

NEUROSCIENCES INSTITUTE

Shaping the future
of neuroscience care

Accepting the Challenges of Leading in a New Healthcare Environment

Dear Colleagues,

Those of us who deal with neurological and neurosurgical disorders face two equally important sets of challenges. First, the remarkable diversity and complexity of these diseases require highly innovative treatment solutions. Second, the current societal pressures to transform healthcare delivery necessitate the creation of novel therapeutic approaches that maximize healthcare safety, efficacy and value.

These unique and interdependent challenges suggest the need for entirely new methods of delivering neuroscience healthcare services – methods that allow for the provision of advanced, high-quality, patient-centered care across the broad continuum of neurological and neurosurgical conditions. At Atrium Health, our Neurosciences Institute was designed to provide precisely this type of essential, transformational care.

This is an exciting time for our program. The national growth in neuroscience research has created unprecedented opportunities for our researchers and clinicians to improve the health and well-being of the patients we serve. The vast clinical support and information technology assets at Atrium Health provide us with unique abilities to measurably improve quality and intelligently transform the delivery of neuroscience services.

In short, the goal of Neurosciences Institute is to be a vanguard in the quality reformation that is sweeping modern healthcare. We appreciate this opportunity to introduce you to our people and programs of expertise. Please do not hesitate to contact us directly if we can provide you with additional information.



Anthony L. Asher, MD, FAANS, FACS
Director and Chief of Clinical Operations
Neurosciences Institute
Program Director, Neurological Surgery Residency
Carolinas Medical Center

A Comprehensive Network of Integrated Expertise

Combining adult and pediatric neurological expertise, one of the country's largest neurosurgical groups and the full resources of a 40-hospital system, we offer our patients the most advanced care across the Carolinas.



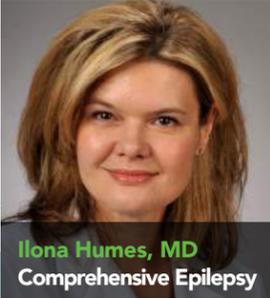
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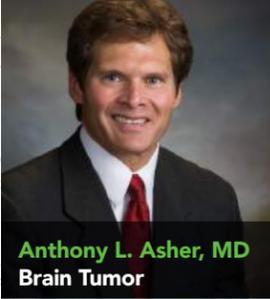
The Expertise to Move Neuroscience Forward

Neurosciences Institute includes some of the country's leading neurological and neurosurgical experts with 120+ specialists across our integrated network.

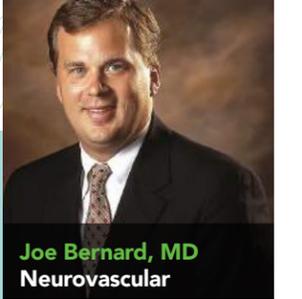
These senior leaders are committed to advancing the science of care.



Ilona Humes, MD
Comprehensive Epilepsy



Anthony L. Asher, MD
Brain Tumor



Joe Bernard, MD
Neurovascular

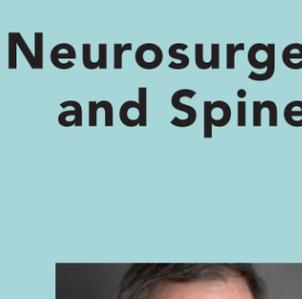
Epilepsy



Rajdeep Singh, MD
Comprehensive Epilepsy



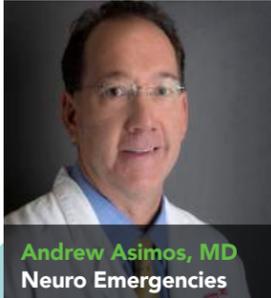
Scott Wait, MD
Pediatric Neurosurgery



Domagoj Coric, MD
Comprehensive Spine



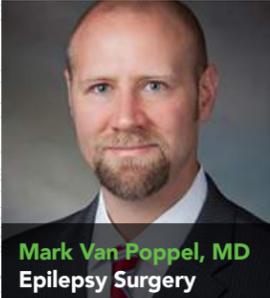
Hunter Dyer, MD
Skull Base Surgery



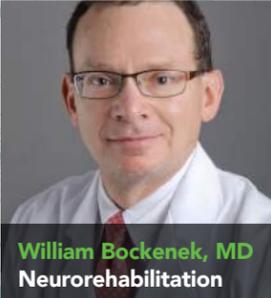
Andrew Asimos, MD
Neuro Emergencies



Jeffrey Bodle, MD
Comprehensive Stroke



Mark Van Poppel, MD
Epilepsy Surgery



William Bockenek, MD
Neurorehabilitation

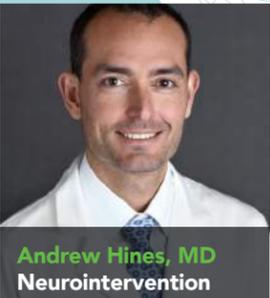


Danielle Englert, MD
Movement Disorders

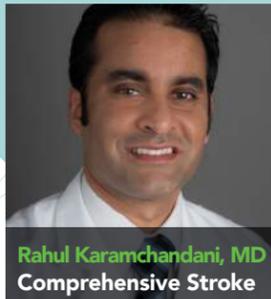
Stroke



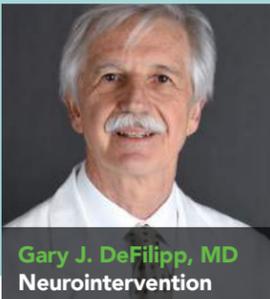
Chut Sombutmai, DO
Telestroke Network



Andrew Hines, MD
Neurointervention



Rahul Karamchandani, MD
Comprehensive Stroke

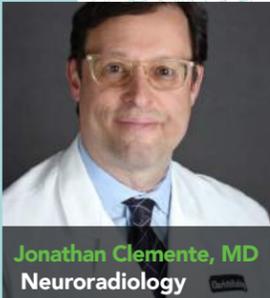


Gary J. DeFilipp, MD
Neurointervention

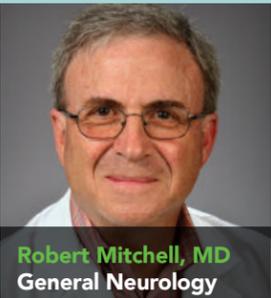
Neurology Specialties



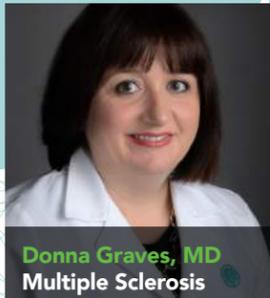
Oleg Tcheremissine, MD
Alzheimer's Research



Jonathan Clemente, MD
Neuroradiology



Robert Mitchell, MD
General Neurology



Donna Graves, MD
Multiple Sclerosis

Brain Tumors and Neuro-Oncology

Brain tumors present some of the most unique treatment challenges in medicine. We transform those challenges into effective solutions through technical sophistication and comprehensive care.

We are committed to providing technically advanced, comprehensive, personalized care to all of our patients with primary and metastatic brain tumors. We are able to achieve this goal by virtue of our large clinical volumes, our relationship with numerous world-class cancer specialists at Levine Cancer Institute (LCI), our nurse navigator program, our clinical and translational research programs, and our team of surgical neuro-oncologists, who collectively have among the highest level of experience removing complex brain tumors of any center in the country.

Advanced treatments to facilitate brain tumor care

As a major brain tumor center, Neurosciences Institute, in close collaboration with LCI, has significant experience in leading-edge therapies. Examples include:

- **Clinical trials.** Our surgical and non-surgical clinical trials, including quality and patient-centered

outcomes research, are designed to make the greatest impact on advancing clinical practice. Numerous advanced clinical trials are available to patients with both primary and metastatic brain cancers.

- **Minimally invasive and skull base techniques.** These advanced surgical techniques allow for less invasive, more focused and more effective tumor removal. Examples include:

- Transnasal endoscopic and supraorbital “eyebrow” approaches, along with other methods of accessing the cranial cavity through minimally invasive approaches, give our neurosurgeons improved access to deep-seated tumors and cause less disruption and damage to blood vessels, nerves and other vital tissues.
- Advanced image guidance and computer simulation of essential brain pathways facilitate treatment

planning and provide real-time feedback to improve patient safety and reduce complications. New computer simulations allow us to see beyond the surface of the surgical field to view essential deep-seated structures and pathways in the brain, thus facilitating removal of lesions while preserving critical neurological functions.

- High-field intraoperative MRI will soon allow our surgeons to image tumors and surrounding neural tissues in real time, further enhancing our capability to perform safe, effective brain tumor resections.
- **Combination therapies.** We are a leading national center in the development of novel combination therapies involving radiosurgery (focused radiation therapy) and traditional surgical techniques.

Comprehensive care and cutting-edge research that redefine clinical practice

The many complexities of brain cancer require a sophisticated, coordinated care team. Along with our own specialists in neurosurgery, neuroradiology, neuropathology, neurology, psychiatry and neuropsychology, we work closely with the nationally recognized medical and radiation oncologists of LCI to offer the latest front-line and experimental chemotherapy and immunotherapy regimens. In addition, our growing nurse navigator program provides a seamless, supportive experience for our patients and families, helping them transition to post-acute and community-based care.

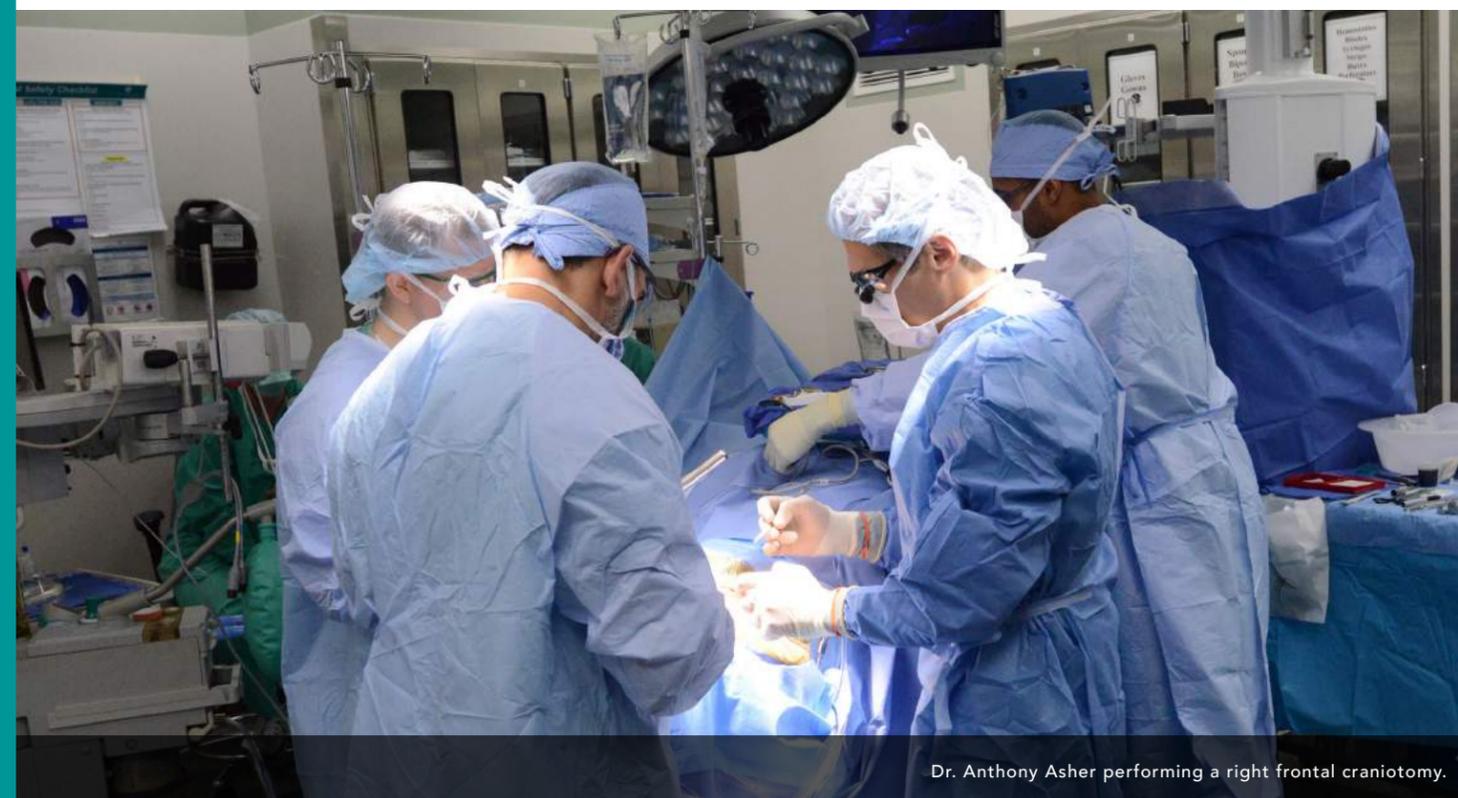
As part of our comprehensive approach to brain tumor care, we are committed to not only delivering cutting-edge therapies but also continually and cooperatively advancing the science of care.

For example, Anthony Asher, MD, (Neurosciences Institute) and Stuart Burri, MD, (LCI) helped lead a 10-year national landmark study (recently published in *The Journal of the American Medical Association*) providing definitive evidence that most patients with one to three brain metastases should no longer receive routine whole brain radiation therapy and should ideally be treated with focused therapy alone to better preserve cognitive function and quality of life. In large part due to this research, the shift to more focused therapies for brain metastases is gaining ground, and this

trend has been supported by ongoing clinical research at our institution.

In our mission to develop the best treatment solutions for patients, we work closely with major cooperative groups such as the Radiation Therapy Oncology Group (RTOG) and other academic institutions in investigating new treatment opportunities, such as immune potentiation (i.e., boosting the immune system to help combat cancer).

500+
tumor surgeries
PER YEAR

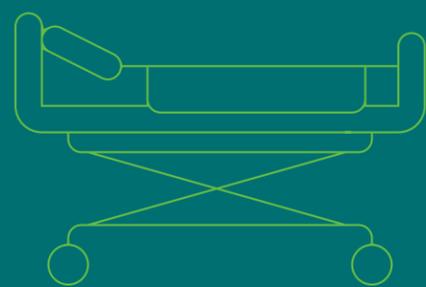


Dr. Anthony Asher performing a right frontal craniotomy.

This program is a collaboration between Atrium Health's Levine Cancer Institute and Neurosciences Institute.

Treatments performed

- Artificial disc implantation (lumbar, cervical)
- Instrumented spinal fusions
- Anterior discectomy and fusion
- Anterior and posterior spinal instrumentation
- Anterior odontoid screw fixation
- C1-C2 transarticular screw fixation and fusion
- Pedicle screw fixation
- Posterior lumbar interbody fusion
- Adult and pediatric scoliosis surgery



Leading surgical volumes in the Carolinas

2,750 inpatient spinal surgeries in 2017 Adult only

(Truven, HPM, SC Office of Research and Statistics, internal data)



Dr. Domagoj Coric performing a posterior lumbar fusion.

Comprehensive Spine

Spine disorders are among the most common causes of pain and disability in society. We are committed to providing our patients with the most advanced treatment options available.

From the most complex spinal deformities to emergency spinal trauma, our dedicated specialists stand at the forefront of advanced care. We continue to expand therapeutic options in spinal surgery – particularly in the realm of minimally invasive spine surgery – with the goal of hastening clinical recovery and helping more patients achieve a better quality of life.

Our spine care program represents an exciting collaborative effort between Neurosciences Institute and the newly formed Atrium Health Musculoskeletal Institute, bringing together all major providers of spine services to advance the quality, safety and value of care.

Advancing minimally invasive surgical options

We specialize in adopting, creating and applying the growing number of minimally invasive techniques designed to significantly reduce pain and recovery times for patients. Tim Adamson, MD, a faculty surgeon at Neurosciences Institute, pioneered the cervical microendoscopic discectomy procedure, using a tubular retractor system and endoscope to safely visualize and remove damaged material to decompress the cervical spine. We have also developed novel minimally invasive surgical techniques for cervical and lumbar fusion procedures.

Unparalleled expertise across procedures and conditions

With 25+ neurosurgeons and 9 orthopedic spine surgeons highly skilled at performing a full range of standard and cutting-edge spinal procedures, our hospitals and specialty centers are well positioned to deliver national caliber care. In addition to minimally invasive procedures, we specialize in treating:

- Spinal tumors (including interventional angiography)
- Degenerative spine disorders for older patients whose conditions may have previously been considered inoperable
- Revision surgery for patients who had unsuccessful results in other care settings
- Complicated spinal trauma
- Spinal deformities, including scoliosis and kyphosis

Advancing the science of spine care

Our longstanding commitment to surgical research and large patient volumes enables our faculty to offer innovative clinical trials at four of our hospitals. Our surgeons participate in investigator-initiated and industry-sponsored trials. Domagoj Coric, MD, chairman of neurological surgery at Carolinas Medical Center, chief of neurosurgery at Neurosciences

Institute, and chief of the spine care program at Musculoskeletal Institute, is a leading innovator in the development of new technologies for cervical and lumbar spine disc replacement. He also leads other important studies including investigations of biological solutions for spinal cord injury and disc repair.

Improving spine care safety and value

We are a leading center in defining, measuring and promoting safe and effective treatment alternatives for spine care. Our surgeons have helped to create the largest national clinical registry of spinal procedures, and we have partnered with groups across the country to develop methods to apply the insights gained from clinical registries to continually improve care. We have adopted advanced real-time imaging and robotic technologies to promote safer, less-invasive surgical procedures.

Additionally, we are committed to comprehensive spine care solutions, which means that we strive to offer the best therapies for specific patients and clinical problems – reserving surgery for those instances when more conservative care solutions have been exhausted. In fact, our extensive experience allows us to avoid surgery whenever possible; more than half of the patients we evaluate are offered and benefit from non-surgical treatments.

This program is a collaboration between Atrium Health Musculoskeletal Institute and Neurosciences Institute.

Advanced Neurosurgery Across the Spectrum

Home to the largest neurosurgical and spine program in the Carolinas, we offer cutting-edge procedures in all areas of advanced neurosurgery. Our highly specialized neurosurgeons – combined with our experienced nursing and ancillary team – provide individualized care for the most complex cranial and spine patients.



Neurotrauma Surgery

From traumatic brain injury to spinal cord injury, we provide comprehensive care for large volumes of traumatic neurologic injuries. We offer the region's only Level I trauma center, including a designated neurosurgical intensive care unit that serves both adults and pediatric patients 24 hours a day, seven days a week. Following surgery, we seamlessly transition patients to our trauma rehabilitation services, providing early intervention to traumatic brain injury and spinal cord injury patients.

Functional Neurosurgery

We treat all chronic neurological disorders, including epilepsy, Parkinson's disease, movement disorders and pain, with the goal of restoring neurological function. We offer advanced surgical options to alleviate epilepsy, including lobe resection, lesionectomy, Corpus callosotomy, functional hemispherectomy, multiple subpial transection, vagus nerve stimulation and responsive neurostimulation device implantation. We are one of the most experienced centers in the mid-Atlantic region for treating trigeminal neuralgia (TN). We offer all major treatments for TN, including stereotactic radiosurgery, microvascular decompression and percutaneous rhizolysis.

Neurovascular Surgery

Neurovascular surgery is now making treatment possible for a variety of life-threatening vascular diseases of the brain and spinal cord, including aneurysms, arteriovenous malformations, carotid stenosis and stroke. Using minimally invasive procedures, we can treat these conditions without opening the skull, neck or back, resulting in potentially shorter hospital stays, fewer possible complications, less pain and a quicker recovery period.

Skull Base Surgery

We use innovative minimally invasive procedures to remove benign and malignant tumors close to the base of the skull, including those in the nose, sinuses, eyes and pituitary. Accessing the skull base through the nasal passages and incisions above the eyebrow results in decreased recovery time for patients and less disruption and damage to blood vessels, nerves and other tissue, and usually requires much smaller incisions.

Pediatric Neurosurgery

Levine Children's Hospital's pediatric neurology and neurosurgery program, named one of the nation's best by *U.S. News & World Report*, offers advanced care across the continuum. With the largest team of pediatric neurosurgeons on the East Coast outside of Boston, we care for the full range of pediatric neurosurgical disorders, including brain tumors, spasticity, movement disorders, epilepsy, hydrocephalus, craniosynostosis, head injuries and spina bifida, as well as other cranial malformations and spinal deformities.

Neurosurgery by the Numbers



Cranial program
2,900 cases



Complex spine surgery program
2,750 cases



5,650 total cases

2017 CASE VOLUMES

1,760 CASES

220 CASES

340 CASES

130 CASES

439 CASES



Dr. Jonathan Clemente reviewing neuroimaging.

Comprehensive Cerebrovascular Care

From emergent interventions for acute stroke patients to the latest aneurysm treatments, we deliver the highest quality cerebrovascular care available.

For the full range of cerebrovascular disease, our expert interdisciplinary teams are committed to the diagnosis, treatment and rehabilitation of the most complex cases. Our stroke program includes a Comprehensive Stroke Center and five other hospitals certified as Advanced Primary Stroke Centers by The Joint Commission. Within this advanced system of care, we treat more stroke patients than any other program in the Carolinas, offering the experience and resources to provide lifesaving care around the clock.

Advanced stroke care, delivered faster

Carolinas Stroke Network connects hospitals across the region, offering accelerated treatment for patients suffering from an acute stroke. From the moment patients arrive, they receive comprehensive and individualized treatment plans, using the latest CT brain imaging techniques to identify the best patients for tissue plasminogen activator (tPA) or intra-arterial (IA) treatment. At Carolinas Medical Center and Carolinas HealthCare System NorthEast, we offer 24/7 access to IA treatment for complex large vessel occlusion strokes, performing 150+ IA mechanical thrombectomy cases per year. Our Comprehensive Stroke Center at Carolinas Medical Center in Charlotte treats some of the highest

volumes of hemorrhagic strokes in the country.

In 2017, our telestroke program became the largest in the region, providing advanced stroke services to 20+ facilities across the Carolinas. Using state-of-the-art, interactive telemedicine capabilities allows our stroke experts immediate access to patients to coordinate rapid bedside assessment and treatment – no matter where patients are seen in our network. This cutting-edge approach has helped patients receive the critical treatment they need as much as 17 percent faster than our previous approach.

Rehabilitation that makes a difference

Positive long-term outcomes for stroke patients depend not just on acute care but also on effective rehabilitation. As one of the largest and most comprehensive stroke rehabilitation programs in the Southeast, we dedicate state-of-the-art resources to helping our patients recover faster. Our experienced teams – including board-certified physicians, physical and occupational therapists, certified rehabilitation registered nurses and neuropsychologists – are pursuing first-in-the-world therapeutic approaches, such as the implantation of neuro-stimulation devices to control hemiplegic

shoulder pain. Our capabilities have helped us become the first multisite stroke rehabilitation program to earn certification from the Commission on Accreditation of Rehabilitation Facilities (CARF).

Advanced aneurysm therapies

We are leading the way in endovascular neurosurgery in the Carolinas, as more complex cerebral aneurysms are treated with minimally invasive catheter-based techniques. Using coil embolization, microcatheter-delivered, flow-diverting stents and other new methods, our neurosurgeons are highly experienced in treating cerebral aneurysms. This includes those that are anatomically inaccessible to traditional surgical approaches and those with complex three-dimensional geometry. Our cerebrovascular surgeons have achieved some of the best patient outcome rates in the country, helping to send aneurysm patients home sooner and with higher levels of functional capacity.

Conditions treated

- Acute ischemic strokes
- Transient ischemic attacks (TIA)
- Subarachnoid and cerebral hemorrhage
- Vascular malformations, including cavernous malformations, aneurysms and arteriovenous malformations (AVMs)
- Arteriovenous fistula treated with stereotactic radiotherapy
- Carotid and vertebral dissection
- Fibromuscular dysplasia
- Atherosclerotic disease, including carotid and vertebral stenosis or intracranial stenosis
- Moyamoya disease

3,400+

stroke patients treated per year
MOST IN THE CAROLINAS



22

facilities in our
Telestroke Network
that provide stroke care
across the Carolinas



The Joint Commission



American Heart Association
American Stroke Association

CERTIFICATION
Meets standards for
Comprehensive Stroke Center

Epilepsy

Every patient with epilepsy is different. So is our approach to treatment.

Helping patients gain control of their seizures can take any number of forms including medication, diet therapy, surgery and/or device implantation. We're proud to offer a truly comprehensive epilepsy program experienced in providing the full range of treatment modalities for adults and children. From initial assessment to long-term management, our epilepsy care team is here to provide the highest level of individualized care.

Identifying the source of seizures with precision

Developing the right treatment plan starts with a rigorous assessment that pinpoints the source of seizures. We offer a state-of-the-art neurodiagnostic laboratory, which is among the few accredited in the state of North Carolina, and epilepsy monitoring units that

have achieved top accreditation from the National Association of Epilepsy Centers. Carolinas Medical Center is a Level IV epilepsy center, and Carolinas HealthCare System NorthEast is a Level III epilepsy center for both adult and pediatric epilepsy.

Beginning with our First Seizure Clinic, our team of epileptologists, neuroradiologists and neuropsychologists performs an extensive evaluation, employing EEG, 3T MRI brain imaging with 3D volumetric post-process software and functional MRI, PET and SPECT scans, as well as advanced software for seizure-focus localization, tracking and trending.



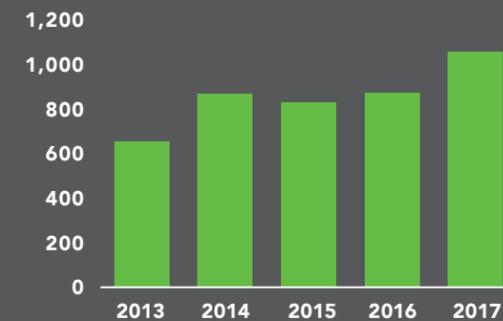
Putting the best technologies to work

Our diagnostic and treatment options include some of the latest technologies available:

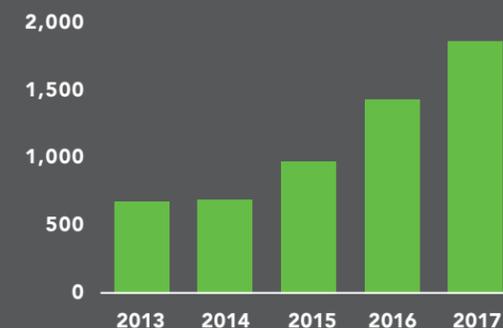
- Intracranial monitoring with stereoelectroencephalography (SEEG) and subdural electrodes
- Laser interstitial thermal therapy (LITT procedure)
- Responsive neurostimulation (RNS) systems to deliver electrical stimulation that terminates seizures before symptoms can begin
- Brain mapping, including speech and sensorimotor mapping
- Foramen ovale electrode recording
- Dietary therapy
- Vagus nerve stimulation (VNS) implantation and programming



Epilepsy Monitoring Unit Admissions



Continuous EEG Monitoring



Bringing Innovation to the Region

Our epilepsy surgeons also incorporate state-of-the-art intraoperative navigation, enabling minimally invasive epilepsy surgery. The navigation system is beneficial for all types of cranial intervention requiring surgical planning based on pre-operative data, precise location of the patient's anatomy, and accurate positioning and handling of instruments. This device assists the surgeon with a wide variety of medical indications and surgical interventions, such as biopsies, electrode implantation for functional procedures (stimulation of the cerebral cortex, deep brain stimulation), open skull surgical procedures requiring a navigation device, endoscopic interventions and any other "keyhole" procedures.

In addition, the tele-epilepsy network provides remote EEG and continuous 24-hour EEG monitoring and reading services for facilities throughout Atrium Health, providing patients access to advanced expertise in diagnosis and treatment of seizures.

Surgical options

- MRI-guided laser interstitial thermal therapy
- Responsive neurostimulation
- Focal cortical excision
- Lobectomy
- Multilobar resection
- Multiple subpial transection
- Corpus callosotomy
- Hemispherectomy

6,472
epilepsy/seizure
inpatients (2017)

29%
annual growth
in epilepsy surgeries (2016)

1 OF
ONLY 2
US centers

with Joint Commission Disease-Specific
Care Certification in Inpatient Epilepsy

In conjunction with Levine Children's Hospital, we offer pediatric patients surgical and non-surgical therapies, including ketogenic dietary plans.

Multiple Sclerosis

As the treatment options for Multiple Sclerosis evolve, we seek out the most promising medical advances to bring hope to our patients.

The latest disease-modifying agents offer new ways to medically manage multiple sclerosis (MS) patients, but they also require new levels of expertise. Through the National Multiple Sclerosis Society's Partners in MS Care program, our MS program is recognized as the only Center for Comprehensive MS Care in the greater Charlotte area. We offer some of the most advanced and specialized care, including critical physical, emotional, cognitive and rehabilitation support to improve patient outcomes and quality of life.

Experience in delivering the latest therapies

Every year the FDA approves more potent MS therapies, while advanced neuroimaging and evolving criteria make earlier diagnosis possible. Our MS fellowship-trained neurologists, with the help of dedicated nurse practitioners, are experts at selecting the right treatments for the right patients. For many of the emerging treatments, we have participated in the associated clinical research studies and serve on industry advisory boards. In addition, our practitioners and infusion center are certified to administer these innovative therapies, including the first approved monoclonal antibody treatment for primary progressive MS.

Critical connections to interdisciplinary expertise

A team-based approach gives our

patients the best chance of improved function and quality of life. As part of Atrium Health, we have access to experts across key subspecialties.

For example:

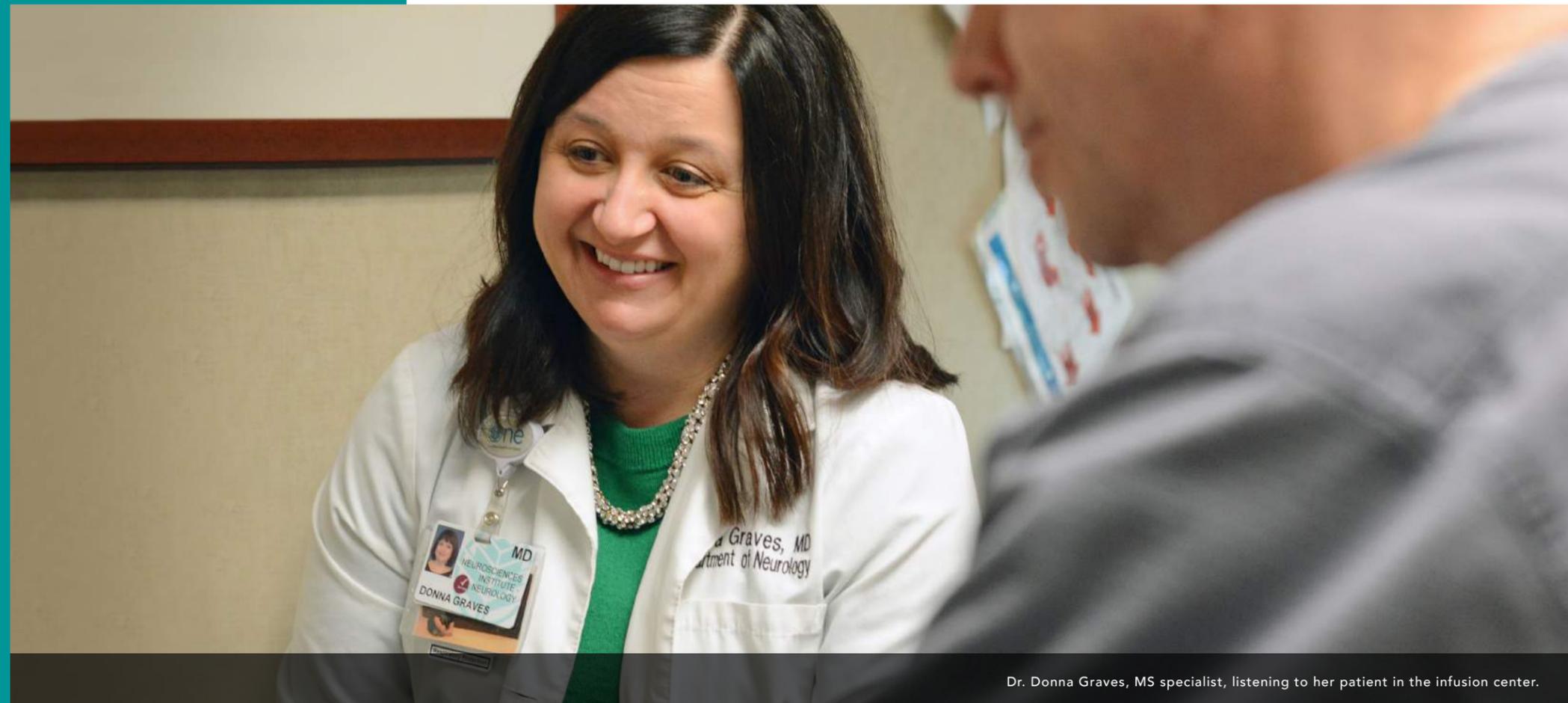
- Neuro-urology teams highly experienced in co-managing patients with bowel or bladder disorders
- Physical medicine and rehabilitation physicians with specialized training and expertise in rehabilitative services, spinal cord disease and co-management of MS symptoms
- Neurosurgeons with expertise in implanting intrathecal baclofen pumps
- Neuroradiologists using the most advanced imaging software to accurately identify and quantify MS lesion burden and changes over time

Support for the whole patient

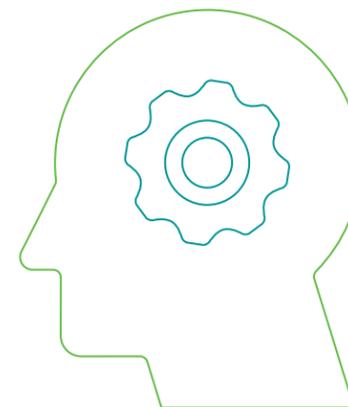
In offering holistic patient-centered care, we provide pharmacologically based preventive and acute therapies in addition to symptomatic treatments that go beyond medication. We offer a comprehensive suite of physical, occupational and speech therapy services as well as dietary support from dedicated MS dietitians. Patients with depression and anxiety can receive counseling from in-house social workers and are connected to community-based groups for ongoing support.

Conditions treated

- Primary progressive MS
- Relapsing-remitting MS
- Secondary progressive MS
- Transverse myelitis
- Neuromyelitis optica (Devic's disease)



Dr. Donna Graves, MS specialist, listening to her patient in the infusion center.



FOLLOWING

5,000+ MS patients

We have participated in 90+ clinical research trials in the past 20 years, advancing insights into the disease and often offering early access to the most innovative MS medicines.



ALS and Neuromuscular Disease

Every day, we are working toward a better quality of life for patients with degenerative neuromuscular diseases – and ultimately, a cure.

Led by internationally recognized experts, our comprehensive Carolinas Neuromuscular/ALS/MDA Center offers the latest in diagnostic assessments and therapeutic options. We are also leading the way – through our research and advocacy – in the development and deployment of lifesaving treatments that will shape the future standard of care.

Groundbreaking clinical research

Founded nearly 20 years ago, our center has been at the forefront of translational research and therapy development for neuromuscular diseases, particularly for amyotrophic lateral sclerosis (ALS). In collaboration with the Northeast ALS (NEALS) and Cooperative International Neuromuscular Research Group

(CINRG) consortia, our ALS program:

- Played a key role in the development of two major FDA-approved therapies for ALS: riluzole and dextromethorphan/quinidine
- Conducted the largest single-site study for ALS in the world and the largest ALS study related to swallowing
- Helped to clarify several aspects of ALS care, including:
 - Benefits of exercise
 - Applicability of certain walking tests to diagnosis
 - Relationship between balance and spasticity as controlled by a particular defect in the nervous system
- Is nationally recognized for our physician leadership and expertise

- Through advocacy, helped fast-track FDA approval for breakthrough treatments in the US, including edaravone, which had already been available in Japan

In addition, our McColl-Lockwood Laboratory for Muscular Dystrophy Research focuses on developing novel therapies – including gene and antisense therapies – for degenerative neuromuscular disorders, such as limb-girdle muscular dystrophy and Duchenne muscular dystrophy.

Expertise from diagnosis to treatment

Our interdisciplinary team of specialists helps our patients maintain their independence through slowing disease progression. In addition to the latest pharmacological treatments, we offer a team approach to treatment with physical, occupational, speech, nutritional and respiratory therapies, and have dedicated ALS, expedited ventilator, spinal muscular atrophy and neurotoxicology clinics. We offer our patients some of the highest levels of respiratory support, resulting in better outcomes and improved quality of life.

From electromyography to nerve conduction studies, we are highly experienced in the full range of neurodiagnostic services and can accurately determine the cause of a patient's symptoms – whether that is ALS, an ALS mimic, an underlying cancer or an autoimmune disease. We are currently exploring different phenotypes of ALS – and the different therapy protocols required to treat them.

Conditions treated

- Amyotrophic lateral sclerosis (ALS)
- Dysimmune neuropathies
- Muscular dystrophy
- Motor neuropathies
- Myasthenia gravis



We received the first Disease-Specific Care Certification in ALS by The Joint Commission.



Only ALS-MDA Center in the Carolinas

designated by the Muscular Dystrophy Association

11

clinical trials & registries

548

patients enrolled



Focus of Our Program

- Parkinson's disease: 70%
- Tremors: 20%
- Dystonias/Huntington's disease/Other: 10%



56 DBS
device implants
per year on average
(New and replacement,
2013–2016)

First Disease-Specific Care
Certification in Parkinson's
Disease from The Joint
Commission



Dr. Danielle Englert, movement disorders expert, examining her patient.

Conditions treated

- Ataxia
- Blepharospasm and hemifacial spasm
- Drug-induced movement disorders
- Dystonia
- Essential tremor and other types of tremor
- Huntington's disease
- Myoclonus
- Parkinson's disease
- Parkinsonian syndromes
- Restless legs syndrome
- Tics and Tourette's syndrome

Parkinson's Disease and Movement Disorders

We continue to redefine what is possible for a wide range of movement disorders.

For 10+ years, the experts at our Parkinson's disease and movement disorders program have offered specialized care for the most disabling cases. Our experience in innovative medical management and surgical interventions, combined with our commitment to quality and a holistic view of patient care, earned our center the first in the nation Disease-Specific Care Certification in Parkinson's disease from The Joint Commission.

Advancing deep brain stimulation

As the only provider of deep brain stimulation (DBS) surgery in the Charlotte area, we are incorporating new approaches and technologies that can improve the quality of life, outcomes and experience for our patients with Parkinson's disease and other movement disorders, such as essential tremor and dystonia. Our specialists utilize a patient-customized frameless stereotactic device that reduces operating time and increases the accuracy of electrode placement. We continually explore the latest technology and devices to improve efficacy and mitigate side effects.

Well-versed in the latest interventions

Novel medications and minimally or non-invasive interventions are changing the ways patients with neuromuscular disorders are managed. Our expertise in advanced therapeutics, including the latest FDA-approved medications, ensures that patients are receiving the most appropriate therapy for their symptoms. We also offer chemodenervation through injections for patients with a wide range of movement disorders, such as dystonia and spasticity.

Neuro-wellness that extends beyond the clinic

To help patients with Parkinson's disease retain their independence, we have created a unique program that helps them lead a more active life: RENEW (Research and Education in Neuro-Wellness) Carolinas. Led by Sanjay Iyer, MD, Parkinson's expert at Neurosciences Institute, and Mark A. Hirsch, PhD, a senior scientist at Carolinas Rehabilitation, RENEW Carolinas is an innovative partnership between Neurosciences Institute, Carolinas Rehabilitation and the Greater Charlotte YMCA.

Leveraging 15+ locations around the region, the program has conducted over 10 clinical trials evaluating the most effective forms of exercise and other factors leading to improved quality of life. By disseminating our expertise across all of our Carolinas Rehabilitation locations and local YMCAs, we have formed the nation's largest exercise network serving patients with Parkinson's disease.

Individualized care delivery

From initial diagnosis through ongoing care management, we take a personalized approach with each of our patients. Viewed as a "medical home" by our patients, we spend considerable time learning about them as individuals – a commitment that has earned us high Press Ganey patient satisfaction scores. Our team works closely with referring primary care providers and neurologists to ensure that patients have a complete and structured care experience.

Physical Medicine and Rehabilitation

We complete the continuum of care with exceptional neurorehabilitation and therapy services unique to the region.

As one of the largest providers of its kind in the Southeast, Carolinas Rehabilitation offers specialized resources and technology to give our patients the best chance of recovery. Across inpatient and outpatient settings, our comprehensive care has earned accreditation by CARF (Commission on Accreditation of Rehabilitation Facilities) for 12 of our programs – the most of any rehabilitation center in North Carolina.

Specialized therapy for major neurological conditions

Our team of board-certified rehabilitation specialists aim to restore the highest possible level of functioning, treating virtually any type of neurological condition, including:

- **Stroke.** From being the first institution in the world to implant a neurostimulation device for the treatment of post-stroke shoulder pain to serving as one of 29 assessment sites in the United States studying stem cell implantations, our stroke program leads the way in state-of-the-art care. We were one of the first facilities in the nation to apply for and receive CARF certification in stroke. Our intensive inpatient therapy (up to three hours per day) leads to 69 percent of stroke

patients being sent home rather than to skilled nursing facilities.

- **Brain injury.** As a TBI Model System follow-up site, we provide high-quality treatment and conduct research aimed at helping patients with traumatic brain injury. Serving local communities, the Brain Injury Association of North Carolina (BIANC) Charlotte Resource Office at Carolinas Rehabilitation promotes awareness and education about TBI throughout Charlotte.
- **Spinal cord injury.** No other regional facility offers more advanced spinal cord injury services, including an innovative outpatient day program to help patients deal with challenges associated with wellness, health literacy and vocational training.

A full suite of neurorehabilitation services

With five inpatient facilities and 20+ outpatient facilities, we provide neurorehabilitation for adults and children, including the only pediatric inpatient rehab facility in the region. In addition to physical therapy, occupational therapy, speech therapy and audiologic rehabilitation, we also offer services specifically designed for patients suffering from neurological symptoms, including:

- **Robot-assisted gait training** to improve guidance, strength and circulation – particularly for spinal cord injury patients – using Lokomat® and ReWalk™ technologies
- **Better Balance Program** to help patients who have fallen recently or are unsteady on their feet
- **Neuropsychology** to assess a patient's thinking skills, behavior and emotional functioning
- **Wheelchair seating clinic** to provide specialized evaluations for complex or custom medical equipment

Raising the standards for quality

Our commitment to quality extends beyond clinical care. We created the EQUADRSM (Exchanged Quality Data for Rehabilitation) network to help inpatient rehabilitation facilities drive quality improvement by sharing best practices. As the first patient safety organization (PSO) designated by the Agency for Healthcare Research and Quality specifically for inpatient rehabilitation settings, Carolinas Rehabilitation is helping to improve quality and patient safety across 19 states in areas such as prevention of falls.



Dr. William Bockenek, neurorehabilitation expert, working with his patient.

More Patients with Complex Conditions

Inpatient rehabilitation volumes in 2016
(2016 eRehab)



~1,000
stroke patients



437
brain injury patients



272
spinal cord injury patients



12 CARF-
accredited
programs

including brain injury, spinal
cord injury and stroke

Quality and Patient Outcomes

We're truly listening to the patient voice to improve the safety and value of healthcare.

Improving patient health and creating a better patient experience begin with fully understanding care from the standpoint of all healthcare stakeholders. At Neurosciences Institute, we are using patient care data, including patient-reported outcomes, to objectively measure the safety, value and quality of the care we provide to help advance our clinical performance. This embrace of continuous improvement has led us to spearhead national quality initiatives as well as our own efforts to revolutionize modern healthcare.

A national model for quality improvement

Our commitment to the quality movement extends far beyond our walls. Anthony Asher, MD, director and chief of clinical operations for Neurosciences Institute, and Matthew McGirt, MD, Neurosciences Institute faculty member and nationally respected spine surgeon, co-founded the Quality Outcomes Database (QOD), a continuous national

clinical registry for neurosurgical procedures and practice patterns. Over the past six years, the QOD has helped the neurosurgical profession redefine quality care for spinal surgery with new initiatives planned in brain tumor, cerebrovascular care and stereotactic radiosurgery. The QOD is now in place in 140+ medical centers nationwide – with ongoing collaborations involving international quality stakeholders, such as the Institute for Healthcare Improvement (IHI). In this way, the QOD is helping to transform the course of modern neurosurgical care.

Beyond participating in national registries like the QOD, we have begun our own longitudinal database of stroke outcomes led by Andrew Asimos, MD, medical director of Carolinas Stroke Network – with some of the largest numbers of enrolled patients in the country. In addition, we have made significant investments in data collection platforms and staffing to ensure our

quality science competencies continue to improve.

Weaving quality into our clinical practice

Prospective, systematic tracking of practice patterns and patient outcomes at Neurosciences Institute has made quality assessment a keystone of our mission. However, clinical data collection, while necessary for quality improvement, cannot advance that objective as an isolated activity. In that regard, we have made a commitment to intelligently apply that data in every aspect of our daily activities. In other words, continuous quality improvement is now a routine aspect of patient care. Our objective at Neurosciences Institute is not only to provide quality leadership within Atrium Health, but also to help advance patient-centered, value-based care on a national basis – changing the healthcare equation to benefit patients and providers alike.

Clinical Neurology Research

Study by study, we're building the foundation for what's possible in neuroscience care.

Because so many neurological disorders are still incurable, we remain steadfast in pursuing treatments that offer patients new levels of hope. Our broad research program is closely integrated with our clinical work, providing patients access to advanced diagnostics, rigorous clinical care and emerging treatment options before they become widely available.



Changing the therapeutic landscape

With 12 neurology clinics, a large patient population and a team of committed researchers, we have been involved in dozens of groundbreaking investigator-initiated and industry-sponsored clinical trials over the past 20 years. Recent highlights include:

- **Alzheimer's disease.** The TOMMORROW Study, a large international trial with 50 sites, aims to uncover whether a biomarker combining age and gene variants can predict a person's disease risk. The study is led locally by Robert Mitchell, MD, medical director of neurology at Neurosciences Institute.
- **Multiple sclerosis.** We participated in the Phase 3 Oratorio OLE trial for ocrelizumab, which led to its being the first drug approved for progressive multiple sclerosis.
- **Amyotrophic lateral sclerosis (ALS).** Overcoming recruitment challenges posed by rare disease studies, our MediciNova trial has enrolled 70 patients with ALS to evaluate the safety, tolerability and efficacy of ibudilast. We have also enrolled 400+ patients in the MDA registry for patients with ALS, Duchenne muscular dystrophy and spinal muscular dystrophy.

Our Educational Mission

Neurosciences Institute is committed to shaping the future of neuroscience care through our educational mission. This mission is carried out in three primary areas:



Educating a New Generation of Surgeons

Our clinical experts amplify their positive impact on patient care through training the next generation of surgical leaders. The Neurological Surgery Residency Program at Carolinas Medical Center is a nationally recognized program designed to educate neurosurgeons dedicated to clinical innovation, medical education and neuroscience research. Our faculty's research is routinely published in major journals and presented at national and international scientific forums. Additionally, several of our faculty neurosurgeons serve as senior leaders of major regional and national neurosurgical associations. We have a special commitment to training surgeons skilled in the techniques of healthcare quality science to effect continual practice improvement.



Connecting with Colleagues

We engage our physician, nursing and ancillary care colleagues through a variety of educational programs, including webinars, electronic correspondence and regional symposia. These efforts are designed to provide the healthcare community with the most up-to-date information regarding cutting-edge treatment options and neuroscience breakthroughs.



Patient and Family Education

Enabling patients to make informed treatment decisions and facilitating their understanding of sometimes complex treatment regimens is critically important to achieving successful clinical outcomes. We regularly share essential medical knowledge with our patients and their family members through a number of programs, including:

- Pre-operative educational forums
- Disease-specific patient and family support groups
- Nurse navigation and social support programs
- Community education programs

How to Refer

With coordinated inpatient and outpatient services available at 50+ locations, cutting-edge care is never far from your patients.

No matter where you're located – close to Charlotte or across the country – our referral coordinators can help your patients access the right members of our team. We're committed to a productive partnership, offering feedback on your patients' cases until we can transition them back to your care.

REFER TODAY

704-512-7878



Atrium Health

Carolinas HealthCare System Neurosciences Institute

AtriumHealth.org/NeuroExperts

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