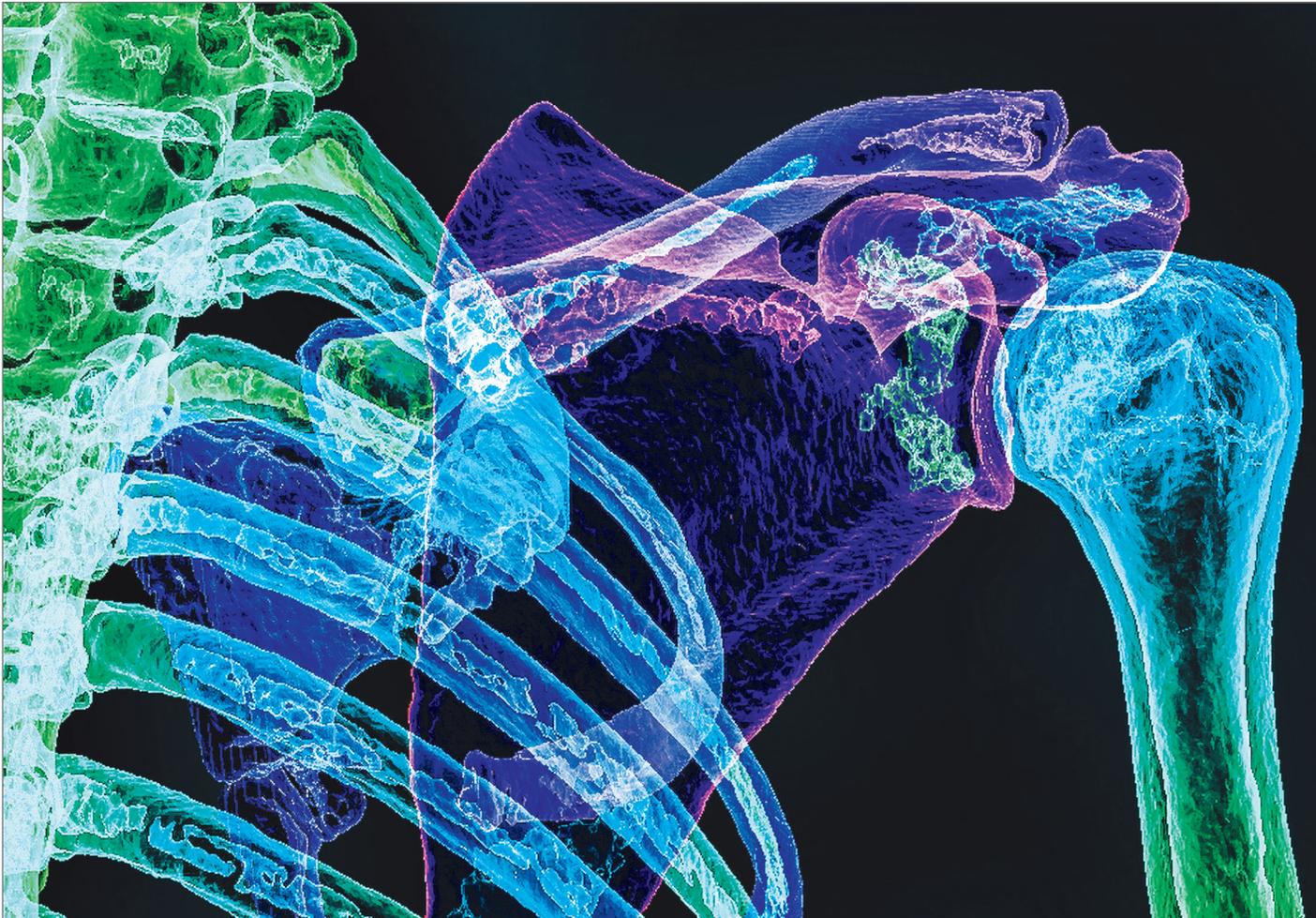




NewYork-Presbyterian Orthopedics

2019 Report on Clinical and Scientific Innovations



**Weill Cornell
Medicine**

**NewYork-
Presbyterian**



COLUMBIA



William N. Levine, MD
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 Department of Orthopedic Surgery
 Columbia University Irving Medical Center
Orthopedic Surgeon-in-Chief
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 Columbia University Irving Medical Center
Editor-in-Chief
Journal of the American Academy of
Orthopaedic Surgeons
President
 American Shoulder and Elbow Surgeons



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New York's #1 Hospital
19 Years in a Row

NewYork-Presbyterian Orthopedics 2019 Report on Clinical and Scientific Innovations

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Welcome

Dear Colleague:

We are pleased to bring you our *2019 Report on Clinical and Scientific Innovations in Orthopedics*. NewYork-Presbyterian – in collaboration with our distinguished medical schools, Columbia University Vagelos College of Physicians and Surgeons and Weill Cornell Medicine – continued to build on the strengths of our exceptional orthopedic services. We are particularly proud to note that we are ranked among the top orthopedics programs in the nation in both adult and pediatric care by *U.S. News & World Report*.

Our outstanding orthopedic surgeons are leaders in their respective specialties, providing nonoperative and surgical approaches for the treatment of complex disorders of the musculoskeletal system. They continue to advance the field of minimally invasive surgery with the development of innovative techniques and technologies that facilitate a return to function and mobility for our patients.

Top-tier clinical and basic researchers are at the forefront of rapidly changing biological and technological knowledge. They are committed to investigating the biomechanics of cells and tissues, the mechanical challenge of attaching tendon to bone, and the nervous system circuits that enable movement in health and limit movement after injury.

Our sports medicine specialists have extraordinary expertise in caring for athletes – be they elite professionals or weekend enthusiasts. NewYork-Presbyterian serves as the official hospital for the New York Yankees and the New York City Football Club, for which our orthopedic surgeons are head team physicians. Our faculty also serve as consultants and in leadership roles for major sports organizations, including Major League Baseball Team Physicians Association, National Basketball Association, National Football League, and National Hockey League, among others.

We are delighted to note that communities in Westchester County are also benefitting from our wide-ranging expertise, including the establishment of the NewYork-Presbyterian Sports Performance Institute in Scarsdale, New York. It brings together sports medicine, orthopedic surgery, rehabilitation medicine, physical therapy, and sports performance training to provide comprehensive and collaborative care for adolescent and adult athletes of various skill levels.

Sincerely,



Steven J. Corwin, MD
President and
Chief Executive Officer
NewYork-Presbyterian



Lee Goldman, MD
Dean of the Faculties of
Health Sciences and Medicine
and Chief Executive
Columbia University
Irving Medical Center



Augustine M.K. Choi, MD
Stephen and Suzanne Weiss Dean
Weill Cornell Medicine



Dr. Steven J. Corwin



Dr. Lee Goldman



Dr. Augustine M.K. Choi

Measures of Distinction

Clinical Care

84

Orthopedic Surgeons

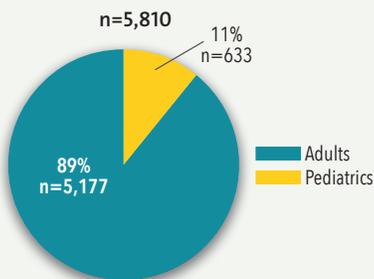
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Primary Care Sports Physicians

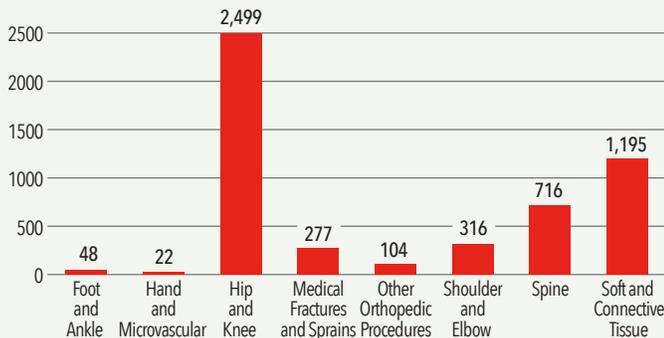
11,981

Ambulatory Surgery Procedures

2018 Inpatient Volume



Inpatient Adult Orthopedic Procedures



Clinical care data includes volume at NewYork-Presbyterian/Columbia University Irving Medical Center, NewYork-Presbyterian Allen Hospital, NewYork-Presbyterian Lawrence Hospital, NewYork-Presbyterian Morgan Stanley Children's Hospital, NewYork-Presbyterian/Weill Cornell Medical Center, and NewYork-Presbyterian Lower Manhattan Hospital.

Research

>\$6 million

received from the National Institutes of Health and other organizations supporting research by orthopedic faculty at Columbia for the academic year, July 2018 to June 2019.

Graduate Medical Education

NewYork-Presbyterian/
Columbia University Irving Medical Center

31 residents

in the orthopedic surgery residency program, including 1 resident in a six-year research track

In 2018, **50%** of the incoming and outgoing residency classes, 2023 and 2018 respectively, were women.

10 fellows

in fellowship programs in:

- Advanced Pediatric Spinal Deformity
- Comprehensive Spine
- Hand and Upper Extremity
- Adult Hip and Knee Reconstruction
- Pediatric Orthopedics
- Shoulder and Elbow
- Sports Medicine

Innovations at a Glance

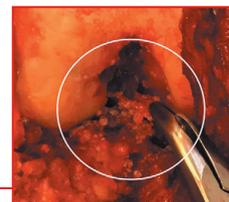
Foot and Ankle Conducted a study, published in the *Journal of the American Academy of Orthopaedic Surgeons, Global Research & Reviews*, that determined the uninjured leg could be used to establish ankle fitness after injury in the absence of baseline testing and despite wide ranges of normal performance. When assessing performance with the side hopping test or other function tests, normal function is restored when the injured leg reaches 90 percent of the ability of the uninjured side.

Hand and Upper Extremity In collaboration with bioengineers in the Columbia Biomedical Technology Accelerator, developed an implantable osteochondral allograft custom-bent to resurface the trapezial side of the basal joint that can be delivered ready for transplantation to the surgeon.



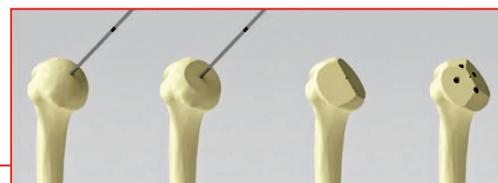
Hip and Knee Reconstruction Demonstrated that adductor canal block (ACB) alone is an inferior method to periarticular anesthetic injections (PAI) for pain management in total knee arthroplasty, with no significant differences noted in pain control between PAI alone and ACB plus PAI. Results were published in *The Journal of Bone and Joint Surgery*.

Orthopedic Oncology Described intra-articular conditions and findings to facilitate a differential diagnosis of common neoplasms and determine when a referral to an orthopedic oncologist is indicated in order to consider a diagnosis of a malignant condition or an aggressive benign process and subsequent evaluation and treatment. Published in *The Journal of Bone and Joint Surgery*.



Pediatric Orthopedics Led the development of best practice guidelines for nonoperative treatment of adolescent idiopathic scoliosis, including hosting a Best Practice Guidelines meeting with 38 international experts at the 2019 Society on Scoliosis Orthopaedic and Rehabilitation Treatment Conference.

Shoulder, Elbow and Sports Medicine Demonstrated that a canal-sparing total shoulder arthroplasty system that uses multiplanar osteotomy restores proximal humeral anatomy with improved accuracy and precision compared to a stemmed arthroplasty system. Results were published in the *Journal of Shoulder and Elbow Arthroplasty*.



Spine Developed best practice guidelines on wrong level surgery in spinal deformity. Published in *Spine Deformity*, the guidelines are based on the consensus of 16 fellowship-trained spine surgeons and serve to reduce the variability in preoperative and intraoperative practices.

Addressing Physician Health and Well-Being

According to the American Psychiatric Association, 300 to 400 doctors commit suicide each year in the United States, more than double the general population. “Something has happened in medicine that has caused disillusionment and disengagement, whether it’s because of pressure from industry, trying to meet standards that might not match clinical experience, or case volumes that are too high. There are innumerable reasons for burnout,” says **Thomas S. Bottiglieri, DO**, primary care sports medicine specialist and Director of Wellness for Orthopedics. In this new position, Dr. Bottiglieri serves on a task force that includes **Jenny Castillo, MD**, Emergency Medicine, and **Lourival Baptista-Neto, MD**, Psychiatry, to identify resources to aid clinicians who may be at risk. “We are now establishing a Council of Wellness within orthopedics with representatives from each specialty,” says Dr. Bottiglieri. “Our goal is to find ways to communicate with all the stakeholders – administrators, physicians, surgeons, medical support staff – to identify obstacles and strategize ways to minimize the stress of physician life. Wellness and maintaining a life balance are critical.”



Dr. Thomas S. Bottiglieri

Quality and Patient Safety

Optimizing Outcomes in Orthopedic Surgery



Abby Morris, MHA, Quality Officer, and Dr. Michael G. Vitale, Vice Chair of Quality and Strategy

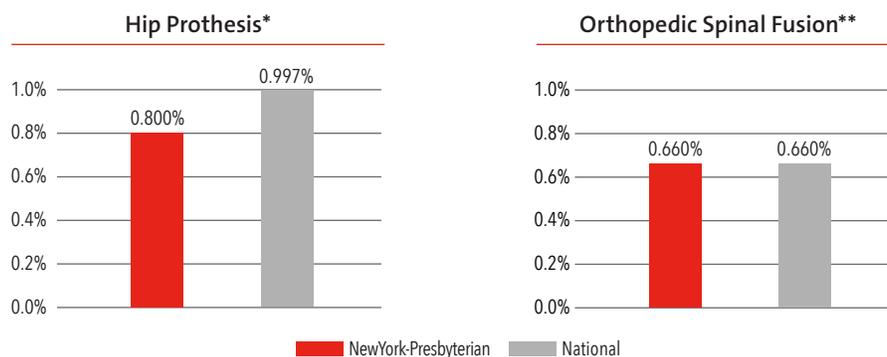
The Department of Orthopedic Surgery at NewYork-Presbyterian/Columbia University Irving Medical Center continued to implement initiatives to improve quality, safety, and the overall patient experience across adult and pediatric orthopedic subspecialties under the direction of **Michael G. Vitale, MD, MPH**, Vice Chair of Quality and Strategy and also Chief of Pediatric Spine and Scoliosis Surgery. “This year, we emphasized our work in the area of total joint replacement, the largest cost of healthcare in orthopedic surgery,” says Dr. Vitale. “We do a large number of joint replacements and the question is how to deliver

the very best outcome to that patient, not only surgically, but also across the whole episode of care.”

According to Dr. Vitale, it’s not unusual for patients requiring joint replacement to have high blood pressure, diabetes, or a medical history of other problems. “We’ve created a quantitative risk severity score that takes into account medical problems that can result from surgery, such as an infection or deep venous thrombosis. This allows us to address risks preoperatively and prepare for the full cycle of care – whether adding more surgeons or specialists in the OR, or planning for additional postoperative time in the ICU with more intense medical management.”

Dr. Vitale and his colleagues also piloted a preoperative multidisciplinary indications conference in pediatric orthopedics. “If you spend a little more time planning for any possible complication, outcomes can improve,” he says. “In our first conference in pediatric orthopedics, we brought in pediatricians, anesthesiologists, and other specialists who might be involved in the patient’s care. This gives us an opportunity to talk about the patient, to show X-ray review panels, and allow those present to share various options or express concerns. Having a diversity of opinion in the room often allows us to understand perspectives that a surgeon alone wouldn’t consider. We’re now extending the conferences to other specialties, including adult spine and total joint replacement. Our goal is to implement similar initiatives for every area of orthopedics.”

2018 Surgical Site Infection Rates



Source: National Healthcare Safety Network/Department of Infection Prevention and Control

*Data: Reflects data compiled from NewYork-Presbyterian/Columbia University Irving Medical Center, NewYork-Presbyterian Allen Hospital, NewYork-Presbyterian Lawrence Hospital, NewYork-Presbyterian/Weill Cornell Medical Center, and NewYork-Presbyterian Lower Manhattan Hospital

**Data: Reflects data compiled from NewYork-Presbyterian/Columbia University Irving Medical Center and NewYork-Presbyterian Allen Hospital

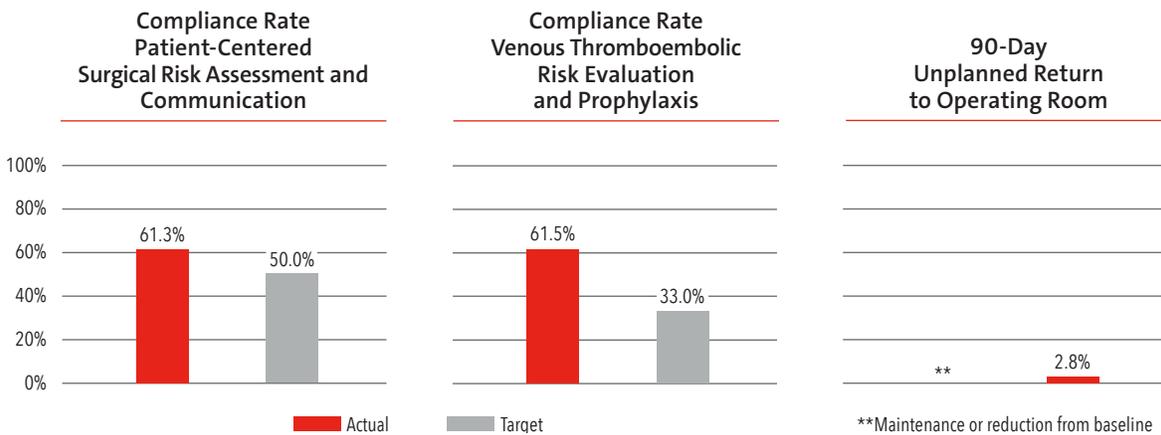
Collaborating with Insurance Companies

In partnership with several insurance companies, the Department of Orthopedic Surgery has further developed pay-for-performance programs, which outline routine processes and protocols and risk severity scores to better identify patients at highest risk for surgical complications.

“These partnerships provide us with the opportunity to develop a process where we routinely use and act on risk severity scores,” says Dr. Vitale. “From the patients’ point of view, it’s a home run because by understanding the

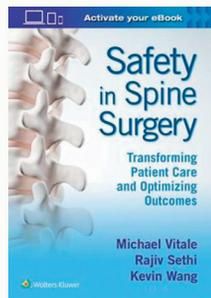
risks more quantitatively, we are able to deliver better outcomes. From the physicians’ point of view, while more work is necessary upfront because patient workups and preoperative preparation are more involved, the result is that we can achieve much lower rates of complications following total joint replacement surgery. And the insurance companies recognize that the patient doesn’t get a DVT or an infection, so it saves them a lot of money in the long run. Healthcare is going in the direction of having a better understanding of and incorporating a value equation.”

United Healthcare Pay-for-Performance Measures Year 1 – Joint Replacement, Adult Spine, and Pediatric Spine



Sharing Expertise to Improve Spine Safety and Outcomes

Dr. Michael Vitale has been a thought leader in quality and patient safety initiatives in orthopedic surgery for more than a decade. For the last four years, he has chaired the Annual Safety in Spine Surgery Summit drawing spine surgeons, spine team members, and patient safety leaders from around the country. Most recently he has authored *Safety in Spine Surgery: Transforming Patient Care and Optimizing Outcome*, a major resource for spine surgeons and other healthcare professionals in the field.



Women in Orthopedics

Changing the Gender Landscape

Despite the increasing number of women entering medical and graduate school, women make up only 6.1 percent of fully accredited practicing orthopedic surgeons in the U.S., a statistic that compelled **William N. Levine, MD**, Orthopedic Surgeon-in-Chief, to change that paradigm within Columbia's Department of Orthopedic Surgery. Since becoming Chair five years ago, Dr. Levine has continued to increase the number of women faculty and the number of women entering Columbia's orthopedic residency and fellowship programs. "Slowly but surely our department is approaching the statistics of medical schools where women number 52 percent. We're at about 30 percent now," he says.

"I grew up in a family with very strong women," notes Dr. Levine. "My mother was a Supreme Court judge, the first in the state of North Dakota. My two sisters were very successful – one in medicine and one in business. I am also married to a Brooklyn Supreme Court judge and our oldest daughter is applying to medical school right now. This is what has informed my perspective and personal view of the workplace."

"When I became Chair, there was a huge push to increase diversity in orthopedics, not just females, but under-represented minorities as well," continues Dr. Levine, who notes his goal was not to hire women per se, but to seek the "best and the brightest people" and if he had the opportunity to hire outstanding women, he would do so.

Dr. Levine attributes part of the gender disparity in orthopedics to the lack of female role models. "We've always been known as having a women friendly program despite not having many female faculty," he says. "But when it came time to mentoring our young women residents from a female perspective, we really couldn't do that. So, I asked Dr. Beth Shubin Stein, a Columbia orthopedics alumna who serves on the sports medicine faculty of Hospital for Special Surgery, if she would serve as a de facto mentor...providing women residents with someone to talk to about the unique qualities of being a female in a male-dominated surgical specialty. Today we have all of the mentorship internally, which was our goal."

In other efforts to increase the pool of women who might be interested in pursuing a career in the field, the department has partnered with The Perry Initiative to host outreach programs for female high school students and medical

students. The Perry Initiative, named for Dr. Jacquelin Perry, who was among the first women orthopedic surgeons in the country, is committed to inspiring young women to be leaders in orthopedic surgery and other science, technology, engineering, and mathematics fields. **Dr. Christen Russo**, pediatric orthopedic surgeon at NewYork-Presbyterian Brooklyn Methodist Hospital, has been instrumental in bringing The Perry Initiative to NewYork-Presbyterian/Columbia. The department also promotes professional development of women in orthopedics through the Ruth Jackson Orthopaedic Society.

"We've had a long, strong history of influential women in our department, including **Dr. Laura Forese**, an alumna of our training program, who is now Executive Vice President and Chief Operating Officer of NewYork-Presbyterian," says Dr. Levine.



"I do think that it's important for women to look for residency programs like Columbia that have proven track records in supporting and promoting female physicians."

– Dr. Laura Forese

"I was one of the first women accepted into the orthopedic residency program," says Dr. Forese. "There were very few women in the field. It was a very competitive atmosphere and, at the time, I would say that the challenge is part of what attracted me. My peers were excellent, and I was treated very respectfully as a woman in the program."

Dr. Forese also was the first woman in the program to have a child during training. "The program had never had any mothers. Fortunately, when I told my Chair I was pregnant, he said, 'OK, we'll figure it out.' I actually got a maternity leave, which was anything but standard at the time since no one had done it before. This is still a conversation going on today in and outside of orthopedics about making



(Front row, from left) Jamie E. Confino, MD, PGY-1, Lauren H. Redler, MD, Christen M. Russo, MD, Nadeen O. Chahine, PhD, Natasha N. Desai, MD, Margaret L. White, MD (2019 graduate), Stephanie S. Shim, MD (2019 graduate); (back row, from left) Josephine R. Cury, MD, PGY-1, Morgan A. Busko, MD, Lynn Ann Forrester, MD, PGY-1, Elise C. Bixby, MD, PGY-3, Suzanne Roberts, MD, Elizabeth R. Dennis, MD, MS, PGY-5, Liana J. Tedesco, MD, PGY-2, Danica D. Vance, MD (2019 graduate), and Wakenda K. Tyler, MD, MPH. Not pictured: Nicole S. Belkin, MD

medical specialties more friendly to women who are of childbearing age. This is a big issue for women.”

While the number of women in medicine is now on par with men, Dr. Forese notes that the number of women in leadership roles has not kept pace. “I would like to see more women serving in leadership roles in orthopedics and in all of medicine. This can be achieved by helping to sponsor women for leadership roles, through promotions, and by making sure that we are encouraging women to pursue positions of increasing responsibility.”

Dr. Forese offers advice to young women who are considering entering orthopedics today. “It’s a great field and extremely rewarding, but I do think that it’s important for women to look for residency programs like Columbia that have proven track records in supporting and promoting female physicians and where you can envision yourself being successful.”

“Dr. Levine has made a huge effort in recruiting women over the last few years. He’s been wonderful about giving women equal opportunities,” says **Morgan A. Busko, MD**, a primary care physician in shoulder, elbow, and sports medicine. “We all feel extremely valued and welcomed. The department has also increased the number of female residents, which I think is immensely important. There’s great camaraderie among the women in the department knowing that we are fully supported and that others want us there.”

“Women who choose orthopedics were either an athlete themselves, had their own injury and experience with orthopedic surgeons as a patient, or somebody in their family is an orthopedic surgeon. I answer yes to all three,” says **Lauren H. Redler, MD**, an orthopedic surgeon specializing in adult and pediatric sports medicine. “I had early exposure to the field, which is why I believe programs like The Perry Initiative are so important. Young women otherwise wouldn’t know that orthopedics is a possibility for them.”

“I’ve been very fortunate because Dr. Lauren Redler has been a mentor to me since day one,” says **Elizabeth R. Dennis, MD, MS**, a PGY-5 resident. “She has guided and helped me throughout medical school and residency. I think we will all feel elated when the distinction of being a woman or an underrepresented minority in orthopedics is synonymous with simply being an orthopedic surgeon. That’s one of the reasons I am serving on a diversity work group for the American Academy of Orthopaedic Surgeons, which is helping to raise awareness amongst members about all of the different types of people who make up and contribute to our community of orthopedic surgeons.”

“We have to acknowledge that the generation before us took the first step that we’re now following, and that will help us to make it a bit easier for the next generation.”

— Dr. Wakenda K. Tyler

“I recently spoke to someone at a professional meeting who was surprised that I am an orthopedic surgical oncologist,” says **Wakenda K. Tyler, MD, MPH**, Chief of Orthopedic Oncology. “He asked if I felt I was physically capable of working in this field. I told him, ‘Orthopedics is not about brawn. It’s about brain, and if you’re using your brawn to get something done, you’re probably doing it wrong.’ He stepped back and said, ‘You’re right.’ So, I think we’ve got a way to go before women are seen as equal to men, but we’ve made strides in the last 15 to 20 years. Every generation is a step in the right direction. We have to acknowledge that the generation before us took the first step that we’re now following, and that will help us to make it a bit easier for the next generation.”

Anterior Hip Replacement

Refining Tools and Techniques to Enhance Outcomes



Dr. Jakub Tatka, Dr. Jeffrey A. Geller, Dr. H. John Cooper, Dr. Alexander L. Neuwirth, Dr. Thomas R. Hickernell, and Dr. Roshan P. Shah

“Anterior hip replacements are gaining in popularity every year and now make up over 40 percent of the total hip procedures done in the U.S.,” says **H. John Cooper, MD**. “There are two variations on the anterior approach – the direct anterior approach and the mini antero-lateral Watson-Jones approach. Both approaches are much less invasive than the posterior approach and significantly less disruptive to muscle. And they are associated with the same benefits, including a lower risk of dislocation.”

“Here at Columbia, our surgeons perform both anterior approaches in about equal number,” adds **Roshan P. Shah, MD, JD**, Director of Complex Adult Hip and Knee Reconstruction. “This enables us to

excel in both and compare the two approaches to study their outcomes.”

“Anterior hip replacement has been a revolution in hip surgery, making the recovery so much faster, easier, and less worrisome,” says **Jeffrey A. Geller, MD**, Chief of Hip and Knee Reconstruction at NewYork-Presbyterian/Columbia, whose team of orthopedic surgeons performs the minimally invasive approach virtually 100 percent of the time. “Although both the posterior and anterior approaches have similar outcomes a year out, dramatically improving recovery in the first few months after surgery is a great benefit. Ours is the only hospital in New York where all of our surgeons are skilled in the anterior approach; that’s all we do.”

Traditional hip replacement surgery involves making an incision on the lateral or posterior side of the hip and cutting several different muscles and tendons off of the bone in order to replace the joint. These muscles and tendons then get repaired, but the best studies show that they never again look or act normal. Consequently, this may increase the risk of hip dislocation, one of the leading causes of revision hip replacements. Anterior hip replacement involves a three- to four-inch incision on the front of the hip that allows the joint to be replaced by moving muscles aside without detaching any tendons. Because the tendons and muscles are not detached, patients can return to normal daily activities much quicker after surgery and take fewer pain medications.

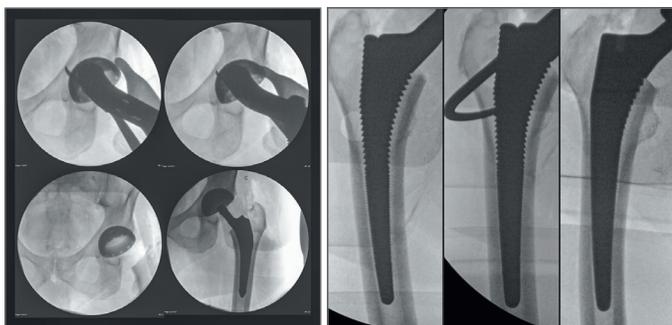
Optimizing the Anterior Approach

“The anterior approach is driving innovation, including the development of new devices that facilitate implantation with greater accuracy and a decreased risk of perioperative complications, such as fracture and stem subsidence,” says **Jakub Tatka, MD**. “We have gained such a high understanding of this approach that we are even doing revision surgeries of failed posterior replacements this way.”

“There are emerging technologies, some of which we are using, that incorporate intraoperative images and special algorithms to tell you the exact position of your implants and whether or not you need to alter them intraoperatively,” says **Alexander L. Neuwirth, MD**. “Making sure the components are in the right place is absolutely critical in hip replacement surgery to ensure proper postoperative function. You can also measure leg lengths with much more accuracy before you leave the OR. With the traditional posterior approach, the only way to assess leg length was through palpation of the knees and ankles, which is far less precise than using a combination of intraoperative physical exam and the use of fluoroscopic images.”

“The use of fluoroscopic-guidance imaging during surgery is a boon in evaluating bone preparation, achieving better intraoperative assessment of cup placement, and accurately measuring leg length within millimeters,” says Dr. Geller. “The surgeon can leave the operating room with the confidence that the components are perfectly aligned and sized, thus ensuring a better outcome.”

“Having the patient supine on the operating table facilitates the use of intraoperative fluoroscopy,” says **Thomas R. Hickernell, MD**. “This enables us to position the implants exactly where we planned.”



Intraoperative fluoroscopy: (left) assessing acetabular component positioning; (right) optimizing femoral sizing and filling of the femoral canal

The surgeons at Columbia have performed the anterior approach for many years with excellent outcomes. “Our perioperative protocols are aimed at reducing complications, including the use of special dressings for patients who are obese or diabetic and more likely to develop wound healing problems,” says Dr. Cooper. “And our femoral complication rate or risk of fracture is essentially zero percent because we have found that certain stem designs worked better from the anterior approach.”

“We are very attuned to implant shape and design and matching the morphology of the implant with the specific anatomy and bone type of individual patients,” says Dr. Shah. “For osteoporotic bone that is at a higher risk of fracture, this might mean using bone cement, which is somewhat of a dying art in other parts of this country. Our main goal is to give patients a perfect reconstruction. This is the best way to ensure patients get-up-and-go faster, with less pain and less time away from their busy lives.”

Improving Pain Management

In a recent study published in the *Journal of Arthroplasty*, members of the Columbia arthroplasty team, in collaboration with the Department of Anesthesiology, showed in a cohort of 550 total joint patients that those given preemptive opioids immediately before surgery experienced more pain, consumed more postoperative opioids, and exhibited impaired early function as compared to those who were not given preemptive opioids. Differences in pain and function were more pronounced in patients undergoing total hip arthroplasty than those undergoing total knee arthroplasty.

“We also have streamlined our perioperative care protocol, both with spinal anesthesia and the use of blocks and preoperative pain control,” adds Dr. Cooper. “Our patients require minimal narcotics postoperatively, a significant change from only eight years ago when I was in training.”

“In addition,” notes Dr. Geller, “we are working with anesthesiologists to minimize the effects of anesthesia so that patients ambulate more quickly after surgery.” Adds Dr. Shah, “This is how we can send so many total hip and knee patients directly home a couple hours after surgery.”

“We are always trying to do more to improve pain control and early postoperative function, while reducing the use of opioids, which historically have been the mainstay of pain control in orthopedics in general,” says Dr. Hickernell. “The anterior approach is gaining in popularity because patients have read about it and they care that their recovery is going to be much easier and faster than with the posterior or lateral approach.”

“Patients request the procedure because they know that their friends who have had it are out of the hospital on the same day or next day as opposed to being hospitalized for a few days,” says Dr. Tatka. “They’re back to doing their activities within weeks instead of months.”

“Some 1,000 anterior hip replacements are performed each year at Columbia. Our high volume and experience bring important value to our patients.”

— Dr. Roshan P. Shah

Cerebral Palsy

Addressing Clinical and Scientific Challenges



Dr. Paulo R. Selber, Dr. Jason B. Carmel, Dr. David P. Roye, Jr., and Dr. Joshua Hyman

The Weinberg Family Cerebral Palsy Center at NewYork-Presbyterian/Columbia University Irving Medical Center serves as a comprehensive program for individuals of all ages with cerebral palsy and a source of important research. “This is the first lifespan center for people with childhood-onset neuromuscular disorders,” says **Joshua Hyman, MD**, Associate Director of the Weinberg Family Cerebral Palsy Center. “There are a number of places that treat children with cerebral palsy. There are very few centers that treat adults with cerebral palsy, and in this region, no other place treats both children and adults. That’s what makes us unique. As a pediatric orthopedic surgeon, my focus is on the treatment of children, but I am also very interested in what happens to my patients when they become adults.”

“Our physicians and scientists are leading the way in research to provide a better quality of life for people with CP,” says **David P. Roye, Jr., MD**, Co-Director of Pediatric Orthopedics and Executive Director of the Weinberg Center. “This research stems from clinical practice, with projects that extend from the laboratory to patient care. Our research team maintains the largest CP patient registry in North America, with over 1,000 patients enrolled, and have 15 years of data on over 4,000 patients. We have recently partnered with the CP Research Network to help make this a national resource. Through prospective data collection and retrospective analysis, the team continues to build this important research tool to expand our understanding of CP and related medical conditions in childhood and across the life span.”

Movement Recovery at its Source

Neurologist **Jason B. Carmel, MD, PhD**, is the Director of the Movement Recovery Laboratory in the Departments of Orthopedic Surgery and Neurology and Scientific Director of the Weinberg Family Cerebral Palsy Center. “Instead of trying to deal with the secondary complications of cerebral palsy – spastic muscles and misaligned joints – we are attacking the problem at its origin, in the brain,” says Dr. Carmel. “My work is about restoring the nervous system connections in order to improve movement.”

Dr. Carmel’s laboratory uses animal models to understand how the brain and spinal cord partner to produce movement. “We seek to understand how neural circuits are compromised by paralyzing injury and how to strengthen brain to spinal connections that are spared by injury,” continues Dr. Carmel. The laboratory uses electrical stimulation of the brain and spinal cord to strengthen movement instructions from the brain and sensory feedback from the spinal cord. Pairing brain and spinal cord stimulation “makes the animals walk better and allows them to better manipulate food when they are eating.”

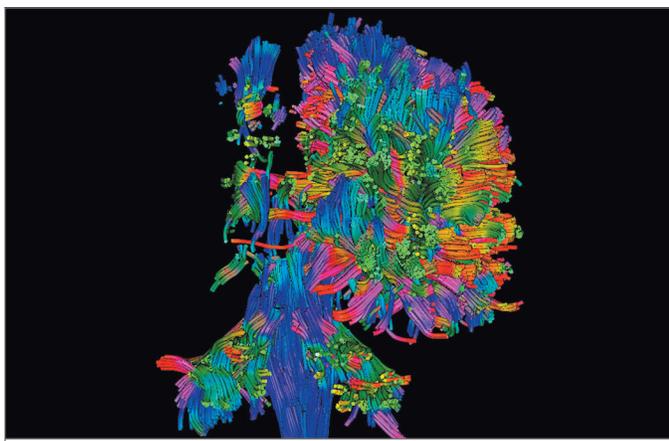
“We seek to understand how neural circuits are compromised by paralyzing injury and how to strengthen brain to spinal connections that are spared by injury.”

– Dr. Jason B. Carmel

Walking and hand use are two of the activities that people with CP want to recover most. “With this sort of promising intervention, we’ve begun to develop a logic for applying it to people,” says Dr. Carmel. Since brain and spinal cord stimulation are used safely and routinely in clinical practice, this strategy could be quickly moved to clinical trial. Emerging science from Dr. Carmel’s lab and other laboratories around the world is altering conventional thinking that says there is very little that can offer significant recovery for a patient with injury to the central nervous system.

Quantifying Gait Patterns

Supporting the work of both clinicians and researchers will be a new state-of-the-art gait analysis laboratory, being made possible by the recent recruitment of orthopedic surgeon **Paulo R. Selber, MD**, an international expert in neuromuscular diseases, who also has particular expertise in gait analysis. “Clinical gait analysis can provide objective identification of inefficient gait patterns to confirm a diagnosis and guide treatment selection,” says Dr. Selber, who serves as Co-Director of the Weinberg Family Cerebral Palsy Center. “It is also crucial for orthopedic surgeons to be able to validate functional outcomes following surgery.”



3-D diffusion tensor imaging scan of a rear view of the brain of a 23-year-old with cerebral palsy showing bundles of white matter nerve fibers, which transmit nerve signals between brain regions and between the brain and the spinal cord.

Gait analysis reveals the patient’s cadence, velocity, length of step, and swing time. Information gathered from motion analysis is provided in a series of graphs showing movement, muscle activity, and force production. “Gait analysis is quantitatively and qualitatively validated. However, the interpretations and how you’re going to treat the patient varies depending on who is reading the data,” says Dr. Selber, who has founded gait analysis labs in Brazil and Australia. “Our goal will be to gather motion analysis data for each patient pre- and postoperatively so that we can plan surgical interventions. Each person with CP has different deficits and outcomes will be different from person to person, so I developed a concept called surgical dosing. Gait analysis helps us determine the best surgical dose for each patient.”

Do Genetics Play a Role?

“We know that in the majority of children with CP, onset was intrauterine and prior to the birth process,” says Dr. Roye. “How much of what we call CP is genetic, how much is acquired injury, and how much might be related to other issues?”

The Weinberg Center is collaborating with **David Goldstein, PhD**, Director, Institute for Genomic Medicine, Columbia University, to study the genetic origins of cerebral palsy. “Over the last few years, studies have revealed that up to 30 percent of people with CP have an associated genetic abnormality,” says Dr. Roye. “Our research seeks to better understand the factors that cause CP and allow us to identify important genetic relationships.” The Weinberg Center’s physicians are now recruiting patients to participate in genetic testing to explore these relationships further.

“Studies have revealed that up to 30 percent of people with CP have an associated genetic abnormality.”

– Dr. David P. Roye, Jr.

“As we have become more sophisticated in our diagnosis, we recognize that the course of CP may differ depending on the cause,” adds Dr. Hyman. “If I suspect CP, I will always send the patients to neurology to get confirmation, and I’ll also send them to genetics. It’s not to determine the underlying genetic cause of their CP, at least it wasn’t, and maybe in the future it will be. Rather, it was to be certain that, in fact, they have CP and not some other underlying problem. I’m hopeful that with increasing genetic knowledge, we’ll be able to cater our treatment better to the patient. It’s on the horizon and we’re seeing developments every year.”



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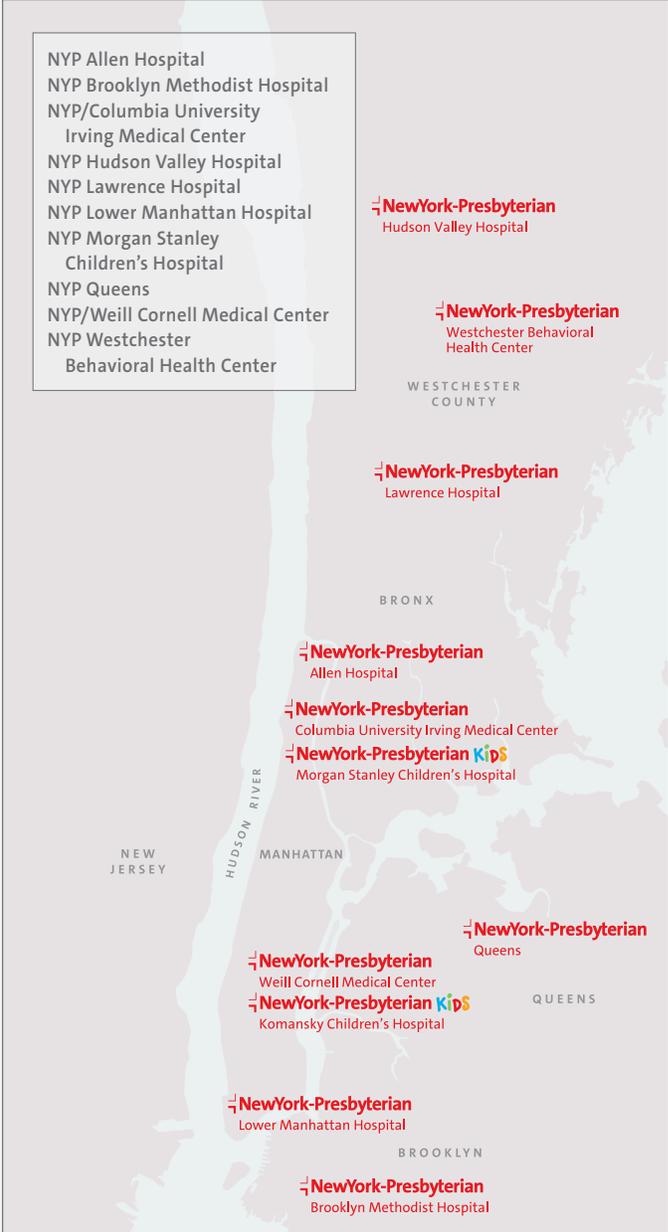
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