

Orthopaedic Update

Division of Pediatric Orthopaedics Stays Ahead of the Curve in Clinical Care, Education and Research

The 11 specialists in the Division of Pediatric Orthopaedics at Rainbow Babies & Children's Hospital see more than 11,500 cases annually, as well as 2,000 emergency room visits, and have one of the largest pediatric spine programs in the country. Those kinds of numbers help produce a steady flow of meaningful activity in clinical care, education and research.

"Our highly successful track record in treating a broad spectrum of pediatric orthopaedic problems, whether with minimally invasive surgery or other new therapies, has resulted in patients from around the globe seeking care here," says **George H. Thompson, MD**, Director of Pediatric Orthopaedics and Professor of Orthopaedic Surgery and Pediatrics.

"In turn, the growing patient load gives us the chance to broaden our experience and research to help even more

children. For example, we set the standard in Ohio for using the Ponseti technique for casting clubfoot, with an 85% to 90% correction rate."

Among the topics and techniques being investigated by physicians and research scientists in the Pediatric Orthopaedics Division at Rainbow Babies & Children's Hospital:

- Video-assisted thorascopic surgery (VATS), a minimally invasive surgical technique for spinal surgery that reduces pain, scarring and length of stay.
- Advanced techniques for spinal cord monitoring.
- Comprehensive blood conservation program (See back page, *No Complications to Date*).
- Pediatric orthopaedic arthroscopy to repair and diagnose knee disorders.
- Improved understanding of bone morphology.

Special areas of interest within the division include:

- ▼ **Trauma**
Pediatric Orthopaedics staff members are an integral part of Rainbow Babies & Children's Hospital Level 1 Trauma Center.
- ▼ **Neuromuscular disorders**
This program provides highly specialized comprehensive care for disease such as myelodysplasia, cerebral palsy, and muscular dystrophy and is respected as one of the best in the United States.
- ▼ **Scoliosis and spinal deformities**
Physicians in this program provide cutting-edge treatments including:
Implanting growing rods
The team employs a new technique to better control the spine in scoliosis in very young children. The rods can be lengthened every six months to allow more normal growth of the spine and lungs before spinal fusion is performed.



Pediatric orthopaedic surgeon and sports medicine specialist Allison Gilmore, MD, works with a 12-year-old patient with an ankle injury.

The Providence brace

This innovative brace successfully stops the progression of scoliosis, yet needs to be worn only at night.

▼ Sports medicine

Our physicians have a major commitment in the evaluation and care of the pediatric athlete. This includes both operative and non-operative therapies.

Contributions to Education

Division staff are represented on the editorial boards of many major orthopaedic publications including *The Journal of Bone*

and Joint Surgery, Clinical Orthopaedics and Related Research, Spine, and the Journal of Pediatric Orthopaedics. Dr. Thompson is co-editor of the latter, which is the official journal of the Pediatric Orthopaedic Society of North America, the European Paediatric Orthopaedic Society, the South American Pediatric Orthopaedic Society, and the Asia Pacific Pediatric Orthopaedic Society.

In addition, staff members hold numerous memberships and

See **Ahead**
Page 3

New Technique in Spinal Fusion for Scoliosis



Pre- and postsurgical radiographs of adolescent idiopathic scoliosis, treated by posterior spinal instrumentation and fusion using pedicle screws.

Jochen Son-Hing, MD, a recent addition to the pediatric orthopaedic team at Rainbow Babies & Children's Hospital, is studying innovative ways of using pedicle screws to reduce complications of scoliosis surgery.

Dr. Son-Hing, who joins spine deformity specialists **Drs. Douglas Armstrong** and **George H. Thompson** in the University Hospitals Case Medical Center Division of Pediatric Orthopaedics, is a specialist in scoliosis treatment, the use of pedicle screws in particular. He completed post-fellowship training with Lawrence Lenke, MD, Co-Chief of pediatric and adult spinal,

scoliosis and reconstructive surgery at Washington University School of Medicine in St. Louis.

Drawbacks to hook-and-rod constructs

Scoliosis, the most common spinal deformity in children, often requires at least one spinal fusion for successful treatment. Decades ago, Harrington rod constructs were the devices of choice for surgical intervention, but many children treated with these developed flat-back deformities. Additionally, many procedures to treat scoliosis require anterior approaches, which often result in decreased pulmonary

function or pulmonary complications later in life.

"Pedicule screws are already in use in certain scoliosis spinal fusions, and are known to greatly increase corrective power and provide stronger fixation," Dr. Son-Hing says. "They have a very low risk of being dislodged, and also offer the possibility of allowing a posterior-only approach. However, they are often used only in the lumbar spine to avoid potential neurological damage via screw penetration through the medial pedicle wall." Dr. Son-Hing's

See **Scoliosis**
Page 2



A Message from the Chairman

Dear Colleague,

In this issue of *Orthopaedic Update*, University Hospitals Case Medical Center's newsletter for physician colleagues across the country, we highlight the wide-ranging work of our Pediatric Orthopaedics Division. This exceptionally talented group of physicians and researchers is tackling some of the most difficult orthopaedic problems children and adolescents face – from deformities of the spine to trauma. The division's century-old reputation for state-of-the-art, quality care attracts patients from throughout our region and the United States.

While the efforts and innovations of our pediatric orthopaedic specialists at Rainbow Babies & Children's Hospital are enabling thousands of children to lead active and normal lives today, our researchers' work at the bench will help improve the quality of life for countless children in the future.

The fascinating new techniques and research projects our pediatric team is exploring are too numerous to feature in one issue of our newsletter. So we offer you this sampling:

- **Jochen Son-Hing, MD**, is helping to forge a path toward more effective and safer treatment of scoliosis, especially for the most severe cases, using newer instrumentation and techniques.
- In our laboratories at Case Western Reserve University, **Guang Zhou, PhD**, is engaged in exciting research that will help elucidate bone growth processes and their role in bone diseases affecting both children and adults.
- **George H. Thompson, MD**, describes a program that dramatically reduces blood loss during pediatric spine surgery, offering significant advantages for children undergoing this type of serious orthopaedic surgery. This groundbreaking blood conservation program has proven exceptionally successful, and is now being investigated for use in pediatric neurosurgical cases as well.

We hope you enjoy perusing *Orthopaedic Update*. I believe that it provides a snapshot of the breadth of innovative, high-quality care offered in the Department of Orthopaedics at University Hospitals Case Medical Center.

We welcome your comments, questions and suggestions. Feel free to contact us via e-mail or phone, or through our Professional Referral Services office, available to facilitate access to our adult and pediatric orthopaedic specialists. We appreciate the trust you place in us when you refer your patients here, and we pledge to provide them with the exceptional care they deserve.

Randall E. Marcus, MD
Chairman, Department of Orthopaedics
University Hospitals Case Medical Center
Charles H. Herndon Professor and Chairman,
Department of Orthopaedics
Case Western Reserve University School of Medicine

Case Study 17-Year-Old Benefits from Switch to Pedicle Screws

Seventeen-year-old Janie S. first developed Scheuermann's kyphosis with pain at age 10. When she came to the Pediatric Orthopaedic group at Rainbow Babies & Children's Hospital she had already had two unsuccessful surgeries to correct her 96° curvature, and a long, complex treatment history. She was in a great deal of pain and using methadone.

Over a two-year period after first being diagnosed, two back braces failed to halt the kyphosis. She then underwent a posterior spinal fusion using rods and hooks.

Initially the surgery seemed successful, but the hooks proved too weak to halt the progressing curvature of the spine. The hooks in the lumbar spine began to pull out and were eventually replaced with pedicle screws. Unfortunately, the kyphosis also continued to progress above the top of the thoracic fusion. Ultimately, a staphylococcus infection necessitated removal of all hardware, and she was converted to a torso cast.

"When Janie came to us in May 2005, we suspected pseudarthrosis," says pediatric orthopaedic surgeon **Jochen Son-Hing, MD**. "The correction that the previous surgeons had achieved still left her in a bent position. Her curvature was so severe; hooks can't grab all three columns of the spine."

Spinal osteotomies were performed with a posterior fusion with pedicle screws from T6-L3. "In this type of case, pedicle screws give much better control and correction than hooks," Dr. Son-Hing says, "and we are increasing our use in the thoracic spine as well as in the lumbar spine."

Janie is doing well, her curvature has been reduced to 51°, and she has gained about 5 inches of height. Much of her pain has subsided and she is being weaned off the methadone. "We are aiming for this to be Janie's last surgery," Dr. Son-Hing says.



FIGURE 1



FIGURE 2

Figure 1: Lateral view of the spine following T6-L3 pedicle screw instrumentation and fusion with T9-L2 Smith-Peterson osteotomies.

Figure 2: Posteroanterior view of same.

SCOLIOSIS

(continued from front cover)

current work includes using the screws along the entire spine rather than solely in the lumbar region. This approach is increasing in use.

Placing pedicle screws in the thoracic spine is technically demanding, but Dr. Son-Hing believes that this may be the best approach for many patients, allowing for more correction than with all-hook or hybrid (hooks on the thoracic spine, and pedicle screws at the bottom) constructs. Currently, many curves up to 90° in magnitude can be treated without an anterior approach.

Comparing instrumentation

Dr. Son-Hing, who earned his medical degree and did his residency at the University of British Columbia in Vancouver followed by a fellowship at Case Western Reserve University School of Medicine, is currently researching the differences between all-hook constructs, hybrid constructs, and all pedicle screw constructs. His study is a retrospective review of prospectively acquired data.



Jochen Son-Hing, MD

In another study, Dr. Son-Hing is examining the use of pedicle screws in children under age 10. Typically the screws have been used in patients who are older.

This study should be completed by the end of the year, and results will be presented at national meetings.

He is also involved in studies of video-assisted thoracoscopic surgery (VATS) for anterior spinal fusion. In addition to his work to improve surgical approaches for children with deformed spines, Dr. Son-Hing is investigating methods to reduce pain and speed recovery for children undergoing spinal

surgery. To that end, his group is using intrathecal morphine prior to surgery to reduce postoperative pain. This group is the first to focus on defining optimal dosages.

New techniques in pediatric femur fractures

Through Rainbow's Level 1 Trauma Center, Dr. Son-Hing also is involved in new ways to treat pediatric femur fracture in children who are older than 10 or who weigh more than 100 pounds.

"After age 10, or in a heavier child, rigid antegrade intramedullary nailing is possible, but there is risk of avascular necrosis, which, although rare, is devastating," Dr. Son-Hing says. "We are now using trochanteric entry rigid nailing to minimize that complication. We are also using minimally invasive percutaneous plate osteosynthesis, or MIPPO, for this older, larger patient population with good results."

For further information, or to discuss or refer a patient, please contact Dr. Son-Hing at 216.844.7200 or Jochen.Son-Hing@UHhospitals.org.



Case Orthopaedic Journal

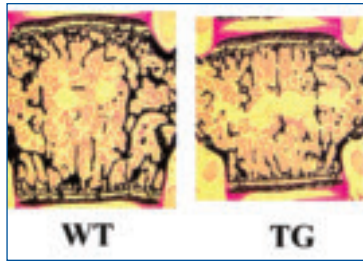
The *Case Orthopaedic Journal* showcases scientific and academic accomplishments of the faculty and residents in the Department of Orthopaedics at University Hospitals Case Medical Center and Case Western Reserve University. All three past issues of the journal – 2004, 2005 and 2006 – are available online at ortho.uhhs.com.

The 2007 issue is expected to be published within the next few months. Editor-in-chief for 2007 is Jerry Juang, MD, who completed his residency in June. Chief Resident Matt Smith, MD, is editor-in-chief for the 2008 issue.

To receive a copy of the *Case Orthopaedic Journal*, please call the department's Education Coordinator, Ellen Greenberger, at 216.844.3233.

Gene Research May Hold the Key to Improving Bone Formation Process

The RUNX2 gene, a central regulator of embryonic and postnatal skeletogenesis, is the focus of intense study by **Guang Zhou, PhD**, assistant professor of orthopaedics at Case Western Reserve University and University Hospitals Case Medical Center.



Von Kossa staining (black spots) of undecalcified vertebral sections of wild-type (WT) and transgenic (TG) mice reveals a severe osteopenic phenotype in the transgenic mice.

“Cleidocranial dysplasia is an autosomal dominant skeletal disease affecting all bones with the characteristic triad of delayed

closure of the fontanel, hypoplastic clavicles and dental anomalies. It is the result of dramatic genetic mutations in this RUNX2 gene,” says Dr. Zhou, who was at Baylor College of Medicine in Houston prior to joining the Orthopaedics Department in 2005. “However, RUNX2 mutations can present in many levels of severity. When it is mild, for example, patients can have short stature and be prone to osteoporosis.”

“One day we may have a way to regulate gene activity in humans to improve their bone health and healing.”

– Guang Zhou, PhD

Dr. Zhou describes RUNX2 as a hub through which the entire body’s bone formation activity passes. Regulating its activity is a crucial capability because numerous pathological conditions can occur when there is a dysregulation in the constant rebuilding process bone requires. “Genetically engineered mouse models have greatly facilitated our understanding of the molecular and genetic basis of skeletal dysplasias,” he notes.

Dr. Zhou has created a novel mouse model with RUNX2 activity down-regulated in osteoblasts. These transgenic mice display low bone mass and brittle bones. He has also observed that stem cell activity is altered in the mutant mice.

“Their stem cells become fat cells much more easily, instead of becoming bone cells. We believe this is due to the genetic changes they have undergone. It is something we plan to study further,” he adds.

“Our model is essential to understanding the biomechanical integrity of bone and bone regeneration in osteoporosis patients,” he continues.

Also in the course of his research, Dr. Zhou has identified a novel RUNX2-interacting protein (RIP). When it is deleted in mice, they develop lethal chondrodysplasia; their cartilage is defective and the mice

are born small and weak. They die shortly after birth due to respiratory difficulty. These experiments have shown that RIP is crucial for cartilage formation. Dr. Zhou plans further investigation of contributions of RIP to chondrogenesis.

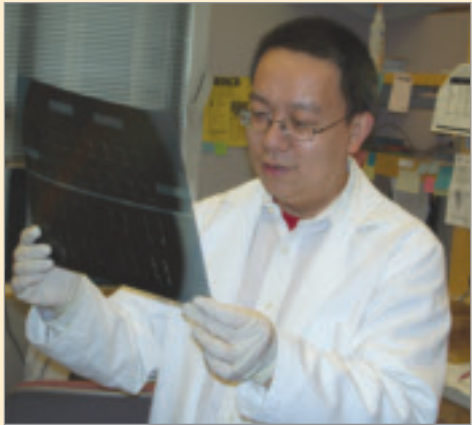
Dr. Zhou, whose research is primarily funded through National Institutes of Health grants (National Institute of Dental and Craniofacial Research) and the UH Department of Orthopaedics, says that while his team’s work is still in the basic research phase, it has enormous potential to impact future clinical understanding of bone healing processes and osteoporosis and pathophysiology of chondrodysplasias.

Ongoing collaboration between clinicians and basic science researchers is crucial to producing such advances. Dr. Zhou’s department at CWRU encourages such collaborations, with the full support of University Hospitals’ Department of Orthopaedics Chairman **Randall Marcus, MD**, and under the leadership of **Edward Greenfield, PhD**, professor and director of research, Department of Orthopaedics.

“We have a long tradition of including basic science in the Department of Orthopaedics. Working together helps us to apply our findings to everyday use as soon as possible,” Dr. Zhou concludes.

Dr. Zhou and colleagues are investigating regulation of bone formation, bone remodeling and bone tumorigenesis. Their research approaches include the use of novel mouse models, cell culture and molecular biology. Ongoing areas of research and specific projects include:

Ongoing Work in Dr. Zhou’s Laboratory



Guang Zhou, PhD

Dr. Zhou and colleagues are investigating regulation of bone formation, bone remodeling and bone tumorigenesis. Their research approaches include the use of novel mouse models, cell culture and molecular biology. Ongoing areas of research and specific projects include:

- ⌘ **Osteoporosis**
- ⌘ **Bone biomechanical integrity**
(a collaboration with **Christopher J. Hernandez, PhD**, director, Musculoskeletal Mechanics and Materials Laboratory; assistant professor, Department of Mechanical and Aerospace Engineering, Case Western Reserve University)
- ⌘ **Bone regeneration in a fracture repair model**
- ⌘ **Mesenchymal stem cell lineage differentiation**
- ⌘ **Lethal chondrodysplasia**
- ⌘ **Chondrocyte differentiation, proliferation, apoptosis**
- ⌘ **Bone tumorigenesis**
- ⌘ **Expressions of candidate oncogenes in a human osteosarcoma**
- ⌘ **Development of a novel mouse model (gain and loss of function) for osteosarcoma**

Contact Dr. Zhou at 216.368.2260 or Guang.Zhou@case.edu.

AHEAD *(continued from cover)*

offices in national and international organizations, such as The American Board of Orthopaedic Surgery, the American Academy of Orthopaedic Surgeons, The Pediatric Orthopaedic Society of North America and the Scoliosis Research Society. Dr. Thompson is currently the president of the Scoliosis Research Society.



George H. Thompson, MD

“Our pediatric orthopaedic fellowship program is one of the most selective in the country, and it provides an educational environment that fosters excellence in scholarship, teaching, and research creativity as well as the development of analytic skills, surgical judgment, and surgical competence,” Dr. Thompson says.

Clinical Trials Under Way

Not surprisingly, the division is a hotbed of research. Current research is focusing on:

- Fusion rates following thoracoscopic release and bone graft substitutes in idiopathic scoliosis.
- Pediatric cervical spine clearance following trauma.
- Radiographic analysis of the cervical spine.
- Classification and treatment

- of osteochondritis desiccans (OCD) lesions.
- Identification of stress fracture risk factors in female college dance majors.
- The role of medications in decreasing blood loss during spinal fusions.



Pediatric Orthopaedics

Rainbow Babies & Children’s nationally and internationally known pediatric orthopaedic specialists diagnose and treat infants, children and adolescents with a wide spectrum of congenital and acquired musculoskeletal problems, both rare and common.

CONDITIONS SEEN INCLUDE:

- ⌘ **Scoliosis and spinal deformities**
- ⌘ **Cerebral palsy**
- ⌘ **Skeletal dysplasia**
- ⌘ **Spina bifida**
- ⌘ **Sports medicine conditions**
- ⌘ **Torsional variations**
- ⌘ **Abnormalities of the upper and lower extremities**
- ⌘ **Bone disorders**
- ⌘ **Clubfeet**
- ⌘ **Congenital hand deformities**
- ⌘ **Developmental hip dislocation**
- ⌘ **Muscular dystrophies**
- ⌘ **Myelodysplasia**
- ⌘ **Neuromuscular disorders**
- ⌘ **Traumatic accident or injury to hands, feet, hips, pelvis and spine**
- ⌘ **Tumors**

For further information, or to discuss or refer a patient, please call 216.844.5416.

No Complications to Date with Pioneering Pediatric Blood Conservation Program

Rainbow Babies & Children's Division of Pediatric Orthopaedics is studying a groundbreaking blood conservation program that uses epsilon aminocaproic acid (Amicar) to reduce the amount of blood loss during spine surgery.



Instead of collecting three units of autologous blood preoperatively as was done 10 years ago, pediatric orthopaedic surgeons at UH now ask the patient for only one. The transfusion rate has decreased to 0.3 units per patient, thanks to the use of epsilon aminocaproic acid (Amicar).

Advantages of Amicar in pediatric orthopaedic spine surgery

- ▼ Dramatically reduces blood loss
- ▼ Shortens operative times
- ▼ Decreases risk of blood-borne disorders
- ▼ Reduces anxiety of family members

"The program has been exceptionally successful, and we are extremely pleased with the results," reports **George H. Thompson, MD**, Director of Pediatric Orthopaedics. "We have dramatically reduced blood loss during spine surgery, which translates into substantial reductions in autologous blood donations and blood transfusions, as well as lower costs and complications." Conserving blood also helps maintain hemodynamic equilibrium and contributes to an unobstructed view of the surgical field.

"Instead of asking patients to donate three units of blood preoperatively as we did 10 years ago," Dr. Thompson explains, "we now ask the patient for only one. Our transfusion rate has decreased to 0.3 units per patient. In other words, only one in three patients requires any donated blood at the time of surgery."

Using Amicar, an antifibrinolytic

agent that has been successfully utilized in pediatric cardiac surgery, results in shorter operations, a decreased risk of blood-borne disorders, and reduced anxiety on the part of family members, Dr. Thompson reports. There have been no intraoperative or postoperative complications with this medication.

With the exception of those who are hypersensitive or who are at risk for thrombosis, all pediatric orthopaedic spine fusion patients at Rainbow Babies & Children's Hospital receive Amicar, which is given by continuous or intermittent intravenous infusion pre- and perioperatively. "Few other facilities are administering Amicar to their spine patients," Dr. Thompson says. "We are the first group to study the drug this thoroughly." Amicar does not increase clotting, but rather decreases clots from dissolv-

ing, thereby decreasing bleeding during surgery.

Pediatric orthopaedic surgeons are also working with Rainbow neurosurgeons to study the use of Amicar in children undergoing surgery for neurological disorders. "This patient population is also known to have the greatest surgical blood loss, and results in this area have been gratifying as well," Dr. Thompson says. "By administering Amicar, we have achieved an almost one-third reduction in blood loss in children undergoing surgery for neurological disorders."

Rainbow pediatric orthopaedists have authored a number of articles on the use of their innovative blood-conserving techniques that have been published in the journal *Spine*.

Staff Updates

Randall Marcus, MD, chairman of the Department of Orthopaedics at Case Western Reserve University and University Hospitals Case Medical Center, was elected the 54th president of the American Board of Orthopaedic Surgery in October.



Henry Bohlman, MD, Director, Spine Institute, received the North American Spine Society's Leon Wiltse Award for his lifelong contributions to the art and science of spinal disorders management.

CWRU Department of Mechanical and Aerospace Engineering Chair **Clare Rinnac, PhD**, has been named Wilbert J. Austin Professor of Engineering. Dr. Rinnac is the Director of Musculoskeletal Mechanics and Materials Laboratories.

Post-doctoral fellow **Jay Henderson, PhD**, won a Young Investigator Award at the International Orthopaedic Research Society meeting in October.

Orthopaedic surgeon and post-doctoral fellow **Takehiko Matsushita, MD, PhD**, received a Young Investigator Award at the 29th annual meeting of the American Society for Bone and Mineral Research in September.



Thomas McLaughlin, MD, in practice at UH Case Medical Center for 33 years and now at Louis Stokes Cleveland VA Medical Center, was honored by Case Western Reserve University for 34 years of service as the university's team physician. The university's new McLaughlin Medical and Training Facility was named in his honor. UHCCM is the official sports medicine provider for CWRU.

Professional Referral Services Resource for Physicians

We recognize the importance of providing easy access to our specialists, along with timely communication. That's why University Hospitals Medical Group (UHMG) Department of Orthopaedics at UH Case Medical Center offers its Professional Referral Services.

Call Professional Referral Services to be linked by pager to Clinical Nurse Manager **Nancy Hagan, RN, BSN**. Ms. Hagan can answer complex questions regarding your orthopaedic patients, triage patients and assure appointments within 48 hours when necessary.

Professional Referral Services
(Monday – Friday, 9 a.m. - 5 p.m.)

216.983.3089

Orthopaedic Appointment Scheduling
(Monday – Friday, 8 a.m. - 5 p.m.)

216.844.7200

Upcoming Grand Rounds Presentations

All physicians are cordially invited to attend weekly grand rounds presentations sponsored by the Department of Orthopaedics at University Hospitals Case Medical Center.

Wednesdays, 7:00 a.m.
Wolstein Research Building Auditorium, First Floor
(unless otherwise noted)

For further information including directions, please contact **Ellen Greenberger, Education Coordinator, Department of Orthopaedics, at 216.844.3233 or Ellen.Greenberger@UHhospitals.org.**

Jan. 9, 2008
Pediatric Cervical Spine Clearance
Allison Gilmore, MD
Assistant Professor, CWRU School of Medicine
UH Case Medical Center

Jan. 23, 2008
Foot and Ankle Surgery Update
Visiting Professor
Judith Baumhauer, MD
University of Rochester

Jan. 30, 2008
Anterior Knee Pain and Patellofemoral Disorders
Donald Goodfellow, MD
Associate Professor, CWRU School of Medicine
UH Case Medical Center

Feb. 6, 2008
Compression Neuropathy of the Upper Extremity
Stephen Lacey, MD
Associate Professor, CWRU School of Medicine
UH Case Medical Center

March 12, 2008
Forefoot Deformity of the First Ray and Hallux Valgus
Randall Marcus, MD
Professor, CWRU School of Medicine
UH Case Medical Center

March 19, 2008
The Team Physician
Amanda Weiss-Kelly, MD
Assistant Professor, CWRU School of Medicine
UH Case Medical Center

March 26, 2008
Impingement and Rotator Cuff Disease
Brian Victoroff, MD
Associate Professor, CWRU School of Medicine
UH Case Medical Center

Orthopaedic Update is published for the Department of Orthopaedics at University Hospitals by the Department of Marketing & Communications to inform physicians of current research, treatment and advances in orthopaedic care.

President and Chief Executive Officer
University Hospitals Case Medical Center
Fred C. Rothstein, MD

Editor
Sandra Erlanger

Contributing Writers
Jean Rothman and Beth Hertz

Chairman, Department of Orthopaedics
Randall E. Marcus, MD

Professional Referral Services
216.983.3089

Orthopaedic Appointment Scheduling
216.844.7200

With 150 locations throughout Northeast Ohio, University Hospitals serves the needs of patients through an integrated network of hospitals, outpatient centers and primary care physicians. At the core of our health system is University Hospitals Case Medical Center. The primary affiliate of Case Western Reserve University School of Medicine, University Hospitals Case Medical Center is home to some of the most prestigious clinical and research centers of excellence in the nation and the world, including cancer, pediatrics, women's health, orthopaedics and spine, radiology and radiation oncology, neurosurgery and neuroscience, cardiology and cardiovascular surgery, organ transplantation and human genetics. Its main campus includes the internationally celebrated Rainbow Babies & Children's Hospital, ranked best in the Midwest and first in the nation for the care of critically ill newborns; MacDonald Women's Hospital, Ohio's only hospital for women; and Ireland Cancer Center, which holds the nation's highest designation by the National Cancer Institute of Comprehensive Cancer Center. For more information, go to www.UHhospitals.org.

