The **ORTHOPAEDIC** SURGERY REPORT

Carolinas HealthCare System

Fall 2016

Letter From the Chairman

Edward N. Hanley Jr., MD
Chair, Department of Orthopaedic Surgery
at Carolinas HealthCare System

DEPARTMENT OF ORTHOPAEDIC SURGERY AT CAROLINAS MEDICAL CENTER, PART OF CAROLINAS HEALTHCARE SYSTEM

The Department of Orthopaedic Surgery at Carolinas Medical Center had another very productive year.

Our orthopaedic subspecialists and their support teams provide world-class care to our patients within one of the largest accountable healthcare systems in the country. Patient care volume was at an all-time high at Carolinas Medical Center, CMC-Mercy and across our integrated local and regional facilities, which comprise Carolinas HealthCare System.

We continue to help shape orthopaedic practice through our peer-reviewed publications, invited national and international presentations, and our innovative clinical and translational research activities. This year, we launched our first continuing medical education program on fracture management for colleagues near and far – and to great acclaim.

We also continue to garner national and international recognition for our leadership in orthopaedic research and clinical practice.

This has resulted in new and ongoing external funding to develop and test innovative interventions. Our department also is piloting a new software platform in partnership with IT that will allow secure access and sharing of diagnostic images among physicians, in real-time, to ultimately advance clinical care and decision-making.

Our residency training program continues to thrive, drawing more than 1,000 applicants this year. It remains among the top echelon of programs in the country, according to Doximity's latest ranking.

This report showcases a few of the innovative areas that we are proud to be leading. I look forward to building on our successes and accomplishments in 2016 and in the years to come.

Respectfully,

Edward N. Hanley, Jr., MD

Ortho Residency Program Earns Top Ranking Once Again

Collegial work environment, resident and faculty satisfaction, exposure to different models of care and high volume of diverse cases all factor in, helping to inspire and create leaders in orthopaedic medicine.

The Orthopaedic Residency Training Program at Carolinas Medical Center was again ranked in the top 20 percent of all orthopaedic programs in the country, and fifth in the Southeastern United States, according to Doximity, an online network of more than 250,000 physician members.

Medical students continue to take notice as well. This year, almost 1,000 applications were submitted. That represents a 10 percent increase over 2015. As well, a majority (82 percent) of all US orthopaedic applicants applied to the program last year. Five residents are admitted annually through a highly selective interview process.

Current and former residents point to a variety of factors that set this residency program apart: a collegial work environment, exceptional mentorship and high volume of cases in all subspecialty areas of orthopaedics.

Exposure to different clinical settings and approaches

Residents are exposed to a unique training experience. Not only are they immersed in more of the traditional health system-based academic orthopaedics, they spend up to 40 percent of their time working in an outpatient setting through OrthoCarolina – the largest independent orthopaedic practice in the country.

"The program gives our residents a deep and thorough understanding of different models of medicine, and is really the best of both worlds," says Joshua C. Patt, MD, MPH, residency program director.

Residents agree. As one alumnus noted, "I could not imagine a better program exists for teaching all domains of orthopaedic surgery."

One-on-one learning

The best way to learn clinical medicine is by teaching one-on-one; the philosophy here is one patient, one attending and one resident.

"A lot of opportunities come from our mentorship model. You're not one of 16 people looking over someone's shoulder, and that's very appealing because you don't have to wait until later in residency to actually see something or do something," says Dr. Patt.

Residents also are provided ample research opportunities and serve as co-authors on a high percentage of peer-reviewed publications each year. On average, members of the teaching faculty or residents publish over 75 peer-reviewed articles or chapters annually.

Responsiveness to emerging educational needs

"I think the greatest testament to the program is the high percentage of residents who end up staying in the Charlotte area and returning to the program in a teaching capacity," says Dr. Patt.

More about the new residency rankings

Doximity, in consultation with U.S. News & World Report, evaluated nearly 3,700 residency programs using a combination of current resident satisfaction, reputation data from practicing doctors and other data, such as publications and research grants awarded. A complete list is available through Doximity's new Residency Navigator Tool, designed to help prospective residents compare programs and find the right program for their specific interests.

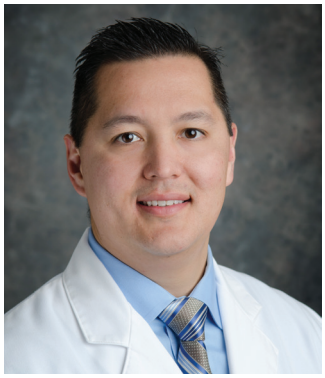
"These rankings are generally helpful, but there's a lot lost in data collection," explains Dr. Patt. "While it provides additional information for incoming residents to consider when comparing programs, it doesn't tell the full story."

For example, he says his program is listed as having a 52 percent rate of board certification when in fact it has maintained a board-pass rate of 100 percent for more than 15 years. Roughly 90 percent of graduates seek additional fellowship training.

WHAT SETS OUR RESIDENCY PROGRAM APART?

- Reputation of the hospital and faculty
- Breadth of cases (trauma, reconstruction, etc.)
- Hands-on exposure to procedures early on
- Patient interaction
- Satisfaction of other residents and faculty
- Expected research and job opportunities
- Innovative programs
- Intensive surgical simulation curriculum

RETURN TO PERFORMANCE PATHWAY: CMC Helps Patients Regain Function after Severe Limb Injuries



Joseph R. Hsu, MD
Associate Professor of
Orthopaedic Trauma

Joseph Hsu, MD, an orthopaedic traumatologist in the Department of Orthopaedic Surgery at Carolinas Medical Center, leads an innovative program that translates advances developed in military medicine into civilian practice. The Return to Performance Pathway – a companion to the Limb Lengthening and Deformity Service program developed by Dr. Hsu and Brian Brighton, MD, at CMC – combines advanced functional bracing and physical therapy to help patients with severe limb injuries regain strength, endurance and balance so they can once again engage in high-intensity activities.

Despite major advances in the area of limb salvage, there is a body of evidence that shows some patients whose limbs have been salvaged have poor long-term functional outcomes.

"There was a real gap, but now we have a solution," says Dr. Hsu.

Working as a military orthopaedic surgeon previously, Dr. Hsu witnessed firsthand the devastation caused by blast injuries. He recalls a considerable number of Wounded Warriors with severe foot and ankle injuries were opting to have their damaged limbs amputated, even two to three years after their injury. Mostly, this was because, at the time, there were no good solutions that would allow these patients to regain enough function to return to their former level of activity.

Turning an unmet medical need into an opportunity to advance orthopaedic medicine, Dr. Hsu and his team developed the "Return to Run" clinical pathway, a program in which patients were fitted with a specially designed passive dynamic ankle-foot orthosis (AFO) and underwent intensive physical rehabilitation. The AFO was specially designed to store and return energy to the limb, while providing stability and support for pain relief and improved functionality. The program was a major success, decreasing the number of amputations at the center and helping many military personnel to return to active duty.

Now, Dr. Hsu is developing a similar program for patients at CMC.

> "Currently, we are the only medical center in the country using this approach in civilian population. It's something we are very excited about and hope will serve as a model for others."
>
> – Joseph R. Hsu, MD

One of the first patients to go through the program at CMC was Fred Oates, a former restaurant manager, whose foot was severely crushed in a motorcycle accident. Following his injury, Oates thought he would never regain his active lifestyle. But with the use of the AFO, intense physical therapy and a tremendous amount of inner drive, Oates is once again snowboarding, hiking and even competing in triathlons.

Dr. Hsu says the success and promise of the program is a testament to a team effort between CMC, Carolinas Rehabilitation and collaboration with prosthetics leaders who build the devices used in the Return to Performance program.

"While we are currently treating patients with traumatic injuries, we are starting to get referrals for patients with hind foot fusions, nerve injuries and post-traumatic arthritis, and we expect to expand the program to include patients with other foot and ankle injuries," says Dr. Hsu.

Patients participating in the CMC program are part of an observational study that assess the effectiveness of the program in improving quality of life. Leaders hope it provides important outcomes data to help secure funding so this approach can be used in foot and ankle and trauma patients across the country.

Orthopaedists Pilot New Software to Securely Share Digital Images, Video from Mobile Devices

They say a picture is worth 1,000 words. Today, this adage is becoming increasingly true in orthopaedics and other medical specialties.

While images, including X-rays and MRIs, always have had tremendous value in medicine, advances in digital photography, coupled with the use of hand-held devices such as tablets and smartphones, is making it easier for orthopaedists and other physicians to capture high-definition photos and videos no matter where they are. But it also presents an important dilemma.

How do we capture useful information at the point of care, but also securely store and subsequently upload protected health information to the medical record? The Department of Orthopaedic Surgery is working to find solutions.

"Traditionally, we have had to translate the visual inspection of the patient's condition, fracture or wound into words, which then gets transcribed into the chart, and subsequently reinterpreted by the next person," says Joseph Hsu, MD, an orthopaedic trauma surgeon in the Department of Orthopaedic surgery at Carolinas Medical Center.

Like the old game of "telephone," an image's diagnostic utility may be somewhat dependent on several interpretations. Being able to more readily access and share actual photographs or short videos among physicians can improve the accuracy and impact on medical decision-making and patient care.

But as with all things in healthcare, what seems simple is often very complex. Protecting patient privacy and information security are two critical issues that impact how these images can be stored and shared across IT networks and personal devices.

"There is inherent risk to healthcare systems, physicians and patients if the data and health information on personal devices are inappropriately managed," says Dr. Hsu. "The technology has moved so quickly, and now the health IT solutions have to catch up."

The orthopaedic trauma service at Carolinas HealthCare System has been selected by the Information Systems Department to pilot a new software platform that would allow secure access and sharing of diagnostic images among physicians. Dr. Hsu says it is designed to capture images using the software to maintain security and confidentiality.

"Together with our Information Systems department, we recognized the need, and had the opportunity to pilot and lead this effort clinically," says Dr. Hsu.

The software can be uploaded onto handheld tablets and phones just like secured email platforms, allowing physicians to access – even annotate and immediately share to the System radiology viewer – an image from a handheld tablet or cell phone from any location within the hospital network. The pictures reside on a secure server and no copy of the photo or video gets stored on the user's personal device.

The major benefit is the ability to capture and upload accurate, efficient and timely visual information about patients. Combining portability and data security allows medical professionals to collaborate quickly and communicate accurately, which is especially important in emergency situations, in the OR for complicated cases or to track clinical progress.

"Over the coming months, input from this pilot program will be used to roll out this capability on a much wider scale within the health system," says Dr. Hsu. "Teamwork between Information Systems and the Department of Orthopaedic Surgery will help refine, streamline and disseminate this tool."

Dr. Hsu believes the successful integration of this software within such a large health system will serve as a model for others to address the concern over handheld technology's impact on protected health information.

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Conference Provides Real-World Experience for Treating Fractures

INAUGURAL CME MEETING DRAWS ORTHOPAEDIC SURGEONS AND ADVANCED CARE PRACTITIONERS FROM ACROSS THE REGION

On Nov. 14, 2015, orthopaedists at Carolinas HealthCare System hosted the center's first Trauma Related Issues and Critical Knowledge Symposium.

Called TRICKS, the impetus for this one-day meeting was to provide busy practitioners with evidence-based guidance and reproducible, practical solutions for managing various fractures.

"Through this forum, we are able to synthesize years of experience in fracture management into a digestible, practical one-day conference," says Joseph R. Hsu, MD, professor of orthopaedic trauma at Carolinas HealthCare System.

A major strength of the program is the esteemed faculty of orthopaedic trauma surgeons who serve on the program faculty.

"These surgeons have a tremendous amount of clinical case experience and are national leaders who are helping to define the way we practice orthopaedics," says Dr. Hsu.

Dr. Hsu, who helped guide the development of this meeting, says the agenda was carefully designed to give orthopaedic surgeons and advanced care practitioners from surrounding areas exposure to world-class expertise and an array of practical real-world scenarios.

"What sets this conference apart is we are not only teaching the evidence behind clinical decision-making for trauma and fracture management, but we also give attendees tools and advanced techniques to help them effectively manage difficult surgical cases," he says.

Based on the feedback, attendees agree. One participant wrote the symposium was "excellent from beginning to end." Another wrote, "The presentations dramatically augmented my care of trauma patients."

In addition to interactive case presentations, sessions covered:

- Open fractures: Evidence on initial management and tips
- Humerus Fractures: When and how to pull the trigger?
- Clavicle Fractures: All, none or something in between
- Tibial plateau fractures: Reducing it and keeping it that way
- Ankle fractures: Clear as mud?
- Nailing metaphyseal tibia fractures: Technical pearls

A variety of topics will be explored each year to ensure the symposium addresses the most important clinical questions in fracture management.

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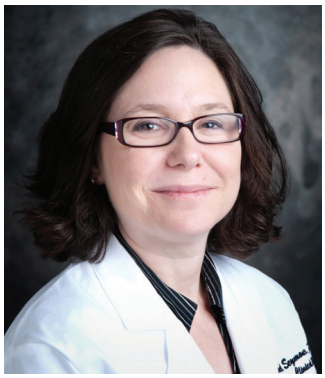
Orthopaedic-Led Research Center of Excellence Shines from the Start

Michael Bosse, MD
COE Director



Rachel Seymour, PhD

The Carolinas Trauma Network Research Center of Excellence (COE) made major strides in its fifth year, already influencing clinical trauma practice and garnering the attention of outside funders.

The COE is a multidisciplinary research consortium led by Michael Bosse, MD, and Rachel Seymour, PhD, of the Department of Orthopaedic Surgery, which partners orthopaedic surgeons and researchers with investigators from general trauma surgery, physical and rehabilitation medicine, and emergency medicine.

Dr. Bosse, orthopaedic traumatologist and COE director, says the COE intentionally brings together these varied disciplines in order to focus on broader issues in trauma care.(See article on page 7.)

"Our strategy was to bring clinicians and researchers from diverse disciplines together to define gaps in clinical care, and to use that information to help drive the research agenda," says Dr. Bosse.

That clinically focused research agenda already has proven fruitful, and it has started to inform new practices and guidelines for care, many of which have been adopted across Carolinas HealthCare System. For example, new concussion guidelines emerging from COE research are resulting in fewer patients moving to level 1 trauma centers and receiving CT scans unnecessarily.

A retrospective study conducted by the COE investigators showed that trauma patient outcomes improve when antibiotics are administered earlier in the care process. As a result, at-risk patients now receive these medicines in the ambulance on their way to System trauma centers.

National funders also are taking notice and investing in this research. Two major awards have been made based on initial work conducted by the COE, both led by the Department of Orthopaedic Surgery.

The COE was awarded a $400,000 grant in 2014 from the Centers for Disease Control and Prevention. The study, Prescription Reporting with Immediate Medication Utilization Mapping (PRIMUM), was one of only two grants given out nationally.

Through this two-year grant, Dr. Seymour and Joseph R. Hsu, MD, along with their multidisciplinary team, created an EMR-based clinical decision support tool to help prescribers avoid prescribing opioids to patients at risk for overdose, which is now fully integrated in the Carolinas HealthCare System.

"The PRIMUM rule searches for criteria that indicate risk and puts it right in front of the prescriber when he or she is writing the prescription," explains Dr. Seymour.

Another area of research in falls prevention that was initiated the first year of the COE's operation is being funded through a grant from the AO Foundation. The research program will use sensor technology to assess gait and help in rehabilitative treatment and planning.

Dr. Seymour attributes the success, robustness and speed of the team's research to both the broad, clinical approach and the large volume of patients using the Carolinas Trauma Network.

"We've created a model for doing multidisciplinary research that has clinical impact within the system," says Dr. Seymour.

> Our strategy was to bring clinicians and researchers from diverse disciplines together to define gaps in clinical care, and to use that information to help drive the research agenda.
>
> – Michael Bosse, MD

New Functional Assessment Using Motion Sensors Will Offer Richer Data To Guide Medical Decision-Making after Injury

The Orthopaedic Engineering Research Laboratory (OERL) and Clinical Research Division at Carolinas HealthCare System have been awarded $727,000 by the AO Foundation of Switzerland as part of a three-year grant to develop functional assessment tools using motion sensors. The tests and protocols being developed will allow physicians and researchers to collect and analyze objective performance-based measures that can help guide patient care and track outcomes following traumatic injuries.

"These tests can provide a quantitative assessment of patients' mobility and stability fairly easily, allowing surgeons to objectively assess how well or quickly someone is recovering from an injury or whether one orthotic or prosthetic is better than another," says Richard Peindl, PhD, director of OERL, and one of the project's co-principal investigators.

The researchers are initially focusing on lower extremity function. The team uses sensors similar to those found in drones, cell phones and remote-controlled vehicles that assess motion and direction. When placed on a patient's sternum, these sensors provide a wealth of useful data about how a person moves through space while performing different tasks.

"These are all things that surgeons look at to make a subjective assessment of how a patient is doing – but through this program we can provide quantitative data, for example, about how stable or erratic a patient is in walking, turning or rising from a chair," says Stephen Sims, MD, the project's other co-principal investigator and project medical director.

By adding electronic data gleaned from the wearable monitor, they are enhancing commonly used, validated tests such as the 10-meter Walk Test, 5-times Sit to Stand test and the Timed Up and Go test.

"We get what surgeons are calling a gait lab on a chip," adds Dr. Sims. "It's a chance to improve the quality of care patients receive in a fairly short timeframe, and given the AO Foundation's international reach, we hope this will have wide clinical application."

The tests and procedures are designed to be fast and accurate in order to fit within the usual doctor-patient interaction. The data are expected to be used first and foremost to inform patient care and help clinicians gauge and compare the relative effect of different therapies, surgical techniques, devices and physical therapy approaches for any particular injury.

Dr. Peindl says the technology also fits well with current efforts by major insurance companies and government payors to develop patient-reported outcomes and performance-based standards to help manage the rising cost of healthcare.

In the future, surgeons and researchers will be able to tie data in with electronic health records to factor in other variables, including comorbid conditions that can affect how a patient recovers.

The research team, which includes Rachel Seymour, PhD, and Madhav Karunakar, MD, from Carolinas HealthCare System; Nigel Zheng, PhD, from UNC Charlotte; and James Kellam, MD, and Joshua Gary, MD, of the University of the Texas Health Science Center at Houston, also are collaborating to create a large database of patients and heathy individuals that will allow users to assess how an individual patient is doing compared to a wide variety of selectable patient or normative populations.

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Intensive Orthopaedic Surgical Simulation Curriculum Transforms Medical Training

SCANNELL RECEIVES DISTINGUISHED TEACHING AWARD FOR SPEARHEADING THIS INNOVATIVE PROGRAM

On March 16, 2015, Brian Scannell, MD, assistant professor of Pediatric Orthopaedic Surgery was presented with the Excellence in Simulation Education teaching award. The award, presented by Drs. Mary Hall and Edward Hanley, is given in recognition of outstanding teaching quality and contribution to simulation-based education.

"The goal is to improve surgical skills, optimize clinical outcomes and support patient safety," says Dr. Scannell, adding his interest in medical education grew from the strong mentors he's had in his career.

He coordinates and oversees a month-long intern simulation program, which involves daily sessions with more than 15 surgeons from a variety of orthopaedic specialties.

"It's an invaluable teaching experience for residents, providing them with practical skills early in residency," says Dr. Scannell. "Surgical simulation will likely play a greater role for practicing physicians, given the focus on provider accountability and outcome-based reimbursement."

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The program allows up-and-coming orthopedists to train in an environment that replicates real-world clinical scenarios and procedures – something Dr. Scannell says is especially important these days as trainees spend less time in the operating room due to hour restrictions and other changes in education. The effort also responds to recent calls by the American Board of Orthopaedic Surgeons to have surgical simulation available to interns in every program.

The intensive program covers everything from anatomy using cadavers, learning different surgical approaches, splinting and casting, soft tissue management, suturing, sawbones models, closed fracture management, preoperative planning, and a computerized arthroscopy simulator to help residents learn how to do an arthroscopy of the knee and shoulder. One popular session focused on physical exams. In it, orthopaedic specialists gave tutorials on how to conduct a detailed exam and gather a patient's medical history.

His nominator says he "demonstrates a mastery of interpersonal skills, professionalism and leadership skills in the OR and the clinic. He is a great physician, professional, person and teacher."

"I was very humbled," says Dr. Scannell about the award. "It certainly validates what we are doing." He credits the success of the program to the support of department leaders.

2015 Publications

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