Otolaryngology - Head & Neck Surgery
UNIVERSITY OF TORONTO

The 30th Annual
PERCY IRELAND ACADEMIC DAY
May 5-6, 2022

The Percy Ireland Oration
on Friday May 6, 2022

by

Professor Patrick J. Gullane, CM, OOnt, MB, FRCSC, FACS,
***Hon* FRACS, *Hon* FRCS, *Hon* FRCSI**
Wharton Chair in Head & Neck Surgery
Professor Department of Otolaryngology-Head & Neck Surgery
Professor of Surgery, University of Toronto

"My Journey: Lessons Learned-Imagine the Future"

and

Our Guest of Honour
Professor Robert V. Harrison

Professor, Department of Otolaryngology – Head & Neck Surgery, University of Toronto
Senior Scientist, Program in Neuroscience and Mental Health
The Hospital for Sick Children, Toronto

Professor Patrick J. Gullane, CM, OOnt, MB, FRCSC, FACS, *Hon* FRACS, *Hon* FRCS, *Hon* FRCSI

Dr. Patrick Gullane was born in Ireland and received his medical degree from NUI-Galway, Ireland. He is a Fellow of the Royal College of Surgeons of Canada and certified by the American Board of Otolaryngology-Head and Neck Surgery. In 1975 he was selected as the McLaughlin Fellow and then pursued advanced Fellowship training in Head and Neck Oncology in Pittsburgh, and New York.

In 1978, Dr. Gullane was appointed to the Department of Otolaryngology-Head and Neck Surgery at the University of Western Ontario, Canada. He was subsequently recruited in 1983 to the Department of Otolaryngology-Head & Neck Surgery at the University of Toronto. He currently holds the Wharton Chair in Head and Neck Surgery at the University Health Network and University of Toronto. In 1989 he was appointed as Otolaryngologist-in-Chief within the University Health Network and in 2002 appointed as Professor and Chair of the Department of Otolaryngology-Head & Neck Surgery, University of Toronto.

Dr. Gullane is a member of numerous Surgical Societies, nationally/internationally and has been invited as a Visiting Professor to over 65 countries lecturing on all aspects of Head and Neck Oncology. He has delivered over 635 invited and Keynote presentations nationally/internationally including the Eugene Myers International lecture in September 2006, received the 2007 Medtronic Alumni Award from the National University of Ireland (Galway) for contributions to Health Care and Medical Science, delivered the Sir Peter Freyer Memorial lecture to the Irish Surgical Forum NUI-Galway in 2009, the John J. Conley lecture to the American Head and Neck Society in 2012, the 87th Abraham Colles lecture at the Royal College of Surgeons in Ireland in February 2012, the Hayes Martin lecture at the 5th World Congress of IFHNOS and annual meeting of the Head and Neck Society in New York in July 2014 and the Gunnar Holmgren Lecture to the Swedish Society of Otolaryngology-Head and Neck Surgery April 2018. He was one of the six International Faculty leaders who conducted the IFHNOS Head and Neck World Tour Program in 2008. Dr. Gullane has published 368 papers in peer-reviewed journals and 98 chapters in textbooks. In addition he has published 10 books on various aspects of Head and Neck Surgery. He has served as President of the American Head & Neck Society, The North American Skull Base Society, President of the Canadian Society of Otolaryngology-Head & Neck Surgery and Vice President of the Triological Society. In recognition of his distinguished achievements, Professor Gullane was awarded an Honorary Fellowship of the Royal Australasian College of Surgeons in 2006, Honorary Fellowship of the Royal College of Surgeons of England in 2010 and an Honorary Fellowship in the Royal College of Surgeons of Ireland in 2012. He was elected to Fellowship in the Canadian Academy of Health Sciences in 2011 and in 2010 was appointed as a Member to the ***Order of Canada*** by the Governor General of Canada, Cited for his inspiration of young surgeons and his contributions to the field of

Head and Neck Surgery. In 2014, in recognition of his outstanding contributions an endowed Chair was named in his honour at the University Health Network/University of Toronto. In February 2015, Dr. Gullane was appointed as a Member to the ***Order of Ontario*** by the Lieutenant Governor of Ontario for his achievements in the field of Head and Neck Surgery. Finally, he has facilitated the establishment of Six University-Hospital Chairs: Head & Neck Surgery, Reconstruction, Radiation Oncology, and Basic Science, from private funding donations in excess of $19.5 M., with continual funding up to the present time.

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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	1st	Dr. Robert Ruben	New York
1993	2nd	Dr. Noel Cohen	New York
1994	3rd	Dr. Howard Lampe	London, ON
1995	4th	Dr. Lauren Holinger	Chicago, IL
1996	5th	Dr. Derald Oldring	Edmonton, AB
1997	6th	Dr. Clarence Sasaki	New Haven, CT
1998	7th	Dr. Murray Morrison	Vancouver, BC
1999	8th	Dr. Stephen Harner	Rochester, MN
2000	9th	Dr. Dominique Dorion	Sherbrooke, QC
2001	10th	Dr. Richard Mabry	Duncanville, TX
2002	11th	Dr. Melvin Schloss	Montreal, QC
2003	12th	Dr. Jonas T. Johnson	Pittsburgh, PA
2004	13th	Dr. Phillip Wackym	Milwaukee, WI
2005	14th	Dr. Lanny Garth Close	New York, NY
2006	15th	Dr. Richard Chole	St. Louis, MO
2007	16th	Dr. David W. Eisele	San Francisco, CA
2008	17th	Dr. Robin Cotton	Cincinnati, OH
2009	18th	Dr. Douglas Mattox	Atlanta, GA
2010	19th	Dr. Robert Ferris	Pittsburgh, PA
2011	20th	Dr. Ehab Y. Hanna	Houston, TX
2012	21st	Dr. Carol Bradford	Ann Arbor, MI
2013	22nd	Dr. Michael G. Stewart	New York, NY
2014	23rd	Dr. Jonathan Sykes	Sacramento, CA
2015	24th	Dr. Bradley Welling	Boston, MA
2016	25th	Dr. Mark Wax	Portland, OR
2017	26th	Dr. Dan Fliss	Tel Aviv, Israel
2018	27th	Dr. Rodney J. Schlosser	Charleston, SC
2019	28th	Dr. Michael Cunningham	Boston, MA
2020	Cancelled due to the pandemic		
2021	29th	Dr. John Yoo	London, ON

Abstracts

Category 1 – Work undertaken by Graduate Degree Students/Postdoctoral Fellows

Presenter:	**Mr. Robel Alemu**
Mentor:	Dr. Karen Gordon
Presenter Category:	Graduate Degree Student
Presentation Time:	9:10 am

Spatial Hearing in Children with Asymmetric Hearing Loss: Defining Impairments and Effects of Cochlear Implantation

Robel Z. Alemu[1,4], Alan Blakeman[1], Sharon L. Cushing[1, 2, 3, 4], Blake C. Papsin[1, 2, 3 ,4], and Karen A. Gordon[1, 3, 4].

[1]Archie's Cochlear Implant Laboratory, The Hospital for Sick Children, Toronto, ON
[2]Department of Otolaryngology, The Hospital for Sick Children, Toronto, ON
[3]Department of Otolaryngology-Head & Neck Surgery, University of Toronto, Toronto, ON
[4]Institute of Medical Science, University of Toronto, Toronto, ON

Asymmetric hearing in development disrupts the ability of the auditory system to integrate sounds from each ear, compromising spatial hearing. Poor spatial hearing in childhood has been linked to deficits in language, cognitive and academic development. The present study aimed to explore: 1) if children with asymmetric hearing loss use head and eye movements to compensate for poor access to binaural hearing when localizing sounds in space and 2) whether cochlear implantation can improve spatial hearing in these children.

To address these objectives, spatial hearing was measured in children with asymmetric hearing loss. Participants were 15 children with single-sided-deafness who received a cochlear implant in the deaf ear (SSD-CI) [mean(*SD*) age at test=11.9(3.66) years, age at CI(SD)=10.1(4.33) years] and 19 children who used a hearing aid in one ear and a CI in the deaf ear (HA-CI) [mean(*SD*) age at test=12.7(3.03) years, age at CI(SD)=6.74(3.86) years]. A control group of 15 older adolescents and adults with typical or "normal" hearing (mean(SD) age at test=25.4(16.1) years) were tested with and without a plug/muff of the right ear. An *L*-shaped moving arm with a speaker fixed to the end presented bandpass filtered white-noise at a distance of approximately 1-*m* from the listener. Stationary sounds were presented along a pseudorandom range within a 120° arc in the azimuthal or horizontal plane and moving sound occurred over large (40°) or small (20°) ranges in left or right direction or with no change in overall direction. Eye-tracking glasses and a motion sensor placed on the top of the head measured unrestricted eye movements and head movements, respectively, in real-time. Analyses focused on root-mean-square-errors (RMSE) between stationary sound location over the 120° arc and response and logistic regression to quantify perception of moving sound direction (right vs left) with CI on versus off. Path length (PL) and area under the curve (AUC) measures were extracted from head and eye tracking data.

Results showed poor localization of stationary sounds in the SSD-CI and HA-CI groups compared to the control group [$F_{(2,\ 43)}$=24.3,p<0.001] but no significant difference in error between the two CI groups [estimate(*SE*)=-3.63(3.39),p=0.54]. In support, there was no significant effect of hearing thresholds in the non-implanted ear on error (p=1.00). Error localizing stationary sound decreased in the hemifield of the implanted ear in the SSD-CI and HA-CI groups when CI was on vs off [$F_{(1,\ 91)}$=11.72,p<0.001; estimate(*SE*)=-11.57(2.90),p<0.001]. Perception of moving sound direction was impaired in the CI groups compared to the control group [$F_{(2,\ 86)}$=178.1,p<0.001] with no significant differences between SSD-CI and HA-CI groups [estimate(*SE*)=-0.03(0.03),p=0.81] and no effect of CI on versus off (p=0.24). CI groups moved their heads less than controls for localization of stationary and moving sound (AUC, moving sound: $F_{(2,\ 28)}$=10.0,p<0.001; AUC, stationary: $F_{(2,\ 32)}$=9.09,p<0.001).

Findings reveal significant spatial hearing impairments in children with asymmetric hearing. These impairments are present regardless of the degree of hearing in the better ear. There are subtle benefits of CI, particularly in the hemifield on the deaf side. Limited use of head movements in these children relative to peers with typical hearing suggests poor compensatory strategies. Future work is needed to encourage strategies for spatial hearing in children with asymmetric hearing.

Presenter:	**Ms. Melissa Hazen**
Mentors:	Drs. Sharon Cushing and Karen Gordon
Presenter Category:	Graduate Degree Student
Presentation Time:	9:20 am

Developmental Effects of Concurrent Vestibular & Auditory Impairments in Childhood

Background: The present study aims to define vestibular testing that can be accomplished in young children and which will predict future balance impairments. Vestibular deficits are particularly prevalent in children with hearing loss (20-70%) and are likely the root of impaired balance in this population. Identifying those children with vestibular impairment could direct habilitation and avoid developmental delays. Present clinical test batteries require behavioural cooperation and comprehension of the task which makes testing vestibular function in children under the age of five years difficult. Potential candidate tests for early vestibular testing are the video head impulse test (vHIT) that measures the high frequency vestibular ocular reflex (VOR) and the ocular and cervical vestibular myogenic potentials (VEMPs) which assess the utricle and saccule, respectively. Our hypothesis is that the vHIT provides better sensitivity and specificity for prediction of balance problems than the VEMPs in children with hearing loss.

Methods: A retrospective review of vHIT and VEMP test results and balance measured by the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2) or the Alberta Infant Motor Skills, Peabody Developmental Motor Scale were available in a clinical cohort of 505 children with hearing loss that ranged from mild to profound with similar sex distribution (247 female, 258 male). The average age was 10.59 years (*SD* = 4.39, IQR: 6.81-14.97). Etiology consisted of 84 acquired hearing losses (45 female, 39 male), 129 congenital hearing losses (69 female, 59 male), and 292 unknown etiologies (129 female, 154 male).

Hearing was affected bilaterally in 148 children (79 female, 68 male), on the left side only in 53 children (25 female, 27 male), and 60 children on the right side (29 female, 31 male). Etiology consisted of 84 acquired hearing losses (45 female, 39 male), 129 congenital hearing losses (69 female, 59 male), and 292 hearing loss with unknown cause (129 female, 154 male). Of these children, 204 used cochlear implants (94 female, 109 male), 10 wore hearing aids (7 female, 3 male), and 151 had no devices (76 female, 74 male). Comparisons between available vestibular and balance tests were conducted using mixed model regressions in R statistical software, accounting for covariates of age, sex, etiology, and degree of hearing loss.

Results: Outcomes of analyses will be presented. The high frequency vHIT results are expected to show the best prediction of balance function.

Significance: This study will gather the preliminary evidence needed to begin to establish vestibular screening protocols and develop better tools to identify vestibular impairments in children with hearing loss at a young age.

Presenter:	**Ms. Priyanka Prince**
Mentors:	Drs. Joseph Chen, Andrew Dimitrijevic, Trung Le and Vincent Lin
Presenter Category:	Graduate Degree Student
Presentation Time:	9:30 am

Neural Correlates of Auditory Working Memory in Cochlear Implant Users are Related to Speech Perception in Noise Ability

Priyanka Prince[1,2], Joseph Chen[3,4], Trung Le[3,4], Vincent Lin[3,4], and Andrew Dimitrijevic[1,2,3,4]

1. Evaluative Clinical Sciences Platform, Sunnybrook Research Institute, Toronto, ON Canada
2. Department of Physiology, University of Toronto, Toronto, ON, Canada
3. Otolaryngology—Head and Neck Surgery, Sunnybrook Health Sciences Centre, Toronto, ON, Canada
4. Faculty of Medicine, Otolaryngology—Head and Neck Surgery, University of Toronto, Toronto, ON, Canada

A common concern for individuals with severe-to-profound hearing loss fitted with cochlear implants (CIs) is difficulty following conversations in noisy environments. Previous work has shown that clinically measured speech perception in noise scores yield high degrees of variability in CI users where 10-22% of variance can be explained by age and duration of hearing and even less can be explained by surgical factors leaving a majority of the variance unaccounted for. A possible factor contributing to the wide range of speech perception scores is individual differences in the recruitment of cognitive resources including working memory and attention. In this study, we investigated behavioural and neural correlates of auditory working memory in 14 CI users using high-density electroencephalogram (EEG) while participants completed an N-back task consisting of two conditions, 0-back and 2-back. The behavioural outcomes and neural activations from this task were then correlated with speech perception in noise scores. The auditory stimuli presented in each trial was ten double-digit numbers (DDN). In the 0-back control condition, the participants were primed with one DDN and were instructed to a indicate with button press when the double numbers were heard. The 2-back experimental condition was similar to 0-back except that the task was to identify DDN matches from two pairs in the sequence. Behavioural results yielded significant correlations between the 2-back task performance and speech in noise perception in noise. CI users with higher speech perception in noise scores perform more accurately on the 2-back condition compared to CI users with lower speech perception scores suggesting higher degrees of working memory ability in this group. Electrophysiology showed that auditory encoding (N1) was significantly related to speech in noise perception and significant correlations between neural oscillations (alpha, 8-12 Hz, beta, 13-30 Hz and theta, 4-7 Hz) and speech perception in noise ability were observed. These results suggest that both bottom-up (encoding) and top-down (attention and working memory) processes contribute to the observed variability in speech in noise perception in CI users.

Presenter:	**Ms. Matsya Thulasiram**
Mentor:	Dr. Alain Dabdoub
Presenter Category:	Graduate Degree Student
Presentation Time:	9:40 am

Using *In Vitro* Whole-tissue Modelling of the Stria Vascularis to Compare the Proliferative Capacity of Neonatal and Adult Tissue

Sound transduction is driven by the stria vascularis (SV), a highly vascularized and specialized tissue which maintains the ionic environment within the cochlea. The SV also serves as the blood-labyrinth barrier, strictly controlling the movement of substances into the cochlea. Degeneration of the SV due to aging disrupts cochlear homeostasis, which results in progressive and significant hearing loss. However, there have been limited efforts to develop treatments for SV-related hearing loss. Therefore, we have developed an *in vitro* organotypic explant technique to investigate the properties of the SV. Using this method, we show that the neonatal SV is highly proliferative while the adult SV is not. We hypothesized that the SV loses the ability to proliferate with age by differential gene expression. Specifically, we examined the role of the Wnt/ß-catenin signalling pathway, which we have previously shown to play a significant proliferative role in cochlear cell types. We demonstrate here that pharmacological inhibition of Wnt/ß-catenin signalling in neonatal SV explants significantly reduces proliferation, which indicates that Wnt/ß-catenin signalling may be a key player in the proliferative capacity of the SV. We are currently investigating the effects of Wnt/ß-catenin activation in adult SV explants to determine whether we can promote proliferation in adult tissue.

Presenter:	**Ms. Angela Fung**
Mentor:	Dr. Karen Gordon
Presenter Category:	Graduate Degree Student
Presentation Time:	9:50 am

Exploring the Use of Auditory Nerve and Brainstem Electrophysiology to Improve Spatial Hearing in Children using Bilateral Cochlear Implants

Angela Fung[1,2], Jaina Negandhi[2], Alan W. Blakeman[2], Robel Z. Alemu[1,2], Sharon L. Cushing[1,2,3,4], Blake C. Papsin[1,2,3,4], Karen A. Gordon[1,2,3,4,7]

1Institute of Medical Sciences, University of Toronto, Toronto, ON, Canada
2Archie's Cochlear Implant Laboratory, Hospital for Sick Children, Toronto, ON, Canada
3Department of Otolaryngology, Head and Neck Surgery, Hospital for Sick Children, Toronto, ON, Canada
4Department of Otolaryngology, Head and Neck Surgery, University of Toronto, Toronto, ON, Canada
7Department of Communication Disorders, Hospital for Sick Children, Toronto, ON, Canada

OBJECTIVES: The study aims to improve spatial hearing in children using bilateral cochlear implants (CIs) by defining balanced current levels between the two devices. We explored the use of electrophysiology to identify asymmetrical and balanced bilateral levels.

BACKGROUND: Electrophysiological responses could help to prevent mismatched bilateral sound input during programming, particularly in child CI users who are unable to provide feedback about their hearing. This may be crucial to support spatial hearing, as children with bilateral CIs have poor detection of inter-aural time differences (ITDs) and thus rely primarily on inter-aural level differences (ILDs) for spatial information. We hypothesized that levels evoking equal-amplitude auditory nerve responses would indicate symmetrical input to the auditory brainstem, thus resulting in 1) a change in the bilaterally-evoked auditory brainstem response, and 2) a perception of balanced sound.

METHODS: Unilateral electrically-evoked auditory nerve (ECAP) responses and bilateral electrically-evoked auditory brainstem responses (EABRs) were recorded in 9 children who received bilateral CIs sequentially (n=3) or simultaneously (n=6). They had used their bilateral CIs for mean(SD) = 4.6(5.3) years and were tested at mean(SD) = 13.9(3.0) years old. Balanced input levels (ILD = 0) were predicted at levels evoking equal amplitudes from ECAPs measured at the time of implantation. Bilateral EABRs were evoked using ECAP balanced levels (ILD=0) and at ILDs of ±4, ±8, and ±12 clinical units (CU) relative to the ILD=0. This process was conducted for 3 different electrode pairs along the basal, mid, and apical sections of the electrode array (electrodes 3, 9, and 18, respectively). Participants also completed a behavioural lateralization task using the same bilateral CI stimuli; they were asked to indicate if they perceived these ILDs on the left or right side. EABR (both unilateral and bilateral) and ECAP responses collected in a previous cohort (n=9, mean(SD)= 5.3(3.5) years old) were also analyzed. In this retrospective cohort, ILD ranges were larger (±10, ±20 CU) and only collected at apical CI electrode pairs.

RESULTS: Overall, bilateral levels corresponding to better-matched unilateral ECAP responses predicted better matched unilateral EABR amplitudes and smaller bilateral EABR amplitudes at apical electrodes ($R2$ = 0.098, p= 0.0012). However, this change in the bilateral EABR was not consistent in our prospective cohort alone, where a narrower range of levels (ILDs of up to ±12 CU) was used across basal, mid, and apical electrode pairs. Lateralization of bilateral input within the ±12 CU ILD range was tested in 8 participants, and balanced perception did not consistently occur at the ILD=0 levels defined by matched ECAP amplitudes.

CONCLUSION: In this study, asymmetry of bilateral levels was evident through both unilateral auditory nerve and bilateral auditory brainstem responses across wide ILD ranges. Our lateralization results, however, suggest that matched auditory nerve responses may not be able to predict a behavioural perception of balance, and that ILD sensitivity is poor at narrower ranges in children using bilateral CIs. Clinical protocols to correct level asymmetries may be needed to provide better access to accurate ILDs and promote binaural/spatial hearing in these children.

Presenter:	**Dr. Christopher Noel**
Mentors:	Drs. Natalie Coburn, Tony Eskander and Rinku Sutradhar
Presenter Category:	Graduate Degree Student
Presentation Time:	10:00 am

Predicting Emergency Department Use and Unplanned Hospitalization in Patients with Head and Neck Cancer: Development and Validation of a Machine Learning Algorithm

Christopher W Noel MD[1,2,3], Rinku Sutradhar PhD[2,3], Lesley Gotlib Conn PhD[2,4], David Forner MD MSc[2,5], Wing C Chan MPH[3], Rui Fu PhD[2,3,4], Julie Hallet MD MSc[2,3,4,6], Natalie G Coburn MD MPH[2,3,4,6], Antoine Eskander MD ScM[1,2,3,4,6]

[1]Department of Otolaryngology-Head and Neck Surgery, University of Toronto, Toronto, Canada
[2]Institute of Health Policy, Management and Evaluation, Dalla Lana School of Public Health, University of Toronto, Toronto, Canada
[3]ICES, Toronto, Canada
[4]Evaluative Clinical Sciences, Sunnybrook Research Institute, Sunnybrook Health Sciences Centre, Toronto, Canada
[5]Division of Otolaryngology-Head and Neck Surgery, Dalhousie University, Halifax, Canada
[6]Department of Surgical Oncology, Odette Cancer Centre, Sunnybrook Health Sciences Centre, Toronto, Canada

Funding: This work is supported by a Canadian Cancer Society Challenge Grant, the Canadian Institute of Health Research Terry Fox New Investigator Clinician Scientist Award, the Academic Health Science Centre Alternative Funding Plan Innovation Fund, the Sheriff Lou Hanna Surgical Oncology Research Chair, and a Harry Barbarian Research Grant. Dr Noel receives salary support through a CIHR Doctoral Award, an Ontario Ministry of Health Clinician Investigator Award, an Ontario Graduate Scholarship, a Raymond Ng Doctoral Award, the Chapnik, Freeman Friedberg Clinician Scientist Award, and the Waratah Hold'Em for Life Oncology Fellowship.

Background: We recently demonstrated that patient reported symptom burden is strongly associated with emergency department use and unplanned hospitalization (ED/Hosp) in head and neck cancer (*Noel et al. 2021 J. Clin Oncol DOI: 10.1200/JCO.20.01845*). We hypothesized that symptom scores could be combined with administrative health data to accurately risk stratify patients.

Objective: To develop and validate a machine learning approach to predict future ED/Hosp in head and neck cancer patients.

Design and Participants: This was a population-based study of patients diagnosed with head and neck cancer between 2007 and 2018. All outpatient clinical encounters were identified. Edmonton Symptom Assessment Scores (ESAS) and clinical and demographic factors were abstracted. Training and test cohorts were randomly generated in a 4:1 ratio. Various machine learning algorithms were explored including: (1) logistic regression using a least absolute shrinkage and selection operator, (2) random forest, (3) gradient boosting machine (4) k-nearest neighbors and an (5) artificial neural network.

Setting: Ontario, Canada

Main Outcomes and Measures: Our main outcome was any 14-day ED/Hosp event following symptom assessment. The performance of each model was assessed on the test cohort using the area under the receiver operator characteristic (AUROC) curve and calibration plots. Shapley values were used to identify

the variables with greatest contribution to the model.

Results: The training cohort consisted of 9,409 patients undergoing 59,089 symptom assessments (80%). The remaining 2,352 patients and 14,193 symptom assessments were set aside as the test cohort (20%). Several models had high predictive accuracy, particularly the gradient boosting machine (validation AUROC 0.80 [95%CI 0.78-0.81]). A Youden-based cut-off corresponded to a validation sensitivity of 0.77 and specificity of 0.66. Patient reported symptom scores were consistently identified as being the most predictive features within models. A second model built only with symptom severity data had an AUROC of 0.72 [95%CI 0.70-0.74].

Conclusions and Relevance: Machine learning approaches can be used to predict ED/Hosp in head and neck cancer patients. This tool can accurately risk stratify patients and may help direct targeted intervention.

Presenter:	**Dr. Zhifen Zhang**
Mentor:	Dr. Trung Le
Presenter Category:	Postdoctoral Fellow
Presentation Time:	10:30 am

Selective Targeting TrkC Receptors as a Disease-Modifying Tool for Noise Induced Hearing Loss

Noise induced hearing loss (NIHL) is caused by neural degeneration characterized by the loss of inner ear hair cells and synaptic connection between cells and their afferent neurons. Neurotrophins (NTs) are a family of growth factors that drive neuronal survival, synaptic maintenance, and function in healthy systems, but can also cause synaptic loss and neuronal death in disease states. This novel paradoxical role of NT receptor signaling in neuronal survival and death makes it a challenging therapeutic target for NT-based neuroprotection strategy. In this study, we focus on characterizing the role of two NT receptor isoforms, TrkC-FL and TrkC.T1, which are both Neurotrophin-3 (NT-3) mediated receptors with opposite roles: full length TrkC-FL regulates survival signals, while truncated version TrkC.T1 promotes neuronal death.

We found significant upregulation of both isoforms in synaptic puncta and spiral ganglion neurons in response to acoustic insult. Using a genetic approach, we engineered knockout mouse of TrkC.T1 and studied functional hearing loss and synaptic damage of different genotypes (+/+, +/-, -/-). Our results showed that inhibiting expression of TrkC.T1 and increased expression of TrkC-FL protected mice from hearing loss and allowed faster synaptic recovery after NIHL trauma. Our results elucidate biological paradoxes of TrkC receptor isoforms and their role in NIHL, validate the concept and importance of selective targeting of TrkC growth receptor as a promising disease-modifying tool to treat NIHL.

Presenter:	**Dr. Jackie Ogier**
Mentor:	Dr. Alain Dabdoub
Presenter Category:	Postdoctoral Fellow
Presentation Time:	10:40 am

ASK1 is a Novel Molecular Target for Preventing Aminoglycoside Induced Hair Cell Death

Aminoglycoside antibiotics are lifesaving medicines, crucial for the treatment of chronic or drug resistant infections. However, aminoglycosides are toxic to the sensory hair cells in the inner ear. As a result, aminoglycoside-treated individuals can develop permanent hearing loss and vestibular impairment. There is considerable evidence that reactive oxygen species (ROS) production and the subsequent phosphorylation of c-Jun N-terminal kinase (JNK) and P38 mitogen-activated protein kinase (P38) drives apoptosis in aminoglycoside-treated hair cells. However, treatment strategies that directly inhibit ROS, JNK or P38 are limited by the importance of these molecules for normal cellular function. Alternatively, the upstream regulator apoptosis signal-regulating kinase 1 (ASK1/MAP3K5) is a key mediator of ROS-induced JNK and P38 activation under pathologic but not homeostatic conditions. We investigated ASK1 as a mediator of drug-induced hair cell death using cochlear explants from *Ask1* knockout mice, demonstrating that *Ask1* deficiency attenuates neomycin-induced hair cell death. We then evaluated pharmacological inhibition of ASK1 with GS-444217 as a potential otoprotective therapy. GS-444217 significantly attenuated hair cell death in neomycin-treated explants but did not impact aminoglycoside efficacy against *P. aeruginosa* in the broth dilution test. Overall, we provide significant pre-clinical evidence that ASK1 inhibition represents a novel strategy for preventing aminoglycoside ototoxicity.

Category 2 – Work undertaken by
PGY2 residents during clinical rotation

Presenter:	**Dr. Justine Philteos**
Mentor:	Dr. David Goldstein
Presenter Category:	PGY2
Presentation Time:	10:50 am

Impact of Advanced Hemodynamic Monitoring on Intra-operative Hypotension Following Head and Neck Free Flap Reconstructive Surgery: A Before–After Study.

Introduction: Despite the improvement in surgical techniques, free flap reconstruction for head and neck cancer is still associated with a high risk of perioperative complications. One of the modifiable risk factors associated with perioperative morbidity is intraoperative fluid therapy and hemodynamic management. Of critical intra-operative importance is the maintenance of both organ and free flap perfusion – this is often achieved through fluids and vasopressors. Intraoperative fluids and vasoactive agents must be carefully titrated to manage intraoperative hypotension (IOH) without promoting edema or vasoconstriction, which inadvertently contributes to free flap compromise and postoperative organ dysfunction. Goal-directed hemodynamic therapy (GDHT), based on advanced cardiac output monitoring, has been explored in several surgical specialties to optimize intraoperative fluid management and minimise hypotension to improve postoperative outcomes. The goal of this study was to determine whether the use of GDHT during head and neck free flap surgery would reduce the duration of intraoperative hypotension (IOH) and post-operative complications.

Methods: This is a matched before-after study. Perioperative data were collected retrospectively on free flap patients from January 1, 2017 to December 31, 2019. The use of an arterial waveform based cardiac output monitor (FloTrac™) was introduced into clinical practice on January 1, 2020 and is associated with an algorithm to guide fluid management. Patients with the advanced hemodynamic monitoring were compared to historical controls; they were matched according to sex, age, comorbidities (age-adjusted Charlson Comorbidity index), and location of malignancy. The primary outcome was the number IOH episodes, defined as > 5 minutes with a Mean Arterial Pressure (MAP) <65 mmHg. A secondary objective was the total intraoperative time with an MAP <65 mmHg. Continuous and categorical variables were expressed as median (IQR).

Results: A total of 414 patients were included in the study cohort: 346 prior to the initiation of GDHT (before group), and 68 after (monitored group) the advanced hemodynamic monitor was implemented. The two groups had no statistically significant differences in terms of patients' age, ASA score, comorbidities, and duration of anesthetic. The number of IOH episodes did not significantly differ with the introduction of the advanced hemodynamic monitoring: 6 (2-12) vs. 8 (3-14) $p<0.15$. Furthermore, the total duration of IOH also did not significantly differ between the two groups: 93 min (33-173) vs. 109 min (47-180), $p<0.21$. Intraoperative fluids administered were comparable between the two groups: 2250 cc (1607-3050) vs. 2210 cc (1700-2807), $p<0.99$). With regards to vasoactive agents, the use of norepinephrine and dobutamine significantly increased from 1.2% to 5.9 % ($p<0.01$) and 2.4% to 30.9% ($p<0.001$) respectively – with greater

use in the monitored group. The total dose of phenylephrine increased from 480**mc**g (160-1344) to 640**mc**g (240-2156), $p<0.05$, in the monitored group.

Conclusion: The implementation of advanced hemodynamic monitoring was not associated with a reduction in the number of IOH episodes or the total duration of IOH. The administration of vasopressors and inotropic agents increased with the introduction of GDHT. We are currently investigating the impact of these anesthetic changes on post-operative flap outcomes, post-operative complications and length of hospital stay.

Presenter:	**Dr. Lily Wang**
Mentor:	Dr. John Lee
Presenter Category:	PGY2
Presentation Time:	11:00 am

Automation and Optimization of Radiological Interpretation of Chronic Rhinosinusitis on Paranasal Sinus Computed Tomography ("Deep Sinus CT")

Introduction: Paranasal sinus computed tomography (CT) is ordered by primary care providers, inpatient teams, and otolaryngologists to assess the presence, severity and extent of chronic rhinosinusitis (CRS). It is also crucial in surgical planning, should patients require surgical intervention. While radiologists often describe the opacification of sinuses qualitatively ("mild, moderate, severe, complete"), such descriptions do not have much bearing in clinical practice. Instead, specialists calculate the Lund-Mackay score (LMS), which is based out of 24 (0 – no opacification, 1 – partial opacification, 2 – complete opacification for 6 different areas of the paranasal sinuses), to determine the radiologic severity of chronic rhinosinusitis and make clinical decisions accordingly. Automatic calculation of the LMS and inclusion in radiology reports would standardize sinus CT reporting with a clinically relevant measure and save significant time per each outpatient encounter.

Methods: A machine learning model was developed to detect and score paranasal sinus opacification with clinical congruency compared to manual LMS scoring by an otolaryngology resident or radiology fellow (ground truth annotation, GT). The Radiology Information System was searched using Nuance mPower for outpatients that underwent CT scan of the paranasal sinuses. De-identified images were uploaded to a secure, web-based annotation platform (md.ai). Individual sinuses on each slice of the axial CT scan were drawn and labelled. Custom machine learning models were then developed and trained using the labelled sinus CT scans. The model was then evaluated by comparing the machine learning model predicted scores versus the manual score, reported as the Dice score. The Dice score ranges from 0 to 1 where 1 corresponds to a pixel perfect match between the deep learning model output and ground truth annotation.

Results: Preliminary results of the machine learning model are promising. In the Sphenoid sinus, comparison of GT labels and auto machine-segmented labels revealed auto segmentation to be more precise in detecting and drawing sinus boundaries. An initial Dice score of 0.5 was achieved with the auto segmentation model. Errors were due to imprecise GT labels and flipped detection of left versus right sinuses. Regarding the ostiomeatal complex (OMC), the machine model was unable to detect the OMC region.

Discussion: Machine learning models are still in development and future iterations of the model are expected to increase the Dice score to 0.7 with the current data set. Iterations of the model will also need to be programmed to better teach the features of the OMC that define the area for identification.

Presenter:	**Dr. Ahmed Saleem**
Mentor:	Dr. David Goldstein
Presenter Category:	PGY2
Presentation Time:	11:10 am

Quantifying Neck Fibrosis: Domain Structure and Validity Assessment of the NFS-13

Ahmed Saleem, MD[1], Christopher W Noel, MD[1,2], Katrina Hueniken, MPH[3], Rajan Grewal[4], Giselle Peralta[4], Adam Kwinter, MD[1], John R de Almeida, MD MSc[1,2,4], David P Goldstein, MD MSc[1,4]

[1]Department of Otolaryngology - Head & Neck Surgery, University of Toronto, Toronto, Ontario, Canada
[2]Institute of Health Policy, Management and Evaluation (IHPME), University of Toronto, Toronto, Ontario, Canada
[3]Department of Biostatistics, Princess Margaret Cancer Centre--University Health Network, Toronto, Ontario, Canada
[4]Department of Otolaryngology - Head & Neck Surgery/Surgical Oncology, Princess Margaret Cancer Centre, Toronto, Ontario, Canada

Objective: We recently described the development of the Neck Fibrosis Scale (Noel, Kwinter et al. 2021 Laryngoscope DOI: 10.1002/lary.29897). In this current submission, we confirm domain structure and validate a scoring system for a modified version of the neck fibrosis scale (NFS-13).

Study Design: Prospective cross-sectional study.

Methods: 127 head and neck cancer patients with varying degrees of neck fibrosis completed the original 15 item Neck Fibrosis Scale (NFS-15). Exploratory factor analysis was performed to identify optimal grouping of questions to measure similar underlying factors. Factorability was checked using the Bartlett test of sphericity and the Kaiser-Meyer-Olkin test for factor adequacy. The number of factors was chosen through parallel analysis (Cattell Scree plot and Kaiser criterion). Factor analyses were computed on Spearman correlation matrices using oblimin rotation and maximal likelihood estimates as the factoring method. Construct validity of the factors was assessed through correlation with the Neck Dissection Impairment Index, neck elasticity and neck range of motion.

Results: Exploratory factor analysis confirmed 13 of the 15 items from the NFS-15 mapped onto two domains ('physical' and 'emotional'). The remaining two items, 'neck swelling' and 'energy', did not load (<0.3). This revised questionnaire was named the NFS-13. The Bartlett test of sphericity reached statistical significance ($p<0.01$), indicating the items were factorable. The Kaiser-Meyer-Olkin test indicated an overall measure of sampling adequacy (>0.7 in all cases). The physical domain explained 41% of the total variance in 9 questions; the emotional domain explained 28% of the variance in 4 questions. Overall test-retest reliability for these two domains is high (>0.7, $p<0.01$). The NFS-13 and its subdomains show strong correlation with objective measures of neck fibrosis.

Conclusions: A reliable and valid patient reported outcome for measuring cutaneous neck fibrosis has been developed. Future efforts should be directed towards evaluating responsiveness through prospective longitudinal assessment.

Presenter:	**Dr. Garret Horton**
Mentor:	Dr. Yvonne Chan
Presenter Category:	PGY2
Presentation Time:	11:20 am

Racial Diversity amongst Otolaryngology-Head & Neck Surgery Programs in Canada

Garret Horton MD MSc, Oluwaseun Daniel Davies MD, Dongho Shin MD, Elysia Grose MD, Tanya Chen MD, Paolo Campisi MSc MD FRCSC, Ian Witterick MD MSc FRCSC, Yvonne Chan MD FRCSC MSc HBSC

Background: In the United States, Otolaryngology-Head & Neck Surgery (OHNS) has been identified as a surgical subspecialty in which racial disparities are particularly pronounced. In 2016, OHNS had the lowest percentage of African American faculty compared to other surgical specialties. Asian Americans and Hispanics were also underrepresented amongst faculty when compared to the proportion of otolaryngology residents who identified as Asian American or Hispanic American.

In Canada, the landscape of racial diversity in academic OHNS programs is currently unknown. Previously, Canadian medical organizations have refrained from collecting race-based data, however new policy guidelines from the Canadian Medical Association supports data collection that may be used to support equity, diversity, and inclusion programs. This study aims to describe racial diversity amongst academic OHNS departments in Canada.

Methods: An online survey was distributed to members of every academic OHNS department in Canada (13 in total). In total there were 255 respondents (response rate of 41%). This anonymous survey collected information regarding each participant's program, position, race, gender, and whether they were based in an academic or community hospital.

Results: Our findings showed that the racial diversity of Canadian academic OHNS departments closely resembles the racial diversity of Canada based on the 2016 Statistics Canada Census data. The proportion of each demographic group in OHNS fell within 10% of the Canadian data, except for the non-visible minority group which represented 77% of the Canadian population and 63% of academic OHNS respondents. Notably, racial diversity declined with academic seniority with 52% of residents being non-visible minorities compared to 59% of lecturers, 60% of assistant professors, 77% of associate professors, and 76% of full professors. Additionally, there is a lack of racial and gender diversity at the level of full professor; 97% are male and 3% are female, and no female full professor respondents were visible minorities.

Conclusion: This study shows that the racial diversity of Canadian academic OHNS departments is similar to the racial diversity of the Canadian population, however at more senior levels women and visible minorities are under-represented.

Presenter:	**Dr. Marc Levin**
Mentor:	Dr. John Lee
Presenter Category:	PGY2
Presentation Time:	11:30 am

Quantifying Surgical Completeness in Patients with Aspirin Exacerbated Respiratory Disease

[1]Marc Levin, [1]Yvonne Chan, [2]Doron Sommer, [3]Andrew Thamboo, [1]John Lee

[1]Department of Otolaryngology – Head & Neck Surgery, St. Michael's Hospital, Unity Health Toronto, University of Toronto, Toronto, ON
[2]Department of Surgery – Division of Otolaryngology Head & Neck Surgery, McMaster University, Hamilton, ON
[3]Department of Surgery – Division of Otolaryngology Head & Neck Surgery, University of British Columbia, Vancouver, BC

Introduction: Recalcitrant aspirin exacerbated respiratory disease (AERD) in patients who have had sinus surgery remains a challenge. Aspirin desensitization and biologics are additional treatment options. It remains unclear if these patients require "adequate" surgery prior to implementing such additional therapies. The purpose of this study was to quantify prior surgery completeness in AERD patients at a tertiary rhinology practice.

Methods: Paranasal sinus CT scans were reviewed by four fellowship trained rhinologists to assess surgery completeness. Using a published CT grading system, each sinus was graded on the completeness of surgery and middle turbinate reduction. A score out of 14 was calculated for each patient (7 per side).

Results: 61 patients with AERD out of 141 available were included. We excluded patients whose prior scans were not available or who did not have prior surgery. Patients' (27M: 34F) ages ranged from 24-77 years (mean = 57). The mean Lund-Mackay score was 20.1. Mean inter-rater agreement across all sinuses was moderate (k = 0.42). The mean completeness score was 6.7/14. The following procedures were rated as completed (means): uncinectomy (L: 84%, R: 82%, k = 0.44), maxillary (L: 83%, R: 77%, k = 0.32), middle turbinate reduction (L: 45%, R: 46%, k = 0.31), anterior ethmoid (L: 35%, R: 39%, k = 0.51), sphenoid (L: 36%, R: 35%, k = 0.4), posterior ethmoid (L: 30%, R: 30%, k = 0.48), frontal (L: 22%, R: 21%, k = 0.46).

Conclusion: Surgical openings from prior surgery in AERD patients were mostly deemed incomplete. Uncinectomy and maxillary antrostomy are the most common procedures previously performed. It remains to be seen whether additional "complete" surgery would provide greater disease control.

Category 3 – Work undertaken by PGY3 residents during clinical rotation

Presenter:	**Dr. Edward Sykes**
Mentor:	Dr. Tony Eskander
Presenter Category:	PGY3
Presentation Time:	11:40 am

Head and Neck Cancer Screening - A Review of Evidence

Malignancies of the head and neck are the seventh most common cause of cancer in Canada. Despite treatment, the five-year survival remains between 50-60%. It is theorized that early detection and treatment of head and neck cancer can decrease surgical comorbidity and improve survival. The purpose of this project is to systematically review national screening programs for their efficacy in (i) reduction of cancer incidence and (ii) stage migration for each head and neck cancer subsite. Three-thousand eighty-six peer-reviewed publications between January 2001-December 2020 were obtained by systematic database search. Studies exploring the clinical efficacy of population-level screening programs were included. A comprehensive meta-analysis will be performed on the accrued data to provide recommendations and criteria for development of a subsite-specific Canadian Head and Neck screening program in the future.

Presenter:	**Dr. Fahad Aldhahri**
Mentor:	Dr. Joel Davies
Presenter Category:	PGY3
Presentation Time:	11:50 am

The role of postoperative radiotherapy in low- and intermediate grade primary salivary gland malignancies of the parotid: a multi-institutional Canada-wide retrospective study

Background: Malignant salivary gland tumors are a rare entity as they only consist 1-3% of all head and neck cancers, and have a wide variety of morphological entities. It has been well accepted in the medical and scientific community that the most important prognostic factor for such tumors are clinical stage at presentation and histopathological grading.

The current standard of practice in most head and neck centres is that all salivary gland malignancies amenable to resection are removed surgically with or without neck dissection based on the clinical presentation. In the case of high-grade histology and advanced stage disease this is usually followed by post operative adjuvant radiotherapy almost universally. On the other hand, in low grade, early stage disease with an N0 neck and clear resection margins, radiotherapy is usually reserved, however, when the margins are close or microscopically positive cases are usually discussed with the radiation oncologist and treatment is mostly tailored to the individual patient based on multiple factors including histopathology, age, ECOG score and other factors that vary between treating centres and based on local practices and physician preferences.

Methodology: This study was designed as a nation-wide multi-center retrospective cohort study looking into adults with low to intermediate grade salivary gland tumors that were resected with close (< 5mm), or microscopically positive (R1) margins. The question we set to answer is whether postoperative radiotherapy was associated with reduced local, regional or distant failure and if it had any significant effect on survival. Data was pooled from multiple head and neck centers across Canada between 01.01.2011 and 31.12.2020.

Results/Conclusion: We will be presenting and discussing our local results here from the participating centre from the University of Toronto.

Presenter:	**Dr. Chantal Li**
Mentor:	Dr. Nikolaus Wolter
Presenter Category:	PGY3
Presentation Time:	1:50 pm

Sleep outcomes and Morbidity and Mortality Predictors for Postoperative Complications following Tonsillectomy for Obstructive Sleep Apnea in Children with Cerebral Palsy

Chantal Li MD[1], Patrick Scheffler MD[2], Evan J Propst MD[1], Nicole K McKinnon MD[3], Indra Narang MD[4], Reshma Amin MD[4], Jackie Chiang MD[4], Clyde Matava MBCHB[5], Nikolaus E Wolter MD[1]

1 Department of Otolaryngology – Head and Neck Surgery, The Hospital for Sick Children, University of Toronto, Toronto, Ontario, Canada
2 Phoenix Children's Hospital, Division of Otolaryngology - Head and Neck Surgery.
3 Department of Critical Care Medicine, The Hospital for Sick Children, University of Toronto, Toronto, ON, Canada
4 Division of Respiratory Medicine, Department of Paediatrics, The Hospital for Sick Children, University of Toronto, Toronto, Ontario, Canada
5 Department of Anesthesia and Pain Medicine, Department of Anesthesia, The Hospital for Sick Children, University of Toronto, Toronto, ON, Canada

Introduction: Adenotonsillectomy is the mainstay of treatment for obstructive sleep apnea (OSA) in children. Rates of surgical success in children with cerebral palsy (CP) are unclear compared to typically developing children. Additional interventions are often required in children with CP due to incomplete resolution of the OSA. Additionally, children with CP have higher risks of perioperative complications compared to the general pediatric population. The objective of this study was to determine sleep outcomes and the morbidity and mortality rate of children with CP following tonsillectomy for OSA.

Methods: A single-center retrospective review of children with CP and sleep disordered breathing (SDB) who underwent tonsillectomy was performed (2003-2021). Children with CP were matched to typically-developing children undergoing tonsillectomy. Extracted data included age, comorbidities, pre- and postoperative polysomnography (PSG) results, disposition, ICU admission, Gross Motor Functional Classification System (GMFCS), Eating and Drinking Ability Classification System (EDACS), Dysphagia Outcome and Severity Scale (DOSS) scores. The primary outcomes were reduction in postoperative OAHI and post-tonsillectomy complication rate. Secondary outcomes included cure rate, need for additional interventions, hospital stay duration, readmission rates and predictors of post-tonsillectomy complications.

Results: Out of 95 children with CP assessed for SDB, 30% (29/97) underwent tonsillectomy, 14% received non-invasive positive pressure ventilation (NIPPV), and 4% received tracheostomy. Mean age at tonsillectomy was similar for children with and without CP (6.3 vs. 6.2).

All children who underwent tonsillectomy and had pre- and postoperative PSGs experienced an initial reduction in OAHI (31.7/h to 2.9/h, $p<0.0001$). There was no difference between the mean percent reduction of OAHI when comparing children with and without CP (85.5 vs 95.4%, $p=0.193$). However, children with CP were less likely to achieve cure (OAHI<1) (62.5% vs 81.8%, $p=0.23$) with an odds ratio of 0.13 (95% CI 0.21-0.84). Three children with CP had an increase in OAHI post-tonsillectomy despite an initial improvement, four underwent additional surgical interventions, and two of these children later went on to require NIPPV.

Four children with CP were admitted pre-operatively compared to one child without CP. Neither group had anesthetic or intraoperative complications. Fifty-seven percent of children with CP had planned ICU

admission postoperatively, compared to 8.7% of children without CP. Mean hospital stay duration was 6.5 days for children with CP and 1.4 days for children without CP. In children with and without CP, readmission rates (13% vs. 8.7%) and post-tonsillectomy bleeding rates (4.3% vs. 4.3%) were similar.

Children with CP had higher rates of postoperative complications (43.5% vs. 8.7%) and significantly higher odds of respiratory complications compared to children without CP (OR 8.9 95% CI 2.1-37.9). Death occurred in one child with CP.

Subgroup analyses in children with CP demonstrated that GMFCS=5 and EDACS=3-5 were associated with significantly greater percentage of respiratory complications post-tonsillectomy compared to GMFCS<5 (p=0.002) and EDACS<3 (p=0.031). While DOSS<5 was associated with a greater percentage of respiratory complications, this was not statistically significant (p=0.072).

Conclusion: Our study demonstrates that children with CP experience an initial improvement in OAHI following tonsillectomy, although cure is uncommon. Ongoing postoperative PSG monitoring is required. Additionally, children with CP have higher rates of post-tonsillectomy complications and GMFCS and EDACS scores can be used as predictors of these complications. These findings may provide useful information to facilitate informed discussions with patients and caregivers considering tonsillectomy during preoperative planning given the surgical risks inherent in the pediatric CP population and improve our ability to anticipate post-tonsillectomy morbidity in these children.

Presenter:	**Dr. Dongho (Brian) Shin**
Mentor:	Dr. Justin Lui
Presenter Category:	PGY3
Presentation Time:	2:00 pm

Examining the Utility of a Photorealistic Virtual Ear in Otologic Education

[1]Dongho Shin MD, [2]Arthur V. Batista MSc, [3]Christopher M. Bell MD, MPT, [3]Ella R.M. Koonar MD, MSc, [1]Joseph M. Chen MD, FRCSC, [5]Sonny Chan PhD, [2,3]Joseph C. Dort MD, MPH, FRCSC, [2,3]Justin T. Lui MD, FRCSC *Corresponding author*

[1]Department of Otolaryngology–Head and Neck Surgery, University of Toronto, Toronto, Canada
[2]Ohlson Research Initiative, Arnie Charbonneau Cancer Institute, University of Calgary, Calgary, Canada
[3]Section of Otolaryngology–Head & Neck Surgery, Department of Surgery, University of Calgary, Calgary, Canada
[4]Faculty of Medicine, Cumming School of Medicine, University of Calgary, Calgary, Canada
[5]Department of Computer Sciences, University of Calgary, Calgary, Alberta, Canada.

Background: Otolaryngology–Head & Neck surgical (OHNS) trainees' operating exposure is supplemented by a combination of didactic teaching, textbook reading, and cadaveric dissections. Conventional teaching, however, may not adequately equip trainees with an understanding of complex visuospatial relationships of the middle ear. Both face and content validation were assessed of a novel three-dimensional photorealistic virtual ear simulator as an educational tool for OHNS trainees.

Methods: A three-dimensional mesh reconstruction of open access imaging was generated using geometric modeling, which underwent global illumination, subsurface scattering, and texturing to create photorealistic VR models of the outer and middle ears. This was compiled into an educational VR platform in which OHNS post-graduate trainees were encouraged to explore. Face and content validity questionnaires were then completed.

Results: Of the 23 participants, the mean comfort level of otologic anatomy was rated 4.8±2.2 out of 10. Senior residents possessed more otologic surgical experience ($p<0.001$) and higher average comfort when compared to junior residents (6.7±0.7 vs. 3.6±1.9; $p=0.001$). Face and content validities were achieved in all respective domains with no significant difference between the two groups. Overall, respondents believed OtoVIS was a useful tool to learn otologic anatomy with a median score of 10.0 (8.3–10.0) and strongly agreed that OtoVIS should be added to OHNS training with a score of 10.0 (9.3–10.0).

Conclusion: OtoVIS achieved both face and content validity as a photorealistic VR otologic simulator for teaching otologic anatomy in the postgraduate setting. As an immersive learning tool, it may supplement trainees' understanding of complex anatomical relationships.

Presenter:	**Dr. Adam Kwinter**
Mentor:	Dr. Adrian James
Presenter Category:	PGY3
Presentation Time:	2:10 pm

Use of a Caprine Model for Simulation and Training of Endoscopic Ear surgery

Adam Kwinter, Am Chayaopas, Andrew Ma, Adrian L James

Objective: The objective of this study was to evaluate the utility of a caprine model in endoscopic ear surgical education using the index procedures of tympanoplasty and osscіuloplasty. Specifically assessing the face and content validity of the caprine model, and the potential impact of anatomical differences on trainee understanding of human middle ear anatomy.

Methods: 12 otolaryngology trainees attended a three hour dissection course utilizing the caprine model. Prior to the course the trainees completed a self-reported needs assessment and knowledge assessment of human middle ear anatomy. Following the seminar the trainees completed a post seminar evaluation and validation questionnaire. They also repeated the knowledge assessment in order to ensure the goat anatomy did not confuse trainees knowledge of human anatomy.

Results: Of the 12 trainees, 9 participated in the study. 5 point Likert scores were used for the needs assessment and validation questionnaire. All domains reported on the learner needs assessment showed an average improvement of 1-point on the post-course evaluation with six of nine domains being significantly improved using the Wilcoxon signed rank test. The model achieved validation in the domains of face, content and global content validity with average Likert score >4. Knowledge assessment scores increased by 7% ($p=0.23$) after the course compared to before.

Conclusion: The caprine model offers a readily available, economically viable surgical simulation model for endoscopic ear surgery education. Further study is needed to develop validated objective assessments within the field.

Presenter:	**Dr. Grace Yi**
Mentor:	Dr. R. Jun Lin
Presenter Category:	PGY3
Presentation Time:	2:20 pm

Formation and Assessment of a Laryngology Pathology Atlas for Resident Education

Grace Yi MD, Amanda Hu MD FRCSC, Caroline C Jeffrey MD FRCSC, Jennifer Anderson MD FRCSC, R. Jun Lin MD FRCSC MSc

Background: By the end of post-graduate training, residents are expected to diagnose common laryngeal pathologies. While conventional reference images may provide educational value, observing dynamic vocal fold function is critical for diagnosis. Our aim was to develop and validate a video atlas of laryngeal pathology for resident education in Otolaryngology – Head & Neck Surgery (OHNS).

Methods: A multi-institution, prospective case-control study was designed for proof-of-concept. Ten videos showing 10 distinct laryngeal pathologies were collected and diagnosed by two fellowship-trained laryngologists. Six videos per category with high interrater reliability (kappa >0.8) were chosen for the database.

To demonstrate construct validity (i.e. that periodic viewing of videos improves recognition of laryngeal pathology), residents were recruited from two Canadian institutions, and randomized to control or intervention groups. The control group was shown a quiz of 10 laryngeal videos at baseline and at 24 weeks later, and free-text diagnoses were scored for accuracy. The intervention group was shown quizzes at baseline and every 6 weeks, with a final quiz at 24 weeks. Descriptive analyses, as well as an analysis of covariance was performed using scores at week 24 as the outcome, and including the variables intervention (vs. control), baseline score value, and PGY level. Two-tailed tests were used to assess inter-group differences using p-value of 0.05.

Results: Twenty-nine residents participated in the study, with 14 (48.3%) randomized to control, and 15 (51.7%) randomized to the intervention. There was high variability in quiz scores. PGY level was found to have a significant impact on diagnostic performance. PGY1 and PGY2 residents scored significantly lower than PGY5 residents (p=0.0171; p=0.0347, respectively), with no significant difference between PGY3 and PGY4 residents compared to PGY5 residents. The PGY-level adjusted mean scores for the intervention group at 24 weeks was 7.55 [6.66-8.43], while for the control group was 6.68 [5.82-7.53]. The mean difference between the groups was 0.87 [-0.35-2.09]; p=0.1528. Further subgroup analysis to determine the effect of PGY level on scores within the intervention and control groups was not possible given the small sample sizes.

Conclusions:
Overall, senior (PGY5) residents scored significantly higher on these quizzes compared to junior residents (PGY1 and 2), supporting content validity of the video atlas. There was no statistically significant difference in the final quiz scores between the intervention and control groups. Future directions include larger studies to elucidate whether repeat video viewing can be effective for resident learning.

Category 4 – Work undertaken by PGY4 residents during clinical rotation

Presenter:	**Dr. Amr Hamour**
Mentor:	Dr. Eric Monteiro
Presenter Category:	PGY4
Presentation Time:	2:30 pm

Post-Operative Opioid Usage Following Thyroidectomy and Parathyroidectomy Surgery: A Multi-Centre Prospective Study

Amr F. Hamour MD, MBT[1]; Mirko Manojlovic-Kolarski MD, FRCSC[1]; Antoine Eskander MD, ScM FRCSC[1,2,3]; Mathew Biskup MD[4]; S. Mark Taylor MD, FRCSC[4]; Frederick Laliberte MD, FRCSC[1]; Allan Vescan MD, MSc, FRCSC[1,5]; Ian J. Witterick MD, MSc, FRCSC[1,5]; Jeremy Freeman MD, FRCSC[1,5]; and Eric Monteiro MD, MSc, FRCSC[1,3,5]

[1] Department of Otolaryngology – Head & Neck Surgery, University of Toronto, Toronto, ON, Canada
[2] Department of Otolaryngology – Head & Neck Surgery, Michael Garron Hospital, Toronto, ON, Canada
[3] Institute of Health Policy, Management and Evaluation, Dalla Lana School of Public Health, University of Toronto
[4] Division of Otolaryngology – Head & Neck Surgery, Department of Surgery, Dalhousie University, Halifax, NS, Canada
[5] Department of Otolaryngology – Head & Neck Surgery, Mount Sinai Hospital, Toronto, ON, Canada

Background: Opioid abuse is widespread in North America and the over-prescription of opioids are a contributing factor. The goal of this prospective study was to quantify over-prescription rates, evaluate post-operative experiences of pain, and understand the impact of peri-operative factors such as adequate pain counselling and use of non-opioid analgesia.

Study Design: Multi-centre prospective observational study.

Methods: Consecutive recruitment of patients undergoing head and neck endocrine surgery was undertaken from January 1st 2020 to January 1st 2022 at four Canadian hospitals in Ontario and Nova Scotia. Post-operative tracking of pain levels and analgesic requirements were employed. Chart review and pre and post-operative surveys provided information on counselling, use of local anesthesia, and disposal plans.

Results: 125 adult patients were included in the final analysis. Total thyroidectomy was the most common procedure (40.8%). Median use of opioid tablets was 2 (IQR 0-4), with 79.5% of prescribed tablets unused. Patients who reported inadequate counselling (n=35, 28.0%) were more likely to use opioids and less likely to use non-opioid analgesia in the early post-operative course. Patients who received local anesthesia peri-operatively (46.4%, n=58) reported less severe pain and used less analgesics on post-operative day one.

Conclusion: Over-prescription of opioid analgesia following head and neck endocrine surgery is common. Patient counselling, use of non-opioid analgesia, and peri-operative local anesthesia were important factors in narcotic use reduction. Formalized protocols focused on these factors and reducing the volume of opioids prescribed may serve to decrease narcotic consumption, thereby reducing the risk of opioid misuse.

Presenter:	**Dr. Vincent Wu**
Mentor:	Dr. John Lee
Presenter Category:	PGY4
Presentation Time:	2:40 pm

Levels of Nasal Nitric Oxide and Inducible Nitric Oxide Synthase Expression in Chronic Rhinosinusitis with Nasal Polyposis

Vincent Wu MD[1], Philip Marsden MD, Michael Cusimano MD, FRCSC, DABNS, FACS, PhD, MHPE, John M. Lee MD FRCSC MSc[1,3]

[1]Department of Otolaryngology – Head and Neck Surgery;
[2]Department of Anesthesiology and Pain Medicine;
[3]Li Ka Shing Knowledge Institute, St. Michael's Hospital

Background: Nitric oxide (NO) in the sinuses is hypothesized to maintain its health, through mucociliary regulation, antimicrobial activity, airborne messaging, and modifications to the inflammatory cascade. The exact mechanism by which nasal NO (nNO) is lowered in chronic rhinosinusitis with nasal polyposis (CRSwNP) remains largely unknown, but may be due to lowered levels of inducible NO synthase (iNOS). Through this translational research study, we aimed to 1) correlate levels of nNO and iNOS expression in CRSwNP; and 2) elicit differences in the activation of inflammatory genes, including iNOS, in CRSwNP.

Methods: This prospective cohort study aimed to compare CRSwNP patients and controls without CRSwNP undergoing sinonasal surgery (ie. endoscopic transsphenoidal surgery for pituitary adenoma resection). Given the translational nature of this study, there were both clinical and laboratory components. Patient-reported outcomes including the Sino-Nasal Outcome Test (SNOT-22), endoscopy score, and CT score were recorded for sinonasal health. nNO was captured pre-operatively. Sinonasal tissue biopsies were taken during the operation from sinonasal mucosa and carefully handled, including immediate treatment with liquid nitrogen to prevent RNA and protein degradation. Sinonasal mucosal samples were used in the detection of iNOS gene activation and iNOS enzyme protein levels. RNA purification was also performed, then tested on NanoDrop 2000 to verify the quality and quantity of extraction. NanoString nCOUNTER will be used to detect levels of specific RNAs based on pre-established inflammatory and iNOS panels as a marker of gene activation. To quantify iNOS protein levels, Western Blot assays were performed. Statistical analyses correlated nNO levels, SNOT-22, endoscopy, and CT scores between CRSwNP and control patients.

Results: A total of 20 patients, 10 CRSwNP and 10 control, were recruited and completed the study. The average age was 57.0 +/- 8.9 years, with 13 (65%) males. Comparison of nNO revealed statistically significant differences between groups, with lowered nNO in CRSwNP (136.6 +/- 106.2) as compared to control (260.7 +/- 100.7), $p<0.05$. SNOT-22 was statistically higher in CRSwNP (57.9 +/- 18.5) versus control (19.4 +/- 15.9), $p<0.05$. The endoscopy and CT scores were both significantly higher for CRSwNP (7.6 +/- 2.4 and 17.6 +/- 4.6, respectively), as compared to control (0.3 +/- 0.7 and 0.4 +/- 1.3, respectively), $p<0.05$. Both endoscopy and CT scores were negatively correlated with nNO levels. RNA purification revealed pure mRNA extraction 260/280 ratio 1.9 +/- 0.2, with mean concentration 63.0 +/- 46.6 ng/uL. Qualitative analysis of preliminary Western blots confirmed the presence of iNOS in the control group only.

Conclusion: This was the first translation study to correlate nNO and clinical sinonasal health scores, with levels of iNOS in CRSwNP patients, compared to a control population. We re-demonstrated decreased nNO and increased SNOT-22, endoscopy, and CT scores reflecting worsening sinonasal health in CRSwNP patients. iNOS was only found in control sinonasal mucosal samples on preliminary analysis. mRNA can be extracted from sinonasal mucosa and purified using a dedicated protocol. Future testing will quantify mRNA levels of iNOS denoting gene activation.

Presenter:	**Dr. Hedyeh Ziai**
Mentor:	Dr. Douglas Chepeha
Presenter Category:	PGY4
Presentation Time:	3:10 pm

Oral Cavity Squamous Cell Carcinoma Tumor Center and Leading Edge have a Temporally Stable, Unique Microbiome Compared to Contralateral Normal Sites

Introduction: Alterations in the composition of the microbiome are associated with and implicated in multiple disease processes, including cancer. The normal oral cavity microbiome is well characterized and extensive. However, temporal and regional (necrotic tumor center versus tumor leading edge) shifts in the oral microbiome of individuals with oral cavity squamous cell carcinoma (OCSCC) are not well understood. We hypothesize that mapping the microbiome in OCSCC will reveal patient-specific and site-specific differences in bacterial composition.

Methods: Samples were collected from 25 patients with primary OCSCC undergoing surgical treatment. Swabs were collected from three sites, tumor center, tumor leading edge, and contralateral normal tissue, at two timepoints, the initial screening (IS) and day of surgery (DoS) visits, separated by 2-4 weeks. Bacterial DNA was isolated and the 16S rRNA gene was amplified and sequenced on an Illumina MiSeq. Quality control excluded 15 swab samples because of low bacterial density and environmental contaminants were filtered from the data. The resulting Operational Taxonomic Units (OTUs, corresponding to different bacterial taxa) were used in subsequent analyses comparing relative abundance, alpha-diversity (within sample), and Bray-Curtis (BC) beta-diversity (between samples) between sampling sites, sample timepoints, and patients. Statistical analyses were done in R.

Results: A total of 120 oral cavity swabs were sequenced and analyzed from three sites, tumor center (n=45), tumor leading edge (n=42), and contralateral normal tissue (n=33). Comparison of the bacterial composition at the IS vs DoS revealed no difference in a number of alpha-diversity metrics (Shannon, p=0.79; Simpson, p=0.97; observed richness, p=0.38) and BC beta-diversity (R^2=0.67, p=0.19). Samples clustered together based on patient BC beta-diversity (R^2=0.49, p=0.001). Differences were observed in BC beta-diversity based on sampling site (R^2=0.023, p=0.044). In particular, samples collected from tumor center and leading edge had higher observed richness (p=0.048) and a number of differentially abundant taxa at each site. Compared to the normal contralateral site, the tumor center had decreased *Bacteroides*, *Streptococcus*, *Akkermansia*, *Clostridium*, *Actinomyces*, *Veillonella*, and *Rothia* and increased *Fusobacterium* and *Capnocytophaga*. The tumor leading edge had increased *Eikenella*, *Fusobacterium*, *Capnocytophaga*, *Porphyromonas*, *Peptostreptococcus*, *Campylobacter*, *Prevotella*, *Selenomonas*, *Catonella*, *Filifactor*, and *Peptostreptococcaceae* compared to the contralateral healthy tissue. The only differentially abundant bacteria between the tumor center and leading edge was *Bacteroides*, which was more abundant at the tumor edge.

Conclusions: Within patients, the OCSCC microbiome is stable over a short time period (2-4 weeks) at both tumor and normal tissue sites. The tumor center and leading edge have a unique microbial community compared to the contralateral normal tissue site with multiple differentially abundant bacteria, while the tumor center and leading edge microbiome is similar. Microbiome clustering by patient suggests correlation with patient-specific factors that warrant further investigation.

Presenter:	**Dr. Jong Wook (John) Lee**
Mentor:	Dr. David Goldstein
Presenter Category:	PGY4
Presentation Time:	3:20 pm

Cigarette Smoking Cessation, Duration of Smoking Abstinence, and Head and Neck Squamous Cell Carcinoma Prognosis

John JW Lee, David Goldstein

Purpose: Tobacco use is a major risk factor for developing head-and-neck squamous-cell carcinoma (HNSCC); however, the prognostic associations with smoking cessation remain unclear. We assessed whether smoking cessation and increased duration of abstinence is associated with improved overall (OS) and HNSCC-cancer-specific survival (CSS).

Patients and Methods: Clinico-demographic/smoking data from HNSCC patients at Princess Margaret Cancer Centre (2006-2019) were retrospectively reviewed; multivariable Cox (OS) and Fine and Gray competing risk models (CSS) were generated.

Results: Among 2482 HNSCC patients, (710/29%, never-smokers; 841/34%, former-smokers; 931/37.5%, current-smokers), former-smokers (aHR=0.72; 95%CI:0.59-0.89; p=0.002) and never-smokers (aHR=0.75; 95%CI:0.59-0.95; p=0.018) had improved OS compared to current-smokers. Compared to current-smokers, former-smokers who quit >10 years prior-to-diagnosis (long-term abstinence; n=615) had the most improved OS (aHR=0.69; 95%CI:0.54-0.88; p=0.003). Among current-smokers, smoking cessation around time-of-diagnosis was significantly associated with improved OS (aHR=1.47 of continued *versus* cessation of smoking at-diagnosis; 95%CI:1.15-1.89; p=0.002). The 5-year cumulative-incidence-function (CIF) rates for HNSCC-specific and HNSCC-unrelated deaths were 16.8% and 9.4%, respectively. Former-smokers (HR=0.60; 95%CI:0.47-0.78; p<0.001) and never-smokers (HR=0.61; 95%CI:0.46-0.79; p<0.001) were associated with decreased HNSCC-specific mortality, compared to current-smokers; in contrast, an association of smoking-abstinence with HNSCC-unrelated deaths was not observed. Abstinence for >10 years was associated with decreased HNSCC-related death compared to current smokers (aHR=0.65; 95%CI:0.46-0.92; p<0.015).

Conclusion:
Smoking cessation before and at the time of diagnosis were associated with improved OS and CCS among HNSCC patients, after accounting for stage and other known prognostic variables. Long-term abstinence (>10 pack years) had a significant benefit on OS and CSS, but not with mortality related to other causes.

Presenter:	**Dr. Weining Yang**
Mentor:	Dr. Tony Eskander
Presenter Category:	PGY4
Presentation Time:	3:30 pm

Epidemiology of Recurrent and Metastatic Head and Neck Squamous Cell Carcinoma

Background: Immunotherapy is altering the treatment paradigm for recurrent and metastatic head and neck squamous cell carcinomas (HNSCC). However, epidemiological data in this population are currently limited. The objective of this study was to determine yearly prevalence, treatment rates, and patterns of care for patients with recurrent and metastatic HNSCC.

Methods: We conducted a retrospective observational study of all new HNSCC patients presenting to a head and neck multidisciplinary oncology center within a regionalized system between January 1st, 2017 to December 31st, 2018.

Results: Of 373 patients, 291 (78.0%) underwent primary treatment without subsequent locoregional recurrence or distant metastasis (NED). 20 (5.3%) patients undergoing primary treatment during the study period experienced 3-year locoregional failure (LRR) and 26 (6.9%) developed distant metastatic recurrence (MR). 36 (9.6%) patients were diagnosed with distant metastatic disease (DM) at the time of initial consultation. Consultation rates for medical oncology (NED 34.3%, LRR 50.0%, MR 63.9%, DM 84.6%) and palliative care (NED 5.5%, LRR 45.0%, MR 69.2%, DM 86.1%) were correlated with prognosis. Over a three year follow up period, 61 deaths (NED 15, LRR 6, MR 14, DM 26) were documented.

Conclusion: Recurrent and metastatic HNSCC patients are increasingly being referred for management by medical oncologists. Our results may inform estimations of HNSCC treatment burden, in the setting of a single payer healthcare system.

Category 5 – Work undertaken by Post-Residency Research & Clinical Fellows

Presenter:	**Dr. Sasan Dabiri**
Mentors:	Drs. Neil Bailie and John Rutka
Presenter Category:	Clinical Fellow
Presentation Time:	3:40 pm

Preservation of Vertical Balance Canals VOR Response in Gentamicin Vestibulotoxicity: A Novel Clinical Finding

Introduction: Vestibulotoxicity of gentamicin is well established and occurs through damage to the vestibular hair cells. Previous studies have shown a hierarchy of susceptibility of the vestibular end organs to injury from gentamicin, with the semi-circular canals being more susceptible than the otolith organs. The susceptibility of individual semicircular canals to gentamicin vestibulotoxicity has not been investigated previously.

Method: Since 2012, all patients receiving systemic gentamicin therapy at the University Health Network have been monitored at the Hertz Multidisciplinary Neurotology Clinic for signs of vestibulotoxicity using a battery of clinical and laboratory tests. Six-canal video head impulse testing (vHIT) was included in the monitoring protocol after 2016. In this retrospective case series, the results of vHIT testing in this patient cohort was analysed. Vestibulo-ocular reflex abnormalities were determined based on a combination of reduced VOR gain and the presence of consistent corrective saccades.

Results: 13 patients have undergone six-canal vHIT testing as part of the UHN gentamicin monitoring protocol. Six patients developed evidence of high-frequency VOR impairment on vHIT testing whilst receiving systemic gentamicin. The involvement of the semicircular canals was as follows: 6 of 12 lateral semicircular canals (50%), 5 posterior canals (42%), and 1 superior canal (8%). The difference between the anterior canal and lateral or posterior canals was statistically significant.

Discussion: Within the limits of this study, the horizontal and vertical canals show different susceptibility to gentamicin vestibulotoxicity. The rarity of superior SCCs involvement supports this assumption. Possible explanations for this finding could include anatomical orientations of the semicircular canals: the molecular density of gentamicin, might result in its accumulation in the more inferiorly placed balance canals – the lateral and posterior semicircular canals have more dependent anatomy in both the erect and supine positions. Another possibility is of ultrastructural differences in semicircular canal neuroepithelium. In terms of phylogeny, the lateral semicircular canals developed later than vertical canals in vertebrates and thus might have more susceptibility to toxicity.

Presenter:	**Dr. Islam Alzayadneh**
Mentors:	Drs. Richard Rival and Philip Solomon
Presenter Category:	Clinical Fellow
Presentation Time:	3:50 pm

Rhinoplasty surgeons' spinal health: specific and unique risks

Objective: The aim of this study is to determine the prevalence, severity and extent of work-related neck and back musculoskeletal problems among plastic surgeons who perform rhinoplasty. Further, it assesses functional disabilities that may impair surgeons' quality of life, and suggests preventative measures.

Materials and Methods: Structured self-administered questionnaire was sent to surgeons who perform rhinoplasty in Canada and around the world using multiple rhinoplasty forums on social media platforms. The first part of the questionnaire was composed of biodata, specific information on neck and back pain, routine practice posture, length of practice, average duration of surgery, presence of known spinal pathology detected by magnetic resonance imaging and the need for surgery or hospitalization due to this issue. In the second part of the survey, participants were asked to complete the Total disability index questionnaire (TDI).

Results: The total number of properly filled questionnaires included in this study was 110 of whom 87.2% (n =96) were males and 12.7% (n = 14) were females. Prevalence of back and neck pain among the respondents was 93.6%, with low back pain predominating in 47.6% of cases. Most of the subjects (90.5%) had a mild-to-moderate level of severity, and only 9.5% had a severe level of spinal pain.

There was a statistically significant relationship between the presence of musculoskeletal back pain and years of rhinoplasty practice, number of rhinoplasty operations performed per week and average working hours per day ($p = 0.001 < 0.01$).

Presenter:	**Dr. Fatemeh Hassan Nia**
Mentor:	Dr. John Rutka
Presenter Category:	Clinical Fellow
Presentation Time:	4:00 pm

Post-traumatic Central Vestibular Dysfunction

Background: Dizziness is a common complaint in traumatic brain injury. Organic causes for post-traumatic dizziness are generally considered to be primarily peripheral vestibular rather than central.

Objectives: This study aims to provide an overview of dizziness post head injury in those with prominent features for central vestibular dysfunction in comparison to those with a post-traumatic peripheral vestibular etiology.

Methods: The UHN WSIB neurotology database (n=4291) between 1998 and 2018 was retrospectively studied for head-injured workers presenting with features for central vestibular dysfunction associated with trauma. All patients had a detailed neurotological history and examination, audiovestibular testing that included video nystagmography(VNG) and cervical vestibular-evoked myogenic potentials (cVEMPs). Imaging studies including routine brain and high resolution temporal bone CT scans and/or intracranial MRI were available for the majority of injured workers.

Results: Among 4291 head-injured workers with dizziness, 23 were diagnosed with features/findings denoting central vestibular dysfunction. The mechanism/severity of head injury, results of intracranial imaging, laboratory audiovestibular tesing and the clinical presentation of those with post-traumatic central vestibular dysfunction were compared to head-injured workers diagnosed with disorders of peripheral vestibular dysfunction (exclusive of BPPV).

Conclusion: Symptomatic post-traumatic central vestibular injury is uncommon. It occurred primarily following high-impact trauma and was reflective for a more severe head injury where shearing effects upon the brain often resulted in diffuse axonal injury. Complaints of persistent imbalance and ataxia were more common than complains of vertigo. Eye movement abnormalities were highly indicative for central nervous system injury even in those with minimal change on CT/MRI.

Presenter:	**Dr. M. Demir Bajin**
Mentor:	Dr. Trung Le
Presenter Category:	Research Fellow
Presentation Time:	4:10 pm

The Ototoxicity of Ceftazidime, Vancomycin, and Clotrimazole in the Rat Middle and Inner Ear

Bajin MD, Zhang Z, Ferdous Z, Chen JM, Situ Y, Lam K, Lin VYW, Le TN

Educational Objective: At the conclusion of this presentation, the participants should be able to understand ototoxicity study methodology in rats and will learn about alternative ototopical medications.

Objectives: The purpose of this study is to examine the ototoxicity of ceftazidime, vancomycin, and clotrimazole on the middle and inner ear of rats and to propose that these antibiotics can be used to treat resistant bacteria as an alternative to traditional topical treatments.

Methods: There were three groups each containing 6 long-evans rats were tested for cochlear function with auditory brainstem response (ABR) and distortion product otoacoustic emissions before and after they were injected intratympanically on the left ears with ceftazidime, ceftazidime + vancomycin, and clotrimazole. Right ears were injected with saline as control. After the 4th week animals were sacrificed and middle ears and tympanic membranes were visually inspected for inflammation, infection, and perforation. The cochleas were collected for whole mount and immunofluorescence.

Results: There were no statistically significant difference between the pre- and post-injection ABR and DPOAE. There were no mucosal reaction, inflammation, infection or persistent tympanic membrane perforation. Immunohistochemistry showed no statistically significant difference in hair cell loss between injected and control ears.

Conclusions: In our clinical practice we often face persistent ear infections that are resistant to common ototopical medications. We believe ceftazidime, vancomycin, and clotrimazole can be viable options. Our next step would be a human pilot study on the safety of these drugs.