



**HALIFAX
NEUROSURGERY**
2021
ANNUAL REPORT



Acknowledgement for Annual Report: Lorraine Bell-Hill

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Message from the Head of Neurosurgery

David B. Clarke MDCM, PhD, FRCSC, FACS

Welcome to the Division of Neurosurgery's 2021 Annual Report

It is remarkable that this is our second Covid-19 pandemic report...who would have guessed? This annual report highlights some of the activities of our wonderful neurosurgical team who have remained devoted and steadfast in their delivery of patient care, teaching, research and administrative duties during these difficult and ever-changing times. To our neurosurgery family members at the QEII Health Sciences Centre, IWK Health Centre and Dalhousie University, I say thank you to each one for courageously showing up every day, giving your best and supporting your colleagues. At the risk of missing something, I would like to highlight some notables from 2021.

We were delighted to have Drs. Rachel Vaughan and Ali Alwadei join our Atlantic Canadian Neurosurgery Residency Program in July. Dr. Vaughan comes to us from Montreal where she earned her Doctor of Medicine degree at McGill University. Dr. Alwadei joins us from Saudi Arabia where he received his medical training at King Khalid University, College of Medicine, Abha, Saudi Arabia. A warm welcome to you both.

We also welcomed two new Fellows: Drs. Aboubakr Amer and Nitish Agarwal. Dr. Amer is our new Spine Fellow: he completed his neurosurgery training in Cairo, Egypt and since has completed fellowships in Functional Neurosurgery (Ohio State University), Neurosurgical Oncology (Moffitt Cancer Center) and Spine (OSU and Beth Israel in Boston). Dr. Agarwal is our new Fellow in Functional Neurosurgery: he completed his neurosurgery training at All India Institute of Medical Sciences, New Delhi. We look forward to working with both of our new Fellows this year.

Congratulations to Dr. Carlos Restrepo (Functional Fellow) who was the recipient of the W.J. Howes Neurosurgery Teaching Award this year. This annual award recognizes excellence in neurosurgery teaching.

Kudos to Dr. Mark MacLean who won the Dr. William D. Stevenson Research Award for his research work presented at Clinical Neuroscience Resident Research Day. Congratulations also to Ryan Greene who received the award for the best Non-Resident Presentation.



Congratulations (x2!) to Dr. Gwynedd Pickett and her team who were successful in having our Neurosurgery Residency Program chosen for a Royal College of Physicians and Surgeons' Fatigue Risk Management pilot project. In addition, Dr. Pickett received the inaugural Award for Excellence in Research Mentorship – Equity, Diversity and Inclusion – from Dalhousie University's Faculty of Medicine.

I would like to recognize Dr. Christie's research leadership at Dalhousie in collaborating with colleagues across the country to find ways to reduce greenhouse gas emissions and environmental degradation linked to the health-care system. Dr. Christie is a co-applicant of a successful \$6 million federal grant titled CASCADES (Creating a Sustainable Canadian Health System in a Climate Crisis). Well done!

I was pleased to see that Camp Brainiac at Brigadoon Village returned as an in-person experience this past year. Camp Brainiac allows children and youth between the ages of 7-18 with neurological conditions to make meaningful connections with others and build valuable skills. I know that Drs. McNeely and Walling are proud of this program and are grateful to the generous donors who help make this experience possible by donating to the Neurosurgery Kids Fund.

There are many activities that contribute to Neurosurgery and I recognize that it is a big effort... our OR teams are exceptional, our in-patient teams work hard and I am so proud that each of us has risen to exceptional challenges during this past year. And through it all, we have remained focused on our patients, on our research, on our work, on each other. I am reminded of how much this effort is appreciated by the correspondence I receive from grateful patients and their families. This is an excerpt from one: *"...We want to pass along how great your [resident] was with everything and the nurses were amazing – kind, compassionate, helpful and clear in explanations. We will be sending a letter to head nurse, Laura Croft. We also were impressed with the physician who spent time with us going over all options. Again, thank you for your kindness and helpfulness. Blessings!"*

Neurosurgery 2021 has indeed been an exceptional year. I hope you enjoy reading more of what Halifax Neurosurgery is about inside these pages...I know you will be impressed!

Neurosurgery Faculty



David B. Clarke MDCM, PhD, FRCSC, FACS

- Head, Division of Neurosurgery
- Professor, Departments of Surgery, Medical Neuroscience, Medicine (Endocrinology) and Ophthalmology & Visual Sciences

Areas of Interest:

- Transsphenoidal Surgery
- Neuro-Oncology
- Epilepsy Surgery
- Neurotrauma and Injury Prevention
- Neurosurgery Simulation/Education



Sean Christie MD, FRCSC

- Vice-Chair, Division of Neurosurgery
- Director of Research, Division of Neurosurgery
- Professor, Department of Surgery

Areas of Interest:

- Minimally Invasive Spinal Surgery
- Complex Spinal Surgery
- Neurotrauma
- Sport-Related Neurological Injuries



Sean Barry MD, FRCSC

- Treasurer, Division of Neurosurgery
- Assistant Professor, Department of Surgery

Areas of Interest:

- Minimally Invasive Spinal Surgery
- Complex Spinal Surgery
- Spinal Oncology
- Neurotrauma



Gwynedd Pickett MD, FRCSC

- Program Director, Neurosurgery Residency Program
- Associate Professor, Department of Surgery

Areas of Interest:

- Cerebrovascular Surgery
- Endovascular Treatment of Aneurysms



Daniel McNeely MD, FRCSC

- Chief, Pediatric Neurosurgery, IWK Health Centre
- Associate Professor, Department of Surgery

Areas of Interest:

- Pediatric Neurosurgery
- Pediatric & Adult Epilepsy Surgery
- Spinal Dysraphism
- Hydrocephalus
- Intraventricular Neuroendoscopy



Simon Walling MBChB, FRCSC

• Assistant Professor, Department of Surgery

Areas of Interest:

- Neurotrauma
- Injury Prevention
- Neuro-Oncology
- Pediatric Neurosurgery
- Surgical Education
- Skull base Surgery



Adrienne Weeks MD, PhD, FRCSC

• Assistant Professor, Department of Surgery

Areas of Interest:

- Cerebrovascular Disease
- Endovascular Treatment of Aneurysms
- Neuro-Oncology



Jacob Alant MBChB, MSc, MMed, FRCSC

• Assistant Professor, Department of Surgery

Areas of Interest:

- Minimally Invasive Spinal Surgery
- Peripheral Nerve Surgery



Lutz Weise MD, PhD

• Associate Professor, Department of Surgery

Areas of Interest:

- Functional Neurosurgery
- Movement Disorders
- Complex Pain
- Stereotaxy
- Image Guidance
- Neurophysiology
- Spinal Surgery



Stephen P. Lownie MD, FRCSC, FAANS

• Professor, Department of Surgery
 • Emeritus Professor, Departments of Clinical Neurological Sciences and Medical Imaging, Western University
 • One Patient One Record (OPOR) Physician Lead, Urban/Academic

Areas of Interest:

- Skull Base Surgery
- Cerebrovascular Disease

Atlantic Canadian Neurosurgery Residency Program

Director: Dr. Gwynedd Pickett
Program Administrator:
Heather Munroe/Monique Brown

The primary objective of the Atlantic Canadian Neurosurgery Residency Program is the development of highly skilled neurosurgeons who can practice anywhere in the world they choose. Residents are exposed to a broad range of clinical neurosurgery cases, with graduated levels of responsibility in patient care, as training progresses. The majority of cases are carried out with significant resident involvement, and at the senior resident level, independent clinical and operative decision-making is promoted. Training in professional, communication and health advocacy skills complement their technical education.

We strive to provide an academic environment in which residents are continually provided with opportunities and challenges suitable for their level of learning, and receive the regular, quality feedback necessary to refine their clinical and technical skills.



Dr. G. Pickett



Heather Munroe



Monique Brown

National changes to the post-graduate medical/surgical training curriculum have placed greater emphasis on formative feedback and individual progression through levels of competence. Half of our residents are now training under the new national system of “Competence by Design,” with more senior residents being grandfathered through under the prior system of evaluation.

The 1:1 ratio of faculty to residents facilitates individual coaching and enables mentoring in a collegial and respectful training environment. Regular teaching rounds and seminars create ample opportunities for in-depth discussion of neurosurgical cases and collaboration with colleagues in neurology, neuroradiology, and other specialties.

The Atlantic Canadian Neurosurgery Residency Program is based in Halifax, Nova Scotia with rotations at the QEII Health Sciences Centre (adult) and the IWK Health Centre (pediatrics.) Residents also pursue rotations at our affiliated Atlantic Canada neurosurgical sites in Saint John and Moncton, New Brunswick, and St. John’s, Newfoundland and Labrador. This provides residents with exposure to a wide variety of neurosurgical problems and practice experiences.

The Division of Neurosurgery strongly believes in the role of research in residency training, and we endeavour to facilitate resident involvement in research projects that suit their interests and support their individual career goals. We are committed to developing a multi-disciplinary approach to research including clinicians and basic scientists. Residents have the opportunity to enroll in Dalhousie University’s Clinician Investigator Program (CIP), which provides structured research training that enables them to become clinician scientists upon completion of their residency. Over the past year, our research residents have been highly successful in obtaining competitive funding awards.

There are currently eleven neurosurgical residents in the program.

Neurosurgery Residents and Fellows



Omar Alsharif MBBS (PGY6)

MBBS King Abdulaziz University 2012 | Jeddah, Saudi Arabia

Dr. Alsharif obtained his medical training at King Abdulaziz University. He worked in the Department of Neurosurgery at King Abdulaziz University as a teaching assistant, and as a research fellow at the University of Toronto, before entering neurosurgical residency at Dalhousie in 2013. He has complemented his clinical learning with graduate courses in Clinical Epidemiology. He is expected to complete his residency training with Dalhousie University in 2022 and plans to undertake fellowship training in skull base surgery in Australia (University of Adelaide).



Alwalaa Althagafi MBBS (PGY6)

MBBS King Abdulaziz University 2013 | Jeddah, Saudi Arabia

Dr. Althagafi obtained his medical training at King Abdulaziz University. Prior to studying medicine, Dr. Althagafi pursued a Bachelor of Medical Laboratory Science at the University of Otago in New Zealand. He is expected to complete his residency training with Dalhousie University in 2022 and plans to undertake fellowship training in adult spine surgery in Vancouver (UBC).



Erika Leck MBBS (PGY6)

MD Dalhousie University 2017 | Nova Scotia, Canada

Dr. Leck obtained her Doctor of Medicine at Dalhousie University in 2017. Prior to studying medicine, Dr. Leck obtained a Bachelor of Science Degree (Honours) in Life Sciences at Queen's University. She is currently pursuing her Masters in Practical Ethics at Oxford University and is also enrolled in the Dalhousie Clinician Investigator Program, supported by a Ross Stewart Smith Research Scholarship. She is expected to complete her residency training with Dalhousie University in 2024.



Mosaab Alsuwaiheli MBChB (PGY5)

MBChB National University of Ireland 2015 | Dublin, Ireland

Dr. Alsuwaiheli obtained his medical training in 2015 from the Royal College of Surgeons in Ireland and joined the Dalhousie program in 2017. Dr. Alsuwaiheli is expected to complete his residency training with Dalhousie University in 2023.



Jae Ho Han MD (PGY4)

MD Dalhousie University 2018 | Nova Scotia, Canada

Dr. Han obtained his Doctor of Medicine at Dalhousie University in 2018. Prior to studying medicine, Dr. Han completed a Bachelor of Science degree (Honours) in Biochemistry & Molecular Biology and Neuroscience at Dalhousie University. He is currently undertaking a Masters in Science in Dr. Weeks' lab, through the Dalhousie Clinician Investigator Program, supported by a Beatrice Hunter Cancer Fellowship. He is expected to complete his residency training with Dalhousie University in 2025.

Neurosurgery Residents and Fellows Cont'd



Mark MacLean MD MSc (PGY4)

MD Dalhousie University 2018 | Nova Scotia, Canada

Dr. MacLean obtained his Doctor of Medicine at Dalhousie University in 2018. Prior to studying medicine, Dr. MacLean completed an MSc in Chemistry at Dalhousie University. He is currently pursuing research in Dr. Alon Friedman's lab, supported by a major grant from the Neurosurgery Research and Education Foundation of North America, and a Ross Stewart Smith Research Scholarship. He is expected to complete his residency training with Dalhousie University in 2024.



Abdulaziz Bokeris MBChB (PGY3)

MBChB National University of Ireland 2017 | Dublin, Ireland

Dr. Bokeris obtained his medical training in 2017 from the Royal College of Surgeons in Ireland and joined the Dalhousie program in 2019. Dr. Bokeris is expected to complete his residency training with Dalhousie University in 2025.



Jenna Smith-Forrester MD MSc (PGY2)

MD University of British Columbia 2019 | British Columbia, Canada

Dr. Smith-Forrester obtained her Doctor of Medicine at the University of British Columbia in 2019. Prior to studying medicine, Dr. Smith-Forrester completed a Bachelor of Science (with Distinction) in Neuroscience and Biology at Dalhousie University, followed by a Masters of Neuroscience at the University of British Columbia. She is a leader and lecturer in quality improvement and patient safety education. She is expected to complete her residency training with Dalhousie University in 2025.



Katherine Tourigny MD (PGY2)

MD University of British Columbia 2020 | British Columbia, Canada

Dr. Tourigny obtained her Doctor of Medicine at the University of British Columbia in 2020. Prior to studying medicine, Dr. Tourigny completed a Bachelor of Science in Behavioural Neuroscience at the University of British Columbia. She is expected to complete her residency training with Dalhousie University in 2026.



Ali Alwadei (PGY1)

MBBS King Khalid University 2017 | Abha, Saudi Arabia

Dr. Alwadei obtained his Bachelor of Medicine and Surgery from King Khalid University, College of Medicine in Abha, Saudi Arabia in 2017, and joined the Dalhousie program in 2021. He is expected to complete his residency training with Dalhousie University in 2027.



Rachel Vaughan MD (PGY1)
MD McGill University | Montreal, Canada

Dr. Vaughan obtained her Doctor of Medicine at McGill University in 2021. Prior to studying medicine, Dr. Vaughan completed a Bachelors in Life Sciences, Psychology, Literature and Linguistics at McGill University. She is expected to complete her residency training with Dalhousie University in 2027.



Carlos Restrepo Rubio MD (Fellow)
MD Universidad el Bosque 2006 | Bogota, Colombia

Dr. Restrepo Rubio obtained his Doctor of Medicine from Universidad el Bosque in 2006 and completed his neurosurgery residency at Universidad el Bosque in Bogota, Colombia in 2014. He completed a Peripheral Nerve Surgery Fellowship at the Mayo Clinic in Rochester, Maine in 2015 and a Deep Brain Stimulation Fellowship at the Mayo Clinic in 2016. He began a Fellowship in Functional Neurosurgery at Dalhousie in 2019.



Shrikant Dalal MBBS (Fellow)
MBBS Shri. Vasant Rao Naik Government Medical College 2008 | Yavatmal, India
Diplomate of National Board (DNB) Orthopaedic 2014
Diploma in Spine Surgery University of Alberta 2019

Dr. Dalal obtained his Bachelor of Medicine/Bachelor of Surgery from Shri Vasant Rao Naik Government Medical College in 2008. He completed his Orthopaedic training in Mumbai. Most recently, he completed a Spine Fellowship in Edmonton.



Ravindra Singh MBBS (Fellow)
MBBS Ganesh Shankar Vidhyarthi Memorial Medical College 2005 | Kanpur, India

Dr. Singh obtained his Bachelor of Medicine/Bachelor of Surgery from Ganesh Shankar Vidhyarthi Memorial Medical College, India, in 2005. He completed his Orthopaedic training in Delhi and then served as a consultant prior to completing a Fellowship in Minimally Invasive Spine Surgery in Seoul, Korea. Most recently, he completed a Fellowship in Paediatric Spine Surgery in Calgary.

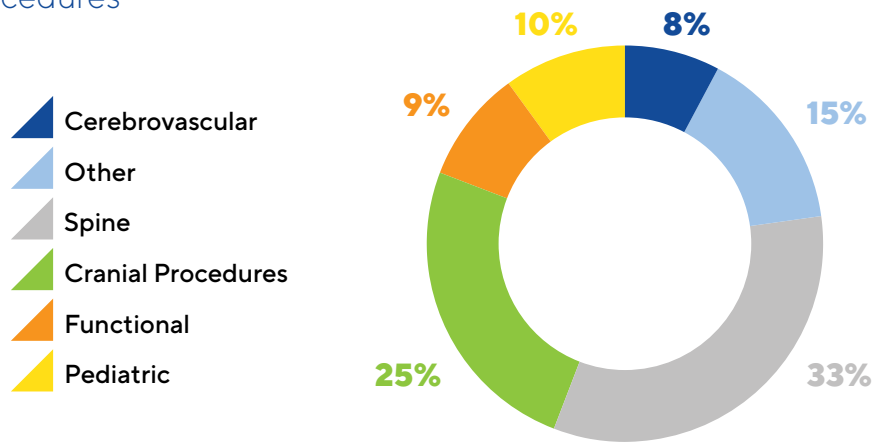


Nitish Agarwal MD (Fellow)
MBBS Maulana Azad Medical College | New Delhi, India

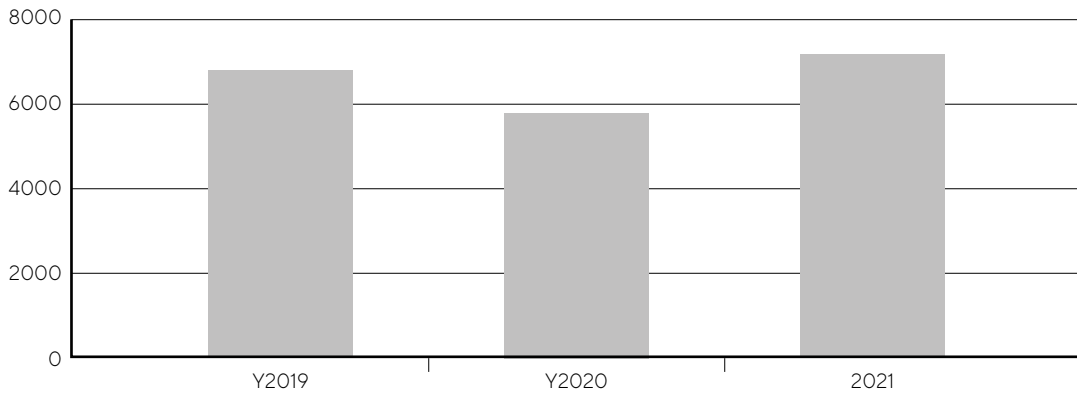
Dr. Agarwal obtained an MBBS degree from Maulana Azad Medical College, New Delhi in 2013 and completed his Neurosurgery residency training at All India Institute of Medical Sciences, New Delhi in 2020. He subsequently worked as an Associate Consultant in Neurosurgery at Fortis Memorial Research Institute, Gurgaon, India until he started his fellowship in Functional Neurosurgery at Dalhousie in October 2021.

Clinical Activities

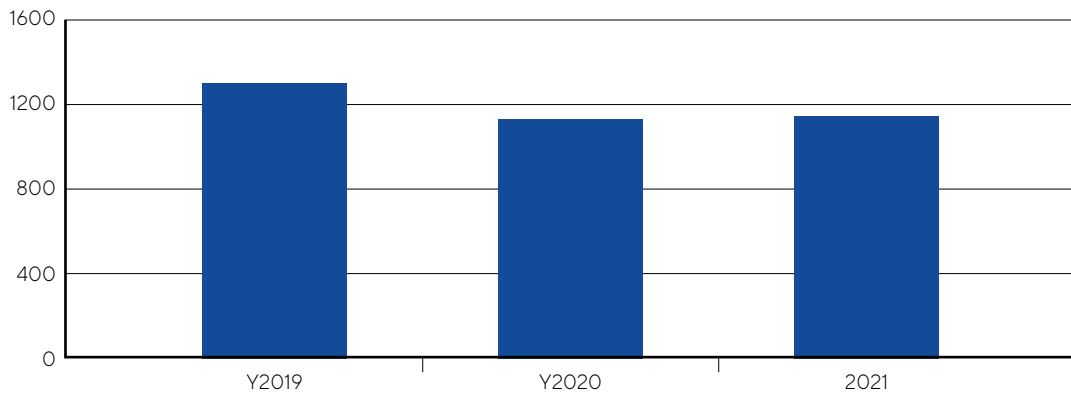
Neurosurgical Procedures



Ambulatory Care Visits



Neurosurgical Procedures



Academic Neuroscience Program and Neurosurgery Inpatient Unit 7.3

Director: Randi Monroe
Health Services Manager:
 Laura Croft, Manager 7.3 Nursing Team
Health Services Manager:
 Joanne Comeau, Manager 7.3
 Interdisciplinary Team

This year, the COVID pandemic continued to evolve and play a significant factor on how we were able to provide care. As policies and guidelines changed as frequently as daily, it required a lot of patience, understanding and flexibility to pivot with the everchanging situations and guidelines. Although it was another year of obstacles and challenges, the staff of 7.3 rose to the challenge again and continued to provide exceptional care and compassion to our patients, families, and each other and demonstrated team resiliency.

Our goal in 2020 was to build capacity in our team and in 2021 we continued to build on that. We added in the role of Clinical Lead Nurse, which is Renee Boudreau.



Randi Monroe



Laura Croft

Although we are still molding the Clinical Lead role to best fit our unit, Renee has been an incredible support to all staff on the unit, particularly new nurses as they enter their nursing career and learn the Neurosurgery specialty. The Clinical Lead is a permanent position that replaces the Resource Nurse role that had previously been in place temporarily. A special mention to experienced staff who have also spent a lot of time orientating new staff and mentoring students this year. Like all years, we said goodbye to some staff as they moved on to continue growing their career paths elsewhere and we gave a warm welcome to many new faces.

Other exciting things this year was the addition of more equipment to facilitate in providing quality care to our patients. Some of that equipment included the installation of more ceiling lifts in patient rooms and improved vital monitors.

Leadership positions on 7.3:

- Charge Nurse: Emily-Rose Tarasco-McGrath returned from maternity leave and stepped back into the charge nurse role, we thank Roy Mollins for covering in her absence. Krissy Dillon left us for a new career opportunity at the IWK and Angela Nabuurs took over charge.
- Clinical Lead Nurse: Renee Boudreau
- Neurosciences Clinical Nurse Educator: Melissa Brinson
- Brain Tumor Nurse: Samantha Warren returned from maternity leave, thank you to Megan Lambert for covering in Sam's absence.

The inter-disciplinary team on 7.3 remains quite stable. A new schedule for recreation therapy has allowed for more consistent staffing and we have had positive feedback about this. Physiotherapy continues with prioritized Saturday services and we will be adding prioritized occupational therapy as well as physiotherapy on the majority of the holidays in 2022. The 7.3 allied health team works very collaboratively with its 7.4 Neurology colleagues to ensure coverage and high-priority needs are addressed. This approach has definitely enhanced patient care on 7.3.

Clinical/Research Staff



Lorelei Audas
RN, BScN, CCRP
Program Coordinator:
Neurotrauma/Simulation



Ryan Greene
MSc
Research Coordinator:
Neurosurgery Spine



Nicky Ayles
RN
Neurosurgery Clinic



Andrea L.O. Hebb
MSc, PhD, RN
Clinical/Research Coordinator:
Brain Tumour
Maritime Lateral Skull Base
Neuropituitary



Renee Boudreau
RN
Clinical Lead
Neurosurgery 7.3



Ron Hill
Technology Coordinator



Missy Brinson
RN
Clinical Nurse Educator



Murray Hong
PhD
Neurosurgery OR/
Technical Specialist



Peggy Flynn
RN
Neuromodulation



Judith Jarrett
RN, CCRP
Program Coordinator:
Cerebrovascular



Lisa Julien

RB, BScN, CCRP

Research Manager/
Coordinator:
Neurosurgery Spine



Shirley MacLeod

Research Assistant:
Neurosurgery Spine



Nelofar Kureshi

MD, MHI

Research Associate:
Neurotrauma/Simulation/
Neurosurgery Spine



Jamie Mason

RN

Neurosurgery Clinic



Megan Lambert

RN

Brain Tumour Liaison Nurse



Saranyan Pillai

PhD

Research Associate:
Neurosurgery Spine



Angela Meagher

RN, NP

Neurosurgery Spine



Christine Potvin

RN

Program Coordinator:
Neuromodulation



Carole-Ann Miller

RN, NP

Cerebrovascular



Haley Power

BSc, BMET

Technology Coordinator

Clinical/Research Staff Cont'd



Marlee Richardson

RN, BScN

Epilepsy Program Nurse



Sarah Szego

RN, NP

Pediatric Neurosurgery, IWK



Taryn Roberts

RN

Neurosurgery Clinic



Samantha Warren

Brain Tumour Liaison Nurse



Rachel Woodman

Neurosurgery Clinic Aide



Administrative Staff



Debbie Amirault

Assistant to
Dr. Sean Barry



Melissa Cook

Assistant to
Dr. Sean Christie



Katharine Anderson

Assistant to
Dr. Gwynedd Pickett



Emma Gillespie-Fraser

Assistant to
Dr. Adrienne Weeks



Lorraine Bell-Hill

Administrator
Division of Neurosurgery



Diane Jardine

Assistant to
Dr. David Clarke



Monique Brown

Residency Program
Administrator



Maureen Kay

Assistant to
Dr. Jacob Alant
Neurosurgery Spine
Referral Coordinator



Cathy Caron

Assistant to
Dr. Daniel McNeely



Kelly Martin

Executive Assistant
to Dr. David Clarke

Administrative Staff Cont'd



Heather Munroe

Residency Program
Administrator



Chrissy Shay

Assistant to
Dr. Simon Walling



Elizabeth Scott

Assistant to
Dr. Stephen Lownie



Pam Slauenwhite

Assistant to
Dr. Lutz Weise

OR Nurses

Team Lead: Denyne Park

Meghan Anderson Matheson
Ivy Adriano
Kandis Church
Jackie Espera
Dawn Manthorne
M. Roge Paciones
Amanda Penny
Allison Purcell
Amanda Russell
Jessica Taylor

Neurosurgery Spine Program

Director: Dr. Sean Christie
Program Manager/Coordinator: Lisa Julien

Mission

The Neurosurgery Spine Program provides comprehensive care to patients with spinal disorders and spinal cord injuries.

Events and Accomplishments

- Due to COVID-19, we conducted our annual Clinical Neurosciences Resident Research Day virtually on March 10, 2021. Dr. Richard Hall was our keynote speaker. It was a great success with 14 presentations from neurosurgery residents, graduate students and trainees.
- Dr. Christie made the news with the article "Greening Nova Scotia's Healthcare system in a Covid-19 world" being published in The Coast.
- Ryan Greene has enrolled at Memorial University, St. Johns Nfld to pursue his PhD in Clinical Epidemiology. His thesis work is to develop and enhance recovery after surgery for elective spine.
- Enrollment in all our studies continued at a steady pace. We enrolled the 1st patient in Canada for one of our clinical trials (MT3291-A01) in Sept 2021.

- We had the great pleasure of having two Spine Fellows, Dr. Shrikant Dalal and Dr. Ravi Singh, join our team in 2020. Both have completed their time in Halifax, and we wish them all the best.

Research Projects

We have had an active research year in the Spine Program, participating in investigator-initiated and pharmaceutical-driven studies, as well as multi-center national and international studies. Below is the list of projects we are conducting.

Ongoing Multi-Centered Studies Clinical Trials

- **MT3291-A01:** A Phase 2, Randomized, Double-blind, Placebo-controlled Study to Assess the Efficacy and Safety of MT-3921 in Subjects with Acute Traumatic Cervical Spinal Cord Injury. Principal Investigator: Dr. Sean Christie
- **M16-077:** A Randomized, Double-Blind, Placebo Controlled Proof of Concept Study to Assess the Safety and Efficacy of Elezanumab in Acute Traumatic Cervical Spinal Cord Injury (ELASCI). Principal Investigator: Dr. Sean Christie
- **CASPER:** The Canadian American Spinal Cord Perfusion Pressure and Biomarker Study. Principal Investigator: Dr. Sean Christie



Neurosurgery Spine Program Cont'd

- **PROTEST:** Prophylaxis for Venous Thromboembolism in Severe Traumatic Brain Injury, a double-blind Randomized Controlled Trial. Currently enrolling. Principal Investigator: Dr. Sean Christie

Ongoing National Registries

- **RHSCIR:** This year marks our 14th year of enrollment in the Rick Hansen Spinal Cord Injury Registry (RHSCIR), a national registry of patients with traumatic spinal cord injury (tSCI). In 2020 we started collecting data on Non-traumatic SCI patients who are admitted to the Nova Scotia Rehabilitation Center. To date, 342 patients have been included in this registry (308 tSCI, 34 non-tSCI).
- **CSORN:** The Canadian Spine Society (CSS) Registry is a national health data registry that tracks outcome measures of the surgical and non-surgical treatment of specific spinal conditions. We are currently in our 7th year of enrollment for this registry. The spine patient populations who are offered participation at our site are surgically managed for the following procedures/indications:
 - Cervical Arthroplasty
 - Cervical Myelopathy/Myeloradiculopathy
 - Lumbar Spondylolisthesis.

Currently 251 patients have been included. Within this registry, patients may/have been eligible for three sub-studies:

1. Management and Outcome of Cervical Spondylotic Myelopathy – A Standardized Clinical Assessment and Management Plan;
2. Surgical Treatment of Degenerative Spondylolisthesis: A Standardized clinical assessment and management plan (SCAMPS) Canadian Spine Society (CSS) multi-center prospective cohort study; and
3. Long-term Patient Reported Outcome Measures of Spine Surgery Instrumentation Systems in Canada: A Canadian Spine Outcomes and Research Network Sub-Study.

Ongoing local studies

- **HEALTHCARE in CLIMATE CRISIS:** Surveying the knowledge and attitudes of moving to a high quality, low carbon system in Nova Scotia. We have surveyed members of the Department of Surgery and Canadian Spine Society. Future surveys will include members of Department of Anesthesia and medical students.
- **HEALTHCARE in CLIMATE CRISIS:** Measuring individualized and total annual greenhouse gas emission through a life cycle assessment of a cervical laminectomy and fusion procedure in a closed cohort.
- **ATLANTIC PROVINCE RURAL AND URBAN:** The Effect of rural and urban living and Distance from a Specialized Spinal Cord Injury Centre on Environmental Barriers, Health and Quality of Life Outcomes in Persons with Spinal Cord Injury. Publication pending.
- **CENTRAL CORD:** Timing of Surgical Decompression and the Natural History of Neurologic Recovery in Acute Traumatic Central Cord Syndrome as Compared to Other Incomplete Cervical Spinal Cord Injuries. Ongoing analysis and manuscript writing.
- **BARRIERS to DISCHARGE:** What factors prevent patients being discharged from hospital after major spine surgery?
- **QoL/cSCI/EOL:** A Canadian Exploration of Medical Assistance in Dying (MAiD) From the Perspective of Individuals Living with a Cervical Spinal Cord Injury (cSCI)
- **FITBIT:** Can We Better Predict Long-Term Success of Permanent Spinal Cord Stimulators?
- **MODIC:** Occult Bacterial Discitis and Modic Change in Patients receiving Surgical Therapy for Lumbar Disc Herniation.
- **MELATONIN:** Plasma Melatonin Levels After Acute Traumatic Spinal Cord Injury in Individuals with Complete and Incomplete Cervical and Thoracic Spinal Cord Injury.

- **TITANIUM:** A Study of Titanium Ion Concentrations in the Whole Blood of Patients Following Metal-on-Metal Cervical Arthroplasty. This project is designed to investigate the level of titanium metal ions in a patient's whole blood. Patients who are invited to participate have previously undergone or are scheduled to undergo cervical arthroplasty surgery using the Medtronic Prestige LP prosthesis or are scheduled to undergo a single level anterior cervical discectomy and fusion with the Atlantis Vision Elite plate. Patients will be monitored for 10 years post-op; all serum samples are sent to a central facility for analysis. If patient titanium levels are reported to be > 100 pbb there may be health concerns.
- **FRAILITY SCI:** Frailty Index in Spinal Cord Injury Patients: The assessment of frailty may be an important determinant in the appropriate management of older SCI patients. A series of standard laboratory values and clinical data have been previously used to determine a frailty index, which has been linked to clinical outcomes in the elderly. This project will investigate whether the frailty index is associated with in-hospital mortality in SCI patients. Analysis is complete and publication is pending.
- **FRAILITY in SPINE PATIENTS:** In collaboration with the Canadian Spine Outcomes and Research Network, we hope to develop a frailty index in spine surgery patients using routinely collected health record data. The questions we are asking are:
 1. What is the association between frailty and adverse outcomes following spine surgery?
 2. Is preoperative frailty associated with functional outcomes following spinal surgery?
 3. Does spinal surgery result in lower frailty levels?
- **MRIs:** Appropriateness of Ordering Lumbar Spine MRI in Nova Scotia. We are conducting a retrospective study to assess the appropriateness of ordering Lumbar spine MRIs in Nova Scotia. We are collaborating with the Department of Diagnostic Imaging. Publication is pending
- **NECK PAIN:** Epidemiology and Outcomes of Neck Pain after Surgery for Cervical Radiculopathy. The study highlights a significant improvement in 12-month post-operative PROMs, including NP, across various commonly employed surgical procedures for the treatment of cervical radiculopathy. These studies offer insight into the utility of these procedures for the reduction of axial neck pain and may allow clinicians to more accurately prognosticate patients' convalescence and aid in surgical decision-making. Publication is pending.

Posters

BritSpine March 10-12, 2021

1. Do patients with recurrent lumbar disc herniations fair worse with discectomy than primary operations?
2. Are There Differences between Men and Women regarding Pre-Operative Expectations and their Post-Surgical Outcome? A Retrospective Analysis of the Canadian Spine Outcomes Research Network
3. Can a Frailty Index for Acute Traumatic Spinal Cord Injury Predict Mortality?

Publications

Alsuwaihel M, Christie S. Surgical Management of Spondyloarthropathies in the Age of Disease Altering Drugs. *Journal of Current Clinical Care*, 11(3): 21-33, 2021.

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Neurosurgery Spine Program Cont'd

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Dakson A, Kameda-Smith M, Staudt MD, Lavergne P, Makarenko S, Eagles ME, Ghayur H, Guo RC, **Althagafi A**, Chainey J, Touchette CJ, Elliott C, Iorio-Morin C, Tso MK, **Greene R**, Bargone L, **Christie SD**. A nationwide prospective multicenter study of external ventricular drainage: accuracy, safety, and related complications. *J Neurosurg*, 1-9, 2021.

Glennie RA, Oxner WM, **Alant J**, **Barry SP**, **Christie S**. Case costing in spine surgery: Can surgeons assist with accurate capture of operating room costs? *Health Manage Forum*, 34(3):158-162, 2021.

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Karim SM, Cadotte DW, Wilson JR, Kwon BK, Jacobs WB, Johnson MG, Paquet J, Bailey CS, **Christie SD**, Nataraj A, Attabib N, Phan P, McIntosh G, Hall H, Rampersaud YR, Manson N, Thomas KC, Fisher CG, Dea N. Effectiveness of Surgical Decompression in Patients With Degenerative Cervical Myelopathy: Results of the Canadian Prospective Multicenter Study. *Neurosurgery*, 89(5):844-851, 2021.

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Funding

Rick Hansen Institute. Rick Hansen Spinal Cord Injury Registry: \$60,000 (2020-2021)

Medtronic of Canada, Ltd. Unrestricted Research Grant: \$40,000 (2021)

NSHA Research Fund Grant (Fitbit study): \$25,000 (2018-2021)

NSHA Research Fund Grant (Melatonin Study): \$25,000 (2019-2021)

QEII Foundation (Donor) (Melatonin Study): \$50,000 (2019-2021)

NSHA Research Fund Grant (Modic LDH): \$25,000 (2019-2021)

CIHR PROTEST Trial: \$742,000 (2018-2023)

CSORN IMPLANT study: \$7,592 (2021)

Abbvie (M16-077): \$367,632 (2020-2023)

Mitsubishi (MT3291-A01): \$168,298 (2021-2025)

UBC Network (CASPER): \$202,500 (2021-2024)

NHSA Research Fund Grant (QoL/cSCI/EOL): \$6,958 (2021-2022)

Department of Surgery, Dalhousie University (Climate Crisis Surveying): \$60,000 (2021)

Environment and Climate Change Canada: \$5,999,989 (2021-2026)

CIHR (ATTACHED RCT): \$520,788 (2021-2025)

Team Members

- Dr. Sean Christie, Neurosurgeon
- Dr. Jacob Alant, Neurosurgeon
- Dr. Sean Barry, Neurosurgeon
- Dr. Lutz Weise, Neurosurgeon
- Lisa Julien, Research Manager/Coordinator
- Ryan Greene, Research Coordinator
- Shirley Macleod, Research Assistant
- Murray Hong, Neurosurgery OR/Technical Specialist
- Debbie Amirault, Administrative Assistant
- Melissa Cook, Administrative Assistant
- Pam Doucette, Administrative Assistant
- Maureen Kay, Administrative Assistant

Team Collaborators

- Dr. Cynthia Dunning Zwicker, Research Manager, Orthopedic Spine Service
- Dr. Andrew Glennie, Orthopedic Surgery
- Dr. Scott Kehler, Geriatric Medicine
- Dr. Jason Leblanc, Microbiology
- Dr. Sonja McVeigh, NS Rehabilitation Centre
- Dr. Kate Montgomery, NS Rehabilitation Centre
- Dr. William Oxner, Orthopedic Surgery
- Dr. Glenn Patriquin, Microbiology
- Dr. Daniel Rainham, School of Health and Human Performance, Dalhousie University
- Gillian Ritcey, Healthy Population Institute, Dalhousie University
- Dr. Ken Rockwood, Geriatric Medicine
- Dr. Matthias Schmidt, Diagnostic Imaging

Neuromodulation Program

Dr. Lutz Weise



Peggy Flynn



Haley Power



Christine Potvin



Ron Hill



Dr. Carlos Restrepo Rubio



Pam Slauenwhite



Murray Hong



Director: Dr. Lutz Weise
Program Coordinator: Christine Potvin
Program RN: Peggy Flynn

Our neuromodulation program provides neuromodulation care to the people of Atlantic Canada (population ~2.3M). The program focuses on improvements to quality of life primarily for people suffering from movement disorders, complex pain syndromes, epilepsy and spasticity. The patient population includes patients with implantable neurostimulators for deep brain (DBS), cortical, spinal cord (SCS), and peripheral stimulation. We currently follow 225 people with stimulators for movement disorders, and 235 with stimulators for pain.

In 2021, the program welcomed Dr. Nitish Agarwal, neurosurgeon from New Delhi, India who will be with the team for a one year fellowship. Dr. Carlos Restrepo finished his two year fellowship in June 2021.

Regular Deep Brain Stimulation (DBS) clinics are scheduled with several Neurologists to provide a comprehensive assessment of potential DBS candidates. In addition, there are DBS rounds in which patients are reviewed by the team and treatment options discussed. The DBS rounds also provide regular academic sessions presenting the current evidence and guidelines. These rounds are certified by the maintenance of certification program of the Royal College. In our complex pain clinic, patients are seen and evaluated by both a neurosurgeon and a complex pain anesthesiologist and a treatment plan is developed.

With their consent, patient information including quality of life surveys and intra-operative microelectrode recording data are entered into a database for analysis.

Various research activities are in progress, including electrophysiological and tractography studies in patients undergoing Deep Brain Stimulation. Ethics approval was obtained on "Correlation of Tractography and Motor Evoked Potentials in Deep Brain Stimulation" and we enrolled 57 patients to date. Further projects include the evaluation of the impact of disease lateralization on imaging characteristics such as tractography; Imaging-based programming; device research registry in which we collect several quality of life questionnaires, as well as pertinent information relating to the device; and examining prediction of success of a spinal cord stimulator dependent on patient activity during a trial period.

Oral Presentations were given at local, national and international meetings.

Publications

Restrepo CE, Clarke DB, McNeely PD, Cooper MD, Hong M, Hill R, Weise LM. Validation of 3D fluoroscopy for image-guidance registration in depth electrode implantation of medically refractory epilepsy. *Acta Neurochirurgica*, 163 (5): 1347-1354, 2021.

Illes J, Lipsman N, McDonald P, Hrinco V, Chandler J, Fasano V, Giacobbe P, Hamani C, Ibrahim G, Kiss Z, Meng Y, Sankar T, **Weise L.** From Vision to action: canadian leadership in ethics and neurotechnology. *International Review of Neurobiology*, 159:241-273, 2021.

Maurer G, Tichy J, Harter P, Noth U, **Weise L**, Quik-Weller J, Deichmann R, Steinbach J, Bar O, Hattingen E. Matching Quantitative MRI Parameters with Histological Features of Treatment-Naïve IDH Wild-Type Glioma. *Cancers (Basel)*, 13 (16): 4060, 2021.

Restrepo CE, McNeely PD, Clarke DB, Weise LM. Author response to: Complications in stereo electroencephalography: are we too severe? *Acta Neurochirurgica*, 163 (11): 3039-3040, 2021.

Presentations

Restrepo CE, Weise, L. Efficacy of an Image-based programming plan in predicting the final stimulation configuration and directionality for subthalamic. 2021 Congress of Neurological Surgeons Annual Meeting.

Team Members

- Dr. Lutz Weise, Neurosurgeon
- Dr. Sean Christie, Neurosurgeon
- Dr. Carlos Restrepo, Neurosurgery Fellow
- Dr. Nitish Agarwal, Neurosurgery Fellow
- Dr. Ian Beauprie, Anesthesiologist/Pain Specialist
- Christine Potvin, Program Coordinator
- Peggy Flynn, Program RN
- Haley Power, Neurosurgery Technology Coordinator
- Murray Hong, Neurosurgery OR/Technical Specialist
- Susan Morris, Neurophysiologist,
Intraoperative Neurophysiological monitoring
- Dr. John Fisk, Neuropsychologist
- Dr. Mark Rubens, Psychiatry
- Dr. David King, Neurologist (movement disorders)
- Dr. Kerry Schoffer, Neurologist (movement disorders)
- Dr. Roger McKelvey, Neurologist (movement disorders)
- Dr. Heather Rigby, Neurologist (movement disorders)
- Pam Slauenwhite, Administrative Assistant

Off-Site Collaborators

- Dr Renju Kuriakose, Neurologist, NB
- Dr Kyna Squarey, Neurologist, NL

Halifax Surgical Epilepsy Program

Chair: Dr. David Clarke
(Co-Chair of Halifax Epilepsy Program
with Dr. Kristin Ikeda)
Epilepsy Program Nurse:
Marlee Richardson

This year our program has continued to advance despite challenges presented by the current pandemic. We are proud to provide outstanding care to patients with epilepsy from across Atlantic Canada.

Epilepsy patients referred from Nova Scotia, Prince Edward Island, New Brunswick, and Newfoundland and Labrador are served by a comprehensive epilepsy program supported by the Divisions of Neurology and Neurosurgery, including:

- specialty outpatient clinics
- Neuropsychologist, Neuropsychiatrist, Psychometrist and Social Worker
- a four-bed inpatient Epilepsy Monitoring Unit (scalp and invasive recordings)
- access to a variety of structural and functional imaging techniques (including 3T MRI, fMRI, PET, SPECT and MEG)
- surgical options including depth electrode implantation (SEEG, and/or subdural electrodes), cortical resection, lesionectomy, corpus callosotomy, deep brain stimulation (DBS), vagus nerve stimulator (VNS), and radiofrequency ablation

Program Goal

- To provide access to extensive investigations, optimal medical management and innovative surgical techniques in the setting of a comprehensive epilepsy program for people in Nova Scotia and throughout Atlantic Canada

Accomplishments

2021 saw a continuation of the service increases resulting from the expansion of the Epilepsy Monitoring Unit. Surgical options were further enhanced by Neurosurgeon Dr. David Clarke and Neurosurgery Fellow Dr. Nitish Agarwal who performed our first SEEG radiofrequency ablations.

- Neurosurgery Fellow Dr. Nitish Agarwal has joined the Division of Neurosurgery this year. Welcome Dr. Agarwal!
- New "Approach to Seizure in the Emergency Department" algorithm has been completed and distributed to emergency departments province-wide. This document was designed collaboratively by the neurology epilepsy team, consisting of Drs. Kristin Ikeda, Stephanie Woodroffe and Ben Whatley, Nurse practitioner Karen Legg and epilepsy program nurse Marlee Richardson. A special thanks to Dr. Stephanie Woodroffe, who hosted virtual education sessions reviewing this algorithm with many Emergency Departments in Nova-Scotia in the spring of 2021.
- Pre-printed Standing Orders for EMU admissions (both SEEG and routine admissions) have been implemented in the EMU in 2021 and are working well.
- There were 49 admissions to the Epilepsy Monitoring Unit (EMU) in 2021. Due to the COVID 19 pandemic and other unexpected closures, the EMU was closed for a total of 3 months this year.
- A total of 15 patients had surgery for epilepsy; this includes 8 surgeries for SEEG and 7 for resection.

- This year, Drs. Clarke and Agarwal introduced SEEG radiofrequency ablation to our epilepsy program. In the fall of 2021, the first three of our patients received treatment with this procedure.
- Number of referrals to the epilepsy program continue to increase for both the first seizure and general epilepsy clinics – 829 referrals processed this year (compared to 677 in 2020; 644 in 2019; 554 in 2018)
- Weekly epilepsy case conferences remain on a virtual platform this year. This has allowed for continued participation of health care providers from the IWK Health Centre, Maritime Medical Genetics and the MEG laboratory, as well as some of our international colleagues.
- Celebration of Purple Day for Epilepsy Awareness on March 26th was a success! Our booth, set up on the 2nd floor of the Halifax Infirmary, provided information pamphlets and goodies to passersby.
- We continue to benefit from the enthusiasm and commitment brought to the program by Fellows and Residents assigned to the Epilepsy Program.

Publications

George RS, Sadler RM, **Clarke DB**. An Unusual Todd's Phenomenon: Post-Ictal Prosopagnosia. *Canadian Journal of Neurological Sciences*, 48(5): 730-731, 2021.

Restrepo CE, Clarke DB, McNeely PD, Cooper MD, **Hong M, Hill R, Weise LM**. Validation of 3D Fluoroscopy for Image-Guidance Registration in Depth Electrode Implantation for Medically Refractory Epilepsy. *Acta Neurochir (Wien)*, 163(5):1347-1354, 2021.

Restrepo CE, McNeely PD, Clarke DB, Weise LM. Author response to: Complications in stereoelectroencephalography: are we too severe? *Acta Neurochirurgica*, 163:3039-3040, 2021.

Brandman D, Hong M, Clarke DB. Preclinical Evaluation of the Stealth Autoguide Robotic Guidance Device for Stereotactic Cranial Surgery: A Human Cadaveric Study. *Stereotactic Functional Neurosurgery*, 99(4):343-350, 2021.

Team Members

- Dr. David Clarke, Neurosurgeon
- Dr. Dan McNeely, Neurosurgeon
- Dr. Lutz Weise, Neurosurgeon
- Dr. Kristin Ikeda, Neurologist
- Dr. Ben Whatley, Neurologist
- Dr. Stephanie Woodroffe, Neurologist
- Dr. Nitish Agarwal, Neurosurgery Fellow
- Marlee Richardson, Epilepsy Program Nurse
- Dr. Antonina Omisade, Neuropsychologist
- Dawnette Benedict-Thomas, Psychometrist
- Dr. Matthias Schmidt, Neuroradiologist
- Dr. Mark Rubens, Psychiatrist
- Karen Legg, Epilepsy, Nurse Practitioner
- Michael Whitehead, Team Lead for EEG/EMG lab
- Philip Godwin, EEG Technologist
- Teona Bjork, EEG Technologist
- Dadel Gayala, EEG Technologist
- Debbie MacDougall, EEG Technologist
- Andrew Kennedy, EEG Technologist
- Heather Smith, Social Worker
- Dr. David Skidmore, Geneticist
- Maher Quraan, MEG unit
- Tim Bardouille, Medical Physicist
- Haley Power, Technology Coordinator
- Murray Hong, Neurosurgery OR Technical Specialist
- Diane Jardine, Administrative Assistant
- Cathy Caron, Administrative Assistant
- Pam Slauenwhite, Administrative Assistant

Team Collaborators

- Neurosurgery Operating Room Team
- EMU/7.3 and 7.4 Inpatient Units
- Neuropathology
- Neuroscience and Perioperative Staff
- Biomedical Translational Imaging Centre Staff (BIOTIC)
- Health Services Managers
- Biomedical Engineering
- Sterile Processing

Neurosurgery Simulation/ Technology Program

Director: Dr. David Clarke

Technology Coordinators:

Ron Hill, Haley Power

OR/Technical Specialist: Murray Hong

Research Associate: Nelofar Kureshi

Rapid technological advances have enabled simulation training to provide reality-based learning experiences for clinician trainees for our next generation of health care professionals. These customizable simulation platforms provide new and augmented educational programs that focus on required skills traditionally practiced in clinical settings.

Current technology, coupled with the needs of advancing health care systems, dictates a strong need for simulation-based learning opportunities for all health care professionals. Simulation supports a cost-effective, accessible and timely system to support well trained practitioners in the delivery of safe health care, with the ultimate goal of improved patient outcomes.

Mission

- To develop and expand simulation-based educational environments for healthcare trainees and inter-professional teams.
- To engage in research and knowledge translation of simulation/technology-based education and treatment.

Goals

- Enhance education and skills for health care professionals through simulation-based training.
- Work to develop and incorporate technologies that will be useful in the OR environment.

Research

- Simulation Training for Perioperative Orthopedic Nurses using Digital Instrument Recognition (the PONDIR study) – effectiveness and health economic implications (Principal Investigator: Dr. R. Hurley). This study seeks to determine the effectiveness of tablet-based simulation training for common orthopedic procedures. Recruitment of participants is underway.
- Robotic technology for stereotactic procedures: Pre-clinical Evaluation of the Stealth AutoGuide Robotic Guidance Device for Stereotactic Cranial Surgery: a Human Cadaveric Study. This study, in cooperation with Medtronic Canada, aims to examine the preclinical use and accuracy of a novel robotic device that may have use in neurosurgical centers worldwide (Investigators: Drs. D. Brandman, M. Hong and D.B. Clarke).

Publication

Clarke DB, Galilee AI, Kureshi N, et al. Knowledge transfer and retention of simulation-based learning for neurosurgical instruments: a randomised trial of perioperative nurses. *BMJ Simulation and Technology Enhanced Learning*. 7:146-153, 2021.

Invited Lecture

Nova Scotia Health, Let's Talk Informatics, "Computational systems in Neurosurgery: informatics in action", January 28, 2021.

Grant

Optimization & Validation of a Novel Emergency Department Point-of-Care MRI: Research Nova Scotia Innovation Trust - Innovation Grant and Atlantic Canada Opportunities Agency (ACOA) - Business Development Program (BDP) Award

Principal Investigator: Steven D. Beyea

Co-Investigators: C. Bowen, D. Chiasson, B. Chronik, **David B. Clarke**, A. Friedman, G. Gubitz, J. Rioux, M. Schmidt, J. Shankar, R. Urquhart.

\$1,260,160.04 (RNST) and \$700,000 (ACOA).

Team Members

- Dr. David Clarke, Neurosurgeon
- Ron Hill, Neurosurgery, Technology Coordinator
- Haley Power, Neurosurgery, Technology Coordinator
- Murray Hong, Neurosurgery OR/Technical Specialist
- Nelofar Kureshi, Research Associate

Team Collaborators

- Dr. Richard Hurley, Orthopedic Surgery
- Dr. Steven Beyea, BIOTIC
- Dr. Chris Bowen, BIOTIC
- Dr. Ryan D'Arcy, Department of Computing Science, Simon Fraser University
- Denise Lalanne, Biomedical Translational Imaging Centre (BIOTEC)
- Conquer Experience, BC



Cerebrovascular Program

Director: Dr. Gwynedd Pickett
Coordinator: Judith Jarrett

The Cerebrovascular Program is a multi-disciplinary program involving neurosurgeons, neuroradiologists, stroke neurologists, nurses and trainees in each of these disciplines. Halifax is the tertiary/quaternary referral centre for the treatment of complex cerebrovascular disorders in Atlantic Canada, with extensive experience in surgical and endovascular management of aneurysms and arteriovenous malformations (AVM), and a stereotactic radiosurgery program for the treatment of patients with AVMs. The cerebrovascular team meets weekly to discuss clinical cases and provide recommendations for an evidence-based approach to patient care.

Mission

Our team is dedicated to providing world class, innovative, patient-centered care for patients with cerebrovascular disorders.

Program Goals

- To treat patients with cerebrovascular disorders using the latest technology.
- To advance the knowledge and techniques for the treatment of cerebrovascular disorders through education and research.
- To translate research into evidence-based practice.

Research

Despite the COVID pandemic, we have had an active year in research, participating in several multi-centre studies and local investigator driven studies as listed below. We maintain a number of databases (data collected from the hospital electronic medical records system) that provide valuable information for local research endeavors.

Ongoing Multi-Centre Studies

- **REACT:** A prospective, multi-centre, double-blind, randomized, placebo-controlled, parallel-group, Phase 3 study to assess the efficacy and safety of clazosentan in preventing clinical deterioration due to delayed cerebral ischemia (DCI), in adult subjects with aneurysmal subarachnoid hemorrhage (aSAH). Although recruitment was on hold for most of the year due to COVID, two subjects have been enrolled. (Funding: \$250,000.00). Principal Investigator: **Dr. GE Pickett**.
- **ENRICH-AF:** A prospective, multi-centre randomized clinical trial assessing the safety of edoxaban for stroke prevention in patients with atrial fibrillation who have had intracranial hemorrhage. (Funding: \$91,750.00). Principal Investigator: Dr. S Phillips.
- **ACTEAST:** A pragmatic quality improvement trial funded by CIHR aimed at improving access and efficiency of acute stroke treatment in Atlantic Canada. Principal Investigator: Dr. N Kamal.
- **EVOLVE:** A phase 3 multi-centre randomized study evaluating oral peri-operative acetylsalicylic acid in subjects undergoing endovascular coiling-only of unruptured brain aneurysms. Now enrolling. (Funding: \$40,000.00). Principal Investigator: **Dr. A Weeks**.
- **CREST2:** Carotid Revascularization and Medical Management for Asymptomatic Carotid Stenosis Trial. Recruitment was on hold due to COVID but has now opened in late 2020. Principal Investigator: Dr. C Herman.
- **STAT:** Stenting in the Treatment of large, wide-necked or recurring intracranial Aneurysm Trial. Recruitment on hold due to COVID. Principal Investigator: **Dr. GE Pickett**.

Ongoing Local Studies

- Evaluation of the Unruptured Intracranial Aneurysm Treatment Score: how does it compare with treatment decisions made by a multi-disciplinary team? Principal Investigator: Dr. GE Pickett.
- Is there an association between geographical location of patients in NS and management of unruptured, incidental intracranial aneurysm? Principal Investigator: Dr. GE Pickett.
- 3D Printed Models: can they assist with information transfer and satisfaction when treating intracranial aneurysms? Recruitment on hold due to COVID-19 pandemic. Co-Principal Investigators: Dr. AC Weeks, Dr. GE Pickett.

Events and Accomplishments

Despite the challenges and limitations imposed on both clinical practice and research by the COVID-19 pandemic, the cerebrovascular team was able to maintain and even expand its work. The volume of stroke cases treated with mechanical thrombectomy (clot retrieval) has grown substantially. In December, the first endovascular procedures in Atlantic Canada using the WEB device for treatment of complex intracranial aneurysms were carried out. A Research in Medicine student joined the team for an important project assessing geographical equity in the treatment of unruptured intracranial aneurysms. The stereotactic radiosurgery program received confirmation of Novalis Certification, an international quality assurance standard – the first in Canada to be awarded this accolade. Meanwhile, although the Brain Aneurysm Support Group has not been able to meet in person, we have provided communication and support as needed by email and phone to brain aneurysm patients and families.

Dr. Stephen Phillips has been a champion and leader in stroke treatment for the past three decades. He was a founding member of the Canadian Stroke Society, and the first co-chair of Heart & Stroke's Canadian Stroke Best Practice Recommendations. He has been instrumental in creating and advancing stroke systems of care in Canada, leading to better treatment and outcomes for people with stroke and their families. This fall, Dr. Phillips was selected by his peers as the 2021 Ramon J. Hnatyshyn Lecturer in stroke. The prestigious Hnatyshyn Lecture was established in 2003 in memory of Canada's 24th Governor General, a founding board member of the Canadian Stroke Network and a strong advocate and supporter of stroke research. This well-deserved honour was timely, as Dr. Phillips will retire at the end of the year. We will miss him greatly and wish him all the best.



Cerebrovascular Program Cont'd

Publications

Pickett GE, Cora A. Electrothermal coil detachment failure in flow diverter-assisted coiling of a small blister aneurysm: technical considerations and possible solutions. *Neurointervention*, 16(2):171-174, 2021.

Diestro JDB, Adeeb N, Dibas M, Boisseau W, Harker P, Brinjikji W, Xiang S, Joyce E, Shapiro M, Raz E, Parra-Farinas C, **Pickett G**, Alotaibi NM, Regenhardt RW, Bernstock JD, Spears J, Griessenauer CJ, Burkhardt JK, Hafeez MU, Kan P, Grandhi R, Taussky P, Nossek E, Hong T, Zhang H, Rinaldo L, Lanzino G, Stapleton CJ, Rabinov JD, Patel AB, Marotta TR, Roy D, Dmytriw AA. Flow diversion for middle cerebral artery aneurysms: an international cohort study. *Neurosurgery* 89(6):1112-1121, 2021.

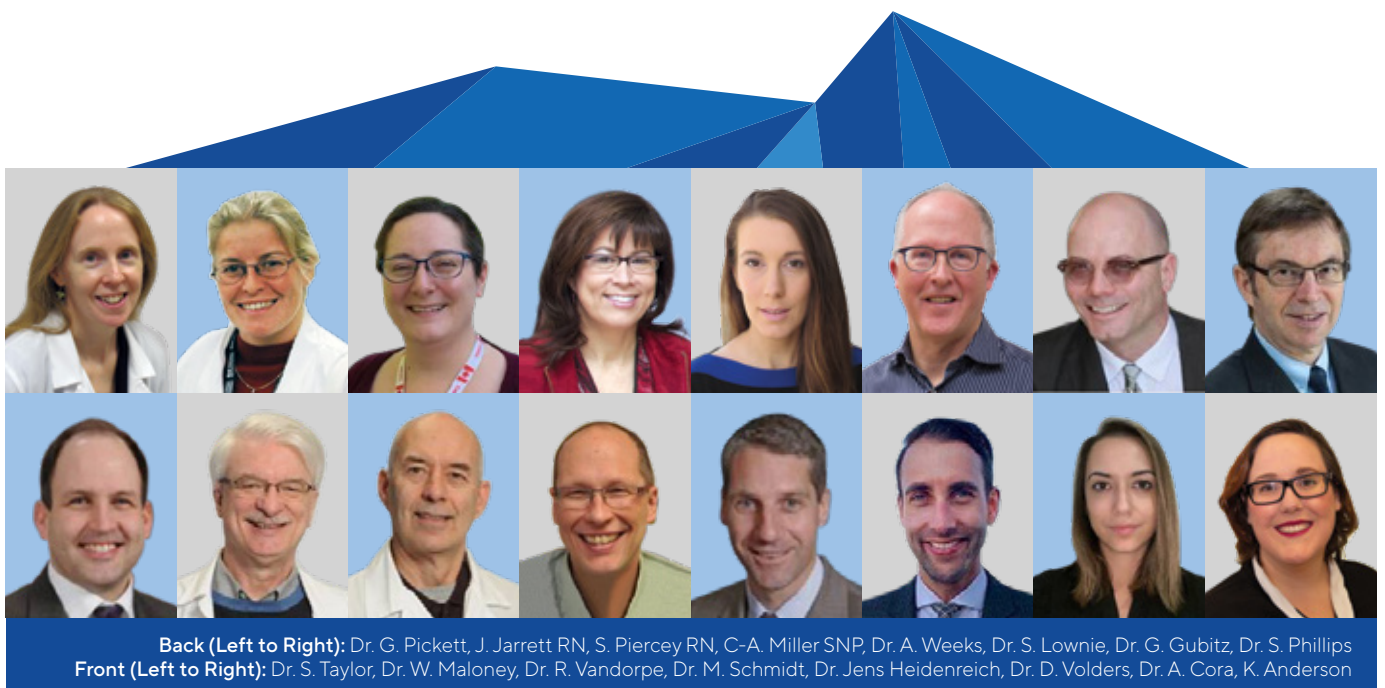
Pelz DM, **Lownie SP**, Mayich MS, Pandey SK, Sharma M. Interventional neuroradiology: a review. *Can J Neurol Sci*, 48(2):172-188, 2021.

Ganesh A, Ospel JM, Menon BK, Demchuk AM, McTaggart RA, Nogueira RG, Poppe AY, Almekhlafi MA, Hanel RA, Thomalla G, Holmin S, Puetz V, van Adel BA, Tarpley JW, Tymianski M, Hill MD, Goyal M; **ESCAPE-NA1 Trial Investigators.** Assessment of discrepancies between follow-up infarct volume and 90-day outcomes among patients with ischemic stroke who received endovascular therapy. *JAMA Netw Open*. 2021 Nov 1;4(11):e2132376.

Nguyen TN, Haussen DC, Qureshi MM et al. (including **Weeks A, Cora EA.**) Decline in subarachnoid hemorrhage volumes associated with the first wave of the COVID-19 pandemic. *Stroke Vasc Neurol* 6(4):542-552, 2021.

Team Members & Collaborators

- Dr. Gwynedd Pickett, Director, Neurosurgeon
- Judith Jarrett, Research Coordinator
- Susannah Piercey, Research Coordinator
- Carole-Ann Miller, Specialty Nurse Practitioner
- Dr. Adrienne Weeks, Neurosurgeon
- Dr. Stephen Lownie, Neurosurgeon
- Dr. Gordon Gubitz, Neurologist
- Dr. Stephen Phillips, Neurologist
- Dr. Sean Taylor, Neurologist
- Dr. William Maloney, Neuroradiologist
- Dr. Robert Vandorpe, Neuroradiologist
- Dr. Matthias Schmidt, Neuroradiologist
- Dr. Jens Heidenreich, Neuroradiologist
- Dr. David Volders, Neuroradiologist
- Dr. Adela Cora, Neuroradiologist
- Katharine Anderson, Administrative Assistant
- Emma Gillespie-Fraser, Administrative Assistant
- Liz Scott, Administrative Assistant



Brain Tumour Program

Program Co-Chairs:

Drs. Adrienne Weeks and Mary McNeil

Brain Tumour Nurse Coordinator:

Samantha Warren/Megan Lambert

Research Coordinator: Andrea L.O. Hebb

The Brain Tumour Program is a multidisciplinary program involving neurosurgeons, medical oncologists, radiation oncologists, neuropathologists, neuroradiologists, nurses, and trainees of each of these disciplines. Weekly meetings of the Neuro-oncology cancer site team provide evidence-based recommendations for patient management. This team organizes visiting speakers and rounds and is responsible for the development of provincial guidelines for the management of patients with brain tumours.

The Brain Tumour Group is actively participating in both clinical and basic science research programs.

Dr. Weeks runs a laboratory at the Charles Tupper Building on the Dalhousie Campus. Her lab team studies the role of RNA stress granules in the malignant brain tumour, Glioblastoma.



Dr. Weeks and Dr. McNeil are currently bringing a research team together to study Glioblastoma survivorship and patient perceptions and attitudes toward medically assisted death. This project will hopefully improve our communication and delivery of care to brain tumour patients. Dr. McNeil was the lead site director of the CCTG Trial CE8, randomizing patients to Marizimib for Glioblastoma that was completed this year.

Team Members

- Dr. Adrienne Weeks, Neurosurgeon, Co-Chair CNS CST
- Dr. Mary McNeil, Medical Oncologist, Co-Chair CNS CST
- Dr. Simon Walling, Neurosurgeon
- Dr. Dan McNeely, Neurosurgeon
- Dr. Steve Lownie, Neurosurgeon
- Dr. David Clarke, Neurosurgeon
- Dr. Gwynedd Pickett, Neurosurgeon
- Dr. Sean Christie, Neurosurgeon
- Dr. Sean Barry, Neurosurgeon
- Dr. Dhany Charest, Neurosurgeon, Moncton
- Samantha Warren, Neurosurgery Brain Tumour Nurse Coordinator
- Megan Lambert, Neurosurgery Brain Tumour Nurse Coordinator
- Andrea Hebb, Neurosurgery Research Coordinator
- Dr. Sid Croul, Neuropathologist
- Dr. Alex Easton, Neuropathologist
- Dr. Kwamena Beecham, Radiation Oncologist
- Dr. Liam Mulroy, Radiation Oncologist
- Dr. Lara Best, Radiation Oncologist
- Dr. Michael Ha, Radiation Oncologist
- Dr. Robert Vandorpe, Neuroradiologist
- Dr. Adela Cora, Neuroradiologist
- Heather MacKenzie, Coordinator, Cancer Care Nova Scotia
- Erin Little, Research Coordinator
- Emma Gillespie-Fraser, Administrative Assistant
- Liam Rappoldt, Msc Student
- Kathleen Atwood, Post-Doctorate Student

Neurotrauma and Injury Prevention Programs

Director: Dr. David Clarke

Research Coordinator: Lorelei Audas

Research Associate: Nelofar Kureshi

Traumatic Brain Injury (TBI) is the leading cause of mortality and acquired disability in Canadians under the age of 40. Direct and indirect costs associated with TBI are estimated at three billion dollars annually in Canada. TBI also impacts the elderly and, in the context of the aging Canadian population, total indirect costs predicted by simulated epidemiology are projected to be \$8.2 billion for TBI by 2031.

The Neurotrauma and Injury Prevention programs are dedicated to conducting research for preventative strategies and improved clinical management for TBI patients and their families. We aim to deliver targeted, evidence-based injury prevention, and clinical programming for TBI care.

Mission

Provide leadership in injury prevention and neurotrauma research, advocacy, education and knowledge translation.

Program Goals

- Participate in regional and national traumatic brain injury research.
- Support evidence-based care solutions that improve access to neurosurgical care, reduce lengths of stay and optimize patient outcomes.
- Implement and support advocacy efforts for neurotrauma injury prevention.

Research

- We published an article on the long-term trends in TBI in Nova Scotia (“Long-Term Trends in the Epidemiology of Major Traumatic Brain Injury”), where we reported the increasing incidence of major TBI over a 16-year period. We also showed a greater than twofold increase in the rate of fall-related trauma.
- Halifax is a member site of the Canadian Traumatic Brain Injury Research Consortium (CTRC), a partnership of Canadian basic and clinician scientists focused on TBI research. (Dr. Clarke, member).
- Halifax TBI database: all TBI admissions to Neurosurgery are reviewed at TBI teaching and quality rounds, overseen by Drs. David Clarke and Simon Walling. Currently, over 2,929 cases have been reviewed for inclusion in the TBI database.
- The QEIIHSC is one of the three Atlantic Canadian sites participating in the “National Study of Impaired Driving in Canada” led by Dr. Jeff Brubacher and locally by Drs. David Clarke and Kirk Magee. This study is investigating the prevalence of drug use, and type of drugs used, in drivers who are moderately or severely injured in a motor vehicle crash. We have collected > 290 samples since study inception.
- “The impact of intoxication on mortality in patients with major traumatic brain injury caused by off-road vehicle crashes” is a sub study of “The investigation of the incidence and economic burden of alcohol-related traumatic brain injury in Nova Scotia”, which is a joint partnership with the Department of Health and Wellness and Trauma Nova Scotia. Between 2002-2014 there were a total of 176 cases of major TBI involving both drivers and passengers of off-road vehicles. Among major TBI patients who died in-hospital following off-road vehicle-related trauma, the vast majority of patients tested for alcohol were positive. Furthermore, a large proportion of patients who died prehospital were intoxicated at the time of injury. These findings demonstrate that alcohol intoxication is a significant risk factor for mortality among off-road vehicle collisions. A manuscript for this sub study is being prepared for publication.

- We have completed a pilot study “Usage of impact monitoring sensors to monitor head impact burden, concussion incidence, and traumatic microvascular injury in university football players” (led by Dalhousie Medical student, Casey Jones). This study utilizes impact-detecting helmets in an entire university gridiron football team. In 2021, we consented 72 Dalhousie football players and completed 8 baseline scans, and 7 post injury scans. A manuscript resulting from the first phase of this study has been submitted for publication.

Publication

Kureshi N, Erdogan M, **Thibault-Halman G**, **Fenerty L**, Green RS, **Clarke DB**. Long-Term Trends in the Epidemiology of Major Traumatic Brain Injury. *J Community Health*, 46(6):1197-1203, 2021.

Funding and Grants

Health Canada (Substance Use and Addictions Program – SUAP), 2019-2022

“Monitoring and Preventing Drug-Impaired Driving in Canada”

Principal Investigator: Jeff Brubacher

Co-Investigators: Herbert Chan, Shannon Erdelyi, Mark Asbridge, Robert Mann and the Canadian Drug-Impaired Driving Research Team (**David B. Clarke**, Raoul Daoust, Philip Davis, Marcel Emond, Chrystal Horwood, Rao Jagadish, Glenda Kaban, Jacques Lee, Kirk Magee, Eric Mercier, Judy Morris, Brian Rowe, Christian Vaillancourt, Erin Weldon, Ian Wishart)
Duration of support: 5 years (June 2019 - May 2024)
\$1,361,356

Department of Health Promotion and Protection, 2013-current

“An Investigation of the Health and Economic Outcomes of Alcohol-Related Traumatic Brain Injury in Nova Scotia”.

Principal Investigator: **David B. Clarke**

Co-investigators: **Simon Walling**, **Nelofar Kureshi**, Rob Green, Mete Erdogan
\$20,000

Team Members

- Dr. David Clarke, Neurosurgeon
- Dr. Simon Walling, Neurosurgeon
- Nelofar Kureshi, Research Associate
- Lorelei Audas, Research Coordinator
- Casey Jones, Dalhousie Medical School (RIM student)

Team Collaborators

- Dr. Alon Friedman, Department of Medical Neuroscience
- Dr. Christina Atkinson, Department of Family Medicine
- Dr. Kirk Magee, Department of Emergency Medicine
- Dr. Robert Green, Department of Critical Care and Trauma Nova Scotia
- Lynne Fenerty, Division of Neurosurgery
- Brain Repair Centre
- Department of Physical Medicine and Rehabilitation
- Department of Health Promotion and Protection
- Atlantic Collaborative for Injury Prevention
- Parachute (ThinkFirst) Canada
- Emergency Health Services



Halifax Neuropituitary Program



Program Co-Chairs:

Drs. David B. Clarke and S. Ali Imran

Mission

Our team provides high quality, innovative care for patients with pituitary/parasellar tumours.

Objectives

- To provide a comprehensive, multi-disciplinary, patient-focused team.
- To be leaders in delivering accessible and innovative health care for patients with pituitary disorders.
- To create an environment that fosters education and research.

This program, unique to the Atlantic Provinces and much of Canada, provides comprehensive care to over 2000 patients with pituitary and sellar region tumours in a multi-disciplinary clinic. Patients are seen by both Neurosurgery and Endocrinology. Transsphenoidal surgery is performed by Drs. Massoud and Clarke. Collaboration with Otolaryngology, Ophthalmology as well as the Stereotactic Radiosurgery Group ensures coordinated assessment, treatment and follow-up. Monthly multi-disciplinary teleconference rounds are held with external sites from Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland and Labrador.

Clinical Activity Highlights

Our program referrals included 37 new HNP surgical referrals, coming from Prince Edward Island (n=1), New Brunswick (n=1), Newfoundland and Labrador (n=2), Alberta (n=1) and Nova Scotia (n=32).

There were 112 new HNP medical referrals, from Prince Edward Island (n=2), Newfoundland and Labrador (n=3), Alberta (n=2), Ontario (n=2) and Nova Scotia (n=103).

There were 639 patient visits to the HNP medical clinic and 211 patient visits to the HNP surgical clinic in 2021.

Twenty-six transsphenoidal surgeries were performed endoscopically in 2021 by Drs. Clarke (Neurosurgery) and Massoud (Otolaryngology).

We have treated our 17th patient as part of our Health Canada approved clinical trial on the stereotactic intracavitary instillation of ⁹⁰Yttrium for treatment of cystic sellar/parasellar lesions (Principal Investigator: Dr. Clarke). The clinical trial is being performed in collaboration with Dr. Steven Burrell and Dr. George Mawko in the Department of Diagnostic Imaging, QEII Health Sciences Centre.

Research/Program Development

In collaboration with the Canadian medical device company, Synaptive Medical Inc., patients with pituitary tumors undergo MR imaging with the Evry, a cryogen-free low-field (0.5 Tesla) system to evaluate its clinical utility relative to a standard 1.5T system.

In collaboration with Drs. Paul Freund and Michael Thorne (Department of Ophthalmology and Visual Sciences), optical coherence tomography (OCT) is being employed to predict the visual outcomes in patients who undergo sellar or suprasellar tumor resection.

In collaboration with Dr. Andrew Orr (Department of Ophthalmology and Visual Sciences), we are continuing to collect sellar/parasellar tumour tissue intra-operatively under the protocol "Functional and Genetic Analysis and Banking of Neuro-Oncological Disease Tissues". We hope to develop a better understanding of the genetic and functional pathways that confer an increased risk of developing neuro-oncological diseases, including neuropituitary tumours.

Our Health Canada Phase III clinical trial "Assessment of the Efficacy of Stereotactic intracavitary instillation of ⁹⁰Yttrium colloid for treatment of cystic lesions of the pituitary and surrounding areas (sellar/parasellar region)" has recruited 19 patients.

Publications

Clarke DB, Hebb ALO, Massoud E, Imran SA. In-Hospital Endocrinology Consultation After Transsphenoidal Surgery: Is It Always Necessary? *Can J Neurol Sci*, 48(4):534-539, 2021.

Van Woensel W, Elnenaei M, Abidi SSR, **Clarke DB**, Imran SA. Staged reflexive artificial intelligence driven testing algorithms for early diagnosis of pituitary disorders. *Clin Biochem*, 97:48-53, 2021.

Outreach

Atlantic Cushing Support Group and Education

The Atlantic Cushing support group is for those individuals who have been diagnosed with Cushing's disease within the Atlantic Canada region. Meetings occur twice yearly. Guest speakers from Neurosurgery, Otolaryngology and Endocrinology attend.

Atlantic Acromegaly Support Group and Education

The Atlantic Acromegaly support group is for those individuals who have been diagnosed with Acromegaly within the Atlantic Canada region. Meetings occur twice yearly with guest speakers addressing conditions as well as treatments available. <http://www.acromegalysupport.ca>

Team Members

- Dr. David B. Clarke, Neurosurgeon
- Dr. S. Ali Imran, Endocrinologist
- Dr. Emad Massoud, Otolaryngology – Head & Neck Surgery
- Dr. Wael Almistehi, Neuroendocrinology Fellow
- Andrea L.O. Hebb, Neurosurgery Research Coordinator
- Lisa Tramble, Endocrinology Clinic Nurse
- Wendy Woods, Program Clinic Coordinator
- Diane Jardine, Neurosurgery Administrative Assistant
- Murray Hong, Neurosurgery OR Technologist
- Dr. Sidney Croul, Neuropathologist
- Dr. Liam Mulroy, Radiation Oncologist
- Dr. Steven Burrell, Diagnostic Radiologist
- Dr. George Mawko, Diagnostic Radiologist
- Dr. Deborah Zwicker, Endocrinologist, Sydney, NS
- Dr. Lenley Adams, Internal Medicine, Charlottetown, PEI
- Dr. Carol Joyce, Endocrinologist, St. John's, NL
- Dr. Cathy Murray, Endocrinologist, St. John's, NL
- Dr. Michael Pelkey, Endocrinologist, Fredericton, NB

Team Collaborators

- Neuroradiology
- Nova Scotia Eye Centre
- Operating room/7.3 Inpatient Unit/Clinic nursing



Back (Left to Right): Dr. David B. Clarke and Dr. Ali Imran
Middle row: Dr. Wael Almistehi
Front (Left to Right): Andrea L.O. Hebb and Lisa Tramble

Maritime Lateral Skull Base Program

Andrea L.O. Hebb



Dr. David Morris



Dr. Steven Lownie



Dr. Simon Walling



Dr. Liam Mulroy



Dr. Nael Shoman

Program Co-Directors:

Drs. David Morris and Simon Walling

Program Coordinator: Andrea L.O. Hebb

The Maritime Lateral Skull Base Clinic provides coordinated care through Otolaryngology, Neurosurgery and the Stereotactic Radiotherapy Group to patients with unilateral or bilateral vestibular schwannomas (also called acoustic neuromas) and a range of other lateral skull base tumours.

The program provides coordinated care to over 1000 patients with a range of lateral skull base tumours including vestibular schwannomas, other cerebellopontine angle (CPA) tumours, lesions of the petrous apex and jugular foramen. Patients are carefully assessed, and appropriate plans formulated. When treatment is required, the experts on our team provide a full range of treatment options including surgery, stereotactic radiation therapy (SRT), as well as balance and hearing rehabilitation.

Our program is unique in Canada in allowing members from all disciplines to formulate management decisions in the same clinic.

Neurofibromatosis Type 2 is a hereditary condition (autosomal dominant, spontaneous and mosaic) most associated with bilateral vestibular schwannomas. NF2 clinics continue to be held once every 2nd month. This clinic is dedicated to patients with Neurofibromatosis Type 2 and includes collaboration with Medical Genetics, Radiology, Nova Scotia Hearing and Speech as well as Ophthalmology. We currently follow over 35 patients with NF2.

Dr. Mathieu Trudel, MD, FRCSC, Neuro-Otology fellow, CHU de Quebec-Universite Laval, joined our team in July 2021.

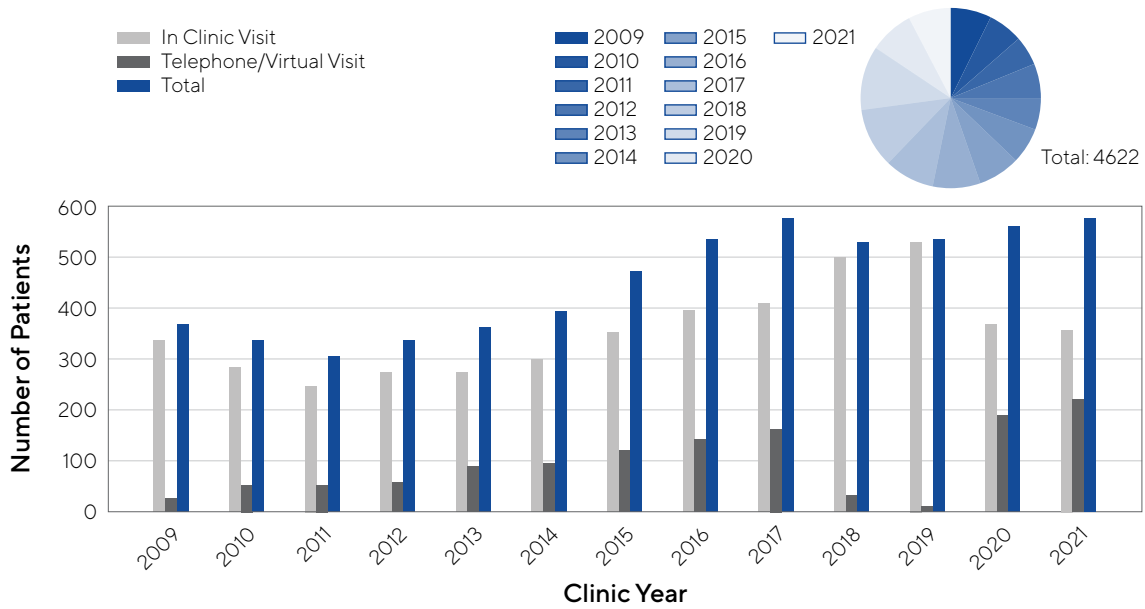


Clinic Visits

576 clinic visits occurred in 2021. There were 296 in-clinic visits and 198 virtual visits for returning patients. There were also 82 new referrals in 2021, to include 21 patients from NB, 4 patients from PEI, 1 patient from NL and 56 patients from NS. Dr. Simon Walling and Dr. Stephen Lownie performed 11 surgeries (with Dr. David P. Morris and Dr. Nael Shoman) to remove CPA tumours in 2021.

In addition, 24 patients underwent stereotactic radiation therapy (SRT) to control tumour growth reminiscent of pre-pandemic treatment numbers.

Number of Patients Seen by Year in Maritime Lateral Skullbase Clinic

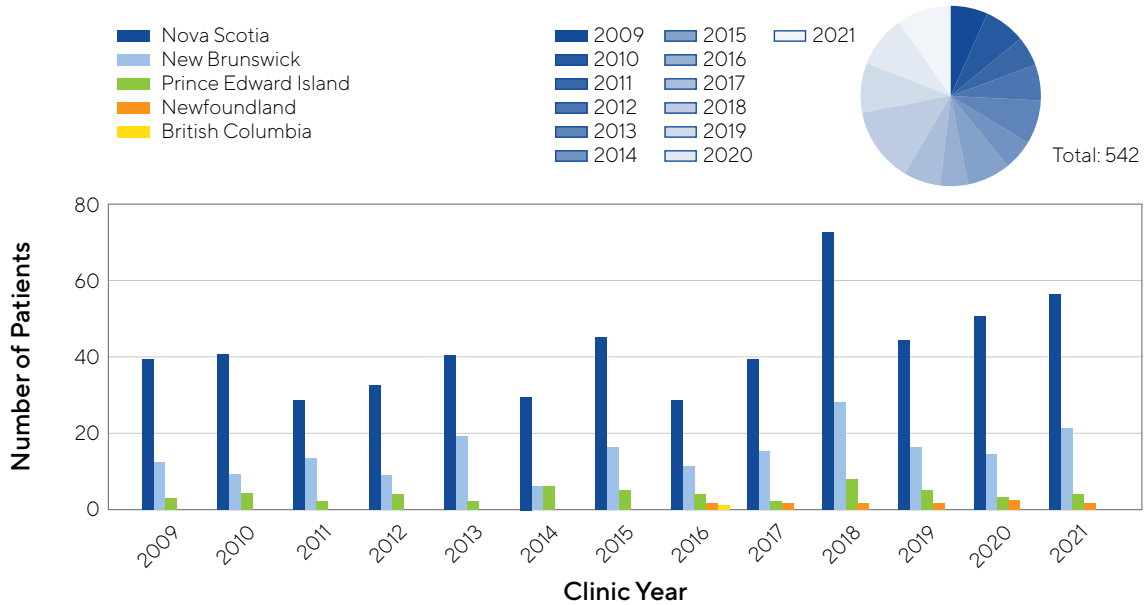


In 2020, due to the COVID-19 pandemic telephone visits were more widely adopted and continued through 2021.



Maritime Lateral Skull Base Program Cont'd

Number of New Diagnoses by Year and Province in Maritime Lateral Skull Base Clinic



Referrals are received across Canada with the majority from the Maritime Provinces. The number of new patients seen by year per province is outlined.

Number of Patients Treated Each Year in Maritime Lateral Skullbase Clinic



The number of patients treated with SRT/SRS or surgery are outlined per year since 2009.

Program Goals

- To offer a single center, multi-disciplinary approach
- To be an internationally recognized centre for lateral skull base lesions
- To be at the forefront of clinical research in lateral skull base lesions
- To maintain a detailed database allowing critical appraisal of current treatment strategies
- To be sensitive to new developments in our specialty allowing us to be critical of our practice and outcomes
- To change our practice with evidence-based research

Research in the Skull Base Program

- Quality of life related to symptomatic outcomes in patients with cerebellopontine angle tumours.
- High-resolution vestibulocochlear schwannoma imaging on 0.5 Tesla MRI.

We have developed several research fronts in this program. Some are listed below:

- What is useful hearing? Speech in noise comprehension with asymmetric hearing in acoustic neuroma subjects, when does the tumor ear stop contributing to binaural hearing?
- Database of tumor growth and outcomes. One of the largest series in the world with the “wait and scan” policy.
- Defining the natural history of vestibular schwannoma as a foundational precept of a statistical model.
- Database of surgical outcomes: looking at facial nerve displacement.
- Patient expectations and attitudes to acoustic neuroma: questionnaire for all patients in our database.
- Subjective hearing handicaps measured with standardized instruments.
- Tinnitus and quality of life questionnaires added to each clinic visit.

Team Members

- Dr. Simon Walling, Neurosurgeon
- Dr. David P. Morris, Otolaryngologist
- Dr. Nael Shoman, Otolaryngologist
- Dr. Stephen Lownie, Neurosurgeon
- Dr. Liam Mulroy, Radiation Oncologist
- Andrea L.O. Hebb, Program Coordinator
- Bonita Meade, Clinic Coordinator
- Adele Greene, Clinic Nurse
- Jenny Barron, Clinic Nurse



MLSBC

Pediatric Neurosurgery

The goal of the Division of Neurosurgery at the IWK Health Centre is to offer the highest quality clinical service to pediatric patients of the region, in collaboration with our colleagues at referring sites. We also strive to offer high quality teaching, and to contribute to the advancement of knowledge through our participation in research.

Camp Brainiac returned as an in-person experience from August 8-13, 2021, hosting 6 campers this past summer. We thank our generous donors who helped make this experience possible via the Neurosurgery Kids Fund.

We have continued to gradually expand our use of virtual visits to remain connected with the patients and families we serve, while obviating the need for travel to the IWK Health Centre.

Our intra-operative neuronavigation technology was modernized over the past year. There were a few growing pains in the process, however we expect this new system to serve our patients well for the coming years.

Finally, we are pleased to now offer nurse-practitioner led clinics to evaluate infant head shape referrals. Our hope is that this additional service will enhance overall accessibility for pediatric neurosurgery consultations.

Team Members and Collaborators

- P. Daniel McNeely, Chief, Pediatric Neurosurgeon
- Simon A. Walling, Neurosurgeon
- Sarah Szego, Neurosurgery Nurse Practitioner
- Kelly Boileau, Brain Tumour Clinic Nurse
- Katherine Wagner, Spina Bifida Clinic Nurse
- Shona McConnell, Neurosurgery OR Nursing Team Lead
- Susan Morris, Neurophysiologist
- Cathy Caron, Administrative Assistant
- Chrissy Shay, Administrative Assistant



Dr. D. McNeely



Dr. S. Walling



Intraoperative Neurophysiology

Neurophysiologist: Dr. Susan Morris
Neurosurgery OR/Technical Specialist:
 Murray Hong
**Neurosurgery OR Technology
 Coordinator/Specialist:** Ron Hill

Intraoperative neurophysiological mapping and monitoring (IONM) uses electrophysiological methods to provide real-time feedback to surgeons about critical brain, brainstem, spinal cord, and nerve function during different types of neurosurgery. As a mapping technique, IONM provides functional guidance to help surgeons identify and navigate vital regions of the central and peripheral nervous system. As a monitoring tool, IONM acts as an early warning signal, enabling timely intraoperative intervention to avoid serious post-operative deficits such as paralysis. Neurosurgeries that most benefit from IONM include brain, brainstem and spinal cord tumour resections and complex spine deformity corrections.

The IONM program in the Division of Neurosurgery is collaboratively run by Drs. Susan Morris and Murray Hong, both of whom have many years of experience in intraoperative neurophysiology.

In addition to clinical work, Drs. Morris and Hong are involved in various departmental research projects. A recent project examined the timing and nature of neurophysiological signal changes in response to experimental spinal cord compression. Rapid detection of intraoperative spinal cord compromise using electrophysiological methods and the development of new IONM techniques is critically important to patient safety during spine and spinal cord surgery.

Team Members

- Susan Morris, Neurophysiologist
- Murray Hong, Neurosurgery OR/Technical Specialist



Susan Morris

Murray Hong



Ron Hill



Neurosurgery Basic Science Labs

Life Sciences Research Institute and Sir Charles Tupper Building Brain Repair Centre

Spinal Cord Injury Laboratory

Dr. Sean Christie

The Christie lab has been very active this year on numerous fronts.

Anna Lopez joined our lab this summer on a NSERC Undergraduate Student Research Award. She is studying neuroprotection after SCI and histologically comparing neuronal survival in different ascending and descending tracts after injury.

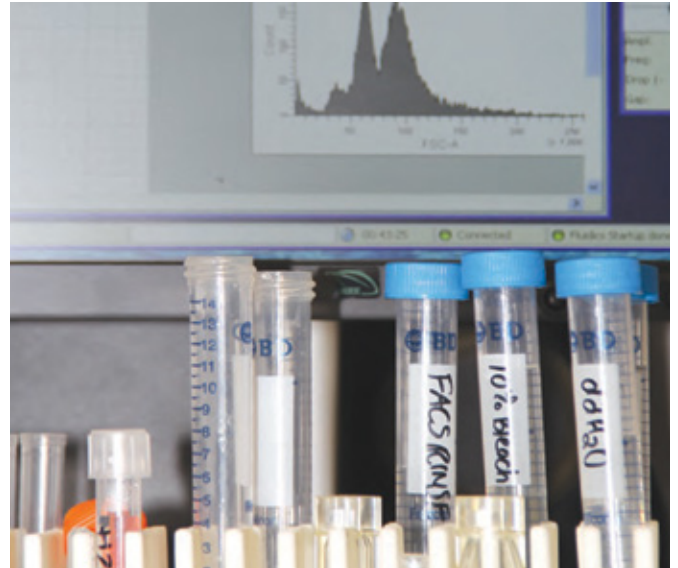
Kennedy Brittain (MSc candidate) is working towards completing her study with Ru265, a novel neuroprotective compound that minimizes mitochondrial calcium overloading following SCI. She's also examining if the drug can be applied effectively over the dura after SCI, thereby minimizing required dose and targeting the lesion directly.

Mustafa Nadi (PhD candidate) is close to completing his research on miRNA regulation after SCI. He has narrowed down select miRNAs of impact after deep sequencing the total miRNA after injury at different stages. He is also studying important miRNA pathways that are modulated by SCI and neuroprotectants, so that they can favourably targeted.

Dr. Saranyan Pillai is our Research Associate training and contributing to all projects. He is heading a study on the role of cannabis extracts on the biochemical indicators of neuropathic pain in the zebrafish model, with Dr. Bryan Crawford's lab of UNB, Fredericton. He is also working on spatial transcriptomics in the mouse model, to simultaneously map the wavefronts of various genes around the expanding spinal cord injury penumbra.

The lab continues to collaborate with Drs. Danielle Tokarz and Richard Cisek of Saint Mary's University on imaging mouse otoconia, collagen arrangement in the dura mater and the glial scar after SCI. The imaging is done by Second Harmonic Generation Laser microscopy. In another collaboration with Drs. McVeigh and Whelan of Division of Physical Medicine & Rehabilitation, we are studying melatonin levels in acute phase patients after cervical spinal cord injury.

Lastly, we would like to acknowledge our gratitude to the Dalhousie Medical Research Foundation and the donor that directed funds towards our miRNA work.



Brain Tumour Laboratory

Dr. Adrienne Weeks

Dr. Weeks runs a laboratory at the Charles Tupper Building on the Dalhousie Campus. Her lab team studies the role of RNA stress granules in the malignant brain tumour, glioblastoma. A recently published paper in the Nature Group Publication "Cell Death and Disease" was the first to demonstrate that interfering with stress granule dissolution by the drug raloxifene increased glioblastoma cell death. The team is exploring other drugs that impair stress granule function in the hopes of bringing new therapeutic strategies to clinic practice.

Dr. Weeks, in collaboration with Dr. Jeremy Roy at the Atlantic Cancer Research Institute in Moncton, New Brunswick and Dr. Sidney Croul in the Department of Pathology at Dalhousie continue a translation research project to study the role of plasma extracellular vesicles in glioblastoma recurrence and pathogenesis. The group received a grant for Atlantic Genome Canada and the QEII Foundation to further this work.

Funding

Dr. Weeks' laboratory is supported by the Department of Surgery, QEII Foundation and Atlantic Genome Canada.

Research Funding

Principal Investigator: **Jacob Alant**
 Co-Principal Investigator: Sean Christie
 Nova Scotia Health Authority Research Fund
 Occult Bacterial discitis and Modic change in patients receiving surgical therapy for lumbar disc herniation
 2021-2022
 \$25,000

Principal Investigator: **Sean Christie**
 Abbvie
 M16-077: Elezanumab in Traumatic Spinal Cord Injury
 2020-2023
 \$367,632

Principal Investigator: **Sean Christie**
 Department of Surgery
 Neuronal Protection Following Spinal Cord Injury through Inhibition of the Mitochondrial Calcium Uniporter
 2019 - 2021
 \$49,122

Principal Investigator: **Sean Christie**
 Medtronic Canada
 Prospective Registry of Clinical Outcomes following Elective Spine Surgery
 2020-2021
 \$40,000

Principal Investigator: **Sean Christie**
 Department of Surgery
 Effects of Cannabidiol on Molecular and Biochemical Indices of Neuropathic Pain
 2020-2021
 \$14,000

Principal Investigator: **Sean Christie**
 Department of Surgery
 Healthcare in a Climate Crisis: Surveying Knowledge and Attitudes of Moving to a High Quality, Low Carbon System in Nova Scotia
 2021-2022
 \$30,000

Principal Investigator: **Sean Christie**
 PRAXIS
 Canadian Spinal Cord Injury Registry (RHSCIR)
 2021
 \$60,000

Principal Applicant: Dr. Fiona Miller
 Partner Applicant: **Sean Christie**
 Environment and Climate Change Canada
 Project CASCADES (Creating a Sustainable Canadian Health System in a Climate Crisis)
 2021-2025
 \$6,000,000

Principal Investigator: Dr Ayoub Dakson
 Co-Principal Investigator: **Sean Christie**
 Kuwait Foundation for the Advancement of Sciences
 Central Nervous System Penetration of SARS-CoV-2: Incidence and Implications
 2020-2022
 \$23,000

Principal Investigator: Dr. Farhad Pirouzmand
 Co-Investigator: **Sean Christie**
 Canadian Institutes of Health Research
 Prophylaxis for Venous Thromboembolism in Severe Traumatic Brain injury (PROTEST): A Double Blind Randomized Controlled Trial
 2019 - 2023
 \$742,000

Principal Investigator: Dr John Frampton
 Co-Principal Investigator: **Sean Christie**
 CRCC - New Frontiers in Research Fund - Exploration Flexible Biomaterial Fibers for Nerve Repair and Regeneration
 2019 - 2021
 \$250,000

Research Funding Cont'd

Principal Investigator: Dr. Sonja McVeigh
 Co-Investigator: **Sean Christie**
 Nova Scotia Health Authority Research Fund
 Plasma Melatonin Levels After Acute Traumatic Spinal
 Cord Injury in Individuals with Complete and Incomplete
 Cervical and Thoracic Spinal Cord Injury
 2019 - 2021
 \$25,000

Principal Investigator: Danielle Torkarz
 Co-applicant: **Sean Christie**
 Research Nova Scotia
 Investigating Otoconia Ultrastructure during
 Degeneration
 2021-2022
 \$100,000

Principal Investigator: Farhad Pirouzmand
 Co-applicant: **Sean Christie**
 Canadian Institutes of Health Research
 Anticoagulation Therapy Timing in Atrial Fibrillation after
 Chronic Subdural Hematoma External Drainage
 2021-2023
 \$520,788

Principal Investigator: Jeff Brubacher
 Co-Investigators: **David Clarke** and several others
 Health Canada (Substance Use and Addictions Program
 - SUAP)
 Monitoring and Preventing Drug-Impaired Driving in
 Canada
 2019-2022
 \$1,361,356

Principal Investigator: Alon Friedman
 Clinical Site Investigator: **David B. Clarke**
 Co-Investigators: Several others including **Simon Walling**
 Canadian Institutes of Health Research
 Microvascular Injury and Blood-Brain Barrier Dysfunction
 as Novel Biomarkers and Targets for Treatment in
 Traumatic Brain Injury
 Funding over five years (\$190,000 per year)
 2016-2021
 \$950,000

Principal Investigator: **David B. Clarke**
 Co-investigators: **Simon Walling**, Nelofar Kureshi, Rob
 Green, Mete Erdogan
 Department of Health Promotion and Protection
 An Investigation of the Health and Economic Outcomes
 of Alcohol-Related Traumatic Brain Injury in Nova Scotia
 2013-2021
 \$20,000

Principle Investigator: Jeff Brubacher
 Co-Investigators: **David B. Clarke** and several others
 Transport Canada, Enhanced Safety Transfer Payment
 Program (ERSTPP)
 Monitoring Impaired Driving in Canada
 2021-2023
 \$1,416,770

Principle Investigator: **Adrienne Weeks**
 Canadian Cancer Society Atlantic Oncology Grant
 The Role of Plasma EVS in Glioblastoma Progression
 2021-2023
 \$150,000

Principle Investigator: Melanie Keats
 Co-Applicant: **Adrienne Weeks** and several others
 Canadian Cancer Society
 The Impact of Resistance Exercise on muscle mass in
 Glioblastoma survivors
 2021-2023
 \$150,000

Principle Investigator: **Adrienne Weeks**
 QE II Foundation
 Brain Cancer Bash Fundraising Grant
 2021
 \$70,000

Publications

Alsuwaihel M, Christie S. Surgical Management of Spondyloarthropathies in the Age of Disease Altering Drugs. *Journal of Current Clinical Care*, 11(3):21-33, 2021.

Althagafi A, **Alant J.** Cystic Disc Herniation. Case Review. *Spinal Columns*, 21(4):26-29, 2021.

Aoude A, Litowski M, Aldebeyan S, Fisher C, Hall H, Manson N, Bailey CS, Ahn H, Abraham E, Nataraj A, Paquet J, Stratton A, **Christie S**, Cadotte D, Nicholls F, Soroceanu A, Rampersaud YR, Thomas KC. A Comparison of Patient and Surgeon Expectations of Spine Surgical Outcomes. *Global Spine Journal*, 11(3):331-337, 2021.

Attabib N, Kurban D, Cheng CL, Rivers CS, Bailey CS, **Christie S**, Ethans K, Flett H, Furlan JC, Tsai EC, O'Connell C. Factors Associated with Recovery in Motor Strength, Walking Ability, and Bowel and Bladder Function after Traumatic Cauda Equina Injury. *Journal of Neurotrauma*, 38(3):322-329, 2021.

Ayling OGS, Ailon T, Street JT, Dea N, McIntosh G, Abraham E, Jacobs WB, Soroceanu A, Johnson MG, Paquet J, Rasoulinejad P, Phan P, Yee A, **Christie S**, Nataraj A, **Glennie RA**, Hall H, Manson N, Rampersaud YR, Thomas K, Fisher CG. The Effect of Perioperative Adverse Events on Long-Term Patient-Reported Outcomes After Lumbar Spine Surgery. *Neurosurgery*, 88(2):420-427, 2021.

Ayling OGS, Charest-Morin R, Eagles ME, Ailon T, Street JT, Dea N, McIntosh G, **Christie SD**, Abraham E, Jacobs WB, Bailey CS, Johnson MG, Attabib N, Jarzem P, Weber M, Paquet J, Finkelstein J, Stratton A, Hall H, Manson N, Rampersaud YR, Thomas K, Fisher CG. National adverse event profile after lumbar spine surgery for lumbar degenerative disorders and comparison of complication rates between hospitals: a CSORN registry study. *Journal of Neurosurgery Spine*, 20:1-6, 2021.

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Chalil I, Raupp E, Duckwiler G, Vinuela F, **Lownie SP.** Hemodynamic and Anatomical Factors in Arteriovenous Malformation Clinical Presentation: 45 Case Studies. *Canadian Journal of Neurological Sciences (CJNS)*, 8:1-7, 2021.

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Presentations

Christie, S. Are there differences between men and women regarding pre-operative expectations and their postoperative surgical outcome? BritSpine, Mar 2021.

Christie, S. Can a frailty index for acute traumatic spinal cord injury predict mortality? BritSpine, Mar 2021.

Christie, S. Do patients with recurrent lumbar disc herniations fair worse with discectomy than primary operations? BritSpine, Mar 2021.

Jones CMA, Audas L, Kureshi N, Kamintsky L, Fenerty L, Atkinson C, Friedman A, **Clarke DB.** Impact-detecting helmets as indicators of concussion and traumatic microvascular injury in university football players. CASEM-AQMS Sport Medicine Conference, May 2021.

Kiwan R, **Lownie S.** Anatomical findings at the circle of willis and cervical carotid arteries during Ivo stroke: observations from cta. e-Poster. Society of Neuro-Interventional Surgery (SNIS) 18th Annual Meeting, May 2021.

Lownie, S. Advanced image-guided surgery of complex aneurysms at the skull base. Joint Virtual Meeting of World Federation of Skull Base Societies 2021 & 10th International Neurosurgery Update, July 2021.

Pickett, G. Automated postgraduate medical education compliant call schedule creation. International Conference on Residency Education, Oct 2021.

Restrepo CE, Weise, L. Efficacy of an image-based programming plan in predicting the final stimulation configuration and directionality for subthalamic. Congress of Neurological Surgeons Annual Meeting, Oct 2021.



Invited Lectures

Alant, J. "Surgical Management Of Unexpected Low Grade Paraspinal Sarcoma." Sarcoma Tumour Board Meeting, Toronto, Nov 2021.

Christie, S. "MAZOR Spinal Robotics System: Introduction to surgical workflow." Webinar Education Series, Nov 2021.

Christie, S. "Spinal Cord Compression: The Neurosurgical perspective." Canadian Association of General Practitioners in Oncology (CAGPO), Sept 2021.

Christie, S. "Practice Guidelines for Management of Acute SCI." Combined Meeting Association of Indian Spinal Surgeons (ASSI /CSS), Aug 2021.

Christie, S. "Recycling in the OR." Panelist for Sustainable Medicine in a Hospital Setting series, Feb 2021.

Clarke, D. "Computational systems in Neurosurgery: informatics in action." Nova Scotia Health Let's Talk Informatics, Jan 2021.

Lownie, S. "Brain School - Vascular Block, Career Path In Endovascular Neurosurgery And Case Presentations." University of Toronto Neurosurgery Residents, Dec 2021.

Lownie, S. "Dual Training In Surgery." Around the World of Neurosurgery Lecture Series, University of Toronto, Dec 2021.

Lownie, S. "The Inaugural Queen's Lecture in Neurointervention: Three decades of change, 1991-2021." Inaugural INR Lecture, Kingston General Hospital / Queen's University Combined Medicine / Radiology Grand Rounds, June 2021.

Pickett, G. "Decompressive Craniectomy and Neurological Determination of Death." Critical Care Canada Forum, Annual National Conference of the Canadian Critical Care Society, Dec 2021.

Pickett, G. "Beyond "Clip or Coil": Updates in the Surgical and Endovascular Management of Subarachnoid Hemorrhage." Canadian Anesthesiologists' Society Annual Meeting, June 2021.

Weeks, A. "Longitudinal Vn96-captured EV-sRNAseq pilot results." Dubai Neuro-oncology Conference, EOC, Nov 2021.

Weeks, A. "Aneurysm complications." CING Meeting, June 2021.

Awards and Recognition



WJ Howes Neurosurgery Teaching Award: Dr. Carlos Restrepo

This award acknowledges excellence in neurosurgery teaching by a resident, fellow or attending neurosurgeon. Dr. W.J. Howes is a neurosurgeon who had a distinguished career in Halifax from 1973-2008.

Department of Neurosurgery Research Day Awards - Best Presentation by a Clinical Fellow: Dr. Carlos Restrepo

Presentation Title: Efficacy of an image-based programming plan in predicting the final stimulation configuration for subthalamic nucleus deep brain stimulation. Supervisor: Dr. Lutz Weise



WD Stevenson Research Award: Dr. Mark MacLean

The WD Stevenson Research award is presented annually to a Neurosurgery Resident for outstanding contributions in basic and clinical research in Neurosurgery.

Study: Work-up and Management of Asymptomatic Extracranial Traumatic Vertebral Artery Injury.

Clinical Neuroscience Resident Research Day Awards - Top Neurosurgery Resident Presentation: Dr. Mark MacLean

Study: Work-up and Management of Asymptomatic Extracranial Traumatic Vertebral Artery Injury.



Clinical Neuroscience Resident Research Day Awards - Top Non-resident Presentation: Ryan Greene

Study: The Effect of Enhanced Recovery After Surgery Protocols for Elective Cervical and Lumbar Spine Procedures on Hospital Length of Stay: A Systematic Review



Department of Neurosurgery Research Day Awards - Best Presentation by a Medical Student: Nicholas Blake

Presentation Title: A province wide assessment of the appropriateness of lumbar spine MRI.
Supervisor: Dr. Sean Christie

Department of Neurosurgery Research Day Awards - Best Presentation by a Graduate Student: Liam Rappoldt

Presentation Title: Establishing a patient derived, in vitro organotypic slice culture of GBM.
Supervisor: Dr. Adrienne Weeks



Award for Excellence in Research Mentorship - Equity, Diversity and Inclusion: Dr. Gwynedd Pickett

Dr. Gwynedd Pickett received the inaugural Award for Excellence in Research Mentorship – Equity, Diversity and Inclusion – from Dalhousie University’s Faculty of Medicine. This is a newly established award for research mentorship. The award specifically acknowledges excellence in mentoring professional development, mentor/mentee relationships and research.

Neurosurgery Residency Program

Dr. Gwynedd Pickett and her team were successful in having our Neurosurgery Residency Program chosen for a Royal College of Physicians and Surgeons’ Fatigue Risk Management pilot project.



Creating a Sustainable Canadian Health System in a Climate Crisis (Cascades):

Dr. Sean Christie

Neurosurgeon and professor, Dr. Sean Christie, is a co-applicant of a successful \$6 million federal grant titled CASCADES (Creating a Sustainable Canadian Health System in a Climate Crisis). Researchers at Dalhousie University are collaborating with colleagues across the country to find ways to reduce greenhouse gas emissions and environmental degradation linked to the health-care system while raising awareness about sustainability through a nationally coordinated network.

Cross-Appointed Faculty

Department of Anaesthesia

- Dr. Ian Beuprie, MD, FRCPC
- Dr. Adam Law, MD, FRCPC
- Dr. Kirk MacQuarrie, MD, FRCPC
- Dr. Thomas Coonan, MD, FRCPC
- Dr. Orlando Hung, MD, FRCPC
- Dr. Michael Schmidt, MD, FRCPC
- Dr. Carlo Mariotti, MD, FRCPC
- Dr. Karim Mukhida, MD, FRCPC

Department of Diagnostic Radiology (Neuroradiology)

- Dr. William Maloney, MD, FRCPC
- Dr. Robert Vandorpe, MD, FRCPC
- Dr. Matthias Schmidt, MD, FRCPC

Department of Medicine (Endocrinology & Metabolism)

- Dr. Ali Imran, MBBS, MRCP, FRCPC

Department of Medicine (Physical Medicine & Rehabilitation)

- Dr. Christine Short, MD, FRCPC
- Dr. Sonya McVeigh, MD, FRCPC

Department of Pathology

- Dr. Alex Easton, MD FRCPC
- Dr. Sidney E. Croul, MD, FRCPC

Department of Radiation Oncology

- Dr. Liam Mulroy, MD, FRCPC
- Dr. Dorianne Rheaume, MD, FRCPC

Department of Surgery (Orthopedics)

- Dr. Bill Oxner, MD, FRCSC
- Dr. Ron El-Hawary, MD, FRCSC
- Dr. Andrew Glennie, MD, MSc, FRCSC

Department of Surgery (Otolaryngology)

- Dr. Emad Massoud, MD, FRCSC
- Dr. David Morris, MD, FRCS (ORL-HNS)
- Dr. Jonathon Trites, MD, FRCSC

Department of Medical Neuroscience

- Dr. Alon Friedman, MD, PhD



Affiliated Faculty

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The Moncton Hospital
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Dr. George Kolyvas
Dr. Andre le Roux
Dr. Aaron Robichaud

Department of Neurosurgery,
Health Sciences Center
Eastern Health, St. John's, NL

Dr. Gerry Murray
Dr. Andre Engelbrecht
Dr. Greg Jenkins
Dr. Roger Avery
Dr. John Adams

HALIFAX NEUROSURGERY 2021

ANNUAL REPORT

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