



Otolaryngology - Head & Neck Surgery
UNIVERSITY OF TORONTO

**The 29th Annual
PERCY IRELAND ACADEMIC DAY
May 7-8, 2021**

**The Percy Ireland Oration
on Friday May 7, 2021**

by

Professor John Yoo, MD, FRCSC, FACS

Dean, Schulich School of Medicine & Dentistry
Western University

*“Mentorship, Menteeship and
Committing to a Career in Surgery”*

and

Our Guest of Honour

Professor Peter Adamson, OOnt, MD, FRCSC, FACS

Professor, Division of Facial Plastic and Reconstructive Surgery
University of Toronto

THE DEPARTMENT OF OTOLARYNGOLOGY-HEAD & NECK SURGERY

TEMERTY FACULTY OF MEDICINE, UNIVERSITY OF TORONTO

WELCOMES

**PROFESSOR JOHN YOO, MD, FRCSC, FACS
WESTERN UNIVERSITY**

THE

PERCY IRELAND VISITING PROFESSOR

MAY 7-8, 2021

Professor John Yoo, MD, FRCSC, FACS

Dr. John Yoo is Dean of the Schulich School of Medicine & Dentistry at Western University. As a practicing surgeon, his research and clinical interests include the spectrum of head and neck oncologic and reconstructive surgery, with a particular focus on the management of the paralyzed face.

Dr. Yoo attained his medical degree at the University of Toronto in 1991, after which he completed his residency in Otolaryngology, and fellowship in head and neck oncologic and reconstructive surgery. After his education in Toronto, he joined the faculty at the Schulich School of Medicine & Dentistry in 1997, where he is currently Professor in the Departments of Otolaryngology-Head and Neck Surgery and Oncology.



Prior to being appointed as Dean in 2020, he served as Chair and City-wide Chief of two different clinical departments over a 14-year leadership career. He served as Chair/Chief of the Department of Paediatrics from 2018-2020, and Otolaryngology-Head and Neck Surgery from 2006-2017.

Dr. Yoo remains fiercely proud of his University of Toronto Otolaryngology connection and is honoured to be invited as the Visiting Professor at this year's Percy Ireland Research Day.

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Chair 1946 - 1966

Dr. Ireland was the first full time Professor of Otolaryngology at the University of Toronto. A medical graduate of the University of Toronto, he trained in Otolaryngology with Harris P. Mosher at Harvard. After a distinguished war career, much of it in the Western Desert, he returned to Toronto and was appointed Professor and Chairman in 1946, a position he held, along with that of Otolaryngologist-in-Chief at Toronto General Hospital until 1966. He finished his University career at Sunnybrook Hospital by helping the change over from a Veterans' to a University Hospital. He retired in 1969, leaving as his legacy a strong academic staff, many of whom held high positions in the University.

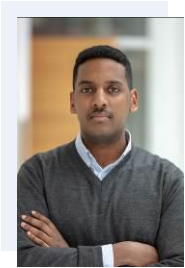
He was a tough but a self-effacing man, who started the residency-training program in Otolaryngology. He was extremely active in the educational field and it is fitting that his name be remembered in an academic event for trainees.

Past Visiting Professors

1992	1 st	Dr. Robert Ruben	New York
1993	2 nd	Dr. Noel Cohen	New York
1994	3 rd	Dr. Howard Lampe	London, ON
1995	4 th	Dr. Lauren Holinger	Chicago, IL
1996	5 th	Dr. Derald Oldring	Edmonton, AB
1997	6 th	Dr. Clarence Sasaki	New Haven, CT
1998	7 th	Dr. Murray Morrison	Vancouver, BC
1999	8 th	Dr. Stephen Harner	Rochester, MN
2000	9 th	Dr. Dominique Dorion	Sherbrooke, QC
2001	10 th	Dr. Richard Mabry	Duncanville, TX
2002	11 th	Dr. Melvin Schloss	Montreal, QC
2003	12 th	Dr. Jonas T. Johnson	Pittsburgh, PA
2004	13 th	Dr. Phillip Wackym	Milwaukee, WI
2005	14 th	Dr. Lanny Garth Close	New York, NY
2006	15 th	Dr. Richard Chole	St. Louis, MO
2007	16 th	Dr. David W. Eisele	San Francisco, CA
2008	17 th	Dr. Robin Cotton	Cincinnati, OH
2009	18 th	Dr. Douglas Mattox	Atlanta, GA
2010	19 th	Dr. Robert Ferris	Pittsburgh, PA
2011	20 th	Dr. Ehab Y. Hanna	Houston, TX
2012	21 st	Dr. Carol Bradford	Ann Arbor, MI
2013	22 nd	Dr. Michael G. Stewart	New York, NY
2014	23 rd	Dr. Jonathan Sykes	Sacramento, CA
2015	24 th	Dr. Bradley Welling	Boston, MA
2016	25 th	Dr. Mark Wax	Portland, OR
2017	26 th	Dr. Dan Fliss	Tel Aviv, Israel
2018	27 th	Rodney J. Schlosser	Charleston, SC
2019	28 th	Michael Cunningham	Boston, MA
2020		Cancelled due to the pandemic	

Our Presenters

Research Fellows/Graduate Degree Students/Postdoctoral Fellows



Mr. Robel Alemu



Christopher Noel



Dr. Carly Anderson



**Ms. Priyanka Prince
Yogarajah**



Dr. Valerie Dahm



Mr. Bowen Xiu



Dr. Emilia Luca

PGY2



Dr. Fahad Adhari



Dr. Adam Kwinter



Dr. Chantal Li



Dr. Brian Shin



Dr. Edward Sykes



Dr. Grace Yi

PGY3



Dr. Amr Hamour



Dr. Jong Wook Lee



Dr. Vincent Wu



Dr. Weining Yang



Dr. Hedyeh Ziai



Dr. Justin Cottrell



Dr. Shireen Samargandy



Dr. Terence Fu



Dr. Jennifer Siu



Dr. Daniel Lee



Dr. Neil Verma

Academic Program

9:00 Introduction and Opening Remarks by Dr. Ian J. Witterick, Chair

Each speaker has 5 minutes to make their presentation followed by 2 minutes for questions and answers

An * (asterisk) denotes an award or scholarship recipient. See page 12 for more information.

Category 1 - Work undertaken by post-residency research fellows/graduate degree students/postdoctoral fellows

Session Chaird by Dr. Karen Gordon

- 9:05 **Mr. Bowen Xiu**
Electrophysiological Correlates of Subjective Cognitive Demand in Cochlear Implant Users During Listening in Noise
Mentor: Dr. Andrew Dimitrijevic
- 9:12 **Mr. Robel Alemu**
Preliminary Findings in Preservation of Spatial Hearing in Single-Sided Deaf Children and the Interaction with Cochlear Implantation
Mentors: Drs. Sharon Cushing, Karen Gordon, & Blake Papsin
- 9:19 **Dr. Valerie Dahm**
The Feasibility of Eustachian Tube Dilation with a Standard Endovascular Balloon: A Comparative Cadaver Study
Mentor: Dr. Trung Le
- 9:26 **Dr. Christopher Noel***
Patient-Reported Symptom Burden as a Predictor of Emergency Department Use and Unplanned Hospitalization in Head and Neck Cancer: A Longitudinal Population-Based Study
Mentors: Drs. Tony Eskander & Natalie Coburn
- 9:33 **Dr. Emilia Luca***
Bulk and Single-Cell RNA-Seq Spotlight the Human Utricle Earliest Regenerative Response after Damage
Mentor: Dr. Alain Dabdoub
- 9:40 **Ms. Priyanka Prince Yogarajah***
Neural Correlates of Visual Stimulus Encoding and Verbal Working Memory that are Related to Speech-in-Noise Perception in Cochlear Implant Users
Mentor: Dr. Andrew Dimitrijevic
- 9:47 **Dr. Carly Anderson**
Atypical Cortical Asymmetry and Function Persist Following Provision of Bilateral Input to Adolescents after Long-Term Unilateral Deafness
Mentors: Drs. Sharon Cushing, Karen Gordon & Blake Papsin

9:54-10:05 BREAK

Category 2 - Work undertaken by PGY2 residents during clinical rotation

Session Chaird by Dr. Tony Eskander

- 10:05 **Dr. Fahad Aldhari**
Clinical Outcomes of Tracheostomy Performed in COVID Critical Ill Patients
Mentor: Dr. Jennifer Anderson
- 10:12 **Dr. Grace Yi**
The State of Gender/Sex Diversity at the Annual Canadian Society of Otolaryngology-Head & Neck Surgery Meetings: 2008-2020
Mentors: Drs. Yvonne Chan, Molly Zirkle, Jennifer Siu
- 10:19 **Dr. Brian Shin**
Trends in Admission for Aspiration Pneumonia in a Tertiary Teaching Hospital, 2008-2018
Mentor: Dr. Jun Lin
- 10:26 **Dr. Edward Sykes***
Evaluation of Nanoparticle Ototoxicity
Mentors: Drs. Trung Le, Warren CW. Chan, Gang Zheng
- 10:33 **Dr. Chantale Li***
Tracheostomy Emergencies Simulation Course: Testing the Effect of Integrated Instruction on Knowledge Acquisition and Retention Among Emergency Medicine Physicians Undergoing Complex Simulations
Mentor: Dr. Paolo Campisi, Ryan Brydges, Justin Cottrell
- 10:40 **Dr. Adam Kwinter**
Quantifying Cutaneous Neck Fibrosis: Development and Validation of a Patient Reported Outcome Measure
Mentor: Dr. David Goldstein

10:47-11:00 BREAK

Category 3 - Work undertaken by PGY3 residents during clinical rotation

Session Chaired by Dr. Jun Lin

- 11:00 **Dr. Weining Yang**
Temporal Trends in Diagnosis and Management of Non-Invasive Follicular Neoplasm with Papillary-Like Nuclear Features (NIFTP)
Mentor: Dr. Tony Eskander
- 11:07 **Dr. Hedyeh Ziai**
Evaluation of Machine Learning, Statistical Predictive Tools, and the National Surgical Quality Improvement Program Surgical Risk Calculations for Predicting Hospital Length of Stay in Patients Undergoing Major Surgery for Oral Cavity Cancer
Mentor: Dr. John de Almeida
- 11:14 **Dr. Vincent Wu***
Admission of Patients with Obstructive Sleep Apnea Undergoing Ambulatory Surgery in Otolaryngology-Head & Neck Surgery
Mentor: Dr. John Lee
- 11:21 **Drs. Amr Hamour* & Jong Wook Lee***
Development of a Murine Model for Chronic Rhinosinusitis
Mentors: Drs. Allan Vescan, Eric Monteiro, John Lee

11:35-11:45 B R E A K

Category 4 - Work undertaken by PGY4 residents during clinical rotation

Session Chaired by Dr. Doug Chepeha

- 11:45 **Dr. Neil Verma**
Simulation-Based Management of Internal Carotid Injury During Endoscopic Sinus Surgery: A Pilot Study
Mentor: Dr. Allan Vescan
- 11:52 **Dr. Terence Fu**
A Cost Utility Analysis Comparing CT Surveillance, PET-CT Surveillance, and Planned Post-Radiation Neck Dissection for Advanced Nodal HPV-Positive Oropharyngeal Cancer
Mentor: Dr. John de Almeida
- 11:59 **Dr. Jennifer Siu***
Development of a Neural Network Model to Predict Long-Term Mortality in Patients Eligible for Tracheostomy in the ICU
Mentor: Dr. Leo Celi
- 12:06 **Dr. Daniel Lee***
Nasal Nitric Oxide as a Long-Term Monitoring and Prognostic Biomarker of Mucosal Health in Chronic Rhinosinusitis
Mentor: Dr. John Lee
- 12:13 **Dr. Shireen Samargandy***
Endoscopic Sinus Surgery Outcomes in Patients with Chronic Rhinosinusitis and Immunoglobulin Deficiencies
Mentors: Dr. John Lee
- 12:20 **Dr. Justin Cottrell***
Morbidity and Mortality from Adenotonsillectomy in Children with Trisomy-21
Mentor: Dr. Nik Wolter

12:27- 12:42 B R E A K

- 12:42 **PRESENTATION OF AWARDS**
Best Paper Category 1
Best Paper Category 2
Best Paper Category 3
Best Paper Category 4
Best Overall Presented Paper
- Wharton Head & Neck Research Award

29th Annual Percy Ireland Academic Day

Saturday May 8, 2021

Registration Information

Register in advance for this meeting:

<https://scotiaevents.zoom.us/meeting/register/tZUocuCvpj4vGtTLOVom2REpa6APspKeODYs>

After registering, you will receive a confirmation email containing information about joining the meeting via Zoom.

There is no fee to participate!

The Department of Otolaryngology-HNS, University of Toronto reserves the right to cancel courses. Registrants will be notified at the earliest possible date in the event of a cancellation.

Recipients of Awards or Scholarships Acknowledged with an * (asterisk) within the Program

Dr. Justin Cottrell	2019-20 Chapnik, Freeman and Friedberg Clinical Scientist Program Award & 2019-20 Dr. Ian Witterick Excellence in Mentorship and Innovation Award & 2019-20 Raymond H. W. Ng Graduate Scholarship
Dr. Amr Hamour	2019 Raymond Ng and Wendy Chiu Foundation for Innovation in Otol-HNS
Dr. Daniel Lee	2019-20 Shiley E. O. Pelausa Award
Dr. Jong Wook Lee	2019 Raymond Ng and Wendy Chiu Foundation for Innovation in Otol-HNS
Dr. Chantal Li	2020 Harry Barberian Scholarship Award
Dr. Emilia Luca	2020 Harry Barberian Scholarship Award
Dr. Christopher Noel	2019-20 Raymond H W. Ng PhD Scholarship
Dr. Shireen Samargandy	2019-20 Shiley E. O. Pelausa Award
Dr. Jennifer Siu	2019-20 Freda Noyek Otolaryngology Merit Award
Dr. Edward Sykes	2020 Harry Barberian Scholarship Award
Dr. Vincent Wu	2019-20 Judy Chauvin Otolaryngology Resident Award
Ms. Priyanka Prince Yogarajah	2020 Harry Barberian Scholarship Award

For additional award information, please see our website at: <https://otolaryngology.utoronto.ca/awards-and-honours>

For Further Information:

Sonia Valente

Tel 416-946-8742

Fax 416-946-8744

e-mail: ohns.chairsassistant@utoronto.ca

Abstracts

Category 1 – Work undertaken by Post-residency Research Fellows/Graduate Degree Students/Postdoctoral Fellows

Presenter: Mr. Bowen Xiu
Mentor: Dr. Andrew Dimitrijevic
Presenter Category: Graduate Degree Student
Presentation Time: 9:05 am

Electrophysiological Correlates of Subjective Cognitive Demand in Cochlear Implant Users During Listening in Noise

Although cochlear implantation is a generally successful avenue of hearing restoration, there is still considerable variability and differences for speech recognition outcomes for cochlear implant (CI) listeners which cannot be explained. A potential factor that may affect outcome variability is the poor degree that clinical testing environments and stimuli reflects listening in real-world environments, which demands a greater amount of cognitive resources serving working memory and attention compared to listening in a quiet and controlled sound booth. The current study examined the how well the brain “follows” natural audiovisual conversations in the presence of multi-talker background noise. Video and audio segments from a dialogue-based television show were presented to 15 adult CI listeners in high, moderate, and low levels of background noise while electroencephalography (EEG) was concurrently recorded. Brain speech tracking to the speech envelope was measured using a linear ridge regression method, and self-reported ratings of cognitive demand for each listening condition were collected using the NASA Task Load Index. Preliminary findings reveal that self-reported mental demand decreases as background noise levels decrease, with concomitant decreases in brain tracking. Comparison between audiovisual and audio only conditions suggests that the addition of visual cues assists in speech recognition. These results suggest that meaningful information about the cochlear implant listening experience can be extracted from brain responses using “ecological” stimuli such as a normal conversation.

Presenter: Mr. Robel Alemu

Mentors: Drs. Sharon Cushing, Karen Gordon, Blake Papsin

Presenter Category: Graduate Degree Student

Presentation Time: 9:12 am

Preliminary Findings in Preservation of Spatial Hearing in Single-Sided Deaf Children and the Interaction with Cochlear Implantation

Objectives: The present study sought to: 1) identify whether children with single-sided deafness (SSD) can compensate for their lack of binaural hearing by using head and eye movements to localize sound; and 2) assess potential benefits of cochlear implantation for spatial hearing in children with SSD.

Rationale: Spatial hearing is crucial for distinguishing between multiple sounds around us and relies on detection of interaural timing and level cues which are not available to individuals with SSD.

Methods: Identification of stationary and moving sound location was measured in two groups of children: 1) children ($M_{Age} = 13.7 \pm 4.30$ SD years of age) who received a cochlear implant to treat early ($n = 2$) or late ($n = 5$) onset SSD [Duration of CI Use; Congenital (2) = 3.48 ± 2.40 SD, Late Onset (5) = 2.22 ± 1.41 SD] and 2) a group of age-matched typically developing peers with normal hearing (NH) ($n = 21$, $M_{Age} = 13.9 \pm 2.83$ SD years of age). Sound source localization and perception of motion were tested simultaneously using an L-shaped moving arm with a speaker fixed to the end which presented bandpass filtered white-noise at a distance of approximately 1-m from the listener along a pseudorandom range within a 120° arc in the azimuthal or horizontal plane. Eye-tracking glasses and a motion sensor were employed to measure unrestricted eye movements and head movements, respectively, in real-time. Localization accuracy was tested in monaural (SSD: no CI; NH: monaural ear plug and muff) and bilateral listening conditions (SSD: CI on; NH: both ears open).

Results: Preliminary analyses indicate that localization of static sound and detection of moving sound direction were less accurate in the SSD than NH groups in the bilateral condition ($p < 0.001$) but were similar to NH in the unilateral condition. Accuracy did not significantly improve or decrease with or without CI use in the SSD group. Assessment of head and eye movements in the NH group revealed clear movement toward the sound in the bilateral condition and increased movement toward the hearing ear in the unilateral condition. Children in the SSD group showed a variety of strategies in both unilateral and bilateral conditions.

Conclusions: Children with SSD use head and eye movements when attempting to localize static and moving sounds and do not show improved spatial hearing skills during early stages of CI use. Limited benefits could reflect poor integration of bimodal hearing in the auditory system (Polonenko et al., 2018) as well as degeneration of pathways from the deaf ear in children with late onset SSD despite CI use (Lee et al., 2020).

Presenter: Dr. Valerie Dahm

Mentor: Dr. Trung Le

Presenter Category: Research Fellow

Presentation Time: 9:19 am

The Feasibility of Eustachian Tube Dilation with a Standard Endovascular Balloon: A Comparative Cadaver Study

Objective: Balloon dilation of the eustachian tube is a new therapeutic option for eustachian tube dysfunction. There is emerging evidence of treatment effectiveness in well selected individuals compared to older therapies. One of the limiting factors of wider adoption of this technique in many parts of the world is the high cost of the devices, in spite of regulatory approval of safety. The aim of this pre-clinical study was to evaluate the performance and usability of standard endovascular balloons for eustachian tube dilation in comparison to an approved device.

Study Design: Cadaver heads were acquired to perform twenty procedures in this study.

Methods: Ten eustachian tube dilations were performed with an approved eustachian tube dilation device. Ten other procedures were carried out with an endovascular balloon of similar dimensions. Cone beam computerized tomography was performed to evaluate the extent of dilation and possible damages. The lumen and mucosal lining were inspected endoscopically post-dilation. Volume measurements were compared before and after the procedure in both groups using contrast enhancement.

Results: All twenty eustachian tube dilations were carried out successfully. No tissue damages could be identified on cone-beam computerized tomography or via endoscopic examination. There was a statistically significant difference of eustachian tube volumes between pre- and post-dilations, with no statistically significant difference between the devices.

Conclusion: Eustachian tube dilation with a less costly endovascular balloon achieved similar results to an approved eustachian tube dilation device. No damages or any other safety concerns were identified in a cadaver feasibility study.

Presenter: Dr. Christopher Noel
Mentors: Drs. Tony Eskander & Natalie Coburn
Presenter Category: Graduate Degree Student
Presentation Time: 9:26 am

Patient-Reported Symptom Burden as a Predictor of Emergency Department Use and Unplanned Hospitalization in Head and Neck Cancer: A Longitudinal Population-Based Study

Purpose: To determine the association between patient-reported symptom burden and subsequent emergency department use and unplanned hospitalization (ED/Hosp) in a head and neck cancer (HNC) patient population.

Methods: This was a population-based study of patients diagnosed with HNC who had completed at least one outpatient Edmonton Symptom Assessment System (ESAS) assessment between January 2007 and March 2018 in Ontario, Canada. Logistic regression models were used to determine the relationship between outpatient ESAS scores and subsequent 14-day ED/Hosp use. A generalized estimating equation approach with an exchangeable correlation structure was incorporated to account for patient-level clustering.

Results: There were 11,761 patients identified, completing a total of 73,282 ESAS assessments and experiencing 5,203 ED/Hosp events. Six of the nine ESAS symptom scores were positively associated with ED/Hosp use, with pain, appetite, shortness of breath, and tiredness demonstrating the strongest associations. A global ESAS score was calculated by selecting the highest individual symptom score (h-ESAS). Among patients reporting a maximum h-ESAS score of 10, 15.1% had an ED/Hosp event within 14 days compared with 1.5% for those with the lowest possible score of zero. In adjusted analysis, the odds of ED/Hosp use increased with h-ESAS (1.23 per one-unit increase [95% CI, 1.22 to 1.25]). When treated as a categorical variable, patients with the maximum h-ESAS score of 10 had 9.23 (95% CI, 7.22 to 11.33) higher odds of ED/Hosp use, relative to the minimum score of zero.

Conclusion: ESAS scores are strongly associated with subsequent ED/Hosp events in patients with HNC. Clinician education around how ESAS data might inform patient care may enhance symptom detection and management.

Presenter: Dr. Emilia Luca
Mentor: Dr. Alain Dabdoub
Presenter Category: Research Fellow
Presentation Time: 9:33 am

Bulk and Single-Cell RNA-Seq Spotlight the Human Utricle Earliest Regenerative Response after Damage

In the vestibular system, loss of inner ear sensory hair cells (HCs) leads to permanent balance deficits. Vestibular organs have a limited capacity to regenerate. Supporting cells (SCs) survive after HC loss, and in newborn mice, SCs can replace HCs by either direct transdifferentiation into HCs or via proliferation followed by transdifferentiation. However, in adults, this process is limited and not sufficient for functional recovery.

To investigate the adult human utricle's immediate response to ototoxic damage in culture, including any evidence for a regenerative response, we damaged HCs from patients with acoustic neuroma via aminoglycoside antibiotic (gentamicin). After 24 hrs, we isolated the RNA from the sensory epithelia only and performed bulk RNA-seq in control and treated samples. We found 1416 genes with significant transcriptional changes between control and damage conditions -210 genes were upregulated and 1206 downregulated - highlighting an intrinsic capacity of the adult sensory epithelium to respond to damage. Importantly, we profiled significant changes in gene expression (upregulation) of Wnt signalling genes: *Rac3*, *Kremen1*, *Sall1*, *Ankrd6*, *Dlx5* and *Sox2* among others; and their targets, indicating a regenerative response. In addition, among upregulated genes, we identified 42 transcription factors, including *NFI* (nuclear factor I) *Nfix* and *Nfia*, known to be involved in regeneration processes in other tissues (skeletal muscle and retinal neurons). Furthermore, to profile gene expression changes at higher resolution, we performed single-cell RNA-sequencing (scRNA-seq) on the same cohort of patients. Our preliminary bioinformatic analyses have revealed a robust difference in the transcriptional profile between gentamicin-damaged and control samples.

SCs represent an endogenous population of cells that is a prime target for regenerative strategies as SCs survive after HC loss. We used scRNA-seq in order to elucidate SC heterogeneity in a human utricle. Our preliminary data indicate that there are six putative types of SCs in the adult human utricle. Characterization of the different SCs is a first step towards identifying which subtype(s) represent 'stem' cells for HC regeneration.

In conclusion, we successfully performed bulk and scRNA-seq on adult human utricles, delineating the earliest response to ototoxic damage. Furthermore, we are delivering the first human utricle gene atlas. Overall, these discoveries will advance fundamental knowledge in the field of inner ear regenerative medicine and pave the way for developing therapeutics for the treatment of balance dysfunction.

Presenter: Ms. Priyanka Prince Yogarajah

Mentor: Dr. Andrew Dimitrijevic

Presenter Category: Graduate Degree Student

Presentation Time: 9:40 am

Neural Correlates of Visual Stimulus Encoding and Verbal Working Memory that are Related to Speech-in-Noise Perception in Cochlear Implant Users

A common concern for individuals with severe-to-profound hearing loss fitted with cochlear implants (CIs) is difficulty following conversations in noisy environments. Recent work has suggested that these difficulties are related to individual differences in brain function, including verbal working memory and the degree of cross-modal reorganization of auditory areas for visual processing. However, the neural basis for these relationships are not fully understood. Here, we investigated neural correlates of visual verbal working memory and sensory plasticity in 14 CI users and age-matched normal-hearing (NH) controls. While recording high-density electroencephalography (EEG), participants completed a modified Sternberg visual working memory task where sets of letters and numbers were presented visually and then recalled at a later time. Results suggested that CI users had comparable behavioural working memory performance compared to NH. However, CI users had more pronounced neural activity during visual stimulus encoding, including stronger visual-evoked activity in auditory cortex, larger modulations of neural oscillations, and increased frontotemporal connectivity. During memory retention of the characters, CI users, in contrast had descriptively weaker neural oscillations and significantly lower frontal-temporal connectivity. Regression analysis revealed that lower scores for speech perception in noise were associated with higher levels of cross-modal reorganization of the auditory cortex in CI users. These results reveal differences in neural correlates of visual encoding and working memory in individuals with auditory system reafferentation after profound hearing loss and suggest that higher degrees of cross-modal reorganization of auditory cortex is associated with lower scores for speech perception in noise.

Presenter: Dr. Carly Anderson

Mentors: Drs. Sharon Cushing, Karen Gordon & Blake Papsin

Presenter Category: Postdoctoral Fellow

Presentation Time: 9:47 am

Atypical Cortical Asymmetry and Function Persist Following Provision of Bilateral Input to Adolescents After Long-Term Unilateral Deafness

Objective: To evaluate the long-term effects of providing children with bilateral deafness access to sound through a cochlear implant (CI) in only one ear.

Background: Traditionally, children with bilateral deafness were provided with access to sound through a CI in only one ear (unilaterally). Delaying bilateral access to sound during development abnormally strengthens pathways from the better hearing ear, resulting in over-representation and preference for the first-implanted ear which may not be possible to reverse¹⁻³. This may be particularly challenging in adolescents who listened with a unilateral CI for most of their lives before receiving a second CI, and who show abnormal responses from the long-deprived ear at early stages of bilateral CI use³. However, the effects of long-term unilateral deprivation on the bilateral auditory pathways and capacity for cortical change in this adolescent cohort are unknown.

Hypotheses: Adolescents with long-term unilateral CI use will show: 1) little effect of CI use in the long-deprived, newly implanted ear over time due to restricted plasticity, 2) asymmetric bilateral responses weighted to the first-implanted ear.

Methods: Auditory-evoked cortical responses were recorded from 13 adolescents with early-onset bilateral deafness who received one CI (right ear) at 2.7 ± 1.1 years of age and a second CI (left ear) at 12.7 ± 2.8 years of age, thus experiencing approximately a decade of unilateral deprivation (10.1 ± 2.9 years). Cortical responses were evoked by biphasic pulses presented at 250 pulses/s in trains of 36ms at a rate of 1Hz either from each CI (unilateral stimulation) or bilaterally. Recordings from 64 cephalic electrodes were obtained longitudinally in each CI user beginning at initial activation of their second CI, and then at follow-up intervals of 1-14 months post-activation. Grand mean cortical waveforms for each mode of stimulation at each time point were plotted and the cortical generators of these evoked responses were examined using the TRACS beamformer imaging method^{4,5}. Linear mixed effects modelling was used to examine the effects of time and ear stimulated on the amplitude of auditory cortical responses.

Results: Consistent with previous reports³, cortical potentials evoked by stimulation of the newly implanted left CI ear displayed atypical morphologies characterized by an abnormally large amplitude peak (103 ± 12.7 ms), with activity atypically lateralized to the left ipsilateral auditory cortex. Increased left-hemispheric lateralization did not reverse with increased duration of bilateral input (no effect of time, $F(3,103)=0.51$, $p=.68$) and predicted poorer bilateral speech perception ($R=.71$, $p=.03$).

Bilateral responses were weighted to the newly implanted ear ($F(1,23)=5.36$, $p=.03$). Greater activation of the ipsilateral cortex by the new CI increased with longer inter-implant delay ($R=.80$, $p=.001$) and was not inhibited as it should be during bilateral CI stimulation ($F(1,24)=12.8$, $p=.002$).

Conclusions: Atypical responses and cortical asymmetries elicited by a new CI in the long-deprived ear suggests atypical development of these pathways in adolescents. Cortical over-representation and weighting of bilateral responses toward the long-deprived ear suggests an asymmetry that compromises binaural processing. Limited changes in cortical asymmetries and functional benefits over time are consistent with reduced plasticity in adolescents.

Category 2 – Work undertaken by PGY2 residents during clinical rotation

Presenter: Dr. Fahad Aldhari
Mentor: Dr. Jennifer Anderson
Presenter Category: PGY2
Presentation Time: 10:05 am

Clinical Outcomes of Tracheostomy Performed in COVID Critical Ill Patients

Background: Despite disparities in clinical evidence and recommendations, tracheostomy has been proposed as a well-accepted way to manage patients requiring prolonged MV, decreasing ICU and hospital stay, mortality, MV dependence, limiting long term airway complications and ultimately improving patient comfort. Yet, growing concerns around aerosol generating medical procedures (AGMP) and their relation to COVID-19 spread to staff and other patients have put a hard stall on performing tracheostomies on chronically vented COVID-19 +ve patient in many parts of the world. There has been emerging data on the safety of tracheostomy in patients with COVID-19 ARDS, however we still have a lot to learn about where do these patients fit in the benefit spectrum.

Methods: This is a retrospective cohort study aimed at assessing short and medium-term clinical outcomes in severely ill COVID patients who underwent tracheostomy due to prolonged intubation. A total of 16 COVID patients during the first and 2nd wave were operated on. Patient's charts were reviewed for parameters including baseline demographics and comorbidities, duration from intubation to tracheostomy and their clinical course post tracheostomy with special emphasis on timelines, ICU stay and final swallowing/voice outcomes.

This group of patients were compared to a group of non COVID patients who were intubated and operated on within the same period again for prolonged intubation and inability to wean off MV.

The two groups were analyzed using measures of central tendencies, as appropriate. Data between the two groups were compared using a chi-square test for categorical and Wilcoxon test for continuous variables to identify any significant differences in baseline and/or outcomes.

Results: Overall patients with COVID-19 ARDS (n=16) were more strictly vetted prior to tracheostomy, evident by an average lower Charlson comorbidity index (CCI) and ventilatory status. They were also likely to get tracheotomized later during their stay but overall had better survival and decannulation rates than our non-covid patients.

With regards to decannulation 7(43%) COVID-19 patients were decannulated in the ICU whilst the rest on the floor. The average time step down from ICU was 25 d (range: 11-55) to decannulation in COVID-19 patients was 29 days (range :11-70). Patients who had lower CCI, were younger and with less COVID related complications were more likely to be off ventilation in a significantly shorter period (POD 2-7 vs. >14).

There were no reported cases of patient to staff transmission while performing tracheostomies.

Conclusion: With proper PPE, tracheostomy can be performed safely in the ICU via percutaneous approach. In addition, with proper selection and allocation of resources, MV dependent COVID-19 patients can significantly benefit from undergoing tracheostomy as to help wean them off sedation and MV even if in cases where tracheostomy did not necessarily contribute to shortening ICU LOS. Finally, swallowing outcomes varied in our study population depending on the patients' baseline and overall neurological recovery after overcoming the infection, but the majority (65%) of patients were discharged on either a full or modified oral diet.

Presenter: Dr. Grace Yi

Mentors: Drs. Yvonne Chan, Molly Zirkle & Jennifer Siu

Presenter Category: PGY2

Presentation Time: 10:12 am

The State of Gender/Sex Diversity at the Annual Canadian Society of Otolaryngology Meetings: 2008 to 2020

Background: The gender disparity in surgical disciplines, and in speakers across North American medical and surgical specialty conferences, has been highlighted in recent literature. Improving gender/sex diversity at society meetings and panels may provide many benefits. Our aim was to determine the state of gender diversity amongst presenters and speakers at the annual Canadian Society of Otolaryngology-Head and Neck Surgery (CSO) meetings.

Methods: Scientific programs for the CSO annual meetings from 2008 to 2020 were obtained from the national website. Participant name, role, gender, location, and subspecialty topic were recorded for all roles other than paper presenter. Gender (male or female) was determined using an online search. The total number of opportunity spots and proportion of women was then calculated. Descriptive statistical analysis consisted of counts and percentages.

Three categories were analyzed: *Leadership Roles* (roles other than oral paper presenter or poster presenter), *Workshop Composition* (male-only panels or “manels”, female-only panels, or with at least one female speaker), and *Oral Paper Presenters* (first authors).

Results: There were 2842 leadership and speaker opportunity spots from 2008 to 2020, of which 24.8% were filled by women. Of the 1570 leadership spots, 102 individual women held 18.8% of spots. Among leadership positions, 15.3% of workshop chairs, 19.8% of panelists and 25% of paper session chairs were female. There was an overall increase in the proportion of positions held by women, from 7.5% of leadership spots in 2008 to 21.8% in 2020.

Of the 402 workshops, 61.3% were led by men only, 37.9% by at least 1 female surgeon, and 2.0% by women only. “Manels” have comprised at least 35% of workshops each year. Out of 1272 oral paper presenters, 32.0% presentations were by women, with minimal increase over the study period.

Conclusions: The proportion of women in speaking roles at the annual CSO meetings has generally increased over time, particularly among panelists, leading to fewer male-only speaking panels. However, there has been a slower rate of growth in the proportion of unique women in speaker roles. There remains an opportunity to increase gender/sex diversity at the major Canadian otolaryngology meeting.

Presenter: Dr. Brian Shin

Mentor: Dr. Jun Lin

Presenter Category: PGY2

Presentation Time: 10:19 am

Trends in Admission for Aspiration Pneumonia in a Tertiary Teaching Hospital, 2008-2018

Objective: To study the trends of in-hospital mortality, length of stay, and total cost for patients admitted with primary diagnosis of aspiration pneumonia and to identify factors that contribute to in-hospital mortality for this patient population at a tertiary hospital.

Methods: Decision Support Services was utilized to identify patients older than 18 years of age who were admitted with a primary diagnosis of aspiration pneumonia from January 1, 2008 to December 31, 2018 at a single tertiary institution in Toronto, Canada. In-hospital mortality, length of stay, and total cost were determined by stratifying age into two groups (<65 vs ≥65 years of age). Multivariate logistic regression analysis was used to identify independent factors that contributed to in-hospital mortality.

Results: A total of 634 patients were included in this study. There were 202 (31.9%) patients younger than the age of 65 and 432 (68.1%) patients who were of the age of 65 or older. In-hospital mortality slightly increased from 20% to 23% from 2008 to 2018 and older patients had a higher proportion of in-hospital mortalities than those aged <65 (27.8% vs. 6.9%, $p < 0.05$). Length of stay did not differ between the two age groups ($p = 0.48$). Total cost increased from \$956,959.60 to \$1,287,956.50 in the 10-year period. Logistic regression identified female gender and avoidance of invasive mechanical ventilation as independent, protective factors against in-hospital mortality.

Conclusion: Elderly patients are a high-risk population group for aspiration pneumonia and are at higher risk of death when hospitalized. This warrants improved preventative strategies in the community. Further studies involving other institutions and creating a Canada-wide database is required.

Presenter: Dr. Edward Sykes
Mentors: Drs. Trung Le, Warren CW Chan & Gang Zheng
Presenter Category: PGY2
Presentation Time: 10:26 am

Evaluation of Nanoparticle Ototoxicity

Introduction: Nanoparticles are a popular substrate for biomedical applications. Ranging from 1-500 nm in size, nanoparticles composed of gold and porphyrin-lipids (porphysomes) can be chemically designed to disrupt cellular adhesion, deliver localized thermal energy, and provide sustained release of medications. This is of particular interest for the middle ear where diseases such as cholesteatomas are prone to recurrence due to the complexity of complete surgical resection. If a nanomaterial adjuvant therapy could be developed to selectively destroy residual diseased tissue when applied post-operatively, it could minimize the need for salvage/revision surgery. However, nanoparticle toxicity within the ear – known as ototoxicity - is largely unknown. The cochlea which serves as the hearing organ of the ear is composed of a basal membrane, neurons, and hair cells. These hair cells detect sound by converting mechanical waves to synapses at specific frequencies. They are extremely sensitive to chemical exposure and can lead to partial or complete deafness. As such, a critical step towards nanomaterial use within the ear will require careful analysis of nanoparticle ototoxicity.

Objective: To evaluate the *in vitro* cochlear toxicity of gold nanospheres and porphysomes.

Methods: Nanoparticle ototoxicity was evaluated using two murine *in vitro* otic models. Sensory cell death was appraised in otic sensory epithelial organoids (otospheres) derived from immortalized multipotent progenitor cells and cultured cochlear explants harvested from neonatal (P3-P5) CD1 mice. Ototoxicity was assessed for 15 nm gold nanospheres surface coated with methoxy-polyethylene glycol, 5 μ m carboxylated polymeric beads, and three 100 nm porphyrin-based porphysomes (PS, ePS, and nPS). Otospheres and explants were exposed to nanoparticle formulations at various concentrations for 30 minutes and allowed to recover in fresh media for 48 hours. Culture-conditioned media was harvested on post-exposure day 1 and day 2 to evaluate cytotoxicity and cell viability by lactate dehydrogenase activity and AlamarBlue assays respectively. Finally, fluorescent microscopy was used to appreciate sensory epithelial viability and morphological perturbations via Myosin VIIa and Phalloidin immunohistochemical staining.

Results: Sensory cell viability in otospheres and cochlear explants were not statistically affected by 30 minute exposure to all nanoparticles tested apart from PS which exhibited a 20% drop in viability at 5 μ M doses. Myosin VIIa expression in otospheres was preserved qualitatively in all formulations apart from porphysomes at concentrations exceeding 5 μ M. However, gold nanospheres and polymeric beads independent of dose exhibited cochlear explant cytotoxicity with a corresponding (i) drop in outer hair cell density and (ii) distortion of normal outer hair cell arrangement. Of the three porphysomes, cytotoxicity was isolated to doses >5 μ M in ePS and nPS while PS demonstrated a 50% elevation in cytotoxicity independent of concentration. Mirroring cytotoxicity, a 40-60% reduction in outer hair cell density was observed in ePS and nPS at 5 μ M exposures and at all concentrations for PS. Inner hair cell density did not appear to be statistically impacted by nanoparticle exposure across all formulations.

Conclusions: The tuneable physical properties of nanomaterials make them ideal surgical adjuvants for drug delivery and local thermal ablation in the middle ear. However, prior to their application, safety of these materials within the ear must be addressed. This study presents the ototoxicity risk of nanoparticles for the first time. We identify that of the particles tested, porphysomes constructed as ePS and nPS are viable nanoparticle candidates as they show minimal perturbation of the cellular and morphological aspects of the murine inner ear. These materials can be assessed for drug delivery and thermal ablative applications that can improve treatment of middle ear infections and potentially delay – if not abrogate - the need for revision surgery for diseases such as cholesteatomas in the future.

Presenter: Dr. Chantal Li

Mentor: Dr. Paolo Campisi

Presenter Category: PGY2

Presentation Time: 10:33 am

Tracheostomy Emergencies Simulation Course: Testing the Effect of Integrated Instruction on Knowledge Acquisition and Retention Among Emergency Medicine Physicians Undergoing Complex Simulations

Emergencies involving patients with tracheostomies often require rapid recognition and effective management to prevent catastrophic outcomes. Several^{1,2} studies have shown that the majority of providers lack comfort with, knowledge of, and proficiency in tracheostomy management. A needs assessment conducted amongst Emergency physicians at Sunnybrook Hospital mirrored these findings. In order to address this gap in clinical care and education, a Tracheostomy Emergencies simulation course was developed by a multidisciplinary planning committee consisting of residents and staff from OHNS, Anesthesia, Emergency Medicine, and Respiratory Therapy. To our knowledge, this is the first targeted tracheostomy management and emergencies simulation course.

While the content of the course has been validated by a multidisciplinary team to ensure it is evidence based, there is lack of direction within the medical education literature on the best instruction methodology to deliver the content. Integrated instruction seeks to link clinical features to basic science knowledge, in contrast to traditional teaching methods that employ unintegrated instruction, presenting basic science and clinical features separately without clear links. Brydges et al.³ recently demonstrated that integrated instruction may improve trainees' skill retention and transfer through gains in conceptual knowledge utilizing a lumbar puncture simulation task. While these study results could be extrapolated to the procedural aspect of tracheostomy management, the effect of integrated instruction in simulations requiring both procedural and clinical decisions has yet to be studied. Our study aims to compare integrated vs. unintegrated instruction curriculums on knowledge transfer and retention performance by Emergency Physicians completing the Tracheostomy Emergencies Simulation course.

A prospective, observational study will be conducted from July 2020 to August 2021 at the Sunnybrook Canadian Simulation Center. All Emergency Medicine staff will be invited to participate with thirty being included and randomly allocated to one of two study conditions: (1) integrated instruction curriculum that links clinical signs and symptoms to basic science knowledge using cause-and-effect explanations (2) unintegrated instruction curriculum that presents clinical features and basic science knowledge separately. Immediate and delayed knowledge will be assessed by evaluating final simulation performance, along with a multiple choice assessment (in development) administered following the curriculum, and at the six-month follow up period.

This study will elucidate the impact of integrated and unintegrated instruction curriculum designs on the knowledge transfer and retention of complex clinical and procedural simulations to help inform future simulation curriculum development. This knowledge will also be used internally to optimize the tracheostomy simulation curriculum before planned scaling to OHNS and Anesthesia training programs.

Presenter: Dr. Adam Kwinter

Mentor: Dr. David Goldstein

Presenter Category: PGY2

Presentation Time: 10:40 am

Quantifying Cutaneous Neck Fibrosis: Development and Validation of a Patient Reported Outcome Measure

Introduction: Despite increasing recognition of the importance of functional outcomes for patients with head and neck cancer (HNC), post-treatment neck fibrosis remains poorly understood. Advancement in the field has been limited by a lack of patient reported outcomes (PROs) and few objective measures specific to this population.

Objective: To develop and validate a PRO for patients with cutaneous neck fibrosis.

Methods: Items were generated using a composite strategy consisting of a systematic review of neck impairment instruments, patient chart review, expert interviews and patient focus groups. Synthesis of these data sources lead to the development of a conceptual framework and a list of candidate questionnaire items. Items were reduced through item impact score method. Early psychometric properties were evaluated through test-retest reliability, construct and criterion validity.

Results: The systematic review revealed 13 neck impairment instruments with relevant items, though none specifically explored health-related quality of life for patients with neck fibrosis. In total, 9 experts were interviewed, and 20 patients were recruited into 4 focus groups. A qualitative and thematic analysis was performed. The conceptual framework included four domains: neck sensation and function, neuropsychiatric, activity and relationships. Independent scales were constructed for each of these domains. The initial 25 item questionnaire was reduced to 12 items following an analysis of 41 item impact scores. Early psychometric testing of the reduced instrument was assessed in 40 patients. Internal consistency was good >0.7 for the overall global scale. Test re-rest reliability was good for all items (ICC(2,1) >0.70 for all items). Three constructs were evaluated, and all were consistent with *a priori* hypotheses.

Conclusion: The Neck Fibrosis Index demonstrates preliminary reliability and validity for discriminate use.

**Category 3 – Work undertaken by
PGY3 residents during clinical rotation**

Presenter: Dr. Weining Yang

Mentor: Dr. Tony Eskander

Presenter Category: PGY3

Presentation Time: 11:00 am

Temporal Trends in Diagnosis and Management of Non-Invasive Follicular Neoplasm with Papillary-Like Nuclear Features (NIFTP)

Background: To more accurately reflect their indolent clinical course, a subset of papillary thyroid cancers (PTC) was reclassified to non-invasive follicular thyroid neoplasm with papillary-like nuclear features (NIFTP) in 2016. Uptake of the NIFTP diagnostic category remains unclear. The objective of our study was to assess diagnostic rates of PTC and NIFTP following reclassification, as well as the subsequent impact on surgical management.

Methods: Retrospective review of a single institution's histopathology database between 2015-2019 was conducted. Clinical and demographic variables of these patients were obtained. Yearly frequency of NIFTP diagnosis and rates of hemithyroidectomy, total thyroidectomy or completion thyroidectomy were determined.

Results: NIFTP prevalence at our institution were lower than in previous population-based data. Furthermore, yearly NIFTP diagnostic rates decreased from 2016 to 2019. Rates of hemithyroidectomy for PTCs increased during the same study period.

Conclusion: Given known population-based estimates, geographic variation in NIFTP prevalence exists within Ontario. We further found a yearly reduction in NIFTP diagnostic rates which may represent an opportunity for improved education surrounding this diagnostic category. Larger multi-centre studies are needed to validate our findings.

Presenter: Dr. Hedyeh Ziai
Mentor: Dr. John de Almeida
Presenter Category: PGY3
Presentation Time: 11:07 am

Evaluation of Machine Learning, Statistical, and the National Surgical Quality Improvement Program's Models to Predict Length of Stay After Major Oral Cavity Cancer Surgery

Background: Surgical management of oral cavity cancer can be associated with complications and functional impairment which may prolong length of stay (LOS). LOS is related to costs and patient expectations. Risk calculators can predict adverse outcomes and support shared decision-making, but existing tools have poor performance in this population and there is limited use of machine learning methods.

Objective: To compare the performance of statistical models, machine learning models, and The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) calculator in predicting hospital length of stay following major surgery for oral cavity cancer.

Study Design: This was a retrospective multicenter database study undertaken from 2018 to 2021. A database with potential predictive variables was constructed. Data from participating institutions was pooled and randomly split into training and validation datasets. Statistical and machine learning models were developed. Performance was evaluated by comparing predicted and actual LOS using R²-values and percent accuracy.

Setting: Patients underwent surgery at two major academic Canadian head and neck cancer centres.

Participants: Patients with oral cavity cancer who underwent major surgery with curative intent between January 1, 2008 and June 1, 2019 were selected by querying databases maintained by the participating institutions.

Main Outcome and Measure: Length of stay, defined as the number of days between the operative date and the discharge date or date of death.

Results: 1097 patients were included. The mean age was 62.5 [SD 12.4] years and 64% of patients were male. Our models demonstrated similar predictive performance: multivariate (R² 0.55, 4 day accuracy 67%), least absolute shrinkage and selection operator (0.55, 69%), machine learning (0.47, 70%). This was superior to the ACS-NSQIP calculator's performance using all patients (0.09, 52%) and free flap patients (0.05, 60%).

Conclusions: We developed statistical and machine learning models that accurately predicted length of stay following major surgery for oral cavity cancer. They demonstrated superior predictive performance compared to the ACS-NSQIP calculator. The machine learning model identified several novel predictors of length of stay. These models must be validated in other institutions before being used to counsel patients about perioperative outcomes and guiding shared decision-making.

Presenter: Dr. Vincent Wu

Mentor: Dr. John Lee

Presenter Category: PGY3

Presentation Time: 11:14 am

Admission of Patients with Obstructive Sleep Apnea Undergoing Ambulatory Surgery in Otolaryngology – Head & Neck Surgery

Background: Within Otolaryngology – Head and Neck Surgery (OHNS), obstructive sleep apnea (OSA) patients are frequently encountered. To implement policies and screening measures for admission of OSA patients undergoing ambulatory surgery, actual rates of admission must first be determined. We aimed to evaluate rates and reasons for admission of OSA patients after ambulatory OHNS surgery.

Methods: Retrospective chart review was undertaken of all OSA patients undergoing elective day-surgery OHNS procedures at a tertiary center from January 1, 2018 – December 31, 2019. The primary outcome measure was percentage of OSA patients admitted to hospital after ambulatory OHNS surgery. Secondary outcome measures included reasons for admission. Additionally, American Society of Anesthesiologists (ASA) score, perioperative complications, and patient demographics were captured.

Results: There were 118 OSA patients, out of 1942 cases performed during the review period. Thirty-eight were excluded as the procedures were not considered ambulatory. The remaining 80 OSA patients were included for analysis, with an average age of 51.7, SD 13.8, and 30 (38%) females. The admission rate was 47.5% (38/80 patients). Admitted patients were older ($p=0.0061$), and had higher ASA ($p=0.039$). Indication for surgery or type of surgery did not differ among admitted and non-admitted patients. The majority of patients, 97% (37/38 patients), were admitted for post-operative monitoring with an average length of stay of 1.07 days.

Conclusion: More than half of OSA patients did not require admission to hospital after ambulatory OHNS surgery, unaffected by indications for surgery or type of surgery. Higher ASA score and older age were found in admitted as compared to non-admitted patients.

Presenter: Drs. Amr Hamour & Jong Wook Lee
Mentors: Drs. Allan Vescan, Eric Monteiro & John Lee
Presenter Category: PGY3
Presentation Time: 11:21 am

Development of a Murine Model for Chronic Rhinosinusitis

Background: Chronic rhinosinusitis (CRS) is a complex inflammatory disease of the sinonasal cavity that has a poorly understood etiology. The negative impact of CRS on patients' overall quality of life and work productivity is well documented. Eosinophilic CRS, in particular, is often recalcitrant to conventional treatment. In order to better understand this disease entity and develop targeted treatment modalities, the creation of a reproducible animal model is an important step. This study aimed to optimize and validate an existing ovalbumin (OVA)-induced murine model of eosinophilic CRS.

Methods: Fifteen female and fifteen male Balb/c mice (n=30), aged 6 weeks old, were included in the eight week protocol. In the first week, experimental animals (n=20) received intraperitoneal sensitization with ovalbumin and adjuvant (aluminum hydroxide gel) in phosphate-buffered saline (PBS). Control animals (n=10) received PBS injection only. Between weeks 2-8, intranasal OVA with aspergillus oryzae protease in PBS was administered three times per week to experimental animals. Control animals received intranasal PBS only. Starting in week 3, four experimental and two control animals were sacrificed per week. Complete blood count (CBC) with differential, peripheral blood smear, IL-4 enzyme-linked immunosorbent assay (ELISA) of nasal lavage, and histological analysis of nasal cavity mucosa were completed on all animals. Standard safety parameters such as body weight, physical well-being, and behaviour were monitored throughout the study.

Results: Histological analysis of experimental animal nasal mucosa revealed significantly higher levels of eosinophilic tissue infiltration and degranulation, hyaline droplets, and Charcot-Leyden crystals, compared to control. Prolonged eosinophilia was associated with an increase in respiratory epithelial thickness (43.0 μ m [41.21, 44.79] in week 8, 14.9 μ m [14.17, 15.63] in control). Compared to control, there were increased levels of IL-4 in serum (72.1 pg/ml [58.46, 85.76], 46.48 pg/ml [30.77, 62.19] in control) and nasal lavage (41.46 pg/ml [34.23, 48.69], 13.14 pg/ml [-4.85, 31.13] in control) following two weeks of intranasal OVA and protease. There was no difference in CBC counts between groups. There were no adverse events observed during the study.

Conclusion: This murine model, utilizing OVA with aspergillus oryzae protease, induced substantial local eosinophilic inflammation within sinonasal mucosa. In the future, this model may be used to evaluate the efficacy of therapeutics designed to target CRS.

**Category 4 – Work undertaken by
PGY4 residents during clinical rotation**

Presenter: Dr. Neil Verma

Mentor: Dr. Allan Vescan

Presenter Category: PGY4

Presentation Time: 11:45 am

Simulation of Management of Internal Carotid Artery Injury in Endoscopic Sinus Surgery

Rationale: Injury to the Internal Carotid Artery (ICA) is a serious and devastating complication for the skull base surgeon. It is an uncommon injury and therefore limited training is received in the management of this complication. Our group had sought to develop a simulation-based learning module around the management of ICA injury during endoscopic skull base surgery, which would serve as an educational tool and provide an algorithm for management.

Methods: Our group aimed to develop a simulation scenario of an ICA injury during endoscopic surgery based on the principles of developing skills related to crisis resource management and interprofessional/interdisciplinary team communication. A modified Delphi approach was previously used to develop a protocol for management of ICA injury known as the Alert-Control-Transfer protocol. A literature search of endoscopic surgical simulation, crisis resource management and multidisciplinary teamwork simulation in medicine as well and the development of ICA injury management protocols.

Results: A 20 minute simulation-based scenario based on the Alert-Control-Transfer protocol was developed in a flow-chart model with structured learning objectives and debriefing session. A structured de-brief session was developed in accordance with educational objectives outlined in the study.

Conclusion: ICA injury remains a devastating complication requiring complex interventions in order to manage appropriately in the acute settings with a wide range of expertise. The implementation of an educational simulation tool would be useful for rare and complex scenarios in order to provide a safe learning environment for the trainee and receive appropriate feedback.

Presenter: Dr. Terence Fu
Mentor: Dr. John de Almeida
Presenter Category: PGY4
Presentation Time: 11:52 am

A Cost Utility Analysis Comparing CT Surveillance, PET-CT Surveillance, and Planned Post-Radiation Neck Dissection for Advanced Nodal HPV-Positive Oropharyngeal Cancer

Background: We compared the cost-utility of image-guided surveillance using computed tomography (CT) and positron emission-computed tomography (PET-CT) to planned post-radiation neck dissection (PRND) for the management of advanced nodal HPV-positive oropharyngeal cancer following chemoradiation (CRT).

Methods: A universal payer perspective was adopted. A Markov model was designed to simulate four treatment approaches with 3-month cycles over a lifetime horizon: (1) CT surveillance, (2) standard PET-CT surveillance, (3) a novel PET-CT approach with repeat PET at 6 months post-CRT for equivocal responders, and (4) PRND. Parameters including probabilities of CT nodal progression/resolution, PET-avidity, recurrence, and survival were obtained from the literature. Costs were reported in 2019 Canadian dollars and utilities were expressed in quality-adjusted life years (QALYs). Deterministic and probabilistic sensitivity analyses were performed to evaluate model uncertainty.

Results: PET-CT surveillance dominated CT surveillance and PRND in the base case scenario, and the novel PET-CT approach was the most cost-effective strategy across a wide range of variables tested in one-way sensitivity analysis. On probabilistic sensitivity analysis, novel PET-CT surveillance was the most cost-effective strategy in 78.1% of model iterations at a willingness-to-pay of \$50,000/QALY. Novel PET-CT surveillance resulted in a 49% lower rate of neck dissection compared to traditional PET-CT, and yielded an incremental benefit of 0.14 QALY with average cost-savings of \$1,309.

Conclusion: Image-guided surveillance including PET-CT and CT are cost-effective over PRND. The novel PET-CT approach with repeat PET for equivocal responders was the dominant strategy and yielded both higher benefit and lower costs compared to standard PET-CT surveillance.

Presenter: Dr. Jennifer Siu

Mentor: Dr. Leo Celi

Presenter Category: PGY4

Presentation Time: 11:59 am

Development of a Neural Network Model to Predict Long-Term Mortality in Patients Eligible for Tracheostomy in the ICU.

Background: Among patients with acute respiratory failure requiring prolonged mechanical ventilation, tracheostomies are often placed after approximately 7 to 10 days. Yet half of patients admitted to the intensive care unit receiving tracheostomy will die within a year, often within three months. Existing mortality prediction models for prolonged mechanical ventilation, such as the ProVent Score, have poor sensitivity and are not applied until after 14 days of mechanical ventilation. We developed a model to predict 3-month mortality in patients requiring more than 7 days of mechanical ventilation using deep learning techniques and compared this to existing mortality models.

Methods: Retrospective cohort study using the Medical Information Mart for Intensive Care III Database. A neural network model for 3-month mortality was created using process-of-care variables, including demographic, physiologic and clinical data for all adults requiring ≥ 7 days of mechanical ventilation. The area under the receiver operator curve (AUROC) was compared to the ProVent14 model at predicting 3 and 12-month mortality. Shapley values were used to identify the variables with the greatest contributions to the model.

Results: There were 4,334 encounters divided into a development cohort (n=3467) and a testing cohort (n=867). The final deep learning model included 250 variables and had an AUROC of 0.74 for predicting 3-month mortality at day 7 of mechanical ventilation versus 0.59 for the ProVent model. Older age and elevated Simplified Acute Physiology Score II (SAPS II) Score on intensive care unit admission had the largest contribution to predicting mortality.

Discussion: We developed a deep learning prediction model for 3-month mortality among patients requiring ≥ 7 days of mechanical ventilation using a neural network approach utilizing readily available clinical variables. The model outperforms the ProVent model for predicting mortality among patients requiring ≥ 7 days of mechanical ventilation. Future research will focus on external validation using a large international ICU database.

Presenter: Dr. Daniel Lee

Mentor: Dr. John Lee

Presenter Category: PGY4

Presentation Time: 12:06 pm

Nasal Nitric Oxide as a Long-Term Monitoring and Prognostic Biomarker of Mucosal Health in Chronic Rhinosinusitis

Background: Nasal nitric oxide (nNO) is a potential biomarker of chronic rhinosinusitis (CRS), and correlates well with endoscopic and radiologic severity of disease. However, the long-term profile of nNO as a biomarker is not established in literature. The objectives of our study were to examine whether nNO can maintain this correlation in a 5-year follow-up following endoscopic sinus surgery (ESS) and to investigate whether nNO value can be used to prognosticate revision rates in patients with CRS.

Methods: We enrolled CRS patients 5 years after they participated in our previous study. Patients underwent initial ESS at St. Michael's Hospital, Toronto, Canada between January 2013 and January 2015. Patients prospectively had the following measurements at baseline, 1-month, 6-month and 5-year post-ESS: nNO levels, Lund-Kennedy Endoscopy Score (LKES), and Sinonasal Outcome Test-22 (SNOT-22) score. We also compared the nNO levels between patients who underwent revision ESS and those who did not.

Results: There were 32 patients included in the study with 8 patients undergoing revision ESS during the 5-year follow up. nNO levels were elevated at 1-month, 6-month and 5-year post-ESS compared to baseline. A significant negative correlation between nNO and LKES was found at 5-year post-ESS. nNO levels were significantly reduced at baseline and 6-month post-ESS in the revision cohort compared to non-revision cohort despite having comparable radiologic severity.

Conclusion: nNO may serve as a non-invasive long-term biomarker to monitor sinus disease severity and to prognosticate patients with CRS. This has implications for potential integration into clinical practice.

Presenter: Dr. Shireen Samargandy

Mentor: Dr. John Lee

Presenter Category: PGY4

Presentation Time: 12:13 pm

Endoscopic Sinus Surgery Outcomes in Patients with Chronic Rhinosinusitis and Immunoglobulin Deficiencies

Background: Patients with chronic rhinosinusitis (CRS) and immunoglobulin deficiencies (ID) have more recalcitrant sinonasal disease and several of these patients undergo surgical management of their CRS. However, there is a paucity of literature on the surgical outcomes in this patient population. The objective of this study was to better elucidate the outcomes of endoscopic sinus surgery (ESS) in patients with ID.

Methods: A case-control study was performed comparing adult patients with ID and healthy controls with CRS that had undergone ESS. Patients were matched based on age, sex, type of CRS, and preoperative Lund-Mackay score. The revision surgery rates and changes in sinonasal outcome tests (SNOT-22) were evaluated.

Results: Thirteen patients with CRS and ID were matched to 26 control patients with CRS. The revision surgery rate for cases and controls was 31% and 12%, respectively. The differences did not reach statistical significance for revision surgery rates or time to revision surgery between the two groups ($p>0.05$). There was no significant difference in the change in SNOT-22 postoperatively between cases and controls ($p>0.05$).

Conclusion: These results suggest that patients with ID may benefit from ESS in a similar way to other patients with CRS. Given the rarity of this condition and the restrictiveness of inclusion criteria to ensure homogeneity, sample size was limited. Future multi-center collaborative research is needed to better understand the impact of ESS in this under-represented cohort of patients.

Presenter: Dr. Justin Cottrell

Mentor: Dr. Nik Wolter

Presenter Category: PGY4

Presentation Time: 12:20 Pm

Morbidity and Mortality from Adenotonsillectomy in Children with Trisomy-21

Importance: Children with trisomy 21 frequently undergo tonsillectomy with or without adenoidectomy, most commonly for Obstructive Sleep Apnea (OSA) and/or recurrent tonsillitis. Unfortunately, Adenotonsillectomy (AT) is less effective at treating OSA in children with trisomy 21. With no previous large-scale single-center studies to characterize the risks and predictors of risk for children with trisomy 21 undergoing AT, practitioners and caregivers are faced with uncertainty when attempting to make informed management decisions.

Objective: To better characterize the risks and determine predictors of morbidity and mortality from AT in children with trisomy 21.

Methods: A single centre retrospective chart review of pediatric patients (age < 18 years) with trisomy 21 who underwent AT was conducted from 1992 to 2019 at a single quaternary academic care centre. Available data was analyzed over more than 10 years post-operatively to extract demographic information, post-operative complications, and treatment failures.

Results: In this retrospective chart review of 251 children with trisomy 21 who underwent AT, 31.5% developed a post-operative complication and 28.7% required a prolonged hospital stay. The most common complications were respiratory issues, poor oral intake, and bleeding. No mortalities occurred. Surgical indication, ASA score >2, severe OSA, preoperative medical instability, and aerodigestive comorbidities were associated with post-operative respiratory complications. Treatment failure was seen in 24.6% of patients with sleep disordered breathing.

Conclusion: Children with trisomy 21 who undergo AT have an increased risk of complications compared to the general pediatric population. This is important to consider when planning pre- and post-operative management and having informed discussions with caregivers.