

THE UNIVERSITY OF VIRGINIA
DEPARTMENT OF OTOLARYNGOLOGY – HEAD & NECK SURGERY
PRESENTS

THE 43RD ANNUAL FITZ-HUGH SYMPOSIUM

RESIDENT RESEARCH PRESENTATIONS

Friday June 21, 2019 at 8:30 am

Riggs Auditorium

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RESIDENT RESEARCH ABSTRACTS

Pre-operative management of spontaneous CSF rhinorrhea with acetazolamide

Heather Koehn MD; Ashwini Talik, MD; Jose Mattos MD MPH; Spencer Payne MD

Objective: To provide data associated with resolution of spontaneous CSF leaks of the anterior skull base when treated pre-operatively with acetazolamide.

Methods: A retrospective review of patients treated for anterior spontaneous CSF leaks by a single surgeon over a 6-year period where acetazolamide therapy (250 mg twice daily) was employed before considering surgical repair. The primary endpoint was whether the patient went on to require surgical repair.

Results: 16 patients were identified who were pre-treated with acetazolamide. Leak sites were noted as cribriform (5/16), sphenoid (8/16), ethmoid (1/16), multiple (1/16), and indeterminate (1/16). Five patients had resolution of their rhinorrhea without surgery (31.3%). Mean follow up for these nonsurgical patients was 470 days (range 64 – 857). There were no differences in the patients' age or site of leak between surgical and nonsurgical patients ($p = 0.65$, $p = 0.52$, respectively). Nonsurgical patients had a lower BMI than surgical patients, $p = 0.04$.

Conclusion: Pre-operative acetazolamide enabled surgery to be avoided in 31.3% of patients in this study. In the absence of other contraindications for delaying repair, a trial of acetazolamide therapy could be considered as an initial option in the management of isolated spontaneous CSF rhinorrhea.

Investigating the role of pattern recognition receptors in acquired sensorineural hearing loss

Garrett Casale MD; Jung-Bum Shin PhD

Objective: To investigate a possible link between two predominantly inflammatory, non-apoptotic cell death pathways in the development of acquired sensorineural hearing loss.

Design: Animal research study

Methods: Adult mice with knockout mutations for AIM2 (absent in melanoma 2) and STING (stimulator of interferon genes), two proteins known to play a critical role in mechanistically separate, predominantly inflammatory pathways of cell death, were acquired and bred. Wild-type mice of the same strain (B16) and age were used as controls. Baseline hearing thresholds were obtained via sedated ABR. The mutant and WT mice were exposed to otodestructive stimuli: (1) broadband noise at 120 dB for 2 hours; (2) kanamycin 600 mg/kg BID x17 days; and (3) furosemide 200 mg/kg followed by cisplatin 1 mg/kg daily x3 days. Post-exposure ABR data was obtained as a primary endpoint with hair cell counts used as a secondary endpoint.

Results: There was no statistically significant difference in post-exposure ABR thresholds between STING KO and WT mice in response to noise exposure. The AIM2 KO mice performed slightly better on post-exposure testing than WT or STING KO mice after exposure to kanamycin ($p < 0.001$). Both STING KO and AIM2 mice performed significantly better on post-exposure testing relative to WT mice after exposure to cisplatin.

Conclusions: AIM2 KO mice and STING KO mice exhibit a significant otoprotective phenotype in response to cisplatin. This implicates the role of two mechanistically separate, predominantly inflammatory cell death pathways in the development of acquired sensorineural hearing loss.

Deep margin status on early-stage melanoma biopsy specimens

Delaney Carpenter MD; Nathan Wakefield MS2; Katherine Fedder MD; David Shonka MD; Mark Jameson MD PhD

Objectives: To determine if an “at least” depth (i.e. positive deep margin) on early-stage melanoma biopsy specimens carries meaning with regards to final pathology characteristics and recommendation for sentinel lymph node biopsy (SLNB).

Study design: Retrospective chart review

Methods: A chart review was performed of all patients who underwent surgery for early-stage (T1-T2, N0, M0) melanoma from January 2015 through April 2019. Patients with recurrent melanoma were excluded.

Results: Data from 153 patients were examined. For biopsy specimens with a positive deep margin, 22% were found to have a final depth of invasion (DOI) deeper than that reported on the biopsy compared to 9% for biopsies with negative deep margin ($p=0.043$, OR 2.9). 12% of biopsy specimens with a positive deep margin and 6% of those with a negative deep margin were upstaged based on final pathology ($p=0.26$).

Conclusions: Patients with early-stage melanoma that has an “at least” depth on biopsy have a nearly 3-fold higher likelihood of having a deeper lesion on final pathology than those patients with a clear deep margin on biopsy. However, it remains unlikely that melanomas with a positive deep margin on biopsy will be upstaged on final pathology. Thus, this study does not support performing a presumptive SLNB for lesions that do not exceed minimal DOI criteria on biopsy despite a positive deep margin.

Three-dimensional airflow modeling of glottic incompetence

Reed Gilbow MD; Junshi Wang MS; Pat Wongwiset; James Daniero MD; Haibo Dong PhD

Objective: Three-dimensional modeling of the human larynx has been an intense area of study over the past 20 years, but most of the publications to date have been based in the engineering literature with little advancement in clinical application. Additionally, previous models have been computationally-derived from imaging studies with none based on phonation studies. Our study focuses on this deficiency.

Methods: We obtained two human larynges, one of a young healthy male and one an elderly female, from the United Tissue Network. Micro-computed tomography (Micro-CT) images were obtained using a Trimodal (PET/SPECT/CT) Bruker Albira Si scanner. The larynges were then phonated in the laboratory with 8L/min of humidified and warmed O₂. Images from a supraglottic and infraglottic view were obtained of phonation using a high speed camera at 4000 frames per second. The Micro-CT images were processed using 3D-Slicer and AutoDesk Maya™ to create a functional model of the larynges. Then, the high speed images were used to animate the larynges in Maya. Using the known flow rate, the animated model was used to solve the interaction between the flow and the vocal folds. An in-house, validated program using the immersed boundary method was utilized to achieve this task. Adaptive mesh refinement was applied along the vocal fold boundary to achieve a more refined solution while drastically saving computing time, a novel approach in the laryngeal aerodynamics.

Results: Vortex structures, pressure, and vorticity were the solved outputs.

Conclusion: These experiments represent a proof-of-concept as the the first time that flow modeling of the human larynx has been achieved using empirically derived data and represents an advancement in the practical application of laryngeal modeling.

Do postoperative antibiotics affect outcomes in Mohs reconstructive surgery?

Matthew Miller MD; Jacqueline Stevens PhD; Stephen Park MD; Jared Christophel MD MPH

Objective: The prescribing of postoperative antibiotics for patients undergoing Mohs reconstructive surgery has increased the last decade and there is no definitive guideline for when antibiotics should be prescribed to decrease the risk of infection. At the same time, antibiotic resistance and antibiotic-associated infections are significant issues affecting health care in the United States and worldwide. We hypothesize that routine prescribing of postoperative antibiotics after Mohs reconstruction does not decrease the risk of surgical site infection.

Design, Setting, and Participants: This retrospective, single-institution cohort study assessed patients who underwent Mohs reconstructive surgery from January 1, 2012, to January 29, 2019. No patients had to be excluded for inadequate follow-up or incomplete medical records.

Main Outcomes and Measures: Postoperative surgical site infections and other complications including partial or full flap/graft necrosis, hematoma, and dehiscence.

Results: A total of 900 defects in 800 patients (mean age [range] 65.33 [21-96], 54.60% female) were identified over the 5-year period. Patient-specific variables reviewed included comorbidities, age, smoking status, and use of anticoagulant or antiplatelet medications. Surgery-specific variables analyzed included location and size of defect, time interval between MMS and reconstruction, reconstructive modalities, and use of postoperative antibiotics. All patients received peri-incisional antibiotics. Single-variable analysis was performed to determine whether each variable was associated with postoperative infections. Use of a cartilage graft (OR 6.53; 95% CI 2.07-20.57; P=.001) and current smoking status (OR 6.67, 95% CI 2.09-21.30, P=.001) were the only two variables associated with an increased risk of postoperative infections. Use of perioperative antibiotics was not associated with a decreased risk of infection (OR 1.82; 95% CI 0.23-14.21; P=0.568).

Conclusions: We found no association between postoperative infections after Mohs reconstructive surgery and the use of postoperative antibiotics. In our review, smoking and the use of a cartilage graft did increase the risk of infection. Our findings suggest that postoperative antibiotics may only be necessary for select patients after Mohs reconstructive surgery. Further work will study this issue in randomized prospective fashion.

Change in PTH from baseline predicts postoperative hypocalcemia following total or completion thyroidectomy

Caitlin Iorio MD; William Swift MS2; Nolan Wages; Indika Mallawaarachchi; David Shonka MD

Introduction: Previous studies have evaluated various methods of predicting postoperative hypocalcemia following thyroid surgery. Many of these studies evaluated specific methods in isolation and/or include multiple institutions/surgeons and calcium supplementation regimens, thereby allowing confounding by surgical technique and/or institution-associated protocols.

Methods: This was a single-institution, single-surgeon, retrospective case series of consecutive patients who underwent total or completion thyroidectomy without postoperative calcium supplementation. Perioperative data were collected including PTH and calcium levels at various time intervals.

Results: 124 patients were included. 24% of patients developed temporary hypocalcemia (Ca < 8.5 mg/dL) which is within the reported median incidence (19-38%). 10.5% met the American Thyroid Association's criteria for increased risk of postoperative hypocalcemia. The majority of the subjects were female, younger than 55 years, and white. When PTH levels decrease from baseline by 10 units or more at 30 mins, 6 hours, and 18 hours post-excision, the risk of developing temporary hypocalcemia increases by 16%, 22%, and 20% respectively. There was not a significant difference between time points for predicting hypocalcemia. No other variables (BMI, Vitamin D levels, parathyroid glands identified intraoperatively, extent of surgery, thyroid pathology, etc.) were found to be significantly associated with increased risk of temporary hypocalcemia.

Conclusion: If PTH levels decrease from baseline by 10 units or more at 30 minutes, 6 hours, or 18 hours post-excision, the odds of developing temporary hypocalcemia significantly increase. No particular postoperative time point for obtaining PTH measurements was statistically superior at predicting hypocalcemia.

Association between olfactory and gustatory dysfunction and cognition in older adults

Ian Churnin MD; Jamiluddin Qazi BS; Cyrelle Fermin BS; James Wilson BS; Spencer Payne MD; Jose Mattos MD MPH

Objective: Determine whether olfactory dysfunction (OD) and gustatory dysfunction (GD) are independently associated with cognitive impairment.

Design: Survey

Setting: 2013-2014 National Health and Nutrition Examination Survey (NHANES)

Other Participants: 2013-2014 NHANES that examines a nationally representative sample of 5,000 persons amongst 15 counties each year was queried for 1,376 older adults (>65 years old) representing a weighted population of 50,816,529 older adult participants.

Interventions: Survey assessed objective olfaction using the Pocket Smell Test (PST), gustation using whole-mouth bitter and salt tastant protocol, and cognitive status using the Consortium to Establish a Registry for Alzheimer's Disease (CERAD) neuropsychological test, Animal Fluency Test (AFT), and Digit Symbol Subtraction Test (DSST).

Main Outcome Measures: Olfaction: OD, hyposmia, anosmia. Gustation: 0.32 NaCl GD, 1 mM GD, 1mM quinine (bitter) GD. Cognition: abnormal AFT, abnormal DSST, CERAD-mild cognitive impairment (MCI), CERAD-dementia.

Results: OD was associated with MCI (OR 1.809, $p = 0.004$) and dementia (OR 3.173, $p < 0.001$) with CERAD testing, abnormal AFT (OR 2.424, $p < 0.001$), and abnormal DSST (OR 4.028, $p < 0.001$). GD based on 1 M NaCl whole mouth taste testing was associated with dementia on CERAD testing (OR 2.217, $p = 0.004$). When smell and taste parameters were included together in the regression model, both OD and GD remained significant independent predictors of dementia status based on CERAD testing (OR 3.133, $p < 0.001$, OR 1.904, $p = 0.015$).

Conclusions: OD and severe GD represent independent predictors of cognitive impairment in a nationally representative sample of older adults.

Effect of unilateral cordotomy on perception of dysphagia

Margeaux Corby MD; Matthew Clary MD; James Daniero MD

Objectives: While CO₂ laser cordotomy is an accepted method to manage long term bilateral vocal fold immobility, it is thought to increase the risk of aspiration. The objective of this retrospective review was to investigate swallowing function after cordotomy using a validated dysphagia symptom specific survey.

Study Design: Multicenter retrospective cohort study

Methods: Retrospective review was performed on patients having undergone unilateral CO₂ laser cordotomy at the University of Colorado and University of Virginia with complete pre and post-operative Eating Assessment Tool (EAT-10) questionnaire data available. Demographic data, including patient age at time of diagnosis, gender, ethnicity, and medical and surgical history, was collected. Descriptive statistics (medians, ranges, interquartile ranges) were calculated for EAT-10 scores.

Results: Eleven patients who underwent primary unilateral cordotomy were available for analysis. The median EAT-10 score during the visit prior to surgery was 6 (range=0-18; IQR 0-14) whereas the post-surgery median score was 2 (range=0-20; IQR 0-15). Furthermore, the median of difference between pre-operative and post-operative EAT-10 scores was not statistically significant ($p=0.76$).

Conclusions: CO₂ laser cordotomy does not appear to contribute to patient reported dysphagia despite creating glottic incompetence. This suggests vocal fold apposition may play a less significant role in normal swallowing function than widely believed.

2015 ATA Guidelines and TSH suppression after thyroid lobectomy

Robert Reed MD; Teresa Martz MD; Kaitlin Kavanagh BS; Katherine Fedder MD; Mark Jameson MD PhD; David Shonka MD

Objective: The 2015 American Thyroid Association (ATA) Guidelines established guidelines for more conservative treatment in low-risk well-differentiated thyroid cancer (WDTC), recommending that lobectomy alone is typically sufficient. For these patients, the guidelines also recommend post-operative TSH suppression to 0.5-2 mU/L. In this study, we examined what percentage of patients would theoretically meet criteria for TSH suppression with levothyroxine after thyroid lobectomy for WDTC.

Design: Retrospective chart review of patients that underwent thyroid lobectomy between 2010-2017 for any cause. Head and neck cancer patients and patients that underwent completion thyroidectomies were excluded. Pre- and post-operative TSH numbers and the number of patients prescribed levothyroxine pre- and post-operatively were collected for analysis.

Setting: Patients that underwent thyroid lobectomy in a tertiary care, academic setting.

Main Outcome Measure: Percentage of patients with a TSH level >2 at 6 weeks and 1 year after thyroid lobectomy.

Results: Final patient cohort was 141 patients. 42 patients (36%) were prescribed levothyroxine post-operatively and 64% of patients did not require levothyroxine post-operatively. At 6 weeks post-operatively, 66% (93) had a TSH value of >2; by 6-12 months after surgery, this increased to 77% (108) of patients having a TSH value >2.

Conclusion: Our analysis indicates that to stay in accord with the 2015 ATA Guidelines regarding TSH suppression for WDTC patients treated with lobectomy, the need for post-operative thyroid hormone supplementation is likely much higher than oft quoted probabilities of 15-30%. At one year, our study suggests that 77% of patients would require post-operative suppressive therapy.

Efficiency of otolaryngology scheduling and utilization of the OPSC

Justin Hyde MD; Jared Christophel MD MPH

Objective: Operating room time is a finite resource shared among users with an abundance of cases. OR utilization remains a crucial factor in scheduling cases in an appropriate amount of time, cost efficiency, and ultimately maintaining a surgical practice. I hypothesize that there is a statistically significant difference in overposted cases versus actual OR time, allowing for improvement in OR utilization and additional revenue.

Design: The Slicer-Dicer program within EPIC was used to sort and identify the most frequently over and underposted cases by CPT code at the Outpatient Surgery Center (OPSC), relative their original posted times. This encompassed the top 85% of all otolaryngology cases over a 2-year period amongst 5 surgeons. Statistical analysis was performed with Wilcoxon signed-rank testing. The second-party reimbursement rates for statistically significant overposted cases were then used to determine revenue potential.

Results: The top utilizers of the OPSC were Drs. Christophel, Park, Payne, Daniero, and Kesser. Their top CPT codes for cases that were over or underposted were all statistically significant with p-values of <0.05. The average time of overposted cases for Drs. Christophel and Park were 34 and 37 minutes respectively, potentially generating \$15,628 and \$17,445 annually. The remaining providers did not have a significant number of overposted cases.

Conclusions: Slicer Dicer is a useful tool for identifying procedures that are inaccurately posted, allowing one to maximize OR utilization, and pinpoint sources of additional revenue. Additionally, trends in underposted cases can then be used to help in future postings.

Development of a high-fidelity laryngeal model to evaluate intubation-related laryngeal injury

Stephen Schoeff MD; Teresa Martz MD; Ethan Handler BS; Christina Stiebris BS; Michael Padmanabhan BS; John Hossack PhD; Kellen Schallert MD; Dan Quinn PhD; James Daniero MD

Objectives:

1. Create a reproducible laryngeal model for evaluation of endotracheal tube induced injury of the glottis.
2. Describe pressure variation among endotracheal tubes in their interaction with the larynx.

Design: High-fidelity 3D-printed models of the larynx were developed using micro-CT laryngeal imaging, epoxy molding, and a 3D scanner in addition to Instron tensile strength measurements of fresh cadaver tissue. Using adhesive piezo-electric sensors, we objectively measured pressure points within the endolarynx secondary to endotracheal tube position in cadaver and model larynges. Multiple sizes and types of endotracheal tubes were tested.

Subjects: Two cadaver larynges were tested in addition to six 3D-printed models

Results: A Young's modulus for the tensile strength of cricoid mucosa was calculated as 0.426 MPa. It is possible to produce a usable model of the endolarynx for the purposes of testing surface interactions. It is additionally possible to measure the pressure relationship of an endotracheal tube with the larynx, with an average pressure exerted of 461.2 mmHg.

Conclusion: A high-fidelity model for endolaryngeal injury can be created and reproduced with 3D printing. This has multiple applications in the study of laryngeal injury from long term intubation in addition to other applications. We identified pressure points secondary to endotracheal intubation and related to endotracheal tube size and design. These provide a target for modification of endotracheal tube makeup and positioning to decrease the posterior glottic injury from long-term endotracheal intubation.

Nose goes: Do eyeglasses wearers have an increased risk of cutaneous malignancies of the nose?

Harrison Bartels MD; Timothy Makkar BS; Jared Christophel MD MPH

Background: Excess exposure to UV rays is a known risk factor for both basal and squamous cell carcinomas. The majority of prescription lenses provide protection against both UVA and UVB rays. While research indicates that sunlight can reflect off of the posterior surface of sunglasses into the eye, no literature is available on reflection of UV rays onto the face from corrective lenses. We hypothesize that reflection of UV rays onto the nose in people who regularly wear corrective lenses puts them at an increased risk of squamous and basal cell carcinoma of the nose relative to those who do not wear corrective lenses.

Setting: Tertiary Care University Hospital

Methods: A retrospective analysis was performed on patients who underwent reconstruction of Mohs defects over a two year period at the University of Virginia. The rate of nasal and non-nasal cutaneous malignancies were compared between patients who do and do not regularly wear corrective lenses. Chi squared analysis was performed to compare the two cohorts.

Results: 256 patients underwent reconstruction of Mohs defects over this period, of whom 154 had data to confirm their corrective lens status. There was no significant difference in the rate of nasal malignancies compared to other facial malignancies between the two groups.

Conclusions: There is a theoretical increase in the nasal exposure to UV rays reflected off of clear lens glasses. Our hypothesis that this theoretical increase in UV exposure was not supported by our data which showed no notable difference in the rate of nasal cancers versus other facial cutaneous malignancies between glasses wearers and non-wearers. Multiple confounding factors limit the ability to generalize these data, namely the lack of clarifying data on frequency and length of glasses wearing as well as use of other corrective eyewear including prescription sunglasses and contact lenses. Additional research should be done comparing the facial UV exposure from eyeglasses.