Method: After obtaining IRB approval, the electronic medical record at a tertiary care medical center was used to retrospectively collect data from January 1, 2000 through December 31, 2013. Patients with a history of head and neck cancer and systemic neurologic diseases were excluded. The Functional Outcome of Swallowing Scale (FOSS) was utilized to assess dysphagia symptoms.

Results: Twenty seven patients underwent a total of 51 esophageal dilations and 20 patients had a cricopharyngeal myotomy. The average pre-procedure FOSS was 1.9 in the dilation group and 2.3 in the myotomy group. Twenty-four of 27 (89%) patients in the dilation group and all patients in the myotomy group reported improved swallow function following the initial intervention. The benefit was not significantly different between the dilation and myotomy patients with both groups reporting an average post-procedure FOSS score of 0.5 (Wilcoxon rank sums test, p<0.1). Twenty-two of 27 dilation (81%) patients had persistent or recurrent dysphagia with 14 (52%) requiring repeat dilation at a mean of 80 weeks. Eight of 20 (40%) patients in the myotomy group had a history of prior dilation. No myotomy patients experienced recurrent dysphagia.

Conclusion: Both endoscopic cricopharyngeal dilation and myotomy led to similar initial improvement in swallow function for patients with cricopharyngeal hypertrophy; however, dilation is more likely to provide temporary benefit with over half of the patients requiring repeat dilation.
NORMAL FLUOROSCOPIC APPEARANCE
STATUS-POST SUCCESSFUL ENDOSCOPIC
ZENKERS DIVERTICULOTOMY

Authors: N. N. Venkatesan, L. M. Evangelista, M. A. Kuhn, P. C. Belafsky

Institution: University of California – Davis

Presenter: Naren Venkatesan

Objective: Endoscopic Zenker’s diverticulotomy (EZD) is a primary treatment for Zenker’s diverticulum (ZD). The interpretation of postoperative videofluoroscopic swallow study (VFSS) may be challenging because the diverticulum is not completely excised. The purpose of this investigation is to describe expected VFSS findings status-post successful EZD.

Method: The charts of ZD patients treated at our center between 10/01/11 and 9/30/14 were abstracted. Included patients underwent EZD and completed pre- and post-operative VFSS. Outcome measures included residual diverticulum size, Eating Assessment Tool-10 (EAT-10), penetration aspiration scale (PAS), pharyngeal constriction ratio (PCR), and pharyngo-esophageal segment (PES) opening.

Results: Twenty patients met inclusion criteria. The mean age was 72 years (± 12.7). Sixty-five percent was male. The mean diverticulum size decreased 47% from 1.9 (± 0.56) to 1.0 cm (± 0.53) [p < 0.001]. The mean EAT-10 decreased from 19.1 (± 8.9) to 7.2 (± 8.5) [p < 0.001]. The PCR improved 33% from 0.17 (± 0.13) to 0.11 (± 0.12) [p < 0.05]. Mean PES opening improved 37% from 0.55 cm (± 0.25) to 0.87 cm (± 0.25) in lateral view and 32% from 0.90 cm (± 0.25) to 1.33 cm (± 0.36) in AP view [p < 0.001]. The pre-operative PAS was 2.25 (± 1.5) compared to a post-operative PAS of 2.1 (± 2.0) [p > 0.05].

Conclusion: VFSS following successful EZD demonstrates reduced diverticulum size, improved pharyngeal contractility, and enhanced PES opening. These novel findings establish a framework to clarify the interpretation of often complex post-EZD fluoroscopic images.
PARKINSONIAN DYSPHAGIA

Authors: N. Mor¹, M. Patel¹, C. Tang¹, A. C. Hambree², A. Blitzer²

Institutions: ¹Roosevelt Hospital, ²Head And Neck Surgical Group

Presenter: Niv Mor

Objective: Parkinson’s disease (PD) is a progressive neurological disorder marked by impaired muscle movement. The leading cause of death amongst PD patients is aspiration pneumonia. We set out to characterize the nature of dysfunctional swallowing in PD.

Method: Charts were reviewed for patients with PD and dysphagia who were assessed by modified barium swallow examination (MBS). MBS were analyzed for features of swallowing (lip seal, oral preparation/propulsion, deglutition, tongue retraction, transit time, pharyngeal initiation, laryngeal elevation; residuals, sensation, penetration/aspiration, compensation, cricopharyngeal opening and bolus movement). Phases of swallowing were graded for dysphagia (0=None, 1=Mild, 2=Mild/Moderate, 3=Moderate, 4=Moderate/Severe, 5=Severe).

Results: Eight PD patients with dysphagia who had an MBS were identified. All patients demonstrated impairment in oral preparation and propulsion, piecemeal deglutition, incomplete tongue retraction as well as an increase in oral and pharyngeal transit time with retained food in the valleculae and pyriform sinus. All but one patient had reduced laryngeal elevation or reduced laryngeal sensation. Three patients had laryngeal penetration/aspiration and none showed protective or compensatory mechanisms. 50% of patients showed dysfunction in esophageal swallowing with either incomplete cricopharyngeal relaxation or delayed esophageal motility. Phases of swallowing were rated as mild/moderate oral dysphagia (mean 1.80); moderate pharyngeal dysphagia (mean 2.60) and mild esophageal dysphagia (mean 0.90).

Conclusion: All three phases of swallowing are affected in PD with the greatest impact seen in pharyngeal phase swallowing. Understanding the mechanism of dysphagia in PD is instrumental in establishing targeted intervention that could lead to fewer complications such as aspiration and asphyxiation.
THE IMPACT OF VOCAL FOLD ASYMMETRY ON DYSPHONIA

Authors: M. V. Morisada, M. S. Benninger, P. C. Bryson

Institution: Cleveland Clinic

Presenter: Megan Morisada

Objectives: The purpose of this study was to characterize specific combinations of vocal fold motion, configuration, and vibration asymmetry and determine their predictive value of vocal dysfunction.

Methods: This is a retrospective chart and video review of 200 new patients presenting to our laryngology clinic from May 2013 until May 2014 who underwent videostroboscopic examination, regardless of chief complaint. Clinician evaluation of dysphonia was determined at the time of visit. Vocal fold symmetry in motion, configuration, and vibration was assessed upon video review.

Results: Of all the combinations of vocal fold motion, configuration, and vibration asymmetries, none strongly predicted voice dysfunction with statistical significance. When comparing proportions of dysphonia among different asymmetry profiles, the highest proportion of dysphonia was observed in patients with all three types of asymmetry (65.8%). However, the second highest proportion of dysphonia was observed in patients with no asymmetry (46.2%). When comparing total number of asymmetries, proportions of dysphonia do not follow a dose-dependent-type response.

Conclusions: While often viewed as a major contributory factor toward vocal disorders, various vocal fold asymmetries are frequently observed and are not the sole determinants of voice dysfunction. Isolated asymmetries and combinations of vocal fold asymmetries do not appear predictive of dysphonia in this patient sample. This highlights the importance of avoiding over-diagnosis or over-emphasis of vocal fold asymmetry. It appears that perceptually normal vocal function can occur in the presence of asymmetrical vocal fold motion, configuration, and mucosal oscillation.
The American Broncho-Esophagological Association

**A-042**

**EFFICACY OF ADDUCTOR SPASMODIC DYSPHONIA BOTULINUM TOXIN INJECTIONS DELIVERED DURING A VALSALVA**

**Authors:** J. Phan¹, S. Halum², P. Wilson¹, I. Castellanos¹

**Institutions:** ¹Indiana University School of Medicine, ²Purdue University, Speech, Language, & Hearing Sciences

**Presenter:** Jennifer Phan

**Objectives:** Despite use of topical/local anesthetic, coughing, swallowing and other laryngeal movements can interfere with the accuracy and resultant effectiveness of botulinum toxin injections for adductor spasmodic dysphonia. We have found that a breath hold (Valsalva) during delivery of Botox therapy in patients with highly sensitive larynges can prevent coughing, swallowing and other laryngeal motions. The goal of this study was to describe this method and compare outcomes with those patients instructed to phonate after needle insertion (conventional technique).

**Methods:** The records of patients who had undergone botulinum toxin therapy for adductor spasmodic dysphonia by a single laryngologist from August 2013 to September 2014 were reviewed. Patient demographics and Voice-Related Quality of Life (V-RQOL) questionnaire scores were analyzed to assess voice outcomes of patients who were administered Botox transcutaneously with the assistance of EMG localization (conventional technique) versus those who received Botox using a modified technique involving a gentle Valsalva.

**Results:** Seventeen patients underwent Botox injection with the Valsalva technique and 19 patients served as controls injected with the conventional technique. All patients reported significant improvement in V-RQOL at peak effectiveness (approximately 1 month post-treatment) regardless of technique (p = 0.000). Overall, there were no significant effects of technique, age, gender, or history of essential tremor on voice outcomes for patients receiving Botox therapy.

**Conclusions:** As the Valsalva technique helps stabilize the larynx and provides outcomes comparable to that of the conventional technique, the Valsalva approach should be considered for patients prone to laryngeal motion (swallowing/coughing) during botulinum toxin injections.
A-043

ISOLATION, CELL CULTURE AND CHARACTERIZATION OF VOCAL FOLD EPITHELIAL CELLS OF RABBITS

Authors: M. Mizuta, C. K. Novaleski, B. Rousseau
Institution: Vanderbilt University School of Medicine
Presenter: Masanobu Mizuta

Objectives: Previous in vivo studies revealed that the vocal fold epithelium undergoes repeated trauma during phonation, leading to disruption of the epithelial structure. This damage may contribute to the development of benign vocal fold pathology (e.g., nodules). However, the characteristics and function of vocal fold epithelial cells remains unclear because of the lack of in vitro experiments. In this study, we isolated and characterized the epithelial cells of rabbit vocal folds to establish an in vitro experimental model.

Methods: New Zealand white breeder rabbit larynges were harvested. The vocal fold epithelium was removed and treated with 0.05% trypsin. The collected cells were cultured with mitomycin C-treated 3T3 cells. After 10-14 days, the cells were transferred to permeable filter inserts. After the cells reached more than 90% confluence, the expression of epithelial markers and tight junction proteins was examined using immunohistochemistry.

Results: During primary culture, more than 50% confluent epithelial cells were achieved within 10-14 days. After passage, colonies without feeder cells were obtained. The expression of epithelial markers Cytokeratin (CK) 13 and CK 14 was confirmed in cells cultured with inserts. The tight junction protein occludin was also positively expressed.

Conclusions: Findings indicate that we successfully isolated and cultured rabbit vocal fold epithelial cells by co-culturing with 3T3 cells. Colonies consisting only of epithelial cells were obtained. These results confirm the establishment of an in vitro model.
COMPARISON OF PRIMARILY PLACED 16 AND 20 FRENCH VOICE PROSTHESES IN TRACHEOESOPHAGEAL VOICE RESTORATION

Authors: M. R. Naunheim\textsuperscript{1,2}, A. K. Remenschneider\textsuperscript{1,2}, G. A. Scangas\textsuperscript{1,2}, G. W. Bunting\textsuperscript{1,2}, D. G. Deschler\textsuperscript{1,2}

Institutions: \textsuperscript{1}Harvard School of Medicine, \textsuperscript{2}Massachusetts Eye And Ear Infirmary

Presenter: Matthew Naunheim

Objectives: Varying sizes of tracheoesophageal voice prostheses (TEVPs) have been used for tracheoesophageal voice restoration (TEVR), but the optimal initial size remains unclear. This study compares outcomes in two commonly used prosthesis diameters [16 vs. 20 French(F)], with regards to prosthesis-associated complications and voice results after primary prosthesis placement.

Methods: All cases of primary placement of 16F and 20F TEVPs at a large academic medical center from 2007 through 2013 were retrospectively reviewed. Prosthesis-related complications (including prosthesis dislodgement, leakage around or through the prosthesis, infection, and formation of granulation tissue) were compared using unpaired t-tests. The frequency of prosthesis change, ability to achieve fluent speech, and time to fluent voicing were similarly compared.

Results: Of 47 patients that underwent TEVR with primary prosthesis placement, 25 received 20F prostheses and 22 received 16F. Postoperative complication rates were similar across groups. When controlled for timing of puncture after laryngectomy, there were no significant differences in prosthesis changes per year (p=0.49), ability to produce fluent speech (p=0.54), or days until fluency (p=0.65). Continued use at the end of the follow up period was similar (p=0.54).

Conclusion: Voice restoration was successfully achieved using both 16 and 20 French prostheses. Prosthesis diameter was not associated with a difference in either prosthesis-related complications or voice outcomes. Therefore, initial primary placement of a smaller diameter prosthesis can be safely and effectively undertaken with potential benefits of smaller physical presence, less trauma to the posterior tracheal wall, and ability to upsize later if necessary.
A-045

CLINICAL TRENDS AND VOCAL FUNCTION OF PRESBYLARYNX; STATUS OF THE MOST ADVANCED AGING COUNTRY, JAPAN

Authors: T. Kono¹, K. Saito¹, K. Uno¹, H. Yabe¹,², A. Yamauchi², T. Nito², K. Ogawa¹

Institutions: ¹Keio University, ²Tokyo University, ³Kawasaki Municipal Ida Hospital

Presenter: Takeyuki Kono

Objective: Urgent management of presbylarynx is being required due to the dramatically increasing elderly population in Japan. The purpose of this study was to assess the clinical characteristics of presbylarynx, including the impact of injection laryngoplasty as a therapeutic modality.

Methods: One hundred and eighty patients were diagnosed as vocal fold atrophy or sulcus vocalis at Keio University Hospital between January 2010 and August 2014. Patients were divided into 2 groups according to their ages (presbylarynx group, P group, ≥65 y.o., n=131; younger group, Y group, >65 y.o., n=49). Furthermore, vocally healthy senile subjects were also incorporated (S group, n=22). Retrospective chart review was performed to clarify risk factors (e.g. smoking, alcohol consumption, BMI, and body weight loss) of this pathology. Both subjective (GRBAS scale, aerodynamics, and acoustics) and objective (VHI and V-RQOL) vocal parameters were examined.

Results: GRBAS scale highlighted the asthenic vocal character in presbylarynx. Our multivariant analysis was unable to define the obvious risk factor of this pathology. Both of subjective and objective parameters showed worse scores in the P group compared with the S group. When compared with the Y group, aerodynamics and objective vocal scores were better in the P group. Although collagen injection laryngoplasty could achieve significant improvements of aerodynamics and objective vocal scores, changes of acoustics were not significant.

Conclusion: Our study clarified subjective and objective vocal characteristics of presbylarynx in the seriously aging country, Japan. Future studies should provide the highly practical preventive and therapeutic options against this increasing pathology.
LONGITUDINAL SCAR LYSIS AND STEROID INJECTION FOR TREATMENT OF VOCAL FOLD SCAR

Authors: W. G. Young¹, M. Hoffman², I. Koszewski², C. Whited², S. Dailey²

Institutions: ¹Proliance Eastside ENT, ²University Of Wisconsin - Madison

Presenter: William Young

Objective: Current surgical interventions for vocal fold scar are characterized by unpredictable outcomes and prolonged recovery times. Goals of surgical management include preserving true vocal fold volume and increasing scar pliability. To accomplish these goals while minimizing formation of new scar, a procedure was developed consisting of mucosal preservation, longitudinal lysis of the underlying scar, and steroid injection.

Method: Retrospective case series of 13 patients undergoing longitudinal lysis and steroid injection for vocal fold scar with analysis of patient-reported, acoustic, aerodynamic, and video-stroboscopic parameters. Complete datasets were not available for all patients; sample size is noted with results. Average follow-up was 38.0±26.4 weeks.

Results: Improvements in Voice Handicap Index (VHI) (59.1±23.1 to 38.4±23.9; n=12; p=0.109), percent jitter (3.03±1.57% to 1.87±0.71%; n=9; p=0.086), and phonation threshold pressure (8.18±0.34 cmH2O to 6.21±2.28 cmH2O; n=5; p=0.112) were observed but did not reach statistical significance. The physical component of the VHI did decrease significantly (25.2±4.8 to 15.0±9.5; n=9; p=0.047). Changes in maximum phonation time, dysphonia severity index, or airflow were not apparent. Subjective improvements in videostroboscopic parameters of glottic closure (4/13 improved), vibratory amplitude (left: 9/13; right: 6/12), and mucosal wave (left: 5/12; right: 4/12) were observed. Subjective worsening was noted in one patient for vibratory amplitude and three patients for mucosal wave.

Conclusion: Longitudinal lysis of vocal fold scar and steroid injection can improve vocal fold vibration in patients with vocal fold scar. Additional studies are required to confirm the preliminary findings observed here with a limited sample.
A-047

IDENTIFICATION OF BONE MARROW-DERIVED MIGRATORY CELLS IN THE NAÏVE AND INJURED VOCAL FOLD

Authors: Y. Kishimoto¹, A. Wei², M. Xiong², Y. Toya³, C. Ling², S. Hirano¹, N. V. Welham²

Institutions: ¹Kyoto University, ²University Of Wisconsin School Of Medicine And Public Health, ³Kumamoto University

Presenter: Yo Kishimoto

Objective: Most work in vocal fold (VF) biology has focused on the role of resident cell populations; however, migrating cells may also be important to VF tissue maintenance and repair. Based on reports in other organs, bone marrow-derived cells can be expected to contribute to VF wound healing; however, the presence of these cells in the VF has not been confirmed. The purpose of this study, therefore, was to evaluate the migration of cells from bone marrow to naïve and injured VFs, using a bone marrow transplantation experimental model.

Method: C57BL/6 recipient mice were treated with 9 Gy total body irradiation (TBI) followed by transplantation of 10 million eGFP-labeled bone marrow cells harvested from transgenic donor mice. Transplantation occurred 24 h post-TBI. Donor cell engraftment was evaluated using flow cytometry analysis of eGFP-expressing cells in peripheral blood. The distribution and immunophenotype of bone marrow-derived cells in naïve, acutely injured, and chronically scarred VFs were investigated using histology and immunohistochemistry.

Results: Donor cell engraftment was confirmed with >80% of circulating peripheral blood cells expressing eGFP. In the naïve VF, bone marrow-derived cells were observed in the immediate subepithelial region; in the injured and scarred VF, bone marrow-derived cells were distributed across the lamina propria. These eGFP+ cells colocalized with a range of repair and regeneration-related immunomarkers, consistent with a variety of cell phenotypes.

Conclusion: Bone marrow-derived cells migrate to the VF mucosa under both naïve and injury conditions, suggesting that they play a role in normal tissue homeostasis and repair.
A-048

CHROMADROITIN SULFATE IN NORMAL AND SCARRED VOCAL FOLDS: A RAT STUDY

Authors: P. Mahattanasakul¹,², I. Tateya², N. Hiwatashi², R. Suzuki², Y. Kawai², Y. Kishimoto², S. Hirano²

Institutions: ¹King Chulalongkorn Memorial Hospital, ²Kyoto University

Presenter: Patnarin Mahattanasakul

Objective: Chondroitin sulfate (CS) is a glycosaminoglycan (GAG) and is known to work in various signal transduction pathways. Recent studies have shown that CS is upregulated in the keloid tissue, and have suggested that CS acts in wound healing by regulating cell adhesion and cell proliferation. We hypothesized that CS may play an important role in the wound healing process of the vocal fold. Expression of CS in the normal and scarred rat vocal folds were examined in this study.

Method: The vocal folds of Sprague-Dawley rats were unilaterally stripped by micro scissors. Rat were sacrificed and larynges were harvested at 1 day, 3 days, 1 week, 1 month and 3 months after stripping. Expression of CS in the vocal fold were examined by immunohistochemistry and quantitative measurement was performed by image analysis.

Results: CS was expressed in both scarred and normal vocal folds. The ratios of area expressing CS was significantly lower in scarred vocal folds than those in normal vocal folds in all time points examined. Expression of CS in 1 day normal and scarred vocal fold

Conclusion: Expression pattern of CS in the scarred vocal fold was different from that in the keloid tissue. The results suggest that wound healing process of the vocal fold is different from that of keloid tissue.
EVALUATION OF VOCAL FOLD MOTION ABNORMALITIES: ARE WE ALL SEEING THE SAME THING?

Authors: L. L. Madden, C. A. Rosen

Institution: University of Pittsburgh School of Medicine

Presenter: Lyndsay Madden

Objective: Flexible laryngoscopy is the principle tool for the evaluation of vocal fold motion. As of yet, no consistent, unified outcome metric has been developed for vocal fold paralysis/immobility research. The goal of this study was to evaluate vocal fold motion assessment (intra- and inter-rater reliability) among general otolaryngologists and fellowship-trained laryngologists.

Design: Prospective Video Perceptual Analysis Study

Method: Flexible laryngoscopic examinations, with sound, of 15 unique patient cases (20 seconds each) were sent to 10 general otolaryngologists and 10 fellowship-trained laryngologists blinded to clinical history. Reviewers were given written definitions of vocal fold mobility and immobility and two video examples of each. The cases included bilateral vocal fold mobility (6), unilateral vocal fold immobility (5), and unilateral vocal fold hypo-mobility of varying degrees (4). Five exams were repeated to determine intra-rater reliability. Participants were asked to judge if there was or was not purposeful motion for each vocal fold (800 tokens in total).

Results: Twenty reviewers (100%) replied. Both general otolaryngologists and fellowship-trained laryngologists had an overall inter-rater reliability of 95%. Difference in inter-rater reliability between the two groups of raters was negligible, 95% for general otolaryngologists and 97.5% for laryngologists. There was no variability in intra-rater reliability within either rater group (99%).

Conclusion: Intra- and inter-rater agreement in determining whether or not the patient had purposeful vocal fold motion on flexible laryngoscopic exam was excellent in both groups. This study demonstrates that otolaryngologists can consistently and accurately judge vocal fold motion.
A-050

PATHOGENETIC MECHANISMS OF LARYNGEAL PAPILLOMATOSIS BASED ON LARYNGEAL EPITHELIAL CHARACTERISTICS

Authors: T. Kurita, S. Chitose, K. Sato, T. Sakazaki, M. Fukahori, S. Sueyoshi, H. Umeno

Institution: Kurume University School Of Medicine

Presenter: Takashi Kurita

Objective: Human papilloma virus (HPV) infects the basal cells of the stratified squamous epithelium through a micro epithelial injury. If the pathogenesis of the laryngeal papillomatosis is the same as that of condyлома-acuminatum at the cervical squamo-columnar junction (cSCJ), laryngeal papillomatosis should develop at the laryngeal squamo-ciliary junction (lSCJ). However, laryngeal papillomatosis often appears at any site on the laryngeal mucosa without stratified squamous epithelium. The purpose of this study is to clarify the pathogenetic mechanisms of the laryngeal papillomatosis based on the characteristics of laryngeal epithelium.

Methods: One newborn and two adults larynges were used. To examine the differences between the lSCJ and sSCJ, the lSCJ was compared with the cSCJ in a surgically removed cervix uteri. The histological differences between newborn and adult laryngeal epithelium distributions were compared, and immunohistochemical stains of p63 as an epithelial stem-cell marker and integrin-α6 as a cell surface HPV receptor were performed.

Results: The morphological characteristics of the lSCJ differed from that of the cSCJ. The lSCJ was present in the supra-glottis of adult larynges but not in newborn larynx. The goblet cells in the pseudostratified ciliated epithelium were found in adult larynges but not in newborn larynx. The basal cells of not only stratified squamous epithelium but also pseudostratified ciliated epithelium expressed p63 and integrin-α6 in both the newborn and adults.

Conclusions: HPV can infect any immature laryngeal epithelium with or without lSCJ. The tumorigenesis can also be caused by squamous metaplasia of pseudostratified ciliated epithelium with the latent HPV infection.
A-051

FIBROBLASTIC FEATURES OF ARYTENOID CARTILAGE CHONDROCYTES IN CULTURE

Authors: Y. Toya, N. Welham

Institution: University of Wisconsin

Presenter: Yutaka Toya

Objectives: We previously presented genetic lineage tracing data suggesting that vitamin A-storing vocal fold stellate cells arise from arytenoid cartilage chondrocytes, as well as data showing that cultured vocal fold stellate cells and fibroblasts hold comparable phenotypes in vitro. The aim of the present experiment was to evaluate the fibroblastic differentiation capacity of arytenoid chondrocytes in an in vitro culture system.

Methods: Canine larynges were used for all experiments. Vocal fold tissues were microdissected and arytenoid hyaline cartilage, elastic cartilage and lamina propria regions were subject to matrix digest, cell recovery and culture. Cells were cultured for 3 passages. Expression of the cartilage marker type II collagen and fibroblast marker type I collagen was evaluated for each cell type and at each passage, using flow cytometry and immunocytochemistry. Canine vocal fold frozen tissue sections were prepared and immunostained for the same markers.

Results: All cell types exhibited fibroblastic morphology and expressed type I collagen at all culture passages. Lamina propria-sourced cells expressed type II collagen during the initial culture period only and lost expression following first passage. Vocal fold lamina propria tissues were positive for type I collagen; arytenoid cartilage tissues were positive for type II collagen.

Conclusions: Vocal fold arytenoid chondrocytes lose type II collagen expression, assume type I collagen expression, and exhibit fibroblastic morphology during passage culture.
A-052

DISTRIBUTION AND CHARACTERISTICS OF SLOW CYCLING CELLS IN RAT VOCAL FOLDS

Authors: Y. Kawai, Y. Kishimoto, R. Suzuki, T. Tsuji, N. Hiwatasi, N. Yamamoto, I. Tateya, S. Hirano

Institution: Kyoto University

Presenter: Yoshitaka Kawai

Objective: Cell therapy is one of the promising treatments for the injured vocal folds (VFs), and the tissue specific stem cells residing in VFs are attracting attentions as a potent cell source. Stem cells are known to proliferate at a slow rate in adult organs, and thus slow cycling cells (SCCs) exhibiting pluripotency are considered to be tissue specific stem cells in some organs. However, SCCs in the VFs are not well documented. Purpose of this study was to clarify the distribution and characteristic of SCCs in rat VFs.

Materials and methods: Exogenous proliferation marker, 5’-bromo-2’-deoxyuridine (BrdU) was intraperitoneally injected to adult SD rats. After a certain period, larynges were harvested and immunostained with BrdU and a second endogenous proliferating marker Ki-67. After confirming the localization of BrdU(+) Ki-67 (+) SCCs, the immunophenotype of them were investigated histologically.

Results: Most SCCs were detected in the basement membrane of the VF epithelium. All SCCs in the basement membrane of epithelium expressed E-cadherin and CK5, while all SCCs in the lamina propria and macra flava didn’t. Vimentin and S100A4 were partially positive in SCCs in the lamina propria and macra flava. The immune signals of CD31, FGFR1, HAS1, HAS2, and HAS3 were not observed in SCCs.

Conclusion: SCCs were observed in both the epithelium and the lamina propria of the VFs, exhibiting various phenotypes. SCCs were thought to contribute to tissue homeostasis in the VFs.
ABCG2 LINEAGE TRACING TO IDENTIFY VOCAL FOLD-SPECIFIC PROGENITOR CELLS IN A MOUSE PROGENY TRACKING MODEL

Authors: A. Wei¹, Y. Kishimoto², Y. Toya², C. Ling¹, N. V. Welham¹

Institutions: ¹University of Wisconsin, ²Kumamoto University, ³Kyoto University

Presenter: Alice Wei

Objective: Tissue-specific progenitor cells can self-renew and differentiate and may contribute to tissue regeneration and repair in the vocal fold. These cells can be identified via their nuclear efflux phenotype, which is conferred by ATP-binding cassette transporters including Abcg2. The purpose of this study was to better characterize Abcg2-expressing progenitor cells in the vocal fold by identifying: (i) possible lineage patterns over time and (ii) regional localization to a micro-anatomic niche.

Method: Using genetic lineage tracing, Abcg2+ cells and their progeny were traced over time in mouse vocal folds. The transgenic model had a DNA rearrangement in the Abcg2 gene, allowing activation of LacZ following tamoxifen-induced Cre-lox recombination. Larynges were harvested 0.5, 1, 3 and 6 months post tamoxifen administration and Abcg2 lineage cells were labeled using X-gal staining. The quantity and location of Abcg2 lineage cells in sub-sites of the epithelium, lamina propria, and thyroarytenoid muscle were recorded and mapped with stereology.

Results: No significant Abcg2 expression was found in the epithelium. In the lamina propria, expression was highest at 0.5 months but increased from 1 to 3 to 6 months. In the thyroarytenoid muscle, expression decreased from 0.5 to 1 month and increased from 1 to 3 months. Similar regions of micro-anatomic localization were observed within the lamina propria across all time points.

Conclusion: Vocal fold Abcg2 lineage cells may exist within micro-anatomic niches, particularly in the lamina propria, and exhibit particular lineage patterns over time.
VIDEO-LARYNGOSCOPY AND VIDEOSTROBOSCOPY: A FEASIBILITY STUDY AND PRELIMINARY FINDINGS

Authors: P. Woo

Institution: Mount Sinai School of Medicine

Presenter: Peak Woo

Objective: 4K-video is a new format. At 3840 x 2160 resolution, it has four times the resolution of 1080 HD-video. This allows laryngologists to magnify the vocal folds without loss of resolution. Combined with videostroboscopy, it may offer added diagnostic detail.

Method: 12 patients were examined by conventional video-stroboscopy (S-VHS) and compared with 4K video-stroboscopy. The video was recorded on a Blackmagic 4K cinema camera in CinemaDNG RAW format. The video was played back on a 4K monitor and compared to standard video. Pathological conditions included: polyps, cysts, cancer, sulcus and nodules. Video-laryngoscopy procedures were performed with continuous and strobe light sources.

Results: Successful 4K-video recordings were achieved in all subjects using a 70 degree rigid endoscope. The system is bulky but similar to standard video-stroboscopy. Playback requires a 4k monitor. As expected, the images were far clearer in detail than standard video. Stroboscopy video using the 4k camera was consistently too dark, thus requiring post recording color grading and rendering. Video recording with standard 150 or 300 watt light showed excellent cinematic detail. No patients had their diagnosis changed.

Conclusion: 4K video is an exciting new technology that can be applied to office laryngoscopy. It allows for cinematic quality of video recording of the larynx. Both continuous and stroboscopic light can be used for visualization. The need for post recording video processing is a distraction. Its clinical utility is feasible but usefulness must be proven. This is the first report of 4K-video application in video-laryngoscopy and videostroboscopy.
Objective: The essential nutrient vitamin A (VA) is a potent regulator of multiple biologic processes. Most systemic VA is stored in hepatic stellate cells and trafficked to extrahepatic target organs (including the larynx) in via retinol-binding protein (RBP). Alternatively, VA can bypass the liver and be trafficked directly to extrahepatic organs by chylomicra. Chylomicron-mediated VA transport can be evaluated via detection of α-retinol, a VA isomer that cannot bind to RBP and therefore cannot be released from hepatic storage. The purpose of this study was to evaluate VA isomer distribution (retinol; retinyl esters; α-retinol; α-retinyl esters) in human vocal fold (VF) mucosa, compared to that of liver and circulating blood.

Method: Larynges, liver biopsies and blood sera were harvested from 6 adult human cadavers (3 male; 3 female; mean age 85.2±13.0 years) within 12 h postmortem and snap-frozen. Bilateral VF mucosae were dissected, and all tissue/serum samples were analyzed using UPLC to determine VA isomer profiles and concentrations.

Results: Total VA and α-retinol concentrations in liver varied widely with certain individuals exhibiting VA deficiency or hypervitaminosis A, whereas retinol concentrations in serum and VF mucosa were held within a relatively narrow range. The VF mucosa exhibited significantly higher concentrations of VA in retinol compared to retinyl ester form (0.349±0.110 nmol/g versus 0.159±0.114 nmol/g, respectively; p<0.05).

Conclusion: The VF mucosa stores VA at a lower concentration than liver. Serum and VF mucosa retinol concentrations are maintained within a narrow physiologic range that does not reflect hepatic storage.
A-056

PREVENTION OF VOCAL FOLD SCARRING WITH LOCAL APPLICATION OF BASIC FIBROBLAST GROWTH FACTOR IN RAT MODEL

Authors: R. Suzuki, S. Hirano, I. Tateya, Y. Kishimoto, Y. Kawai, N. Hiwatashi

Institution: Kyoto University

Presenter: Ryo Suzuki

Objectives: The Vocal fold requires an ideal viscoelasticity for rapid mucosal vibration during phonation. Vocal fold scarring is intractable state with histological alteration of lamina propria. It occurs as a consequence of inflammation or injury. We have shown that local injection of basic fibroblast growth factor (bFGF) has therapeutic potential for vocal fold scarring. The current study aims to clarify the preventive capacity of bFGF against scarring by local application at the same time of vocal fold injuring.

Method: Sprague-Dawley rats (n=20) were anesthetized and bFGF with different concentrations (100ng/10µL, 10ng/10µL, 1ng/10µL, 10µL of PBS only) was injected in the thyroarytenoid muscle, then unilateral vocal fold lamina propria was stripped until the thyroarytenoid muscle was exposed. Histological and immunohistochemical studies were performed 2 months after the procedure.

Results: Histological examination showed that hyaluronic acid was significantly increased and collagen was significantly decreased in bFGF –treated group at 100ng/10µL compared with sham –treated group. Immunohistochemical examination showed that collagen type ? and type ? were significantly decreased in bFGF –treated group at 100ng/10µL as compared with sham –treated group.

Conclusion: The current results suggest that local injection of bFGF at the time of injury has the potential to prevent vocal fold scarring. Preventive injection of bFGF could be applied at phonosurgery to avoid postoperative scar formation.
VOICE OUTCOMES FOLLOWING SURGICAL AUGMENTATION FOR VOCAL FOLD ATROPHY

Authors: V. Young, S. Akbulut, L. Smith\textsuperscript{1}, A. Gillespie, J. Gartner-Schmidt, C. Rosen

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Presenter: VyVy Young

Objective: Results of surgical treatment for vocal fold atrophy have been poorly studied, despite frequent use of these procedures. We report detailed results following vocal fold augmentation in these patients.

Method: Records from 55 vocal fold atrophy patients who underwent 80 augmentation procedures between 2008-2013 were reviewed. VHI-10 scores, phonatory effort (DME), and audio-perceptual evaluation (CAPE-V severity) were analyzed. Successful response to treatment was defined as decrease in VHI-10 $\geq$ 5.

Results: Vocal fold augmentation materials included carboxymethylcellulose (CMC) (n=56), lipoinjection (n=10), Gore-tex medialization laryngoplasty (GML) (n=7) and calcium hydroxyapatite (CaHA) (n=7). Rate of treatment success was 71\% of GML, 70\% of lipoinjection, 51\% of CMC, and 29\% of CaHA. Average change in VHI-10 was $-8\pm8$ in lipoinjection, $-5\pm8$ in CMC, $-4\pm8$ in GML, and $-4\pm14$ in CAHA. CMC injection patients demonstrated statistically significant decrease in VHI-10 ($p=0.000$), DME ($p=0.013$), and severity score ($p=0.003$) following treatment. Lipoinjection patients showed significant decrease in VHI-10 ($p=0.008$) and severity ratings ($p=0.034$). GML patients demonstrated significant decrease in severity score ($p=0.032$). The CaHA group did not demonstrate any significant changes.

Conclusion: This study provides evidence to support the use of surgical augmentation in the treatment of vocal fold atrophy; however, results may be variable and patients should be counseled regarding this possibility. Variability in voice outcome following augmentation may be related to underlying heterogeneity associated with vocal fold atrophy vs. differences in augmentation material. Augmentation using carboxymethylcellulose, autologous fat, and GML appear to result in better outcomes than CaHA.
In-office KTP Ablation of Vocal Fold Polyps: Vocal and Stroboscopic Outcomes

Authors: L. M. Dominguez, C. Law, C. B. Simpson

Institution: University of Texas Health Science Center at San Antonio

Presenter: Laura Dominguez

Objective: The potassium titanyl phosphate (KTP) laser has become a valuable tool in the treatment of benign vocal fold lesions. We report vocal and stroboscopic outcomes in a series of patients undergoing in-office KTP ablation of vocal fold polyps.

Method: A retrospective review was performed of patients who underwent in-office KTP ablation of vocal fold polyps between April 2007 and May 2014. Thirty-one patients were identified and then limited to those who provided pre- and post-treatment VHI-10 scores and had accessible videolaryngostroboscopy imaging in order to assess mucosal wave. Medical records were additionally reviewed for laser settings, resolution of the lesion, and time to complete resolution.

Results: Sixteen patients with adequate follow-up were identified with a mean age of 50.31 years. 81.3% of patients were male. Across all patients, mean VHI-10 score improved from 22.5 pre-treatment to 6.81 post-treatment. On average, patients required 1.44 treatments with laser settings of 24.44 watts, pulse width of 20 milliseconds, and 2.30 pulses per second. The polyp completely resolved in 87.5% of cases with nearly 75% of patients experiencing resolution within 3 months of their last treatment. 62.5% of patients had a return of normal mucosal wave with the remainder of cases demonstrating return of wave but decreased relative to the untreated vocal fold.

Conclusion: In-office KTP ablation is an effective method for addressing vocal fold polyps. Most patients in our series experienced an improvement in VHI-10 scores, return of mucosal wave, and complete resolution of the polyp.
A-059

PROSPECTIVE STUDY OF VOICE OUTCOMES AFTER BALLOON DILATION OF SUBGLOTTIC STENOSIS

Authors: A. T. Hillel¹, S. Karatayli-Ozgursoy¹, K. Teets¹, M. Simpson¹, H. Starmer², S. R. Best¹, L. M. Akst¹

Institution: ¹Johns Hopkins University School Of Medicine, ²Stanford University

Presenter: Alexander Hillel

Objective: To prospectively study changes in voice in adult patients with subglottic stenosis (SGS) undergoing balloon dilation.

Method: Voice-related quality-of-life (V-RQOL), Dyspnea index (DI), acoustic and aerodynamic analysis, and Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V) were compared pre- and post-operatively in SGS patients who underwent balloon dilation.

Results: At the time of abstract submission 10 patients completed pre- and post-operative measures at this time. Average V-RQOL increased from 75 to 86.5 (Not significant, NS). Average DI decreased from 27 to 8 (p=0.0001) CAPE-V overall severity scores decreased from 30.2 to 21.8 (NS). Aerodynamic parameters improved for expiratory volume (2.30 to 3.04, p<0.05), phonation time (9.97 to 11.32, NS), mean expiratory airflow (156 to 161, NS), aerodynamic resistance (110 to 59, NS), mean peak air pressure (9.05 to 8.83, NS). Acoustic parameters did not change.

Conclusion: Following dilation, patients with SGS demonstrate improvement in voice quality of life, perceptual assessment of voice, and aerodynamic measures with no improvement in acoustics. Reasons for improvement after dilation may relate to better breath support and/or better vocal mechanics with more laminar airflow through the subglottis reducing turbulence through the vocal folds.
A-060

A NOVEL APPROACH TO THE CHALLENGING INJECTION LARYNGOPLASTY

Authors: R. M. Mayerhoff, T. K. Meyer

Institution: University of Washington

Presenter: Ross Mayerhoff

Objective: Injection laryngoplasty is typically performed either awake or under general anesthesia with paralysis. There is a subgroup of patients, however, for whom neither of these is a good option. For such patients, we report a hybrid technique that allows for a percutaneous approach with spontaneous ventilation, but also with sedation to increase patient tolerance. Supraglottic airway laryngotracheal intervention (SALTI) brings the benefits of vocal fold injection to a new group of patients previously underserved.

Method: Injection laryngoplasty cases using SALTI technique from July 1, 2013 to September 30, 2014 were reviewed. Data was collected regarding the indication for injection, success of injection, comorbidities, and outcomes.

Results: Sixteen subjects were reviewed. Indication was paresis or paralysis in 13/16, bowing in 2/16, and scar in 1/16. All were successfully injected. Follow up data was available for 13/16 subjects. Twelve of thirteen experienced symptomatic improvement at first follow up.

Conclusion: This study proves the feasibility of the SALTI technique for injection laryngoplasty. The technique is also useful for other procedures, such as steroid injection and dilation. Advantages include lack of paralysis and neck extension, maintenance of spontaneous ventilation, and accommodating difficult neck anatomy. Disadvantages are increased time and cost related to the operating room and anesthesiologist, and also the need for an assistant. In sum, this allows people to benefit from injection laryngoplasty that would not have previously.
POST OPERATIVE OUTCOMES AFTER THE CO2 LASER ARYTENOIDECTOMY IN PATIENTS WITH BILATERAL VOCAL FOLD PARALYSIS

Authors: H. Umeno, S. Chitose, K. Sato

Institution: Kurume University

Presenter: Hirohito Umeno

Objective: CO2 laser arytenoidectomy is an effective surgery for widening the posterior glottis in patients who suffer from dyspnea due to bilateral vocal fold paralysis. Twenty six cases who received CO2 laser arytenoidectomy against bilateral vocal fold paralysis were reviewed. We have experienced during the period from 1984 to 2010. They were 11 male and 15 female and the distribution of age ranged from 6 to 75 years old.

Method: The voice functions (MPT, MFR, F0 range, SPL range, PPQ, APQ, and NNEa) before and after the surgery in 18 cases who received CO2 laser arytenoidectomy are reviewed. And the occurrence rates of postoperative granuloma after the two surgical techniques in 26 cases, submucosal cartilage vaporization and internal posterior glottal mucosa + cartilage vaporization was compared.

Results: After the surgery MPT, F0 range, and SPL range decreased significantly after the surgery. MFR and PPQ increased significantly after the surgery. However, APQ and NNEa did not show statistically change between the pre- and post-operation. The occurrence rate of postoperative laryngeal granuloma for submucosal cartilage vaporization was 24%. However, occurrence rate for mucosa and cartilage vaporization cases was 80%.

Conclusion: The most important point of this surgery is to perform the laser arytenoidectomy submucosally. So that it will be prevent granuloma formation or scar tissue formation after the surgery. CO2 laser arytenoidectomy is an effective surgery for widening the posterior glottis in patients and preserve some voice function.
MINIMAL ACCESS SURGERY EMPLOYING SIALENDOSCOPES TO ADDRESS VOCAL FOLD SCARRING IN A LIVE PORCINE MODEL

Authors: J. H. Woo¹,², H. T. Hoffman¹, S. H. Dailey², S. Thibeault²

Institutions: ¹University of Iowa, ²University Of Wisconsin

Presenter: Seth Dailey

Educational Objectives: At the conclusion of the presentation participants should be able to demonstrate knowledge of how technical surgical advances are being developed to modify the current management of vocal fold scarring.

Objectives: The purpose of this study was to evaluate an external, sterile, image-guided approach to operating in Reinke’s space.

Study Design: Live animal study.

Methods: Vocal folds of 4 female live pigs (9-week-old; 19-24 kg) were scarred during transoral microlaryngoscopy employing biopsy forceps under general anesthesia. Eight weeks later microendoscopy of Reinke’s space was performed under general anesthesia employing sialendoscopes through a sterile external approach with scar lysis and implantation of allogenic porcine adipose tissue derived mesenchymal stem cells mixed with hyaluronic acid hydrogel scaffold. Video documentation of the procedure and follow up examination of the recovering pigs was performed.

Results: Technical considerations developed through previous study of microendoscopy of Reinke’s space permitted successful application in a live animal model to further standardize instrumentation and technique.

Conclusions: Microendoscopy of Reinke’s space through an external approach employing sialendoscopes permits sterile delivery of biologically active material in an operative field addressed through minimal access surgery.
LARYNGOSPASM, CHRONIC COUGH AND PARADOXICAL VOCAL FOLD MOTION: APPROACHING THE DIVERGENT MANIFESTATIONS OF LARYNGEAL DYSFUNCTION

Authors: S. Tan¹, B. K. Crawley¹, A. Zhukovitskaya², L. Sulica², T. Murry²

Institutions: ¹Loma Linda University Medical Center, ²Weill Cornell Medical College

Presenter: Sisi Tian

Objective: Laryngospasm, chronic cough, and paradoxical vocal fold motion (PVFM) are distinct clinical conditions though current literature suggests interrelated clinical profiles and pathologic pathways. We studied initial assessments of patients who were eventually diagnosed with these conditions with the purpose of profiling their complaints and delineating clinical patterns.

Method: The records of 37 patients presenting with choking, shortness of breath, and chronic cough were retrospectively reviewed. Data collected included age, gender, and duration of symptoms prior to presentation at an academic voice center. Initial Voice Handicap Index-10 (VHI-10), Reflux Symptom Index (RSI), Dyspnea Severity Index (DSI) and Cough Severity Index (CSI) data were compiled.

Results: Eleven of fourteen patients (3M;11F) with shortness of breath and reflective DSI scores (avg 23.1) were diagnosed with PVFM. This group had low RSI, CSI and VHI-10 scores. Of 13 patients with chronic cough (4M;9F), 8 were found to have vocal fold paresis, 3 had PVFM and 2 had laryngospasm. DSI scores were distinctly low, while other indices averaged 12-16. This group was the most divergent in initial clinical profile and eventual diagnosis. For patients with choking, RSI scores dominated and 7 of 10 patients (2M;8F) were diagnosed with laryngospasm, while 6 also had muscle tension dysphonia, and 5 had PVFM.

Conclusion: Our results emphasize the overlapping as well as the distinguishing presenting features of laryngospasm, PVFM and chronic cough, implicating possible common pathways with distinct manifestations. These similarities must be considered during diagnosis and treatment planning, and are a target for future study.
MORPHOLOGICAL RECOVERY OF RABBIT VOCAL FOLD EPITHELIUM AFTER ACUTE PHONOTRAUMA

Authors: T. Kojima¹, M. Mizuta², C. V. Valenzuela², C. K. Novaleski², G. C. Garrett², B. Rousseau²

Institutions: ¹Tenri Hospital, ²Vanderbilt University Medical Center

Presenter: Tsuyoshi Kojima

Objective: We previously reported that repetitive trauma during phonation leads to compromise of vocal fold epithelial structure, which adversely affects barrier function. However, it is unknown how acute episodes of phonotrauma affect the recovery of the vocal fold at the ultrastructural level. This study utilized electron microscopy to describe morphological changes in the vocal fold following phonation-induced trauma in an in vivo rabbit model.

Method: 65 New Zealand white breeder rabbits were randomized to normal (n=5), modal intensity (n=30), or raised intensity (n=30) phonation for 120 minutes. Larynges were harvested at 0 hours, 4 hours, 8 hours, 1 day, 3 days, or 7 days following phonation and were compared to normal. Scanning electron microscopy evaluated microprojection structure and transmission electron microscopy assessed the depth of the remaining viable epithelial cell surface layer.

Results: Raised intensity phonation resulted in extensive damage to the vocal fold immediately following phonation. However, the epithelium after raised intensity phonation shared relatively similar recovery patterns with the modal intensity phonation group at approximately 24 hours. Both phonation groups returned to normal between 3 and 7 days.

Conclusion: Results revealed a critical time point between 3 and 7 days in which morphological epithelial damage begins to recover. Because this study examined the wound healing response following biomechanically-induced injury during acute phonotrauma, it may help to direct future research on vocal fold recovery and voice rest.
COMPOUND MOTOR ACTION POTENTIAL QUANTIFIES RECURRENT LARYNGEAL NERVE INNERVATION

Authors: N. Bhatt, A. M. Park, M. T. Al-Lozi, R. C. Paniello

Institution: Washington University

Presenter: Neel Bhatt

Objective: The compound motor action potential (CMAP) is the summated action potential from multiple muscle fibers activated by a single nerve impulse. For small muscles, it essentially represents the activity of the entire muscle. In this study, the utility of laryngeal muscle CMAP for quantifying innervation following recurrent laryngeal nerve (RLN) injury was investigated.

Method: In a series of canines, both RLNs were exposed 5cm inferior to the cricoid and a stimulating electrode placed. Maximum CMAP amplitudes from the thyroarytenoid (TA) muscles were obtained at baseline and at six months following injury to the RLN. Injury mechanisms included crush, stretch, cautery, and complete transection with reanastomosis.

Results: Prior to injury, baseline CMAP amplitudes averaged 22.5 mV. Immediately following injury, the CMAP dropped to zero in all cases. Six months following injury, average maximum CMAP amplitudes were 16.62 mV (73.9% of baseline) for stretch, 15.6 mV for crush (69.3%), 14.75 mV for cautery (65.6%), and 8.58 mV for transection/repair (38.1%) injuries. These values were approximately correlated with evoked measures of muscle strength, and with histologically determined axon counts.

Conclusion: The CMAP is an accurate measure of RLN innervation of the TA muscle. It may offer advantages over other measures in certain types of laryngeal experiments, which are discussed. The technique could be further developed for clinical applications as well.
AERODIGESTIVE MANOMETRIC AND LARYNGEAL ELECTROMYOGRAPHIC DIFFERENCES: BETWEEN PRESSED AND HEALTHY PHONATION: AN INVESTIGATION INTO MUSCLE TENSION DYSPHONIA

Authors: J. L. Gartner-Schmidt, Ph.D.

Institution: University Of Pittsburgh

Presenter: Jackie Gartner-Schmidt

Objective: Little is known regarding the activation of intrinsic laryngeal muscles and thoracic pressure changes during different types of phonation (pressed versus healthy phonation) despite the high prevalence of muscle tension dysphonia. We performed high-resolution esophageal manometry (HRM) and bipolar hook-wire laryngeal electromyography (LEMG) to characterize pressure and muscle activation patterns during these phonatory modes.

Method: HRM and LEMG were performed during two trials of all-voiced sentences which were repeated in triplicate using pressed and healthy phonation. Pressures (mmHg) from the upper esophageal segment (UES), esophageal body (intrathoracic), lower esophageal segment (LES) and abdomen, as well as muscle activation of the cricopharyngeus, laryngeal adductors and abductors were recorded. Respiratory kinematics, flexible laryngoscopy and voice samples were obtained simultaneously.

Results: Laryngoscopic and audio-perceptual analysis confirmed pressed or healthy phonation. HRM demonstrated higher pressures during pressed compared to healthy phonation in the intrabdominal (89.2 +/- 0.1 vs. 15.3 +/- 1.1 mmHg), LES (18.7 +/- 4.2 vs. 12.4 +/- 3.5 mmHg) and intrathoracic (6.2 +/- 1.2 vs. 3.4 +/- 1.1 mmHg) regions. UES pressures were lower during pressed as compared to healthy phonation (71.3 +/- 5.4 vs. 82.4 +/- 8.1 mmHg). LEMG revealed increased cricothyroid and cricopharyngeus muscle activation during the two phonatory modes (pressed vs. healthy). There was no change in thyroarytenoid-lateral cricoarytenoid complex or posterior cricoarytenoid muscle activation between the two phonatory modes.

Conclusion: Results from this investigation contradict the literature that characterizes pressed phonation as principally involving intrinsic laryngeal muscular involvement, and underscores the relationship between respiration (thorax) and phonation (larynx).
A FUNCTIONAL EVALUATION OF LARYNGOHYOID SUSPENSION AND CRICOPHARYNGEAL MYOTOMY IN AN OVINE MODEL OF PROFOUND OROPHARYNGEAL DYSPHAGIA

Authors: C. M. Johnson, MD\textsuperscript{1}, N. Venkatesan\textsuperscript{2}, M. Siddiqui\textsuperscript{2}, D. Cates\textsuperscript{2}, M. Kuhn\textsuperscript{2}, G. Postma\textsuperscript{1}, P. Belafsky\textsuperscript{2}

Institutions: Georgia Regents University\textsuperscript{1}, University of California-Davis\textsuperscript{2}

Presenter: Christopher Johnson

Objective: Profound aspiration is a devastating condition with few treatment options. The objective of this investigation is to evaluate the efficacy of laryngohyoid suspension (LHS) with and without cricopharyngeal myotomy (CPM) in the prevention of aspiration utilizing an ovine model of profound oropharyngeal dysphagia.

Methods: The head and neck of a dorper cross ewe was placed in the lateral fluoroscopic view. Five conditions were tested: baseline, thyroid cartilage to hyoid approximation (THA), thyroid cartilage to hyoid to mandible (laryngohyoid) suspension (LHS), laryngohyoid suspension with cricopharyngeal myotomy (LHS-CPM) and cricopharyngeal myotomy (CPM) alone. Five trials of 20cc of barium sulfate were delivered into the oropharynx under fluoroscopy for each test condition. Outcome measures included the penetration aspiration scale (PAS) and the NIH swallow safety scale (NIH-SSS).

Results: Baseline PAS and NIH-SSS scores were 8(+/-0) and 6(+/-0) respectively. THA scores were not significantly reduced from baseline [PAS 8(+/-2.2), p=0.317; and NIH-SSS 6(+/-0.4), p=0.317]. LHS alone reduced the PAS to 1(+/- 0) [p=0.025] and NIH-SSS to 2(+/- 0) [p=0.025]. LHS with CPM reduced the PAS to 1(+/- 0) [p=0.025] and NIH-SSS to 0(+/- 0) [p=0.025]. CPM alone did not significantly reduce the PAS [8(+/- 0), p=1.00] or the NIH-SSS [6(+/- 0.4), p=0.317]. LHS with CPM displayed a significantly better NIH-SSS score than LHS alone (p=0.003).

Conclusion: Laryngohyoid suspension significantly improves both PAS and NIH-SSS in an ovine model of profound oropharyngeal dysphagia. Laryngohyoid suspension combined with cricopharyngeal myotomy provides significant benefit over laryngohyoid suspension alone.
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Dr. Harvey M. Tucker (1980)
Dr. John A. Tucker (1970)
Dr. Donald P. Vrabec (1978)
Dr. Duncan D. Walker, Jr. (2000)
Dr. Louis W. Welsh (1977)
Dr. John R. Williams (1965)
Dr. M. Lee Williams (1965)
Dr. Eiji Yanagisawa (1979)
Dr. Charles T. Yarling, Jr. (1970)
Dr. Anthony J. Yonkers (1973)
ABEA Membership Information

Do we have your correct information?

Please update your information, tear the sheet out and leave at the ABEA Registration desk before 11:00 am on Thursday, April 23, 2015.

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Future Meeting Dates

AAO-HNSF ANNUAL MEETING & OTO EXPO
SEPTEMBER 27-30, 2015
DALLAS, TEXAS

COSM 2016
MAY 18-22, 2016
HYATT REGENCY CHICAGO
CHICAGO, ILLINOIS

COSM 2017
APRIL 26-30, 2017
MANCHESTER GRAND HYATT
SAN DIEGO, CALIFORNIA

COSM 2018
APRIL 18-22, 2018
Gaylord National Resort and Convention Center
NATIONAL HARBOR, MARYLAND

COSM 2019
MAY 1-5, 2019
JW MARRIOTT AUSTIN
AUSTIN, TEXAS