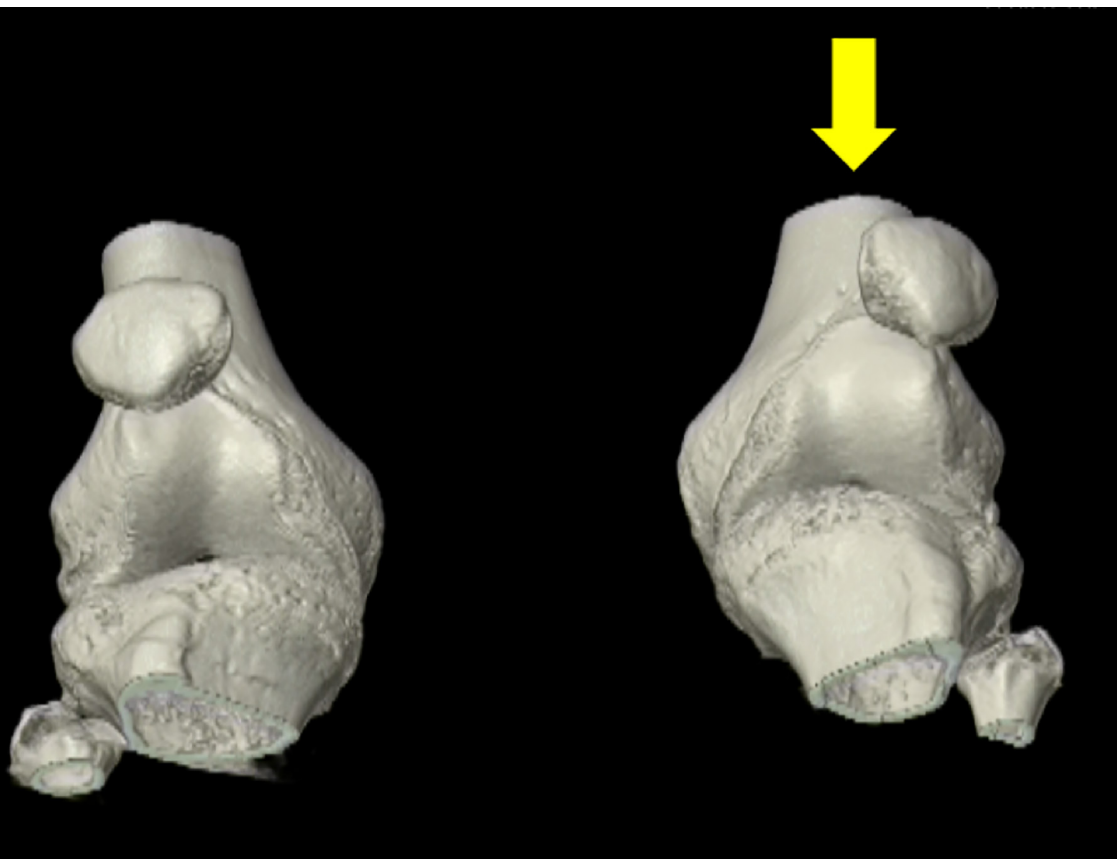


## Innovating Treatment for Recurrent Patellar Instability



**A**ndrew Cosgarea is contributing to a better understanding of patellar instability. Unlike other knee injuries that he treats — such as ACL tears, which tend to be similar in pathology — patellar instability cases “have a tremendous amount of variation from patient to patient,” says Cosgarea, an orthopaedic surgeon and professor of orthopaedic surgery. “Some patients with recurrent patellar instability have relatively normal anatomy, and others have clear anatomic abnormalities. Anatomic abnormalities and degrees of instability are all on a spectrum.”

While there are numerous operations for recurrent patellar instability — including medial patellofemoral ligament reconstruction and various types of osteotomy — Cosgarea says there is no consensus on any particular approach. With the wide range of anatomic and physiological factors that may cause instability, it is difficult to determine the most

effective, individualized treatment plan. “My research focuses on using advanced



“My research focuses on using advanced imaging to identify which factors predispose patients to dislocations and to simulate different surgical interventions.”

– Andrew Cosgarea

imaging to identify which factors predispose patients to dislocations and to simulate different surgical interventions,” Cosgarea says.

In collaboration with **Shadpour Demehri**, associate professor in the Department of Radiology and Radiological Science at Johns Hopkins; John Elias, senior research scientist at the Cleveland Clinic Akron General; and Miho Tanaka at Massachusetts General Hospital, Cosgarea uses a four-dimensional computed tomography (4DCT) scanner to create individual models of his patients’ knees. Unlike static imaging, 4DCT captures the bones in motion. Cosgarea then takes information from MRI, which shows the thickness of the cartilage, and overlays an image of the cartilage onto the bony 4DCT model. This creates a complete, computer-generated image of the joint.

Using this model, Cosgarea and team can simulate an intervention, such as surgery or physical therapy, and, through computational analysis, compare the pre- and post-intervention biomechanical and joint-reactive forces borne by the knee to determine whether a particular procedure achieves the desired clinical outcome. “We use the modeling

**A static image captured from a dynamic 4DCT scan demonstrates unilateral patella maltracking in a 19-year old patient who has a history of recurrent patella dislocations.**

to understand, at a biomechanical level, what the effect of an intervention is or would be and to study different types of interventions,” Cosgarea says. With an actual model, rather than a theoretical model, Cosgarea is able to understand the patient’s specific anatomy and more accurately predict postoperative outcomes. Over 100 patients have completed 4DCT modeling so far.

As imaging technology progresses, Cosgarea has a vision for future research. “We aim to create models that simulate actual, functional activities,” he says. “Our modeling is currently limited to a squat, for example, so we are trying to create more sophisticated modeling techniques to capture more complex motion.”

Cosgarea is excited to share his knowledge with the greater orthopaedic community. He explains, “Johns Hopkins is one of the few centers in the world with a dynamic 4DCT scanner. My job is to take this technology and then translate my findings into knowledge applicable to clinicians without access to 4DCT.” With the resources at Johns Hopkins, Cosgarea says, “We have the ability to assess all levels of complexity, from the most straightforward to the most severe cases.” ■

 To refer a patient, call **443-997-2663**.

# New Protocol Reduces Opioid Use by Up to Two-Thirds in Trauma Patients

For the past year and a half, orthopaedic trauma surgeon **Babar Shafiq** has implemented a pain alleviation protocol for trauma patients that has reduced opioid prescriptions by approximately two-thirds, and he plans to further reduce that number by half in an upcoming prospective study. “It has been very successful,” says Shafiq, who is also an assistant professor of orthopaedic surgery. “Before this protocol, many people were prescribed up to 120 pills on discharge, and now we are prescribing them 42. Patients are not dissatisfied, as some would expect.

We have also noticed that patients are not requesting refills as much as they used to, despite being given far less of these medications, because we have incorporated multimodal treatment.”

During the height of the opioid epidemic, Shafiq recognized the need for a standardized way to treat orthopaedic trauma patients, so he partnered with anesthesiologist Marie Hanna, director of Johns Hopkins’ Acute Pain Service and the Perioperative Pain Clinic, to create a new pain-alleviation protocol. Together, they developed what Shafiq describes as “a full complement

of effective pain alleviation strategies” that can be implemented easily by providers.

The pain alleviation protocol involves two pathways, one for opioid-naïve patients (patients without significant prior opioid history) and another for opioid-tolerant patients (patients with chronic opioid use and those with dependence on illicit opioids). These protocols involve preoperative multimodal treatment with acetaminophen, gabapentin, cryotherapy and elevation, as well as patient education. Intraoperatively, patients receive non-steroidal anti-inflammatory drugs, ketorolac (which is very effective for pain relief) and regional anesthesia. The treatment pathway for opioid-tolerant patients uses this multimodal approach but also incorporates acute pain services, ketamine and longer-acting nerve blocks. Postoperatively, patients receive the same multimodal regimen as preoperatively, with limited narcotics and an aggressive 10-day weaning schedule. “We give them prescriptions that will last two weeks, but I meet with each patient and explain that I really want them to stop these medications in three to seven days,” says Shafiq.

For opioid-tolerant patients, the Perioperative Pain Program led by the anesthesia department assists with long-term medication weaning, with the goal of returning patients to their baseline narcotic use or no narcotic use at all. “Patients are very happy with this program,” says Shafiq. “It helps provide opioid-tolerant patients with individualized pain alleviation strategies postoperatively when their pain was often under-alleviated before. Before the protocol, opioid-tolerant patients would be prescribed the same prescription as opioid-naïve patients, but they would use it all very rapidly. This was problematic, but we have a program for them now. We have a solution.”

Shafiq’s future research will focus on multi-center studies to help understand the ethical issues regarding pain alleviation in orthopaedics and to develop best practices that include medication-related and psychosocial treatment. Shafiq admits, “There is a psychological component to pain that we do not

*continued on pg. 4*

## PATHWAYS OF THE NEW PREOPERATIVE PAIN PROTOCOL

### OPIOID NAÏVE PATHWAY

#### Preoperative

- Acetaminophen
- Gabapentin
- Cryotherapy
- Elevation
- Education

#### Intraoperative

- Non-steroidal anti-inflammatory drugs
- Ketorolac
- Regional anesthesia

#### Postoperative

- Same treatment as preoperative plus limited narcotics and aggressive 10-day weaning

### OPIOID-TOLERANT PATHWAY

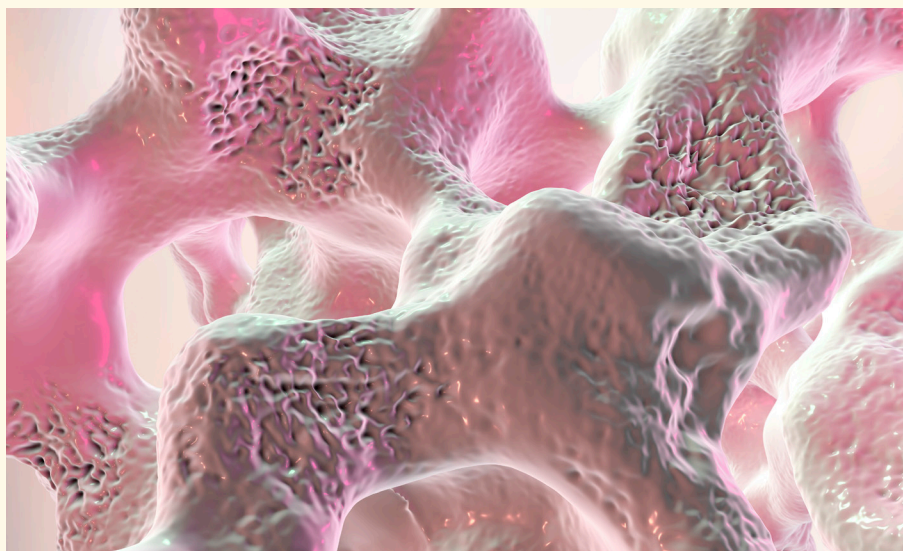
Acute pain services

Ketamine

Longer-acting nerve blocks

Long-term medication weaning

## HIGHLY SKILLED EXPERTISE



A Johns Hopkins clinician-researcher is studying how to maximize the benefit of steroids while minimizing damage to growing bone. Above, an image shows bone tissue affected by osteoporosis.

## Innovations for Children with Steroid-Induced Osteoporosis

As a pediatric endocrinologist in the Department of Orthopaedic Surgery, **Janet Crane** is well-equipped to deal with complex cases. “I often work with patients whose conditions are initially a giant question mark,” says Crane. “Primarily, I see kids with chronic illnesses who have secondary forms of osteoporosis. This may be a complication of an underlying disease or a medication-related complication.”

Many of Crane’s patients have steroid-induced osteoporosis, and approximately 1 in 6 have Duchenne muscular dystrophy. Although steroids can prolong life expectancy for patients with this disorder, they can also lead to bone loss, osteoporosis and fractures. Crane works with families to make the best treatment decisions for their children, weighing the benefits of steroid treatment against the adverse effects.

In addition to her clinical work, Crane conducts research using young mice with steroid-induced osteoporosis to learn how to maximize the benefit of steroids while minimizing damage to growing bone. “Mouse models usually



# Combining Two New Surgery Techniques to Improve Spine Outcomes

**A**mit Jain is on the forefront of spine surgery innovation as an early adopter of minimally invasive lateral access and robotic spine surgery, or MILARS. “This specific combination of technologies — lateral access and robotics — has the potential to change our field, to move the entire field of spine surgery forward,” says Jain, chief of minimally invasive spine surgery and assistant professor of orthopaedics and neurosurgery at Johns Hopkins. “This innovative technique can really provide significant benefits to our patients.” Jain is part of a team of Johns Hopkins surgeons, including **Jay Khanna, Khaled Kebaish, and Nick Theodore**, who are developing clinical and research protocols for this combination of procedures.

As opposed to traditional open spine surgery, which involves extensive muscle manipulation, MILARS uses a different approach. “Lateral access allows us to perform spine surgery in a way that is frequently muscle sparing, which has profound implications for recovery. You can substantially minimize blood loss and the duration of hospital stays because it is not as disruptive of the physiology of the body,” Jain says.

Lateral access spine surgery allows for indirect spinal decompression, which avoids the nerve irritation that may occur with direct manipulation. These aspects combined make the procedure more efficient in terms of operating room use. “You can accomplish a goal very quickly. For example, you can perform a lateral access surgery with robotic screw placement in less than an hour, as opposed to an open approach that

could take several hours,” Jain says.

MILARS relies on a state-of-the-art robotics navigation and guidance system, which was approved by the FDA in 2017. Surgeons can use the robot to guide pedicle screw placement. “It’s precision medicine,” Jain says. “With robotics you can, in a very accurate manner, instrument the spine, making the operation safer for the patient.”

The ideal patients for this combination of techniques are those with a focused problem in one, two or three spinal levels. Patients with spondylolisthesis, foraminal stenosis or lumbar spinal stenosis can benefit greatly from MILARS. Other indications include adjacent segment disease and degenerative scoliosis.

Jain also sees the potential for major savings in health care resources. “More than a quarter million

**“You can perform a lateral access surgery with robotic screw placement in less than an hour.”**

– Amit Jain



**The ideal patients for minimally invasive lateral access and robotic spine surgery are those with a focused problem in one, two or three spinal levels.**

lumbar fusions are performed in the country each year, and if perhaps a fifth of them can be performed with MILARS, the reductions in blood loss, morbidity, intensive care unit stays, and hospital stays would have a substantial impact,” Jain says.

Patients will appreciate the benefits, as well, he says. “Patients love having faster recovery, better outcomes, smaller scars and the ability to go home the next day instead of a week later.” For many patients, the difference in recovery time would make traveling to Johns Hopkins, even from far away, worthwhile. “We are among a handful of surgeons nationally that combine lateral access surgery with robotic spine operations. At Hopkins, we could provide a fundamentally different surgical experience with MILARS than that of the traditional method available at local community hospitals,” he says.

Jain has published over 130 peer-reviewed journal articles focused on improving outcomes of spine care. ■



Learn more about Amit Jain at [bit.ly/hopkinsjain](https://bit.ly/hopkinsjain).

focus on the adult skeleton, so there is a huge gap in knowledge about the effects of different steroid doses on a growing child’s skeleton,” Crane explains. To create a model for studying pediatric bone health, Crane and her team inject glucocorticoids daily into young mice of different ages and adjust the dosage based on their growth.

“To extrapolate mouse findings to humans, we have to ensure our mouse models mimic the complications seen clinically. We started working on the model four to five years ago,” Crane says. Basing the glucocorticoid dose on body size rather than weight has resulted in a model that demonstrates both growth impairment and osteoporosis. Her team has published a paper based on the model, and additional studies are ongoing. “The main questions we are now exploring are: What are the signaling molecules that are disrupted in the bone by the glucocorticoids, and how can we manipulate them with other medications? Should we continue to use the osteoporosis medications currently on the

market, or do we shift our focus to new drugs being developed?”

Crane is uniquely positioned to understand the needs of her patients. “As a pediatrician, I understand that this dose may need to be adjusted for disease control,” she says. “As an endocrinologist, I can interpret this dose relative to what the body should normally be making and I understand how a high dose of steroids can cause complications particularly on the skeleton.”

With NIH funding, Crane collects patient specimens to study bone cells and gene expression in

**“We are looking for a biomarker in the blood to predict risk of fracture in children taking steroids.”**

– Janet Crane

children for whom chronic steroid treatment leads to osteoporosis versus healthy children or those for whom the same treatment does not lead to fractures. “We are looking for a biomarker in the blood to predict risk of fracture in children taking steroids so we can use it as a way to make the diagnosis of osteoporosis earlier, prior to a fracture and to monitor response to treatment,” she explains.

Crane’s research is an example of how Johns Hopkins researchers target gaps in medical knowledge while addressing the needs of individual patients. “This is what Hopkins is,” says Crane. “Our specialized knowledge lets us develop the most personalized plan that makes the most scientific sense.” ■



Learn more about research in the Department of Orthopaedic Surgery in the Orthopaedic Surgery Archives: [bit.ly/hopkinsorthoresearch](https://bit.ly/hopkinsorthoresearch).

## New Protocol Reduces Opioid Use by Up to Two-Thirds in Trauma Patients

continued from pg. 2

manage well. Self-efficacy and pain catastrophizing are important concepts that can affect a patient's recovery. These are phenomena we are starting to understand better, and I am trying to incorporate these concepts in my treatment of patients." Most importantly, he says, "We listen to the patient. We strive to treat the person, not just the fracture." ■



Learn about the Johns Hopkins Perioperative Pain Clinic at [bit.ly/hopkinsperioperativepain](http://bit.ly/hopkinsperioperativepain).



## Download the Johns Hopkins Doctor Referral App

This new app provides a simple way for health care providers to connect with and refer patients to physicians across Johns Hopkins Medicine in the departments of orthopaedics, surgery, neurosurgery and urology. Registration required.

Visit [bit.ly/hopkinsapp](http://bit.ly/hopkinsapp)

## Your Vital Links

### Johns Hopkins Orthopaedic Surgery

Call 443-997-BONE (2663)

Visit [hopkinsortho.org](http://hopkinsortho.org)

### Hopkins Access Line (HAL)

Your 24/7 connection with Johns Hopkins faculty in any specialty

Call 410-955-9444 or

800-765-5447

### Online Referral Directory

Find a Johns Hopkins physician by name, specialty and more

Visit [hopkinsmedicine.org/doctors](http://hopkinsmedicine.org/doctors)

### Clinical Trials

Visit [trials.johnshopkins.edu](http://trials.johnshopkins.edu)

### CME Programs

Visit [hopkinscme.edu](http://hopkinscme.edu)

Call 410-955-2959

Email [cmenet@jhmi.edu](mailto:cmenet@jhmi.edu)

# JOHNS HOPKINS Orthopaedic Surgery

This newsletter is one of the many ways we seek to enhance our partnership with our thousands of referring physicians. Comments, questions and thoughts on topics you would like to see covered in upcoming issues are always welcome. Please email [lrademar@jhmi.edu](mailto:lrademar@jhmi.edu).

*Johns Hopkins Orthopaedic Surgery* is published by Johns Hopkins Medicine Marketing and Communications.

Johns Hopkins Medicine  
Department of Orthopaedic Surgery  
601 N. Caroline St.  
Baltimore, MD 21287

### Orthopaedic Surgery

James Ficke, M.D., *F.A.C.S., Director*

Lee Riley, III, M.D., *Executive Vice Chair*

Thomas Clemens, Ph.D., *Vice Chair for Research*

A. Jay Khanna, M.D., *Vice Chair for Professional Development*

Dawn LaPorte, M.D., *Vice Chair for Education*

Carol Morris, M.D., *Vice Chair for Clinical Operation*

Robert Sterling, M.D., *Vice Chair for Quality and Safety*

Colin Semper, *Chief Administrative Officer*

© 2020 The Johns Hopkins University and  
The Johns Hopkins Health System Corporation

### Marketing and Communications

Suzanne Sawyer, *Senior Vice President, Chief Marketing and Communications Officer*

Justin Kovalsky, *Editor*

Lisa Eddy, *Managing Editor*

Kerry Kennedy, Jenni Weems, *Writers*

Rachel Sweeney, *Designer*

Keith Weller, *Photographer*

For questions or comments, contact:

Lisa Eddy at [lrademar@jhmi.edu](mailto:lrademar@jhmi.edu)

or 443-287-2527.

Non-Profit Org  
U.S. Postage  
PAID  
Baltimore, MD  
Permit No. 5415



# JOHNS HOPKINS Orthopaedic Surgery

Spring 2020

Inside



1

**Innovating Treatment for Recurrent Patellar Instability**



2

**New Protocol Reduces Opioid Use by Up to Two-Thirds in Trauma Patients**



3

**Combining Two New Surgery Techniques to Improve Spine Outcomes**

