Melting Frozen Shoulder

Frozen shoulder is a wintry mix: First is the freezing stage in which the shoulder becomes more and more painful and begins to feel stiff. Next is the actual frozen stage—when the pain may subside, but the stiffness worsens. Finally, there’s the thawing stage in which shoulder motion begins to improve.

While this common condition often resolves with extensive physical therapy, it may be painful and debilitating for up to two years or longer. BIDMC orthopaedic researchers are hoping to speed up this recovery process and cure frozen shoulder with a single injection of a drug in development. Although realizing that goal is still in the future, the team has successfully created an animal model that mimics this problem in humans and allows them to accurately quantify changes in range of motion.

Prior to this study, assessing improvement in joint stiffness was subjective. “Now we have a highly accurate, computer-guided device that measures torque and range of motion in an animal model,” says orthopaedic trauma surgeon and investigator Edward K. Rodriguez, MD, PhD. “This technical achievement allows us to quantify the effectiveness of potential therapeutic options.”

An estimated 2 to 5 percent of Americans (6 to 16 million) develop frozen shoulder, which translates into significant health care costs. Those affected are generally between the ages of 40 and 60 and mostly women. The pain interferes with normal daily activities, such as getting dressed and reaching kitchen shelves. Patients often have difficulty sleeping, particularly on the affected shoulder.

The condition is also known as adhesive capsulitis, because the shoulder capsule, or the connective tissue surrounding the joint, thickens and becomes stiff. Idiopathic or primary frozen shoulder occurs without a known cause, while secondary frozen shoulder typically occurs after an injury or arm-related surgery.

“There is usually an inciting event, something that causes pain, inflammation, and a period of immobilization,” says Miguel Perez, MD, a
Letter from the Chairman

Dear Colleagues and Patients:

Over the past year, our Orthopaedics Department has continued to grow, and we have expanded partnerships with community hospitals and physician organizations, helping to ensure our patients receive timely and convenient high quality care. In this issue of “Orthopaedic Connections,” we share exciting news about our latest faculty additions and affiliations as well as research advances.

A noteworthy addition to our faculty is John Kwon, MD, who joins the department as the Chief of Foot and Ankle Surgery. A graduate of our Harvard Combined Orthopaedic Residency Program, he comes to us from Massachusetts General Hospital and is extremely qualified to head this growing service.

I am also excited to announce that Richard Mulroy, MD, has been named Chief of Orthopaedics at Signature Healthcare Brockton Hospital, one of our community-based affiliations. Our partnership with his department will help expand orthopaedic services offered locally and give patients access to BIDMC specialists when needed. We welcome Dr. Mulroy to our academic faculty at BIDMC.

At BIDMC, we continue to be innovative in our clinical practice, teaching, and research. In this issue, you can read about a leg holding device designed to assist in applying a cast, a new citywide training program developed for hand surgeon fellows, and a laboratory instrument created to accurately measure shoulder restriction. You can also learn about an important BIDMC study revealing the underdiagnosis of osteoporosis in men.

I would like to take this opportunity to congratulate Dr. Tamara Rozental on receiving an NIH R03 grant. We look forward to hearing results from this study on bone strength.

Sincerely,

Mark C. Gebhardt, MD
Chief, Department of Orthopaedics

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### DEPARTMENT OF ORTHOPAEDICS

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A kin to a canary in a coal mine, a broken wrist can be a warning of a future fracture. The most common upper extremity fracture, broken wrists are strongly associated with fractures of the hip and spine and usually occur 10 to 15 years earlier.

The cause of fractures in both older men and women is often osteoporosis or brittle bones. Yet a recent study found the risk of this disease is frequently ignored in men. In fact, researchers discovered that following a fracture of the distal radius (the wrist end of the larger forearm bone), men are nearly 10 times less likely than women to receive a bone density scan and 15 times less likely to be treated with bisphosphonates, medications to increase bone mass. Men are also 5 times less likely to receive subsequent treatment with calcium and vitamin D supplements.

This disparity may be due to men and their doctors tending to think of osteoporosis as a woman’s disease. “Men need to think about bone health and have a conversation with their doctor,” says orthopaedic hand surgeon Tamara Rozental, MD, senior author of the study, published in the Journal of Bone and Joint Surgery. “Physicians also need to play a more active role and pursue screening for patients at risk of future fracture.”

The research compared the medical records of 95 men and 344 women over the age of 50 treated for wrist fractures at BIDMC between 2007 and 2012. In calculating their results, investigators took into account severity of fracture, mechanisms of injury, age, and prior history of fracture.

The discrepancy found in osteoporosis evaluation and treatment is especially remarkable at BIDMC, which strongly emphasizes secondary prevention of fragility fractures. BIDMC’s rate of screening after a fracture for women is approximately 3 times the national average and for men, more than 4 times.

“Treating men for bone fractures, but not the underlying cause, places them at greater risk for future bone breaks and related complications,” says Rozental. “Further clinical assessment and bone density testing would help identify men over 50 who are at high risk of future fracture and would benefit from treatment for osteoporosis.”

Some might argue that more extensive screening is too expensive but not when economic and health costs due to future fragility fractures are taken into consideration. According to the National Bone Health Alliance, the cost of treating osteoporosis and fractures in elderly Medicare recipients in the U.S. was estimated at $22 billion in 2008.

Each year nearly two million Americans suffer osteoporosis-related fractures and that number is predicted to increase substantially as the population ages. Hip fractures are particularly devastating with 50 percent of sufferers never regaining previous function. And notably, studies have shown that men who suffer hip fractures have twice the mortality rate of women both during initial hospitalization and in the following year.

“Fragility fractures among men are expected to increase threefold by the year 2050, making adequately evaluating and treating men for osteoporosis of paramount importance,” says Rozental.
The patient needed a long cast to help his leg heal after a quadriceps tendon repair. In the casting room, he lay on a bed as one orthopaedic technologist held his foot upward and another applied the cast, starting at the hip. Suddenly the patient flinched, causing the two technologists, Mitch Philibert, OTC/CFo, and Kelvin Sylvester, OTC/CFo, to fear the recent repairs might be torn.

Fortunately, no re-injury occurred, but the incident spurred Philibert and Sylvester (both certified orthopaedic technologists and orthotic fitters) to think of a way to avoid this possibility in the future. They grabbed paper and pencil and began drawing a leg-holding device that would eliminate the need for manual support and free the assisting technologist to stabilize the extended leg. By standing to the side of the patient, the assistant would be able to make sure the leg was kept in full extension with sutures straight and tension free.

“Our goal was to use the manpower we have creatively and most efficiently,” says Sylvester. “First and foremost, we were concerned about patient safety and the quality of care.”

In addition to rerupturing a repair, any contraction of the quadriceps muscle can cause the cast to be too loose. When the contracted muscle later relaxes, extra space is left inside the cast, allowing the leg to move.

From idea to reality
Design in hand, the inventors went to Philibert’s father, Michael, who just happens to be a sheet metal fabricator. He agreed to build a prototype based on their drawings. The result was a durable, stable device, capable of holding a patient weighing up to 250 pounds. The original model featured a metal S-shaped plate to hold the heel and prevent it from sliding. A newer version, designed by the pair, has a sheepskin-lined hammock sling to hold the foot.

“Both are simple, but simple things matter,” says Philibert. “We built the one with the sling for someone who might have sensitivity in the heel, such as a patient with diabetes. The sling is also more comfortable for knee surgery patients using the device for long periods to elevate their leg and reduce swelling.”

Before using the innovative device in an actual patient care setting, Philibert and Sylvester sought advice and approval from both their orthopaedic surgeon colleagues and BIDMC patient care quality personnel. And they received enthusiastic endorsements.

The leg-supporting device can act as an assistant during casting of fractures of the patella (kneecap), tibial plateau (top of the shinbone), and tibiofibular (lower leg bones) joints. It can also steady patients during cast removal with a saw.

The device is adjustable, enabling technologists to elevate the patient’s leg enough to determine where the top of the cast should be. “We need to consider a patient’s functionality after going home,” says Sylvester. “Will they be able get in and out of a car, use the toilet, slide in and out of a chair, or, in some cases, return to work wearing the cast? We also have to be careful that the cast doesn’t chafe or cut into the skin. Being able to see clearly what we’re doing helps us achieve a good fit and reduce the number of cast adjustments needed.”

In addition to safeguarding patients, the new device helps prevent strain and back injuries in employees by reducing the bending required to hold the foot.

Philibert and Sylvester already envision new functions and designs for their device. Plans include using brightly colored alloys in the future. “There’s a lot of room for growth and improvement in the product,” says Philibert.
Introducing New Chief of Foot and Ankle Service

John Y. Kwon, MD, was recently named the first Chief of Foot and Ankle Surgery for the Department of Orthopaedics. He comes to BIDMC from Massachusetts General Hospital (MGH), where he spent four years on the orthopaedic staff working on both the foot and ankle and orthopaedic trauma services. A graduate of New York Medical College, Kwon was a surgical intern at MGH and a resident in the Harvard Combined Orthopaedic Residency Program. Following his residency, he completed a year-long foot and ankle fellowship at Mercy Medical Center in Baltimore, Maryland, then performed additional trauma training in external fixation techniques at Legacy Emanuel Hospital in Portland, Oregon, before returning to Boston.

Orthopaedic Connections recently spoke with Kwon about his background and plans for the Foot and Ankle division.

Q: During your residency you were interested in trauma as well as foot and ankle surgery. Why did you decide to specialize in foot and ankle?
A: Specializing in foot and ankle surgery allowed me to take care of a wide range of pathology from ankle sprains to bunions to calcaneus fractures. My main clinical and research interest continues to be fractures of the foot and ankle, which combines both interests.

Q: What attracted you to Beth Israel Deaconess?
A: The opportunity to work with world-class surgeons in an environment that recognizes that the academic mission is inseparable from the clinical one was very exciting to me. I was familiar with many of the faculty, since I had rotated through Beth Israel Deaconess as a resident, and I thought the BIDMC would be a place where I could really contribute. This position offered the opportunity to help build a foot and ankle division with my partner Dr. Joshua Lamb and change how we deliver foot and ankle care.

Q: What kind of care does your division offer?
A: In the Foot and Ankle Service, we treat a wide range of problems from sports injuries and tendon disorders to fractures and arthritis. We offer comprehensive care to any patient who has a foot and ankle problem. As clinician-scientists, we try to stay on the cutting edge of the latest treatment options that may benefit our patients yet continue to take a conservative, evidence-based approach.

Q: Primary care providers sometimes worry that if they send their patients to surgeons, they will look for a surgical solution first. Is that the case with the Foot and Ankle service at BIDMC?
A: Actually, for Dr. Lamb and me, quite the opposite is true. Although there are some problems that can only be remedied by an operation, many disorders of the foot and ankle are successfully treated with non-operative measures, such as bracing or physical therapy. Only when patients fail conservative treatment and their foot problems cause significant pain and disability do we look for surgical options.

Q: What is your relationship with the BIDMC podiatrists?
A: Orthopaedic surgeons are not the only providers that take care of foot and ankle problems. By working collaboratively with Dr. Giurini and the Division of Podiatry, we can offer the best care to our patients. A collaborative approach ensures that the most qualified providers are taking care of the problems that fall within their area of expertise.

Q: What are the missions of the Foot and Ankle division?
A: First, to offer world-class compassionate care to our patients. Aside from that, to advance the care of future patients through research and innovation. Our third mission is to educate the future leaders in our field—orthopaedic residents, fellows, and other trainees.

Q: On a lighter note, what do you like to do when you’re not fixing feet?
A: My biggest hobby is fishing. I also enjoy running and spending time with my wife and daughter.
Residents of southeast Massachusetts with torn cartilage, arthritis of the knee, low back pain, and other common orthopaedic problems can now find high quality care close to home. Beth Israel Deaconess Medical Center (BIDMC) is bringing its clinical expertise and leading edge technology to affiliate Signature Healthcare, which includes the Signature Medical Group and 245-bed Brockton Hospital.

“What existed prior to our arrival was excellent, and we’re going to make it better,” says Richard Mulroy, MD, FACS, the newly appointed Chief of Orthopaedics at Signature Healthcare and a BIDMC faculty member. “We want to provide patients with easy access to care within their community and a broader diversity of care.”

Before joining BIDMC and Signature Healthcare in December, Mulroy headed orthopaedics at Milford Regional Medical Center. A specialist in total joint replacement, he was an intern and resident at Tufts Medical Center. He then trained as a hip and implant fellow at Massachusetts General Hospital under the tutelage of William H. Harris, MD, a world-renowned leader in arthroplasty.

“Rich is extraordinarily well trained and a superb doctor,” says Douglas Ayres, MD, Chief of the Division of Arthroplasty at BIDMC. “I have known him for 20 years and can vouch for his professionalism, excellent outcomes, and surgical expertise.”

Mulroy is working to enhance and expand the range of musculoskeletal services offered in Brockton and serves as a link to BIDMC. “I’m enjoying the challenge of integrating an in-town major teaching hospital orthopaedic program with a community orthopaedic program,” he says.

The department at Signature Healthcare includes five fellowship-trained orthopaedic physicians—two surgeons specializing in joints and two surgeons specializing in upper extremities (who all belong to BIDMC’s Harvard-affiliated physician group) as well as a spine specialist. The practice also has five physician assistants. Signature Healthcare, which remains an independent organization, provides facilities that include state-of-the-art operating rooms as well as MRI, CT, and other diagnostic tools.

Care in the right place
The availability of local services makes life easier for orthopaedic patients, who are often in pain and mobility-impaired. “We want to make getting care as efficient, convenient, and as pain free as we can for all our patients,” says Mulroy. “Because of our relationship with the Beth Israel Deaconess physicians, we can call them for a quick second opinion if needed, so the patient doesn’t have to go downtown.”

The vast majority of orthopaedic procedures, including rotator cuff repair, hip replacement, carpal tunnel release, anterior cruciate ligament repair, and arthroscopy, can be done at Signature Healthcare.

“The subset of patients who have either medical conditions that are very complex or orthopaedic surgical conditions that might be extraordinary would be referred here [to BIDMC],” says Ayres.

When patients are referred to BIDMC, medical records and X-rays from Signature Healthcare are waiting upon the patient’s arrival, thanks to a seamless electronic transfer system.

Future directions
“We’re adopting the Beth Israel Deaconess approach towards treating patients—their protocols, pathways, and patient education,” says Mulroy. “These programs will supplement what exists here and make it a better experience for patients.”

Collaboration has already begun in the area of joint replacements. The Signature Orthopaedic Department is now following guidelines established by BIDMC to optimize outcomes and minimize potential complications from surgery, such as infections and blood clots.

“Primary care physicians should now have confidence that Signature has an excellent surgical chief and patients will get excellent care,” says Ayres. “In instances where additional expertise is needed, the backup is our very well established Department of Orthopaedics and Division of Arthroplasty at BIDMC.”

As the program at Signature Healthcare grows, Mulroy hopes to add more diverse subspecialties, such as hand surgery, foot and ankle surgery, and operative spine care. He is also eager to collaborate in clinical research conducted at BIDMC.
Orthopaedic hand fellows citywide now have the opportunity to train together thanks to an unprecedented collaboration among Boston-area hand fellowship programs. The usually competitive programs at Beth Israel Deaconess, Massachusetts General, Brigham and Women’s, and Tufts medical centers have joined to form the Hand Fellowship Collaborative with plans to hold quarterly training sessions featuring a variety of FDA-approved devices for hand surgery. This Harvard Medical School-endorsed group seeks to coordinate educational efforts and enrich the learning experience of hand fellows.

Eleven fellows as well as junior attending physicians participated in the first combined educational program held in October at the New England Organ Bank in Waltham. The course focused on nerve injury, regeneration, grafting, and repair. Fellowship program collaborators Drs. Charles Day, BIDMC; Chai Mudgal, MGH; Philip Blazar, Brigham and Women’s Hospital; and Charles Cassidy, Tufts Medical Center, designed the course, which was sponsored by medical technology company AxoGen. The fall session featured lectures by nationally known nerve experts from the Cleveland Clinic, San Francisco Buncke Clinic, and Philadelphia Hand Center. Cadaver lab training followed each talk.

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postdoctoral researcher. “It could be rotator cuff tendonitis or an injury like a fracture or cuff tear. Even when the triggering problem is resolved, the shoulder remains very painful and stiff and can take almost two years to recover.”

Current treatment includes physical therapy to restore motion, non-steroidal anti-inflammatory medications like ibuprofen, and steroid injections to reduce pain and swelling. If symptoms are not relieved, arthroscopic surgery may be performed to reduce scar tissue. Results are uncertain, however, since surgery itself may lead to more scarring.

“Our aim was first to establish an animal model,” says principal investigator Ara Nazarian, DSc, of BIDMC’s Center for Advanced Orthopaedic Studies. “Now we can test different therapeutic options at the animal level to make sure they are efficacious. Once we cross that bridge, then we can conduct human trials with the new therapies we are also working on.”

Replicating restricted motion

In order to quantify treatment, postgraduate researcher Stephen Okajima, BS, a biomedical and computer engineer, built a device that could apply a specific amount of torque or twisting force to a limb and then accurately measure angular movement in response. Conversely, a specific angular movement can be prescribed, and the resultant torque measured. The amount of torque required for the arm to move is a surrogate for joint stiffness.

“One of the most innovative aspects is that the whole device is fully automated,” Juan Villa, MD, a postdoctoral researcher. “Other research groups have measured torques and angles, but they have done so manually, moving the limb until they feel resistance. Our device is much more accurate and objective.”

After measuring the range of motion of the shoulder at baseline, the researchers induce frozen shoulder in the animal model by immobilizing the shoulder joint. Eight weeks later, they measure the range of motion again to see how much change has occurred.

Researchers anticipate that their research program will lead to an eventual treatment for frozen shoulder. “When you’re trying to get to the moon, you have to build a rocket first,” says Rodriguez. “The next step will be perfecting a drug treatment protocol under development in our lab that will likely change the way stiff joints, such as frozen shoulder and other forms of arthrofibroses, are treated.”
Faculty Activities

Megan Anderson, MD, Orthopaedic Oncology, authored the chapter on “Spine Tumors in the Young Athlete” in *Spinal Injuries and Conditions in the Young Athlete*, a 2014 book edited by Lyle Micheli, MD, and others, and published by Springer Publishing Company. Bridget Quinn, MD, Sports Medicine, contributed the book’s chapter on “Spine Injuries in the Aesthetic Athlete.”

Paul Appleton, MD, and Edward Rodriguez, MD, PhD, Orthopaedic Trauma Surgery, and others published “The primary determinants of radiation use during fixation of proximal femur fractures” in the October issue of *Injury*.

Paul Glazer, MD, Spine Center, and others published “Primary Extradural Tumors of the Spine—Case Review with Evidence-guided Management” in *Surgical Neurology International* in August.

Stefan Muzin, MD, Spine Center, presented “Occupational Low Back Pain Treatment Approaches” at General Electric’s Leading Edge Conference in June. The lecture was broadcast live to all GE medical clinic staff at locations across North America.

Ara Nazarian, DSc, Center for Advanced Orthopaedic Studies, and others published “Computed tomography-based rigidity analysis: a review of the approach in preclinical and clinical studies” in November in BoneKEy Reports, the journal of the International Bone and Mineral Society.

Tamara Rozental, MD, Hand, Wrist, and Elbow Surgery, and Shaun Patel, MD, and Shawn Anthony, MD, MBA, orthopaedic residents, and others published “Radiographic Scoring System to Evaluate Union of Distal Radius Fractures” in the August issue of the *Journal of Hand Surgery*.

Andrew P. White, MD, Spine Center, and others published “The influence of kyphosis correction surgery on pulmonary function and thoracic volume” in *Spine* in October.

Departmental Promotion

Edward K. Rodriguez, MD, PhD, Chief of Orthopaedic Trauma Surgery, has been named Senior Director of Clinical Services for the Department of Orthopaedic Surgery. In this leadership role, he will support superlative care and teamwork among departmental faculty and staff.

Clinician-Researcher Awarded NIH Grant

The National Institutes of Health has awarded a two-year grant to hand and upper extremity surgeon Tamara Rozental, MD, to study bone strength in patients with prior wrist and hip fractures, using a small, handheld device, known as an OsteoProbe. This new device, available for research use only, measures the ability of bone material to resist microindentations. Mary Bouxsein, PhD, Director of the Center for Advanced Orthopaedic Studies, will serve as her co-investigator.

The Orthopaedic Hand Fellowship Collaborative leaders — Drs. Charles Day (center) of BIDMC, Philip Blazar of Brigham and Women’s Hospital (left) and Chai Mudgal of Massachusetts General Hospital. (Not pictured is Dr. Charles Cassidy of Tufts Medical Center.)