Spine Center Marks 5th Anniversary

When a middle-aged man, weighing more than 350 pounds, suffered sudden back pain and weakness in one of his legs, an emergency medicine physician diagnosed him with a large herniated, or bulging, spinal disc and recommended he follow up with a surgeon. But after his evaluation in BIDMC’s multidisciplinary Spine Center, doctors advised against surgery and proposed a more conservative course of treatment. Nonoperative specialist physiatrist Stefan Muzin, MD, helped the patient find relief with a series of epidural steroid injections and physical therapy. After months of counseling and treatment, the patient progressed until he was able to dramatically decrease his use of addictive pain medications and, for the first time in his life, become physically active. Today, without surgery, he has lost more than 50 pounds and his overall health and well-being have vastly improved.

Patients with back pain have found comfort in the collaborative care available at BIDMC’s Spine Center, which celebrates its 5th anniversary this year. At the Center, patients have access to some of the best orthopaedic surgeons, neurosurgeons, physiatrists, and pain management specialists the region has to offer. This unique multidisciplinary team ensures patients get the care they need quickly and in one location.

“Patients are assured of seeing the right physician,” says orthopaedic surgeon Kevin McGuire, MD, Co-Director of the Spine Center.

Each surgeon is paired with a nonsurgeon anesthesiologist and physiatrist. Most patients can see a nonoperative provider first. Only 10 percent of patients go on to have surgery, while 90 percent are successfully treated conservatively.”

In addition to McGuire, Spine Center directors include neurosurgeon Efstatios Papavassiliou, MD, and pain management specialist and anesthesiologist Christopher Gilligan, MD. Before joining the Spine Center in July, Gilligan was Director of the Center for Pain Medicine at

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Letter from the Chairman

Welcome back to Orthopaedic Connections. We have exciting news to share that highlights our commitment to excellent patient care, innovative research, and top quality education.

This issue features BIDMC’s Spine Center. The Spine Center brings together specialists from Orthopaedics, Neurosurgery, and Pain Management to ensure that patients receive coordinated, comprehensive care for their spinal problems. In addition, we profile an outstanding Orthopaedic Spine Fellow, who recently completed our one-year fellowship program.

I am also delighted to announce that Mary Bouxsein, PhD, an NIH-funded osteoporosis researcher, is the new Director of our Center for Advanced Orthopaedic Studies. In this role, she will be leading the advancement of the laboratory towards its goal of becoming the premier orthopaedic science research center in the country. In conjunction with this, we spotlight promising, new research from the lab on regenerating knee cartilage as well as educational programs for summer interns and incoming residents.

Other noteworthy events covered this issue include: the opening of our Chestnut Hill location, which provides a new home base for Sports Medicine; the first Orthopaedics continuing medical education course to be held in January, and the addition of a new orthopaedic oncologist to our faculty.

I hope you enjoy reading these stories and look forward to your comments.

Sincerely,

Mark C. Gebhardt, MD
Chief, Department of Orthopaedics

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**DEPARTMENT OF ORTHOPAEDICS**

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A team approach

Located on the fourth floor with a lofty view, Sports Medicine adjoins the outpatient rehabilitation clinic, which offers physical and occupational therapy. Together, the sports medicine and rehabilitation specialists assess and treat injuries, allowing athletes to heal and return to their activities.

“Our goal is to keep people on the field playing their sports,” says Ramappa. “We try to keep them from being injured and take care of them if they are. We want to keep them functioning at their highest level.”

The highly experienced physical and occupational therapists provide treatments designed to improve strength, flexibility, and endurance. The rehabilitation clinic features private treatment rooms, an open gym space surrounded by windows, and equipment, such as treadmills, bikes, stability balls, and weights. The clinical staff also provide screening and education to help prevent injuries.

In addition, radiology services, including X-rays and CT scans, are available on site.

The community-based setting provides easy access to care (as well as nearby shops and restaurants) and features plenty of free parking. To make an appointment, call Sports Medicine at 617-66-SPORT (617-667-7678). For Rehabilitation appointments, call 617-754-9100.

Orthopaedic Oncologist Joins BIDMC

The Department of Orthopaedics welcomes Santiago A. Lozano Calderón, MD, PhD, to its Orthopaedic Oncology Division, where he will care for patients with bone and soft tissue tumors and metastatic bone disease. He recently completed the combined Musculoskeletal Oncology Fellowship Program at Massachusetts General Hospital, Boston Children’s Hospital, and BIDMC.

A graduate of the Pontificia Universidad Javeriana Medical School in Bogotá, Colombia, Lozano completed a five-year internship and residency in general orthopaedics at New York Medical College. In addition, he holds a master’s degree in clinical epidemiology and biostatistics from the Colegio Mayor de Nuestra Señora del Rosario University in Bogotá and a PhD in clinical orthopaedics from the University of Amsterdam in the Netherlands. He also was a clinical research fellow in hand and upper extremity surgery at Harvard Medical School.

Dr. Santiago Lozano Calderón
Can a favorite summer bug’s chemistry help us learn about sore knees? Yes, indeed, says Ryan Porter, PhD, at BIDMC’s Center for Advanced Orthopaedic Studies. By borrowing a firefly’s glow, he and his fellow researchers are able to visualize and track the activity of potentially healing cells transplanted into damaged joints. Replicating the firefly’s chemically caused light emission allows the scientists to tag and noninvasively image implanted cells in an animal model of joint injury. Like a high-lighter, this bioluminescence can mark the location of the introduced cells. Depending on the experiment, it can also indicate the particular activity of cells.

Porter and his research team hope to harness the regenerative capacity of skeletal stem and progenitor cells, primitive cells found in the body, to repair joint tissue damaged by injury or disease. Unlike a fractured bone placed in a cast, articular cartilage—the smooth, white tissue covering the ends of bones in joints—does not typically self-repair after injury. Even small defects in the cartilage can erode with continued joint use, leading to pain.

“Once cartilage erosion has taken hold, replacing the damaged joint surfaces with metal or plastic may be the only option to restore mobility,” Porter says. “We’re hoping to come up with more biologically inspired solutions to resurfacing. We know the potential is there—certain adult stem and progenitor cells have shown to be able to form cartilage. So far, though, this result has been limited to the laboratory, under well-controlled conditions.”

Porter and his team are studying animal models to better understand how joints develop, what goes wrong during cartilage repair, and how to apply that knowledge to patients with injured joints. While some clinics outside the U.S. have begun offering procedures that involve the injection of adult stem cells into injured or arthritic joints to reduce inflammation, Porter says there’s no conclusive evidence that this approach will have sustained benefits to the joint.

His lab group is focusing on how to better direct progenitor cells, which are developmentally in between stem cells and mature cells, to become chondrocytes, the cells that make up cartilage. Their goal is to repair cartilage in a way that is both functional and long lasting.

“Progenitor cells are recruited naturally as a response to damage in the body,” says Porter. “Because cartilage tissue lacks blood vessels, progenitor cells cannot effectively reach the defect site without surgical intervention, such as making channels from the defect to the underlying bone marrow.”

Investigators are currently studying how progenitor cells, harvested and grown outside the body, can be used for cartilage healing.

Many of the first attempts involved researchers putting these cells into scaffolds and encouraging them to become chondrocytes in the lab. But more recently, Porter and other investigators are attempting to direct progenitor cell differentiation after implantation into a defect. This approach eliminates costs associated with generating mature cartilage in the lab.

To track implanted cells during healing, the scientists are relying on bioluminescence. They introduce the light-emitting protein from the firefly into their animal model of injury. The animal is

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Using genetic engineering, researchers can reproduce the bioluminescence of the firefly in mammalian progenitor cells, then noninvasively study cell activity following implantation within animal models of joint injury.
New Director of Orthopaedic Lab

Mary Bouxsein, PhD, has been named the new Director of BIDMC’s Center for Advanced Orthopaedic Studies (CAOS). Taking over from Christopher Evans, PhD, she will lead the Center towards its goal of becoming a world-class musculoskeletal research laboratory.

Established in 1979 as the Orthopaedic Biomechanics Laboratory, the lab has grown to include 7 principal investigators, 9 postdoctoral fellows, and 20 graduate and undergraduate students. CAOS receives more than $2 million annually from the National Institutes of Health, Department of Defense, and several foundations to fund basic, translational, and clinical studies to advance knowledge and treatment of musculoskeletal conditions and injuries.

Bouxsein joined the BIDMC biomechanics lab in 1992, initially as a postdoctoral fellow, after earning a PhD in Mechanical Engineering from Stanford University. Her long-time research focuses on osteoporosis and understanding skeletal fragility from a biomechanics viewpoint. She has served as an advisor to NASA on the long-term effects of weightlessness on skeletal health and conducted an experiment on the space shuttle Atlantis in 2011. She has a strong interest in the use of novel noninvasive imaging techniques to predict fracture risk and monitor the response to osteoporosis therapies.

In addition to her role as Director of CAOS, Bouxsein is a faculty member in the Harvard-MIT Health Sciences and Technology Program and an active member of the Endocrine Unit at Massachusetts General Hospital.

Recently she was promoted to Associate Professor of Orthopedic Surgery at Harvard Medical School. She has taught, mentored, and advised numerous students and fellows at the BIDMC laboratory as well as MGH and Harvard Medical School.

A prolific author, Bouxsein has published more than 200 peer-reviewed articles as well as 25 book chapters and invited reviews. She is also a sought-after speaker, delivering lectures throughout the world. She serves on the committee of scientific advisors for the International Osteoporosis Foundation and is a former board member of the International Bone and Mineral Society.

Summer Interns in CAOS Lab

Students from all over the United States came to the Center for Advanced Orthopaedic Studies during the summer to gain experience working in a lab. The 15 interns, with academic majors such as biomedical engineering and biology, worked closely with orthopaedic research investigators on a variety of projects for 6 to 10 weeks. Ranging from college sophomores to first-year medical students, the interns represented 10 different educational institutions, including Duke University, Boston University, the University of Arkansas, and the University of Pennsylvania. In addition to working in the lab, interns shadowed orthopaedic surgeons at BIDMC.

To apply for next year’s summer intern program, contact Paula Cohen, pcohen@bidmc.harvard.edu.
During his recent one-year orthopaedic fellowship in the Spine Center at BIDMC, David Lunardini, MD, saw patients with a wide range of problems caused by trauma, degenerative conditions, tumor, and spinal deformity. But perhaps his most memorable patient was a 45-year-old emergency care worker whose skull was dislocated from the rest of his spine during a motor vehicle crash. While his survival initially seemed extremely unlikely, BIDMC emergency department staff were able to stabilize his condition. And the next day, he was brought to the operating room, where Lunardini along with orthopaedic spine surgeon Andrew P. White, MD, and others from the Spine Center team were able—with great care and attention to detail—to fuse his skull to his spine.

“He recently came in to see me for his six-month follow-up appointment and was able to walk into the office,” says Lunardini. “It was really gratifying to see that he’s doing so well.”

Early in his orthopaedic residency, Lunardini thought joint replacement surgery was the subspecialty for him. But during a spine surgery rotation, he was captured by the intricacy of the anatomy and loved thinking about how spinal trauma affects stability. He also found the surgery itself very satisfying.

“I really liked the delicate nature of working around the spinal cord and nerve roots,” he says. “Taking the pressure off and watching them recoil back to their normal shape, you know that you have helped that patient.”

A graduate of Pennsylvania State University, Lunardini earned his medical degree at the University of Virginia School of Medicine. He then went on to complete a residency in orthopaedics at the University of Pittsburgh Medical School.

His fellowship in BIDMC’s Spine Center allowed him to see the perspectives of both orthopaedists and neurosurgeons. “I was taught more than I could list,” says Lunardini. “In a general sense, it was a nice blend of an appropriately conservative approach to spinal surgery and some of the newer minimally invasive techniques. That will shape how I view things going forward in my practice.”

He cites White, who is Director of the Combined Orthopaedic and Neurosurgical Spine Fellowship, and Kevin McGuire, MD, Co-Director of the Spine Center, as being most influential in his training at BIDMC. “Both were outstanding experts at their craft and so humble and approachable,” he says. “They were great mentors to me.”

In addition to clinical work during his fellowship, Lunardini participated in a variety of research, including working to validate a new classification for disc degeneration in the lumbar spine. He also studied cervical spine immobilization practices for different conditions among spinal surgeons nationwide.

His primary research project involved increasing efficiency in the operating room by standardizing and streamlining the equipment sets used by spine surgeons. The goal of the project was to minimize waste and consolidate instruments into one set agreed on by surgeons, the perioperative director, nurses, surgical technicians, and sterile central processing staff. The new optimized instrument trays improve patient safety, reduce the physical burden on staff (each tray now weighs 17.5 pounds less), and save costs associated with cleaning, packaging, and transporting. He and his fellow researchers published the results of the study in *Spine* on June 19, 2014 (“Lean Principles to Optimize Instrument Utilization for Spine Surgery…”). In November, McGuire will present their findings at the North American Spine Society meeting in San Francisco.

Since leaving BIDMC in July, Lunardini has joined the Department of Orthopedics and Rehabilitation Medicine at Fletcher Allen Health Care/University of Vermont in Burlington, Vt., where he will specialize in cervical spine and trauma surgery. In addition, he will be on the faculty of the residency program, training the next generation of spine surgeons. He is excited to have the opportunity to stay in academics, live in a beautiful college town, and enjoy outdoor activities like skiing, hiking, and fishing.
Massachusetts General Hospital. Orthopaedic spine surgeon Andrew P. White, MD, serves as Director of the Combined Orthopaedic and Neurosurgical Spine Fellowship.

“We offer the best care possible under one roof,” says Papavassiliou. “This saves patients from traveling from specialist to specialist. It’s convenient ‘one-stop shopping’ for patients with back, neck, or spine problems. Very often a patient can see two physicians in the same day.”

To add to this convenience, Spine Center outpatient services are also offered at BIDHC-Needham and BIDHC-Lexington. Radiology and physical therapy are available at all locations.

The Center’s combined services are popular with patients—patient care volume grew 23 percent from 2008 to 2012. During that time, while the complexity of surgical cases increased 20 percent, the average length of stay decreased a full day (from 4.7 to 3.7 days).

The Spine Center staff works as a team, discussing patient problems with each other. “Free-flowing discussions between surgeon and nonsurgeon are valuable for expediting care and generating patient-specific care plans,” says McGuire. “We are collaborative, more like a cancer center team.”

“We have a very harmonious relationship among all the specialists,” adds Papavassiliou. “There is an understanding among the groups, and we learn from each other.”

Twice a month, the Spine Center staff holds conferences in which they present difficult cases. This allows them to share experiences and avoid problems. “We work together to determine the best practices which lead to the best patient outcomes,” says Papavassiliou.

When patients contact the Spine Center for an appointment, they are carefully matched, based on a specially developed algorithm or pathway, with the appropriate subspecialist. Trained appointment coordinators follow step-by-step guidelines to make sure the patient receives the most appropriate appointment as soon as possible. For instance, a patient who has had back pain for one week and has not had an MRI may see a pain management specialist first, whereas, a patient with a tumor of the spine will see a neurosurgeon.

“We have about 6,000 patient visits a year,” says McGuire. “But the number of surgeons in the Spine Center is quite small, since most patients do not require surgery. For the majority, we offer appropriate nonoperative care that gets them on the road to recovery.”

To make an appointment, call 617-754-9000 or e-mail spinecenter@bidmc.harvard.edu. Primary care providers may also refer patients by entering an order for a consult using the computerized electronic medical records system. The Spine Center is able to accommodate urgent appointments and sometimes even same-day requests when appropriate.
Faculty Activities

Ron Alkalay, PhD, Center for Advanced Orthopaedic Studies, and others published “MR diffusion is sensitive to mechanical loading in human intervertebral disks ex vivo” online in the Journal of Magnetic Resonance Imaging on June 3, 2014.

Dennis Anderson, PhD, Center for Advanced Orthopaedic Studies, John Keel, MD, Spine Center, and Mary Bouxsein, PhD, Center for Advanced Orthopaedic Studies, and others published “Computed tomography-based muscle attenuation and electrical impedance myography as indicators of trunk muscle strength independent of muscle size in older adults” in the July issue of the American Journal of Physical Medicine & Rehabilitation.

Charles Day, MD, MBA, Hand, Wrist, and Elbow Surgery, was recently honored at a Boston Red Sox home game as the “Medical All-Star” for his years of clinical and research accomplishments at BIDMC.

Tamara Rozental, MD, Hand, Wrist, and Elbow Surgery, has been awarded the prestigious 2014-2015 Sterling Bunnell Traveling Fellowship by the American Society for Surgery of the Hand. The fellowship provides scholarship funding for a young hand surgeon to pursue an educational or academic goal that requires national and international collaboration.

Kevin McGuire, MD, Co-Director of the Spine Center, and others co-authored “The Effect of High Obesity on Outcomes of Treatment for Lumbar Spinal Conditions: Subgroup Analysis of the Spine Patient Outcomes Research Trial (SPORT), which was accepted for publication in Spine. In addition, he and Melinda Van Niel, MBA, Department of Health Care Quality, published an invited review entitled “Electronic Patient Reported Outcomes: Lessons Learned from a Pilot at a Large Academic Medical Center and Accountable Care Network” in the May/June edition of SpineLine, a publication of the North American Spine Society.

Ryan Porter, PhD, of the Center for Advanced Orthopaedic Studies, and others published “Electrostatic interactions enable rapid penetration, enhanced uptake and retention of intra-articular injected avidin in rat knee joints” in the August issue of the Journal of Orthopaedic Research.

Arun Ramappa, MD, Chief of the Sports Medicine Division, and the MARS (Multicenter ACL Revision Study) Group, with which he collaborates, won this year’s O’Donoghue Sports Injury Research Award from the American Orthopaedic Society for Sports Medicine (AOSSM). The award in recognition of the group’s outstanding paper “Revision Anterior Cruciate Ligament Reconstruction Graft Choice Impact on Outcome in the MARS Cohort” was presented at AOSSM’s annual meeting in Seattle in July.

Academic Promotion

We are pleased to announce that Joseph DeAngelis, MD, of the Division of Sports Medicine and Shoulder Surgery, has been promoted to Assistant Professor of Orthopedic Surgery at Harvard Medical School. In addition to his role as a clinician at BIDMC, he is Director of Sports Medicine Research.

HCORP Hands-On Boot Camp at Center for Advanced Orthopaedic Studies

As part of a month-long “boot camp,” incoming residents in the Harvard Combined Orthopaedic Residency Program spent a day of intensive training in orthopaedic biomechanics, and open reduction and internal fixation (ORIF) at BIDMC’s Center for Advanced Orthopaedic Studies. Twelve residents took part in the training session led by BIDMC researcher Ara Nazarian, DSc, and orthopaedic trauma surgeon Edward K. Rodriguez, MD, and Michael Weaver, MD, and Mitchel Harris, MD, orthopaedic trauma surgeons from Brigham and Women’s Hospital.

Following a lecture on the basics of orthopaedic biomechanics by Nazarian, the residents were divided into groups and asked to fix distal fractures with different internal and external constructs to gain a better understanding of repair stability, and stresses and strains. Using a mechanical testing system, the groups were able to test and compare the relative stiffness and stability of their repair constructs. In the afternoon, a lecture by Weaver on ankle fracture reduction was followed by hands-on training.

Trauma surgeon Edward K. Rodriguez, MD, (right) during a resident boot camp demonstration with Ara Nazarian, DSc, (second from right)