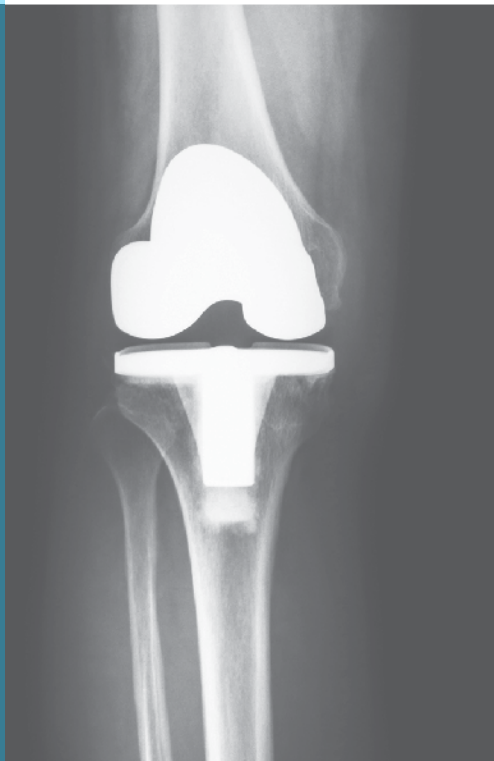


Department of Orthopaedic Surgery

UT Southwestern Orthopaedic Journal

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From the Editor

It is with great pleasure that I present the fourth annual edition of the *UT Southwestern Orthopaedic Journal*. This journal stays true to its original vision of providing program updates, highlighting faculty and resident academic achievements, summarizing research, and displaying the camaraderie within the program. I would like to thank all the people who made this journal possible. Julie Mitchell and our editing team, your tireless dedication to this journal is evident throughout its pages. Additionally, thank you to all the faculty and residents who have helped fill this journal by contributing their research and academic achievements.

The 2019-2020 academic year was an incredibly exciting and busy time for UT Southwestern. Our department continued to grow stronger with the addition of new faculty members across multiple specialties. Additionally, we welcomed an excellent class of six new interns. Our scholarly output continued to flourish, as evidenced by our more than 125 publications featured in this journal. Furthermore, our faculty and residents had the privilege to share our research at podium and poster presentations around the world. Finally, we have now successfully sent 11 residents to train in Auckland, New Zealand.

It's hard to believe how quickly these five years have flown by for my class. It seems like just yesterday the six of us were walking into the hospital for our first day of work. We owe an incredible debt of gratitude to all of our faculty for their tireless dedication to our education. We want to thank those staff at UT Southwestern, Parkland, Texas Scottish Rite, and Auckland/Starship Hospital for their patience, guidance, and instruction along our orthopaedic journey. The six of us are honored to join the distinguished alumni of UT Southwestern, and we are proud to carry on their legacy.

I would like to thank my wife, Anna, for her unwavering support these last five years. You have been an incredible mother to our new son, Michael Aurelio, and the two of you are my world. Lastly, I would like to thank my mother and father for their commitment to my education and the wisdom and guidance they have provided over the years. I am forever grateful.

Please enjoy the 2019-2020 *UT Southwestern Orthopaedic Journal*. We look forward to continuing this journal's tradition of sharing program updates, highlights, and research for years to come.

Michael Del Core, M.D.

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Message from the Chairman



The Department of Orthopaedic Surgery is pleased to publish the fourth edition of the *UT Southwestern Orthopaedic Journal*. This issue would not have been possible without the hard work of Dr. Michael Del Core (Editor) and Julie Mitchell (Coordinator to the Chair).

It would be an understatement to say that this has been a challenging year. COVID-19 has become a household word and wreaked havoc on health care systems around the globe. We are blessed with truly outstanding leadership at UT Southwestern, and, despite the enormous financial impact of COVID-19, the Medical Center has a great foundation on which to begin the process of healing and recovery. In the midst of this crisis, some silver linings arose. All of us benefited from virtual meetings and education, making us rethink the traditional model of meetings and conferences. On a personal note, I truly enjoyed walking my dogs and drinking coffee while listening to meetings. Heightened faculty and resident engagement was evident during these conferences. Prior to COVID-19, most orthopaedic surgeons were not practicing telemedicine. Yet somehow even seasoned citizens like myself were able to navigate EPIC and perform a virtual visit. Telemedicine, in some form, is here to stay and will likely expand in the future.

During this past academic year, members of our orthopaedic family experienced tremendous personal loss. Dr. Frank Gottschalk, longtime faculty member, passed away on November 29, 2019. Frank was thoroughly enjoying retirement, and his passing was far too early. Frank's South African accent made everything sound so much more sophisticated when he spoke at conference. I will miss seeing him at the coffee pot on Wednesday mornings. Dr. Rob Russell, a recent graduate of the residency program, passed away on April 12, 2020. Rob was truly a rising star in orthopaedic surgery, and he had a profound impact on all who knew him. It is fair to say that Rob set the bar for orthopaedic residents. People like Rob are few and far between, and his legacy will live on. Bette Rathjen, 21-year-old daughter of Carolyn and Dr. Karl Rathjen, died on May 1, 2020. At the time of Bette's death she was completing her sophomore year at SMU. Carolyn and Karl have been so important to our orthopaedic family as benefactors and friends, and our thoughts and prayers are with them.

Yes, it has been a difficult and challenging year. This journal illustrates that, despite adversity, UT Southwestern Orthopaedic Surgery is moving "Onward and Upward." Hope is eternal. Personally, I would like to thank the entire department for "stepping up" during the past year. Legacies are defined by how you handle adversity, and I am proud of everyone for their leadership.

Sincerely,

A handwritten signature in blue ink, reading "Dane K. Wukich".

Dane K. Wukich, M.D.

Professor and Chair, Department of Orthopaedic Surgery

Holder of the Dr. Charles F. Gregory Distinguished Chair in Orthopaedic Surgery

Orthopaedic Surgery Program

Over the course of five years, the Department of Orthopaedic Surgery at UT Southwestern affords residents a comprehensive combination of patient care, research opportunities, and didactics. This experience extends over multiple hospitals and surgical centers throughout Dallas, many of which have received national recognition for their service to patients and to the field of orthopaedic surgery.

Orthopaedic surgery continues to be one of the most sought-after training programs for graduating U.S. medical students. This year, more than 750 medical students applied to the UT Southwestern Department of Orthopaedic Surgery program, and 91 students formally interviewed on campus for six first-year positions. Applications for fourth-year “subinternships” have also become more competitive. According to Doximity’s ranking of residency programs by reputation, UT Southwestern’s Orthopaedic Surgery program is the top-ranked program in Texas.

Every Wednesday morning, residents, faculty, ancillary staff, and medical students gather for Chief’s Conference. In addition to lectures from orthopaedic faculty and other departments at UTSW, visiting professors from other medical centers around the country offer a diverse, evidenced-based perspective on modern orthopaedics. This is followed by presentations of select surgical cases that reflect our complex patient population and broad spectrum of subspecialty coverage. In addition, a bimonthly M&M conference offers insight into how to avoid and manage the myriad complications that one can encounter while practicing orthopaedic surgery.

Boundless efforts are put forth by faculty and residents alike to provide a year-round curriculum of enriching experiences, including journal clubs, in-training exam reviews, anatomy labs, and surgical skill labs.

UT Southwestern Medical Center

UTSW has one university hospital: William P. Clements Jr. University Hospital (CUH), a 12-floor, 460-bed facility opened in 2014 (and expanding to 751 beds in 2020) – along with the Zale Lipshy Pavilion of CUH, a 148-bed facility that has served North Texas since 1989. Elective inpatient surgery is performed at Zale Lipshy. Surgical cases requiring cardiac and/or pulmonary intensive care are performed at CUH. Outpatient cases are performed at the Outpatient Surgery Center (OSC), a modern, efficient surgical center within a mile of both CUH and Zale. Residents gain exposure to hip, knee, shoulder, hand, spine, foot and ankle, trauma, and sports cases at these facilities.

William P. Clements Jr. University Hospital



Parkland Memorial Hospital

Parkland Memorial Hospital (Parkland Health & Hospital System)

Parkland Memorial Hospital has gone through many phases throughout its service to Dallas County. It began as a wooden structure on Oak Lawn and Maple avenues in 1894. On August 20, 2015, the \$1.3 billion, 17-story, 862-bed facility at 5200 Harry Hines Boulevard opened its doors. It remains one of the busiest Level 1 trauma centers in the United States, admitting more than 7,500 trauma patients each year, many of whom have orthopaedic injuries. The clinical volume and pathology at Parkland provide excellent education for residents. In addition to the heavy trauma load they experience, junior and senior residents manage joint reconstruction, hand, spine, sports, and oncology cases.

Texas Scottish Rite Hospital for Children

During their PGY-3 year, orthopaedic residents have the unique opportunity to spend time at the world-renowned Texas Scottish Rite Hospital for Children (TSRH). Over a six-month period (often referred to as a mini-fellowship), residents perform surgical cases and see pathology in clinic that residents at other programs might only read about in textbooks. TSRH has more than 35,000 clinic visits every year – many of which are from international patients who have traveled great distances to see leaders in the field of medicine. The hospital treats children with orthopaedic conditions such as scoliosis, clubfoot, hand disorders, hip disorders, and limb length discrepancies, as well as neurological disorders.

Ranked #1 hospital in DFW – again



UT Southwestern’s orthopaedic care earned High Performing recognition from *U.S. News & World Report* for 2019–20, placing us among the country’s leading hospitals for the treatment of orthopaedic injuries and conditions.



In the 2019-20 listings, UT Southwestern was, for the third year in a row, ranked the No. 1 Best Hospital in Dallas-Fort Worth and the No. 2 Best Hospital in Texas, and the orthopaedics program was nationally ranked.

Children’s Medical Center Dallas (Children’s Health)

Children’s Health is a private, not-for-profit system that is one of the largest pediatric care providers in the United States. Children’s Medical Center is its flagship hospital. It was also the first Level 1 pediatric trauma center in Dallas. More than 800,000 patients are seen at Children’s and affiliated locations throughout the Metroplex every year. Because of this volume, residents at the PGY-1, -2, and -3 levels become experts at surgical and non-operative treatment of pediatric orthopaedic trauma while rotating here. They are supported by a dedicated team of pediatric orthopaedic surgeons and other health care providers.

Dallas Veterans Affairs Medical Center (VA North Texas Health Care System)

The VA North Texas Health Care System is the second-largest VA system in the nation. The Dallas VA Medical Center has proudly cared for America’s veterans for more than half a century. Residents rotate through the VA as PGY-3, -4, and -5s. The growing population of veterans offers encounters with patients over a wide range of ages. In the same clinic, a resident might indicate an 18-year-old Marine with an ACL rupture and a 95-year-old WWII vet with hip arthritis. Residents are expected to apply knowledge of a variegated spectrum of orthopaedic maladies in the clinic, operating room, and wards.

New Zealand Rotation

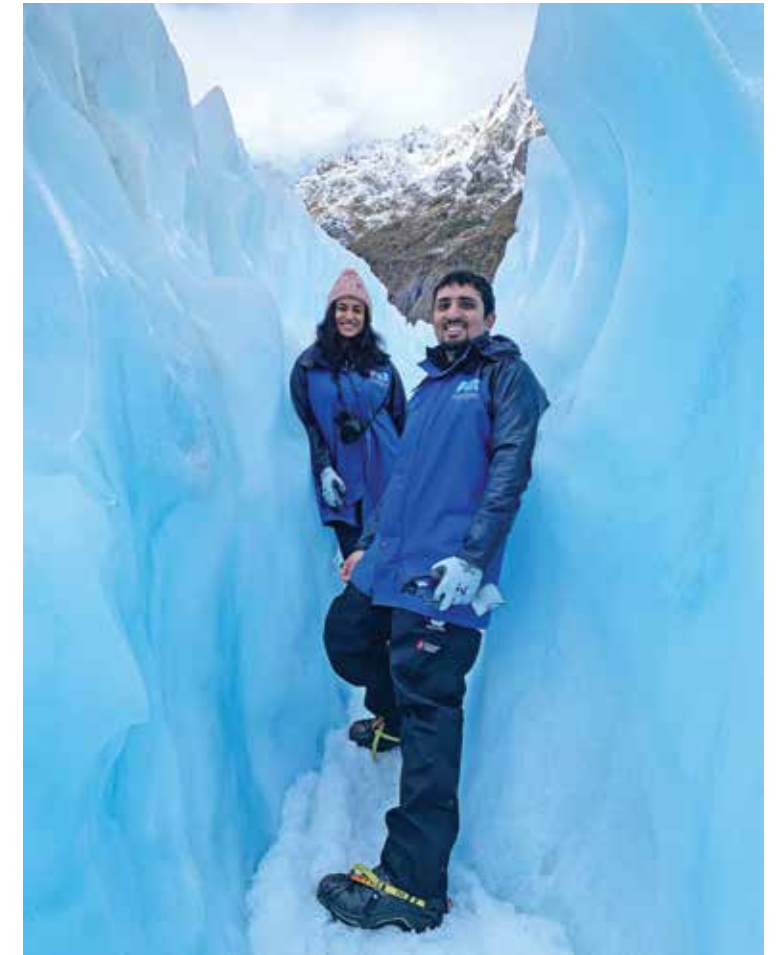
In 2018, the Department of Orthopaedic Surgery began offering senior residents a three-month orthopaedic surgery rotation in Auckland, New Zealand.



Auckland City Hospital is the major tertiary referral hospital in Auckland, New Zealand, providing services to the population of central Auckland as well as serving as a regional and national referral center for many specialist services. Seventeen orthopaedic surgeons in the Orthopaedic Department provide a comprehensive range of orthopaedic services, and the department is an integral part of the Regional Trauma Service. In association with the Starship Hospital Paediatric Orthopaedic Department on the same campus, there is a commitment to training orthopaedic residents who rotate through the service as part of the New Zealand Orthopaedic Training Program. Fellowship programs are available in trauma, spinal surgery, and arthroplasty. The orthopaedic surgeons at Auckland City Hospital, under the leadership of Dr. Stuart McCowan, have embraced the opportunity to have UT Southwestern residents rotate through the orthopaedic service at the hospital.



Starship Children's Hospital is New Zealand's only tertiary-level children's hospital and, therefore, serves all of New Zealand and many areas of the South Pacific. There are 12 surgeons in the children's orthopaedic department. In addition to a busy acute trauma load, there is also a very high rate of musculoskeletal infections, exposing residents to a broad range of acute orthopaedics. Staff surgeons cover the full range of subspecialty paediatric orthopaedic practice and, in doing so, offer residents the opportunity to be exposed to a wide variety of elective children's orthopaedics. UT Southwestern residents work alongside New Zealand residents and also have the opportunity to collaborate with three fellows, some of whom are international fellows. This adds to the breadth and variety of residents' learning experience at Starship Children's Hospital.



Department of Orthopaedic Surgery Faculty



Dane K. Wukich, M.D.
Professor and Chairman



Robert L. Bass, M.D.
Associate Professor



Alison Cabrera, M.D.
Assistant Professor



Alexandra Callan, M.D.
Assistant Professor



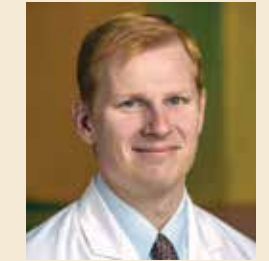
Christopher McCrum, M.D.
Assistant Professor



Varatharaj Mounasamy, M.D.
Assistant Professor



Katherine Raspovic, D.P.M.
Assistant Professor



Drew T. Sanders, M.D., M.P.H.
Assistant Professor



Douglas Dickson, M.D.
Assistant Professor



Maureen A. Finnegan, M.D.
Associate Professor



Kevin Gill, M.D.
Professor



Ann S. Golden, M.D.
Assistant Professor



Ashoke K. Sathy, M.D.
Associate Professor



Timothy G. Schacherer, M.D.
Professor



Jay P. Shah, M.D.
Assistant Professor



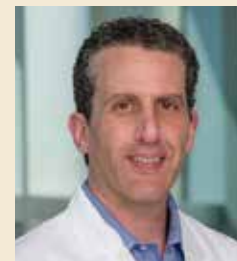
Adam J. Starr, M.D.
Professor



Michael H. Huo, M.D.
Professor



Matthew Johnson, D.P.M.
Associate Professor



Michael S. Khazzam, M.D.
Associate Professor



Daniel Koehler, M.D.
Assistant Professor



Megan Sorich, D.O.
Assistant Professor



David C. Tietze, M.D.
Assistant Professor



Michael D. VanPelt, D.P.M.
Associate Professor



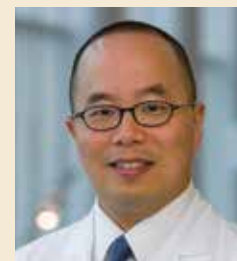
Shaleen Vira, M.D.
Assistant Professor



Trapper Lalli, M.D.
Assistant Professor



Yen-Shen Lin, Ph.D.
Assistant Professor



George T. Liu, D.P.M.
Associate Professor



Sharon Walton, M.D.
Assistant Professor



Joel Wells, M.D., M.P.H.
Assistant Professor

Texas Scottish Rite Hospital for Children Faculty



Daniel Sucato, M.D.
Professor and Chief of Staff



John Birch, M.D.
Clinical Professor



Alexander Cherkashin, M.D.
Assistant Professor



Jane Chung, M.D.
Assistant Professor



Amy McIntosh, M.D.
Associate Professor



Shane Miller, M.D.
Associate Professor



William Z. Morris, M.D.
Assistant Professor



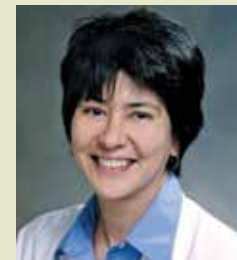
Scott Oishi, M.D.
Professor



Lawson Copley, M.D.
Professor



Henry Ellis, M.D.
Assistant Professor



Marybeth Ezaki, M.D.
Clinical Professor



Corey Gill, M.D.
Assistant Professor



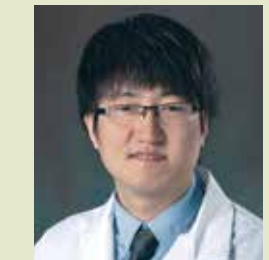
David Podeszwa, M.D.
Associate Professor



Brandon Ramo, M.D.
Assistant Professor



Karl Rathjen, M.D.
Professor



Yinshi Ren, Ph.D.
Assistant Professor



John Anthony Herring, M.D.
Professor



Christine Ho, M.D.
Associate Professor



Charles Johnston, M.D.
Professor



Lori Karol, M.D.
Professor



Anthony Riccio, M.D.
Associate Professor



B. Stephens Richards, M.D.
Professor



Mikhail Samchukov, M.D.
Associate Professor



Christopher Stutz, M.D.
Assistant Professor



Harry Kim, M.D.
Professor



Chi Ma, Ph.D.
Assistant Professor



Philip Wilson, M.D.
Associate Professor



Robert Lane Wimberly, M.D.
Associate Professor

Faculty with Secondary Appointments



Carlos Bagley, M.D.
Associate Professor
Neurological Surgery



Avneesh Chhabra, M.D.
Associate Professor
Radiology



Beth Deschenes, D.P.T., M.S.
Associate Professor
Physical Therapy



Yasin Dhafer, Ph.D.
Professor
Physical Medicine & Rehabilitation



Douglas Sammer, M.D.
Associate Professor
Plastic Surgery



Yi-Ting Tzen, Ph.D.
Assistant Professor
School of Health Professions



Paul Weatherall, M.D.
Professor
Radiology



Carol Wise, Ph.D.
Professor
Eugene McDermott Center for
Human Growth and Development



Nicholas Haddock, M.D.
Associate Professor
Plastic Surgery



Paul Kim, D.P.M.
Professor
Plastic Surgery



Javier LaFontaine, D.P.M.
Professor
Plastic Surgery



Lawrence Lavery, D.P.M.
Professor
Plastic Surgery



Metin Yavuz, D.Eng.
Associate Professor
School of Health Professions



Jason Zafereo, Ph.D., M.P.T.
Associate Professor
Physical Therapy



Andrew Zhang, M.D.
Associate Professor
Plastic Surgery



Edward Mulligan, D.P.T.
Professor
Physical Therapy



Scott Oishi, M.D.
Professor
Plastic Surgery



Ross Querry, Ph.D.
Professor and Chair
Physical Therapy



Jonathan Rios, Ph.D.
Associate Professor
Eugene McDermott Center for
Human Growth and Development

Chief Residents ... "Onward and Upward"



1 Ryan Fairchild with his father Richard, mother Judy, and girlfriend Brittany. Ryan will be moving to Tampa, Florida, for his fellowship in orthopaedic trauma at the Florida Orthopaedic Institute.

2 Kshitij Manchanda and his wife, Priya. The Manchanda family will be moving to Miami for Kshitij's foot and ankle fellowship at the Miami Orthopedics and Sports Medicine Institute.

3 Stephen "Blake" Wallace, his wife Allison, and sons Stephen and Andrew will be moving to Denver, Colorado, for Blake's fellowship in foot and ankle surgery.



4 Michael Del Core and his wife, Anna Hanson. Mike will be remaining in Dallas for his fellowship in hand surgery and then heading to Cleveland, Ohio, for a fellowship in shoulder and elbow surgery at the Cleveland Clinic.

5 Stephen Gates and his wife, Lauren, along with their children, Theodore and Adelia. The Gates family will be moving to Philadelphia for Stephen's shoulder and elbow fellowship at the Rothman Orthopaedic Institute at Thomas Jefferson University.

6 Zach Shirley and his mother. Zach will be moving to Philadelphia for a fellowship in adult reconstruction at Penn.

Department of Orthopaedic Surgery Incoming Interns



Junho Ahn

Hometown: Denton, TX

Education: M.D., UT Southwestern Medical School

B.S. Public Health | UT Austin

Personal Interests: Mavericks basketball, rock climbing, golf, soccer, traveling



Jack Beale

Hometown: Chesapeake, VA

Education: M.D., Eastern Virginia

B.S. Biochemistry, Biology | Virginia Tech

Personal Interests: Travel, water sports, ice hockey, snowboarding, home projects/renovations, Virginia Tech football, spending time with family/friends



Peter Cannamela

Hometown: Boise, ID

Education: M.D., University of Utah

B.S. Biology | University of San Diego

Personal Interests: Golf, hiking, mountain biking, snowboarding, USC football



Jack Riley Martinez

Hometown: College Station, TX

Education: M.D., UT Southwestern Medical School

B.S. Biomedical Sciences | Texas A&M University

Personal Interests: Bow hunting, fishing, golfing, boating, college football



Ivy Nguyen

Hometown: Austin, TX

Education: M.D., UT Southwestern Medical School

B.S. Bioengineering | Stanford University

Personal Interests: Oil painting and pastel portraiture, trying new recipes, reading, group exercise



Garrett Sohn

Hometown: New Braunfels, TX

Education: M.D., Baylor College of Medicine

B.S. Biochemistry | Texas Christian University

Personal Interests: Soccer, golf, running, hiking, fishing, spending time with family, trying new restaurants, TCU football, the Dallas Cowboys



Holders of Endowed Chairs



Dane K. Wukich, M.D.
Dr. Charles F. Gregory Distinguished Chair in Orthopaedic Surgery
Established in 1994 to support Orthopaedic Surgery.



Kevin Gill, M.D.
Aaron A. Hofmann, M.D. and Suzanne Hofmann Distinguished Chair in Orthopaedic Surgery in Honor of Richard E. Jones, M.D.
Established in 1994 to support resident research projects, awards, and education.



Timothy Schacherer, M.D.
Robert W. Bucholz, M.D. Professorship in Orthopaedic Surgery
Established in 2016 to support resident research and education.



Adam J. Starr, M.D.
Hansjoerg Wyss Distinguished Professorship in Orthopaedic Trauma
Established in 2004 to support orthopaedic trauma research, education, and clinical care.



Yasin Dhafer, Ph.D.
R. Wofford Cain Distinguished Chair in Bone and Joint Disease
Established to support research in bone and joint disease.



Visiting Professor

Marybeth Ezaki, M.D., was born and raised in Allentown, Pennsylvania. She was educated at Yale University, where she earned both her undergraduate degree in biology and her medical degree, and then completed an internship and residency in orthopaedic surgery at UT Southwestern Medical Center in Dallas. Following a fellowship in hand surgery in England, she returned to UTSW to join the faculty, at first covering general orthopaedics but also focusing on hand and upper limb. In 1998, she moved to Texas Scottish Rite Hospital for Children as a full-time hand surgeon, where she and Peter Carter developed a fellowship training program for hand surgeons. She retired as head of the unit in 2015.

Dr. Ezaki has served as a reviewer and/or associate editor for multiple orthopaedic, plastic surgery, and hand journals. Her professional organizations include the ABOS, AAOS, ASSH (for which she served as President in 2002), POSNA, ABJS, CHASG, and others. She has lectured locally and internationally and has published in peer-reviewed journals on hand and upper limb conditions, especially those related to the pediatric upper limb. Her research interests have focused on congenital anomalies and limb overgrowth conditions.

Dr. Ezaki resides near Dallas and also spends time in Boston, Los Angeles, and Colorado.



Marybeth Ezaki, M.D.

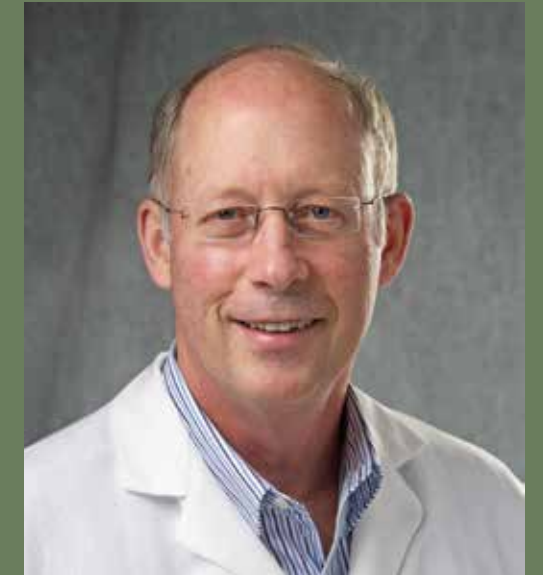
W.B. Carrell Visiting Professorship

J. Lawrence Marsh, M.D., is the Carroll B. Larson Chair and a tenured professor in the Department of Orthopedics and Rehabilitation at the University of Iowa Carver College of Medicine. For many years, he was also the Director of the Orthopedic Residency Training Program there. Dr. Marsh received his B.A. from Colgate University and his medical degree from Upstate Medical Center in Syracuse, New York. Following completion of his residency in orthopaedic surgery at Boston University, he served for two years as University Lecturer in orthopaedic surgery at Oxford University in England.

Dr. Marsh's clinical practice is devoted to orthopaedic trauma and adult reconstruction. He has developed techniques of minimally invasive articular fracture surgery, while his research has focused on articular fractures and techniques of image analysis to assess the mechanical factors leading to post-traumatic osteoarthritis. He has also been instrumental in initiatives that have led to new requirements for laboratory-based surgical skills training for orthopaedic residents, and his research in this area has resulted in new skills assessments and validated skills training techniques.

Dr. Marsh's research has been funded by the DoD, NIH, OTA, Arthritis Foundation, AO, and NBME. He and his co-authors were recipients of the 2011 OREF Clinical Research Award for their work on post-traumatic osteoarthritis.

Dr. Marsh also has a long-standing interest in orthopaedic education. He has been the Chair of the Residency Review Committee for Orthopaedic Surgery for the ACGME and was instrumental in leading orthopaedic surgery into the next accreditation system and adoption of milestones. He is a past President of the American Board of Orthopaedic Surgery and a past Director of the Board. He is also a past President of the Mid-America Orthopaedic Association and the American Orthopaedic Association.



J. Lawrence Marsh, M.D.

Carroll B. Larson Chair and Professor
Department of Orthopedics and Rehabilitation
University of Iowa Carver College of Medicine

Charles F. Gregory Memorial Lectureship

The Gregory Memorial Lecture was cancelled this year because of the COVID-19 pandemic. However, we would like to acknowledge the work of our residents in preparing their research projects over the past year. In addition, we express our appreciation to our scheduled guest speaker, Dr. Anna N. Miller, for her interest in appearing at this event.

The Charles F. Gregory Memorial Lectureship was established to honor Charles F. Gregory, M.D., Chairman of Orthopaedic Surgery at the University of Texas Southwestern Medical School from 1956 to 1976. Dr. Gregory's commitment to postgraduate education led him to formulate objectives for the education of orthopaedic surgeons. These objectives included nurturing of a medical conscience, respect for the heritage of medicine, acquisition of essential information, development of surgical skills, development of respect for the scientific method, and continual pursuit of new advances and refinement of existing skills.

Charles F. Gregory Memorial Lecture Day – June 19, 2020

Keynote Presentation

Anna N. Miller, M.D., FACS

“Moral Injury, Resilience, and Burnout in Orthopaedic Surgery” and

“Traveling Fellowships: What I Learned and Why You Should Consider Applying”

Graduating Resident Presentation

Kshitij Manchanda, M.D.

“Short-Term Radiographic and Patient Outcomes of a Novel Biplanar Plating System for Hallux Valgus Correction”

(Kshitij Manchanda, M.D.; Alice Chang, B.S.; Blake Wallace, M.D.; Junho Ahn, B.S.; George Liu, D.P.M.; Katherine Raspovic, D.P.M.; Michael VanPelt, D.P.M.; Avneesh Chhabra, M.D.; Dane Wukich, M.D.; Trapper Lalli, M.D.)

Fourth-Year Resident Research Presentations

Nathan Boes, M.D.

“Combined Transphyseal and Lateral Extra-Articular Pediatric Anterior Cruciate Ligament Reconstruction”

(Nathan Boes, M.D.; Philip L. Wilson, M.D.; Charles W. Wyatt, CPNP; John Wagner III, B.S.)

Garen Collett, M.D.

“Reduction of Opioid Use with Enhanced Recovery Program for Total Knee Arthroplasty in the Veterans Affairs Patient Population”

(Garen Collett, M.D.; Allison Insley, CRNA; Secherre Michaelis, CRNA; Sherly Shaji, CRNA; Bobbi Feierstein, PA; Paul Nakonezny, Ph.D.; John R. Martell, M.D.)

Adam Green, M.D.

“Novel Approaches to the Elbow”

(Adam Green, M.D.; Drew Sanders, M.D.; Adam Starr, M.D.; Tyler Youngman, M.D.; Matthew Landrum, M.D.; Ashoke Sathy, M.D.; Brian Sager, M.D.)

Bruno Gross, M.D.

“Femoral Tunnel Fixation for Medial Patellofemoral Ligament Reconstruction in the Growing Patient Is Safe for Future Growth”

(Bruno Gross, M.D.; Breann Tisano, M.D.; Meagan J. Sabatino, B.A.; Madison Brenner; Charles W. Wyatt, CPNP; Philip Wilson, M.D.; Henry Ellis, M.D.)

Jonathan Tran, M.D.

“Timing and Risk Factors for Venous Thromboembolism After Rotator Cuff Repair in the 30-Day Perioperative Period”

(Jonathan Tran, M.D.; Brian Sager, M.D.; Junho Ahn, B.S.; Michael Khazzam, M.D.)

Charles F. Gregory Visiting Professor

Anna N. Miller, M.D., FAAOS, FACS, FAOA, is a Vice Chair in the Department of Orthopaedic Surgery and Chief of the Orthopaedic Trauma Division at Washington University School of Medicine in St. Louis. Dr. Miller grew up in Texas and attended Rice University, graduating with honors in biology. After earning her medical degree from Baylor College of Medicine, Dr. Miller was selected for residency training at the prestigious Hospital for Special Surgery. She then completed an orthopaedic trauma fellowship at Harborview Medical Center in Seattle, Washington. Prior to joining Washington University Orthopaedics, Dr. Miller was Assistant Director of the Orthopaedic Trauma Service at Wake Forest School of Medicine and was selected for its Career Development for Women Leaders program and as a Brooks Scholar in Medicine.



Anna N. Miller, M.D., FAAOS, FACS, FAOA

Associate Professor, Orthopaedic Surgery
Vice Chair, Department of Orthopaedic Surgery
Chief, Orthopaedic Trauma Division
Washington University School of Medicine

Dr. Miller has particular interests in the improvement of orthopaedic trauma care on a national level and is the Chair of the Orthopaedic Subgroup for the American College of Surgeons' Committee on Trauma. She is also interested in the management and outcomes of elderly patients with fragility fractures and is involved with the AOA and the AAOS in that area, as well as being on the National Quality Forum Trauma Outcomes Steering Committee. Dr. Miller is also part of numerous multicenter national studies. She is a co-investigator on several federally funded grants, particularly focusing on traumatic injury and how it relates to the treatment of U.S. soldiers in combat situations, as well as an automotive crash injury investigation with the National Highway Traffic Safety Administration.

Regents' Outstanding Teaching Award – 2019

Presented to John Herring, M.D., FRCS
Professor, Department of Orthopaedic Surgery
Chief of Staff Emeritus, Scottish Rite Hospital for Children

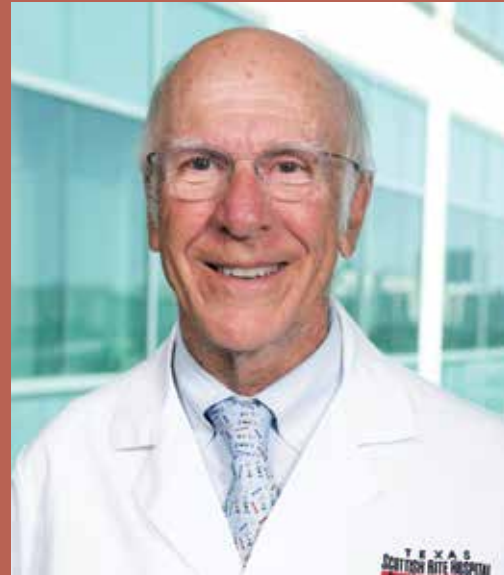
In 2019, Dr. Herring was recognized with the UT System's highest educational honor – the Regents' Outstanding Teaching Award – for his academic prowess and mentoring of talent.

Dr. Herring served as Chief of Staff at Scottish Rite Hospital for Children for 34 years. During his career, he helped train nearly 200 fellows and an estimated 400 orthopaedic residents.

A native of Vernon, Texas, Dr. Herring attended the University of Texas at Austin, where he graduated Phi Beta Kappa before entering medical school at Baylor College of Medicine. After an internship in internal medicine at Peter Bent Brigham Hospital in Boston, he completed a residency in the Harvard Combined Orthopaedic Residency program and then served a two-year tour of duty in the U.S. Navy.

During his nearly four-decade career at Scottish Rite, Dr. Herring has seen the orthopaedic staff grow from two surgeons to 20 and facilities expand from one site to three. Aside from his clinical and surgical duties, he has been active in research, authoring more than 140 peer-reviewed publications, as well as co-authoring and editing four editions of major textbooks in pediatric orthopaedics. In addition, he has given 90 invited lectureships at major institutions on four continents and received lifetime achievement awards from the Pediatric Orthopaedic Society of North America (also serving as its President), the Scoliosis Research Society, the Pediatric Orthopaedic Society of the German Speaking Countries, and the Royal College of Surgeons of Ireland. Dr. Herring is also a recipient of the American Medical Association's Benjamin Rush Award for Citizenship and Community Service.

Professionally, Dr. Herring has two great passions: the care of children with orthopaedic needs and the teaching of students, residents, fellows, and co-workers. "I have truly enjoyed virtually every day of my practice," he says.



John Herring, M.D., FRCS

"I will always greatly treasure this award because I feel so strongly about the importance of teaching. All of us are beneficiaries of more than a few great teachers who have influenced us at various stages of our lives. They inspire as well as inform, and by example help us to be better people, and I am proud to be considered one of them."

In Remembrance

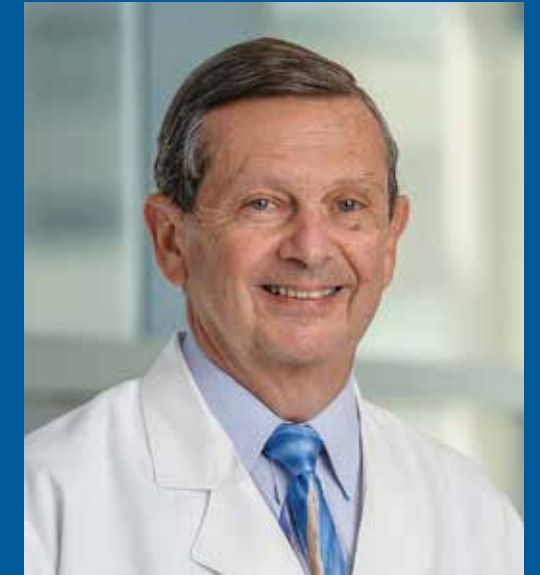
Frank Gottschalk, M.D.
1945-2019

Dr. Frank Gottschalk was born in Johannesburg, South Africa, and immigrated with his wife, Karen, and sons to Dallas in 1984, when he joined the faculty of the Department of Orthopaedic Surgery at UT Southwestern Medical Center, eventually earning the rank of Professor. He retired from UT Southwestern in 2016 after 32 years of service.

Frank initially trained as a surgeon in South Africa and subsequently in Switzerland and Germany. He was a Fellow of the Royal College of Surgeons of Edinburgh, Scotland.

During his career, Frank treated thousands of patients and published more than 70 scientific papers, abstracts, and book chapters. He visited and lectured on six of the seven continents. Frank had a passion for teaching and trained countless numbers of medical students, physical therapy students, and orthopaedic residents. His mentees included his own three sons, each of whom entered the medical field – two as orthopaedic surgeons and one in biotechnology.

Frank's work ethic and moral compass were unrivaled. He seemed larger than life and impacted many people. He will be missed.



Frank Gottschalk, M.D.

Simulation Center

UT Southwestern's Simulation Center is a state-of-the-art training facility occupying 49,000 square feet of the new West Campus Building 3. The facility opened in September 2018 with the goal of providing high-quality, innovative, simulation-based education to medical students, trainees, and physicians alike.

The Simulation Center features seven meeting rooms, 20 standardized patient rooms, a multiskill lab with arthroscopy and robotic surgery simulators, an engineering and innovations lab, and a wet/dry lab with a 140-person capacity that is utilized regularly by the orthopaedics residency program for anatomy dissections. The facility has badge access 24 hours a day, so residents have the opportunity to fine-tune their arthroscopy skills before or after their clinical duties conclude for the day.

In its first year of operation, the Simulation Center recorded more than 22,000 learner hours. It has already been recognized as one of the most advanced centers of its kind in the country, earning a nomination for *D Magazine's* Innovation in Education award in 2020.



Department of Orthopaedic Surgery Events



- 1 Residents and family enjoy a monster truck rally at AT&T Stadium.
- 2 Dr. Liu and Dr. VanPelt share dinner with their foot and ankle residents.
- 3 Residents stay up overnight and help Dr. Reinert prepare for his annual pig roast.



- 4 Ortho residents at the annual department Christmas party.
- 5 Residents dressed up at the Dallas Petroleum Club.
- 6 4th-year residents and their significant others enjoy a night out.
- 7 Residents attend the annual Ortho Halloween party.

Resident Awards

Aaron A. Hofmann, M.D., and Suzanne Hofmann Distinguished Chair in Orthopaedic Surgery Graduating Resident Awards

Dr. Aaron A. Hofmann established the following awards for graduating residents to honor three orthopaedic surgeons who significantly influenced him during his orthopaedic residency at UT Southwestern.

The Awards

W. Brandon Carrell Distinguished Physician Award

Presented to the current PGY-5 resident who throughout his or her residency consistently displayed empathy, concern, and compassion for his or her patients, colleagues, and staff.

The W. Brandon Carrell Award winner is determined by current full-time faculty.

G. Truett James Award for Excellence in Teaching

Presented to the current PGY-5 resident who was most dedicated to teaching others.

This award is determined by residents.

Vert Mooney Award for Academic Achievement

Presented to the current PGY-5 who has performed at a high academic level during his or her residency.

This award is determined by the resident's overall academic achievement during residency, i.e., research, posters, and presentations.

2019 Annual Resident Awards

Brandon Carrell Award – Benjamin Schell, M.D.

Vert Mooney Award – Emmanuel Nwelu, M.D.

G. Truett James Award – Benjamin Schell, M.D.

Past Hofmann Resident Award Recipients

2018

Brandon Carrell Award – Craig Birch, M.D.

G. Truett James Award – Brian Sager, M.D.

Vert Mooney Award – Marcel Wiley, M.D.

2017

Brandon Carrell Award – Jessica Wingfield, M.D.

G. Truett James Award – Matthew Swann, M.D.

Vert Mooney Award – Matthew Swann, M.D.

2016

Brandon Carrell Award – Sheena Black, M.D.

G. Truett James Award – Ryan Rose, M.D.

Vert Mooney Award – Timothy Brown, M.D.

2015

Brandon Carrell Award – Kelly Cline, M.D.

G. Truett James Award – Kelly Cline, M.D.

Vert Mooney Award – Robert Russell, M.D.

2014

Brandon Carrell Award – Grant Hogue, M.D.

G. Truett James Award – Drew Sanders, M.D.

Vert Mooney Award – Kenneth Estrera, M.D.

2013

Brandon Carrell Award – Guillaume Dumont, M.D.

G. Truett James Award – Paul Chin, M.D.

Vert Mooney Award – Justin Knight, M.D.

2012

Brandon Carrell Award – Jacob Zide, M.D.

G. Truett James Award – Charles Osier Jr., M.D.

Vert Mooney Award – Chris Espinoza-Ervin, M.D.

2011

Brandon Carrell Award – James R. Phelps, M.D.

G. Truett James Award – Joshua Fox, M.D.

Vert Mooney Award – No recipient

2010

Brandon Carrell Award – Henry Ellis, M.D.

G. Truett James Award – Hilton Gottschalk, M.D.

Vert Mooney Award – Henry Ellis, M.D.

2009

Brandon Carrell Award – Daniel Chan, M.D.

G. Truett James Award – Chad Hanson, M.D.

Vert Mooney Award – Megan Swanson, M.D.

Faculty Awards

Harold A. “Pete” Mattson Award for Outstanding Leadership

This award is given annually to a physician who demonstrates outstanding personal, moral, and professional leadership for our residents. The award is named in honor of a man who embodied all of these virtues.

2019 Mattson Award Recipient

Adam J. Starr, M.D.

Past Mattson Award Recipients

2018 – Karl Rathjen, M.D.

2017 – Drew T. Sanders, M.D.

2016 – Adam J. Starr, M.D.

2015 – Robert W. Bucholz, M.D.

2014 – Michael H. Huo, M.D.

2013 – Adam J. Starr, M.D.

Charles M. Reinert Award

This award is presented annually to a physician for going above and beyond the call of duty ... for selfless dedication to resident education ... for being a pillar of consistency amidst a sea of change ... for always being available for assistance ... for being a role model in the truest sense of the word ... for teaching us to do the right thing.

2019 Reinert Award Recipient

Drew T. Sanders, M.D.

Past Reinert Award Recipients

2018 – Brigham Au, M.D.

2017 – Adam J. Starr, M.D.

2016 – Timothy G. Schacherer, M.D.

2015 – Timothy G. Schacherer, M.D.

2014 – Adam J. Starr, M.D.

2013 – William “Bill” Robertson, M.D.

2012 – Michael H. Huo, M.D.

2011 – Michael H. Huo, M.D.

2010 – James B. “Monty” Montgomery, M.D.

Robert W. Bucholz Award

This award is presented by the graduating class to a faculty member who is an exceptional surgeon, dedicated educator, leader, mentor, and caring friend who embodies these virtues both as a physician and as a person.

2019 Bucholz Award Recipient

Michael H. Huo, M.D.

Past Bucholz Award Recipient

2018 – Adam J. Starr, M.D.

Contemporary Comparison of Short-Term Outcomes After Total Ankle Replacement and Ankle Arthrodesis

Ahn J, Manchanda K, Wallace SB, Wukich D, Liu G, VanPelt M, Raspovic K, Lalli T

Foot and Ankle Orthop. 2019 Oct;4(4). doi.org/10.1177/2473011419S00089.

Background: During the past 20 years, studies comparing total ankle replacement (TAR) and ankle arthrodesis (AA) appear to demonstrate lower complication rates with TAR than with AA. However, advances in implant technology and surgical techniques have dramatically reduced complication rates. As a result, studies comparing TAR and AA require more patients to detect differences in rare events. Despite this, few epidemiologic studies have been performed examining short-term outcomes after TAR and AA using a contemporary patient population. The purpose of the current study was to compare perioperative outcomes after TAR and AA using patient data from the American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP) database between 2012 and 2017.

Methods: We reviewed patient data from the ACS-NSQIP database collected between 2012 and 2017 using Current Procedural Terminology (CPT) codes 27700 (TAR), 27702 (TAR), 29899 (AA), and 27870 (AA). Patients were then excluded if they were treated for fractures, infections, non-foot- or ankle-related conditions or had revision procedures. Patients were also excluded if they were older than 90 years because ACS-NSQIP does not report age above 90 years. The study population included those treated in inpatient and outpatient settings. The main outcomes of interest were readmission and reoperation related to initial surgery, surgical site complications, and hospital length of stay (LOS). Predictors of adverse outcomes were evaluated through multivariate regression of patient demographics, comorbidities, and treatment characteristics.

Results: Out of 1,214 patients included in the study, 187 (15.4%) patients were treated with AA and 1,027 (84.6%) underwent TAR. Patients with AA were younger, had higher body-mass index, had higher white blood cell count, more often had diabetes mellitus (DM) treated with insulin, received more dialysis treatment, had higher anesthesia risk classification, and were treated in the outpatient setting more often than patients with TAR. Among outcomes, AA patients had longer hospital LOS, more deep surgical site infections, and more reoperations than TAR patients. Postoperative readmissions were not significant but were higher in AA patients (2.7% vs. 0.9%, $p = 0.101$). Combining these adverse outcomes, multivariate regression revealed that higher anesthesia risk category ($p = 0.0007$), DM ($p = 0.029$), and AA ($p = 0.049$) had positive correlations with adverse outcomes.

Conclusion: Ankle arthrodesis appears to be independently associated with perioperative complications compared to TAR, consistent with previous reports. Although complications were rare, patients with DM and higher anesthesia risk seem to be important factors to consider. Interestingly, patients with DM had fewer adverse outcomes with TAR than AA (3.8% vs. 7.4%). The difference was even greater in DM patients treated with insulin (4.3% vs. 13.3%) although only 38 patients had DM controlled with insulin in the cohort. Further studies are needed to identify patient populations at risk of complications, specifically those with DM.

Lower Extremity Necrotizing Fasciitis in Diabetic and Nondiabetic Patients: Mortality and Amputation

Ahn J, Raspovic KM, Liu GT, Lavery LA, La Fontaine J, Nakonezny PA, Wukich DK

Int J Low Extrem Wounds. 2019 Jun;18(2):114-121. doi:10.1177/1534734619836464.

Abstract: Lower extremity necrotizing fasciitis (NF) is a severe infection requiring immediate surgery. The aim of this study was to assess patient factors predictive of amputation and mortality in diabetes mellitus (DM) and non-DM patients with lower extremity NF. The American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP) database was reviewed retrospectively. Out of 674 patients with lower extremity NF, 387 had DM (57.4%). Patients with DM had lower mortality ($P = .004$). Increased mortality was independently associated with age > 60 years (adjusted odds ratio [aOR] = 3.96, 95% confidence interval [CI] = 1.69-9.77), partial thromboplastin time > 38 seconds (aOR = 2.66, 95% CI = 1.09-6.62), albumin < 2.0 mg/dL (aOR = 2.84, 95% CI = 1.13-7.37), coagulopathy (aOR = 3.29, 95% CI = 1.24-9.19), higher anesthesia risk category (aOR = 3.08, 95% CI = 1.18, 8.59), chronic obstructive pulmonary disease (aOR = 3.46, 95% CI = 1.13-10.9), postoperative acute respiratory distress syndrome (aOR = 5.24, 95% CI = 2.04-14.4), and postoperative septic shock (aOR = 5.14, 95% CI = 1.94-14.1). Amputation was independently associated with DM (aOR = 4.35, 95% CI = 2.63-7.35) but not mortality. Although DM was associated with more amputations for lower extremity NF, patients with DM had lower mortality than non-DM patients in the bivariate analysis. Further research is needed to investigate outcomes among DM and non-DM patients in the context of lower extremity NF.

Renal Function as a Predictor of Early Transmetatarsal Amputation Failure

Ahn J, Raspovic KM, Liu GT, Lavery LA, La Fontaine J, Nakonezny PA, Wukich DK

Foot Ankle Spec. 2019 Oct;12(5):439-451. doi:10.1177/1938640018816371.

Abstract: Chronic kidney disease (CKD) is a major concern in patients with foot disease because it is associated with high rates of neuropathy, peripheral vascular disease, and poor wound healing. The purpose of this study was to evaluate renal dysfunction as a risk factor for reamputation after initial transmetatarsal amputation (TMA). Patients who underwent a TMA were retrospectively identified in the American College of Surgeons National Surgical Quality Improvement Program database. Of 2,018 patients, reamputation after TMA occurred in 4.4%. End-stage renal disease (ESRD) was associated with 100% increased odds of TMA failure (adjusted odds ratio [OR] = 2.00; 95% CI = 1.10, 3.52), 128% increased odds of major amputation (adjusted OR = 2.28; 95% CI = 1.27, 3.96), and 182% increased odds of 30-day mortality (adjusted OR = 2.82; 95% CI = 1.69, 4.64). In addition, white blood cell count > 10 000/mm³ and deep infection at the time of surgery were independently associated with TMA failure. In conclusion, severe renal dysfunction is associated with TMA failure in the short-term, perioperative period. There was no incremental increase in risk of TMA failure with worsening level of renal function before ESRD. A multidisciplinary approach should be implemented in patients with CKD to prevent foot-related pathologies that may necessitate lower-extremity amputation.

Level of Evidence: Level III-retrospective cohort study.

Restoration of Normal Pelvic Balance from Surgical Reduction in High-Grade Spondylolisthesis

Alzakri A, Labelle H, Hresko MT, Parent S, **Sucato DJ**, Lenke LG, Marks MC, Mac-Thiong JM
Eur Spine J. 2019 Sep;28(9):2087-2094. doi:10.1007/s00586-019-05973-8.

Purpose: To investigate the effectiveness of surgical reduction in high-grade spondylolisthesis in maintaining or restoring a normal pelvic balance, as related to QoL.

Methods: This is a retrospective analysis of prospectively collected data of 60 patients (17 males, 43 females) age 15 +/- 3.1 years who underwent surgery for high-grade spondylolisthesis and were followed for a minimum of two years after surgery. Patients with a residual high-grade slip following surgery were referred to the postoperative high-grade (PHG) group, while patients with a residual low-grade slip were referred to the postoperative low-grade (PLG) group. Pelvic balance was assessed from pelvic tilt and sacral slope in order to identify patients with a balanced pelvis or unbalanced pelvis. The SRS-22 questionnaire was completed before surgery and at last follow-up.

Results: Postoperatively, there were 36 patients with a balanced pelvis and 24 patients with an unbalanced pelvis. The improvement in QoL was better in patients with a postoperative balanced pelvis. There were 14 patients in the PHG group and 46 patients in the PLG group. Four of seven patients (57%) in the PHG group and 21 of 26 patients (81%) in the PLG group with a preoperative balanced pelvis maintained a balanced pelvis postoperatively ($P = 0.1$). None of the patients in the PHG group and 11 of 20 patients (55%) in the PLG group improved from an unbalanced to a balanced pelvis postoperatively ($P < 0.05$).

Conclusions: Surgical reduction in high- to low-grade slip is more effective in maintaining and restoring a normal pelvic balance postoperatively. Slides can be retrieved under Electronic Supplementary Material.

Low-Energy, Lateral Ankle Injuries in Pediatric and Adolescent Patients: A Systematic Review of Ankle Sprains and Nondisplaced Distal Fibula Fractures

Beck JJ, VandenBerg C, Cruz AI, **Ellis HB Jr.**
J Pediatr Orthop. 2019 Aug 12. doi:10.1097/BPO.0000000000001438.

Background: Lateral ankle injuries are one of the most common musculoskeletal injuries sustained by pediatric and adolescent athletes. These injuries can result in significant time lost from competition, affect performance when returning to play, and represent a significant burden on the health care system as a whole. The purpose of this study was to systematically review the literature on the diagnosis, treatment, and prevention of acute lateral ankle injuries and their chronic effects in pediatric and adolescent athletes (younger than 19 y).

Methods: This systematic review was conducted according to PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analysis) guidelines between September and December 2018. PubMed and Google Scholar were systematically searched using the search terms: ("distal fibula fracture" OR "ankle sprain") AND ("youth" OR "pediatric" OR "adolescent"). All authors participated in article review ($N = 172$) for relevance and age restrictions in which 30 met the inclusion criteria.

Results: Thirty articles met inclusion criteria [Levels of Evidence I to IV (I: $n = 4$, II: $n = 16$, III: $n = 9$, and IV: $n = 1$)], including distal fibula fracture diagnosis and treatment and risk factors, prevention, and chronic sequela of lateral ankle injuries in pediatric and adolescent patients.

Conclusions: Low-energy, lateral ankle injuries are common in pediatric and adolescent patients yet are underrepresented in the medical literature. There is a lack of high-quality literature on diagnosis, treatment, and outcomes after Salter-Harris I distal fibula fractures. Available literature, however, suggests that there remains overdiagnosis and overtreatment of presumed Salter-Harris I distal fibula fractures. Adolescent ankle sprains dominate the available literature, likely due to the high recurrence rate. Youth athletes and coaches should address risk factors and engage in injury prevention programs to prevent and minimize the effect of acute lateral ankle injuries.

Level of Evidence: Level III-systematic review.

Effect of Distal Ulna Osteochondroma Excision and Distal Ulnar Tether Release on Forearm Deformity in Preadolescent Patients with Multiple Hereditary Exostosis

Belyea C, Pulos N, **Ezaki M**, Wall L, Mills J, Beckwith T, **Oishi SN**
J Pediatr Orthop. 2020 Mar;40(3):e222-e226. doi:10.1097/BPO.0000000000001427.

Background: Multiple hereditary exostosis is a benign condition that can lead to significant forearm deformity secondary to physeal disturbances. As the child grows, the deformity can worsen as relative shortening of the ulna causes tethering, which may lead to increased radial articular angle, carpal slippage, and radial bowing; over time, this tethering can also result in radial head subluxation or frank dislocation. Worsening of forearm deformities often requires corrective reconstructive osteotomies to improve anatomic alignment and function. The purpose of this study is to evaluate the effectiveness of osteochondroma excision and distal ulnar tether release on clinical function, radiographic anatomic forearm alignment, and need for future corrective osteotomies.

Methods: The authors reviewed a retrospective cohort of preadolescent patients who underwent distal ulna osteochondroma resection and ulnar tethering release (triangular fibrocartilage complex). Patients were invited back and prospectively evaluated for postoperative range of motion, pain scores, self-reported and parent-reported Disabilities of the Arm, Shoulder, and Hand (DASH) and Pediatric Outcomes Data Collection Instrument (PODCI) scores. In addition, preoperative and final postsurgical follow-up forearm X-rays were reviewed.

Results: A total of six patients and seven forearms were included in our study with an average age of 7.9 years at time of surgery. The average final follow-up was 7.4 years. With respect to range of motion, only passive radial deviation demonstrated improvement -20 to 14 degrees ($P = 0.01$). Although there was not statistically significant change in radial articular angle, this study did find an improvement in carpal slip 75.7% to 53.8% ($P = 0.03$). At final follow-up, the DASH score was 5.71 ($\sigma = 5.35$), PODCI Global Function score was 95.2 ($\sigma = 5.81$), and PODCI-Happiness score was 98 ($\sigma = 2.74$). Visual analogue scale appearance and visual analogue scale pain assessment were 1.67 ($\sigma = 1.21$) and 1.00 ($\sigma = 1.26$), respectively, at final follow-up. No patient in the cohort developed a radial head dislocation. Only one of seven forearms required a corrective osteotomy within the study's follow-up time period.

Conclusions: Surgical excision of forearm osteochondromas with ulnar tether release in preadolescent patients improves carpal slip, may help to prevent subsequent surgical reconstruction, and provides satisfactory clinical results at an average seven-year follow-up.

Level of Evidence: Level III-therapeutic study.

Comparison of Anderson-Green Growth-Remaining Graphs and White-Menelaus Predictions of Growth Remaining in the Distal Femoral and Proximal Tibial Physes

Birch JG, Makarov MA, Jackson TJ, Jo CH

J Bone Joint Surg Am. 2019 Jun 5;101(11):1016-1022. doi:10.2106/JBJS.18.01226.

Background: Epiphysiodesis of the distal femoral and/or proximal tibial physes is commonly performed in children and adolescents to treat lower-limb length discrepancy. It is important to determine the amount of growth remaining in the physes of these patients. Two main methods are used to make this determination: the White-Menelaus arithmetic method, which assumes a consistent amount of growth per year until skeletal maturity, and the Anderson-Green growth-remaining charts, which diagram average growth per year +/- 2 standard deviations. The purpose of the present study was to evaluate these apparently disparate predictions of growth remaining in a cohort of patients managed with epiphysiodesis.

Methods: From a database of patients managed with epiphysiodesis for lower-limb length discrepancy, we identified all healthy, unoperated leg segments with follow-up to skeletal maturity. We compared the amount of observed growth with the growth predicted by the White-Menelaus method and the Anderson-Green growth-remaining graphs, for both skeletal and chronological ages.

Results: A total of 441 healthy segments (201 femora and 240 tibiae) in 221 patients (105 boys and 116 girls) with an age range of 9.0 to 16.5 years at the time of epiphysiodesis were analyzed. We observed no relationship between the length percentile of the leg segments at the time of epiphysiodesis and the amount of growth that actually occurred. Growth in the distal femoral and proximal tibial physes was relatively constant (9 and 6 mm per year of skeletal growth, respectively). Skeletal age was a better predictor of growth remaining than chronological age for both methods of estimation. Although the distribution of growth remaining in the present study resembled the Anderson-Green growth-remaining charts, that distribution was not associated with the initial length of leg segments.

Conclusions: The White-Menelaus method predicted the amount of growth remaining more accurately than the Anderson-Green growth-remaining charts. The distribution of growth remaining observed in the present study resembled that of the Anderson-Green growth-remaining graphs but was not predicted by the initial bone segment length.

Clinical Relevance: The present study found no positive association between the length percentile of leg segments and the amount of growth that occurred in an epiphysiodesis-age group. This finding can explain the comparative accuracy of the White-Menelaus method and the possible source of prediction errors in the straight-line graph and multiplier methods.

Amputation Versus Staged Reconstruction for Severe Fibular Hemimelia: Assessment of Psychosocial and Quality-of-Life Status and Physical Functioning in Childhood

Birch JG, Paley D, Herzenberg JE, Morton A, Ward S, Riddle R, Specht S, Cummings D, Tulchin-Francis K *JB JS Open Access.* 2019 Apr 5;4(2):e0053. doi:10.2106/JBJS.OA.18.00053.

Background: Fibular hemimelia, a congenital disorder characterized by the partial or complete absence of the fibula, tibial growth inhibition, and foot and ankle deformity and deficiency, is the most common deficiency of long bones. The purpose of the present study of children with congenital fibular hemimelia was to examine the functional and psychosocial outcomes at a minimum of two years after treatment either with amputation and a prosthesis or with reconstruction and lengthening.

Methods: Twenty children who were managed with primary amputation were compared with 22 children who were managed with staged limb reconstruction. The average age of the patients at the time of evaluation was 9 years (range, 5 to 15 years). Patients and parents completed psychosocial, quality-of-life, and satisfaction surveys. Patients underwent instrumented gait analysis and a timed 25- or 50-yard dash. The number and nature of surgical procedures were recorded from a retrospective chart review.

Results: Families of children managed with amputation had lower economic and educational levels and were more ethnically diverse compared with the families of children managed with limb reconstruction. Scores on psychosocial and quality-of-life surveys were comparable with those from healthy patient populations. Parents of males treated with amputation perceived a lower school-related quality of life for their child; socioeconomic and ethnic differences between groups might account for this finding. Statistically but not clinically significant differences were measured during instrumented gait analysis at a self-selected walking speed and during a timed 25- or 50-yard dash. The majority of patients and parents reported satisfaction with the treatment method selected and would select the same treatment method again.

Conclusions: At this interim stage of growth, there were no significant functional or psychological differences between groups. Both groups were satisfied with the outcome in mid-childhood, irrespective of the selection of amputation or limb reconstruction.

Level of Evidence: Therapeutic Level III. See Instructions for Authors for a complete description of levels of evidence.

Expectations for Postoperative Improvement in Health-Related Quality of Life in Young Patients with Lumbar Spondylolisthesis: A Prospective Cohort Study

Bourassa-Moreau E, Labelle H, Parent S, Hresko MT, **Sucato D**, Lenke LG, Marks M, Mac-Thiong JM *Spine (Phila Pa 1976).* 2019 Feb 1;44(3):E181-E186. doi:10.1097/BRS.0000000000002788.

Study Design: Prospective multicenter study of the changes in Scoliosis Research Society Outcome Questionnaire 22 (SRS-22) scores for 78 patients younger than 25 years old surgically treated for lumbar spondylolisthesis.

Objective: Report the change of health-related quality of life (HRQOL) in patients younger than 25 years after surgical treatment of lumbar spondylolisthesis.

Summary of Background Data: There is a paucity of data with regard to the influence of surgical treatment on the HRQOL of patients with lumbar spondylolisthesis. Large prospective studies are needed to clearly define the benefits of surgery in the young patient population.

Methods: A prospective multicenter cohort of 78 patients younger than 25 years (14.8 +/- 2.9, range: 7.9-23.6 yr) undergoing posterior fusion for lumbar spondylolisthesis was enrolled. There were 17 patients with low-grade (< 50%) and 61 with high-grade (>= 50%) slips. SRS-22 scores calculated before surgery and after two years of follow-up were compared for all patients using two-tailed paired t tests. Subanalyses for low- and high-grade patients were done using two-tailed Wilcoxon signed-rank and paired t tests, respectively. The level of significance was set at 0.05.

Results: HRQOL was significantly improved two years after surgery for all domains and for the total score of the SRS-22 questionnaire. The individual total score was improved in 66 patients (85%), and 52 patients (67%) improved by at least 0.5 point. All domains and the total score of the SRS-22 questionnaire were significantly improved for high-grade patients, whereas only pain, function, and total score were improved for low-grade patients.

Conclusion: This is the largest study comparing the HRQOL before and after surgery in young patients with low- and high-grade lumbosacral spondylolisthesis. HRQOL significantly improves after surgery for the majority of patients, especially for high-grade patients. This study helps clinicians to better counsel patients with regard to the benefits of surgery for lumbosacral spondylolisthesis.

Level of Evidence: Level II.

Elbow Release and Tricepsplasty in Arthrogryptic Patients: A Long-Term Follow-Up Study

Cao J, Stutz C, Beckwith T, Browning A, Mills J, Oishi SN
J Hand Surg Am. 2019 Sep 16. doi:10.1016/j.jhsa.2019.08.002.

Purpose: Obtaining elbow flexion to improve hand-to-mouth reach capability is an essential component of achieving functional independence in pediatric patients with arthrogryposis. This study analyzed the long-term outcomes of elbow release and tricepsplasty in a series of children with arthrogryposis at a tertiary institution.

Methods: Medical records of patients with arthrogryposis who underwent elbow release and tricepsplasty from 1993 to 2015, with at least two years of follow-up, were reviewed. Collected measures included preoperative elbow passive range of motion (ROM), postoperative elbow passive and active ROM, shoulder passive and active ROM, and Pediatric Outcomes Data Collection Instrument (PODCI) scores. Our analysis compared pre- and postoperative follow-up of elbow passive ROM and reviewed PODCI scores with age-adjusted normative values.

Results: Seventeen patients (4 female and 13 male) with 24 affected upper extremities (10 left elbow and 14 right elbow) were included in final analysis. Age at final follow-up averaged 11 years (range, 4-20 years); mean age at surgery was 2.7 years (range, 9.6 months-9.3 years) with mean follow-up by extremity at 8.3 years (range, 2-18 years). Differences in pre- and postoperative passive elbow ROM were significant for extension, flexion, and total arc of motion. Most parent and self-reported PODCI scores were less than the age-adjusted normal population, except in the domains of Comfort and Pain and Happiness.

Conclusion: Long-term follow-up of elbow release and tricepsplasty in patients with arthrogryposis indicates both increased and sustained elbow flexion and arc of motion. Although PODCI scores were lower compared with the age-adjusted norm, pediatric patients with arthrogryposis were just as happy and had no more discomfort than their unaffected age-adjusted norms.

Level of Evidence: Level IV-therapeutic.

Cannulated Screws

Carpenter B, Bohay D, Early JS, Jennings M, Pomeroy G, Schubert JM, Wukich DK
J Foot Ankle Surg. 2019 Mar;58(2):333-336. doi:10.1053/j.jfas.2018.08.035.

Abstract: The use of cannulated screws in foot and ankle surgery has increased over the years but remains controversial and largely subject to surgeon preference. A research roundtable of questions has been submitted to six invited foot and ankle surgeons relative to their individual use of these cannulated devices. The purpose of this symposium is to explore some of the pertinent controversies between traditional solid screws and cannulated screws. With our current worldwide health care cost concerns, design, and manufacturing, there will be a convergence in a quest for value in our implants.

Regional Muscle Changes in Adult Dysfunctional Hip Conditions of Femoroacetabular Impingement and Hip Dysplasia

Chalian M, Schauwecker N, Cai A, Dessouky R, Fey N, Xi Y, Chhabra A, Wells J
Skeletal Radiol. 2020 Jan;49(1):101-108. doi: 10.1007/s00256-019-03263-4. Epub 2019 Jun 28.

Objective: To analyze regional muscle CT density and bulk in femoroacetabular impingement (FAI) and hip dysplasia (HD) versus controls.

Methods: Patients who obtained perioperative CT imaging for FAI and HD before surgery were retrospectively studied. Asymptomatic controls were included for comparison. Two readers independently evaluated regional hip muscle [iliopsoas (IP), rectus femoris (RF), gluteus minimus (Gm), and medius (GM)] density, muscle area, and muscle circumference. Inter-observer reliability was calculated using an intraclass correlation coefficient (ICC).

Results: A consecutive series of 25 FAI patients, 16 HD patients, and 38 controls were recruited in the study. FAI patients had significantly greater Gm and GM circumferences as well as greater RF and IP areas on the normal side compared to the asymptomatic control group (p values 0.004, 0.032, 0.033, and 0.028, respectively). In addition, Gm and RF circumferences and RF area were significantly larger (p values 0.029, 0.036, and 0.014, respectively) in FAI patients on the affected side compared to the control group. HD patients had significantly smaller Gm and GM circumferences on the affected side than normal side measurements in the FAI group (p values 0.043 and 0.003, respectively). The normal side GM circumference was also smaller in HD patients than normal side FAI hips (p value 0.02). There was no significant difference between the measurements on normal and abnormal sides in each disease group. No significant difference was found between measurements of HD compared to controls (p > 0.05). No muscle density differences were seen among different groups. There was moderate to excellent inter-reader reliability for all measurements except Gm muscle density.

Conclusion: Muscle analysis was able to quantify differences among patients with FAI, HD, and asymptomatic controls. These changes could indicate either a muscle imbalance contributing to the pathology or disuse atrophy, which might have implications for specific muscle-strengthening therapies and rehabilitation procedures in such patients.

Concurrent Bilateral Anterior Tibial Stress Fractures and Vitamin D Deficiency in an Adolescent Female Athlete: Treatment with Early Surgical Intervention

Chung J, Sabatino M, Fletcher A, Bone H
Front Pediatr. 2019 Oct 4;7:397. doi: 10.3389/fped.2019.00397. eCollection 2019.

Case: A 16-year-old African American multisport female athlete presented with bilateral worsening activity-related leg pain for five months. Multiple bilateral anterior tibial diaphyseal stress fractures and significant vitamin D deficiency were identified. She was treated with a combination of vitamin D supplements and static intramedullary nailing of the bilateral tibias, resulting in clinical and radiographic healing and a return to sports.

Discussion: Vitamin D deficiency and a high level of activity in a young athlete may be the etiology to atypical multiple stress fractures. In athletes who want to return to sport rapidly, early operative intervention and correction of vitamin D deficiency might be treatment options.

Level of Evidence: Level V – case study.

Association Between Sleep Quality and Recovery Following Sport-Related Concussion in Pediatrics

Chung J, Zynda A, Didehban N, Hicks C, Hynan L, Miller S, Bell K, Cullum CM
J Child Neurol. 2019 Oct;34(11):639-645. doi: 10.1177/0883073819849741. Epub 2019 May 22.

Abstract: Our objective was to determine the association between sleep quality, symptom severity, and recovery following sport-related concussion in pediatric athletes. A review of data from the North Texas Concussion Network Prospective Registry (ConTex) was performed. Participants were diagnosed with a sport-related concussion and were ≤ 18 years old. Participants were categorized based on their initial clinic visit Pittsburgh Sleep Quality Index composite score (0-21) into good sleep quality (GS ≤ 5) and poor sleep quality (PS > 5) groups. The PS group reported higher median total symptom scores at three-month follow-up (3.0 vs. 0.0, $P < .01$) and took more than a median of two weeks longer to recover compared to the GS group (35.0 days vs. 20.0 days, $P < .01$). Poor sleep quality was strongly associated with greater symptom severity and longer time to recovery following sport-related concussion. Early recognition of concussed athletes with poor sleep quality at initial clinic visit may help predict prolonged recovery.

Posterior Vertebral Endplate Fractures: A Retrospective Study on a Rare Etiology of Back Pain in Youth and Young Adults

Conlee EM, Driscoll SW, Coleman Wood KA, McIntosh AL, Dekutoski ML, Brandenburg JE
PM&R. 2019 Jun;11(6):619-630. doi:10.1016/j.pmrj.2018.10.002.

Background: Posterior lumbar vertebral endplate fracture occurs with avulsion of the ring apophysis from the posterior vertebral body. Although this has been described in adolescents and young adults, proper diagnosis is often delayed or missed entirely. Surgery may be curative.

Objective: To determine the common clinical features and treatment outcomes in youth and young adults with posterior lumbar vertebral endplate fractures.

Design: Retrospective case series.

Setting: Academic medical institution.

Patients: Patients 10 to 25 years old from 2000 through 2012 with posterior vertebral endplate fracture diagnosis.

Main Outcome Measurements: Demographic characteristics, diagnostic studies, interventions, and change in symptoms postoperatively.

Results: A total of 16 patients had posterior vertebral endplate fractures (eight male patients; mean age, 15.2 years) – 8.3% of 192 patients within the inclusion age range undergoing spinal surgery for causes unrelated to trauma, scoliosis, or malignancy. The most common signs and symptoms were low back and radiating leg pain, positive straight leg raise, hamstring contracture, and abnormal gait. Cause was sports related for 12 patients (75%). Mean (range) time to diagnosis was 13.0 (3.0–63.0) months. Diagnosis was most commonly made with lumbar magnetic resonance imaging ($n = 6$). Most fractures occurred at L5 ($n = 8$, 50%) and L4 ($n = 5$, 31.3%). Conservative measures were trialed before surgery. Nine patients had “complete relief” following surgery and seven “improved.”

Conclusions: Posterior vertebral endplate fracture should be considered in differential diagnosis of a youth or young adult with back pain, radiating leg pain, and limited knee extension, regardless of symptom onset. For patients in whom conservative management fails, consultation with an experienced physician whose practice specializes in spine medicine is recommended.

Level of Evidence: IV.

The Effect of Withholding Antibiotics Prior to Bone Biopsy in Patients with Suspected Osteomyelitis: A Meta-Analysis of the Literature

Crisologo PA, La Fontaine J, Wukich DK, Kim PJ, Oz OK, Lavery, LA
Wounds. 2019 Aug;31(8):205-212.

Objective: The aim of this meta-analysis is to evaluate the effect of withholding antibiotics prior to obtaining a bone biopsy in the diagnosis of osteomyelitis.

Methods: Literature searches on Scopus, PubMed, and Google Scholar were performed with the input antibiotic, bone, biopsy, osteomyelitis, and prior both separately and together, though initially as a combination, as keywords for all study types in the English language published up until July 2018. The initial combination search (and subsequent additional search of the references) yielded 924 related articles, which ultimately resulted in 12 articles with adequate data for analysis. Data were analyzed using an inverse variance method to determine the weight of the studies in a random effects model, pooling the data for odds ratios (OR) and heterogeneity. Bias risk was determined with the Quality Assessment of Diagnostic Accuracy Studies 2 system.

Results: Of the 12 studies, eight failed to demonstrate that antibiotics administered prior to bone biopsy have an effect on culture yield, while four reported a significant effect on culture yield. The total weighted OR for all studies was 2.02 (95% confidence interval [CI], 0.94-4.36; $P = .04$), and the prediction interval was 0.17-23.63. When vertebral osteomyelitis (VO) and nonvertebral osteomyelitis (NVO) articles were evaluated separately, the VO OR was 2.95 (95% CI, 1.40-6.24) and the prediction interval was 0.40-21.53. The OR for NVO was 0.66 (95% CI, 0.04-12.03), and the prediction interval was 0-114.53.

Conclusions: When all studies as well as when NVO studies only were evaluated, there was no significant difference in bacterial pathogen yield based on antibiotic exposure. When VO studies were evaluated separately, there were fewer pathogens recovered than when antibiotics were administered prior to obtaining bone cultures.

Trends in Concomitant Meniscal Surgery Among Pediatric Patients Undergoing ACL Reconstruction: An Analysis of ABOS Part II Candidates from 2000 to 2016

Cruz AI Jr., Gao B, Ganley TJ, Pennock AT, Shea KG, Beck JJ, Ellis HB
Orthop J Sports Med. 2019 Sep 24;7(9). doi:10.1177/2325967119869848.

Background: Rates of anterior cruciate ligament (ACL) reconstruction among pediatric and adolescent patients are increasing. Limited knowledge exists about population-level rates of concomitant meniscal surgery in this age group.

Purpose/Hypothesis: This study sought to examine trends in concomitant meniscal procedures and describe short-term complications in pediatric and adolescent patients undergoing ACL reconstruction. We hypothesized that overall meniscal surgery rates are increasing and that the likelihood of performing meniscal repair or meniscectomy is associated with patient- and surgeon-specific factors.

Study Design: Cross-sectional study.

Methods: We queried ACL procedures in patients younger than 19 years reported by American Board of Orthopaedic Surgery (ABOS) part II examination candidates from 2000 to 2016. Regression models examined associations between patient and surgeon characteristics, year of surgery, follow-up time, meniscal procedure type, and number and type of complications.

Results: A total of 9,766 cases were identified. Females represented 46% ($n = 4468$) of included cases. Mean patient age was 16.1 years (SD, 1.62 years; range, 0-18 years). The rate of concomitant ACL-me-

niscal procedures increased from the years 2000 to 2016 (49%-60%; $P = .005$). Surgeons with sports medicine (+7.0%) or pediatric orthopaedic fellowship (+6.6%) training had a higher likelihood of reporting a concomitant ACL-menisal procedure ($P = .003$ and $.006$, respectively). Sports medicine-trained surgeons were more likely to perform meniscal repair compared with meniscectomy (+3.0%; $P = .016$). Younger patient age was associated with increased likelihood of undergoing meniscal repair compared with meniscectomy. Overall reported complication rate was 12.8%. Notable reported complications included infection (1.61%), arthrofibrosis (1.14%), and deep venous thrombosis or pulmonary embolism (0.11%). Sports medicine and pediatric orthopaedic fellowship training was associated with higher rates of reporting postoperative stiffness and/or arthrofibrosis.

Conclusion: Among ABOS part II candidates, concomitant ACL-menisal surgery has become more common than isolated ACL procedures. Procedures involving sports medicine fellowship-trained surgeons and younger patients were associated with increased rates of meniscal repair compared with meniscectomy. Pediatric orthopaedic and sports medicine training was associated with a greater likelihood of being involved in a concomitant ACL-menisal procedure of any kind, and surgeons with such training also reported a higher incidence of postoperative stiffness and/or arthrofibrosis in patients.

Comparison of Complications, Reoperations, and Outcomes Between Tension Band Wiring and Plate Fixation in Olecranon Fractures

Del Core MA, Ahn J, Gates S, Jo Chan-hee, Maroto M, Sanders D

J of Orthopaedics Trauma Surgery and Related Research. 2019 Feb 27.

Background: Olecranon fractures are relatively common upper extremity fractures often treated with tension band wiring and plate fixation. The purpose of this review is to compare the complications, reoperation rates, and clinical and radiographic outcomes of tension band wiring and plate fixation in patients treated surgically for olecranon fractures at our institution.

Methods: A retrospective review identified 59 patients (27 men and 32 women) treated operatively for olecranon fractures between 2006 and 2016 at our Level 1 trauma center. The average age was 47 years (range: 17 to 81 years). Medical records were reviewed for complications, reoperation rates, and other perioperative variables. The average follow-up time was 12 months. All patients were assessed clinically and radiographically at their latest follow-up.

Results: Of the 59 patients with an olecranon fracture, 23 underwent treatment with tension band wiring and 36 underwent plate fixation. The overall complication rate was 55.9%. The most common overall complication was symptomatic implants seen in 44.1% of patients. Complications were greater in the tension band group (65.2%) compared to the plate fixation group (50%). The overall rate of implant removal for both fixation groups was 39.0%, performed at an average time of 11.6 months. This was seen in 43.5% of the tension band group and 36.1% in the plate fixation group. Implant removal was most commonly performed for symptomatic hardware. The mean elbow extension deficit was 7 degrees for both groups. Plate fixation required significantly longer operating times (110 versus 81 minutes). Radiographic arthrosis was seen in nine patients (15.3%), and heterotrophic ossification was seen in seven (11.9%).

Conclusion: Though both tension band wiring and plate fixation are reliable fixation methods that provide a consistent union of olecranon fractures, our series demonstrates high rates of complications and reoperations for both methods.

Clinical and Radiographic Outcomes of Femoral Head Fractures Associated with Traumatic Hip Dislocations

Del Core MA, Gross B, Ahn J, Wallace B, Starr A

Strategies in Trauma and Limb Reconstruction. 2019 Jan-Apr;14(1):6-10. doi: 10.5005/jp-journals-10080-1416.

Background: Femoral head fractures are an uncommon but severe injury. These high-energy injuries typically occur in association with traumatic hip dislocations. Initial treatment includes urgent concentric reduction; however, controversy exists regarding specific fracture management. The well-known complications of avascular necrosis (AVN), post-traumatic arthritis (PTA), and heterotrophic ossification can leave patients with a significant functional loss of their affected hip. The purpose of this study is to evaluate the clinical and radiographic outcomes of femoral head fractures.

Methods: A retrospective review was performed at our institution assessing all patients who presented from 2007 to 2015 with a femoral head fracture associated with a hip dislocation and at least six months of clinical and radiographic follow-up. Twenty-two patients met our inclusion criteria. There were 15 males and 7 females with an average age of 36 years (range: 17-55). The average follow-up time was 18 months (range: 6-102). Fractures were classified according to the Pipkin classification. The Thompson and Epstein score was used to determine functional outcomes.

Results: There were five Pipkin I, three Pipkin II, zero Pipkin III, and 14 Pipkin IV femoral head fractures. Sixteen patients were successfully closed reduced in the emergency department (ED), and six patients required open reduction after failed reduction in the ED. Four patients (18%) were successfully treated with closed reduction alone, and 18 patients (82%) required operative intervention. Of those undergoing operative intervention, one patient underwent excision of the femoral head fragment, seven underwent open reduction internal fixation (ORIF) of the femoral head, nine underwent ORIF of the acetabulum, and one underwent ORIF of the femoral head and the acetabulum. Nine patients (41%) had an uneventful postoperative course. Two patients (9%) developed AVN, both requiring total hip arthroplasty (THA). Five patients (23%) developed PTA, two eventually requiring a THA. Two patients (9%) had sciatic nerve palsy. One patient (5%) developed a postoperative infection, and four patients (18%) developed heterotrophic ossification (HO), none requiring operative treatment. Two patients (9%) had persistent anterolateral (AL) thigh numbness. Overall functional results were excellent in six patients (27%), good in six (27%), fair in seven (32%), and poor in three (14%). Four patients (18%) required a THA.

Conclusion: Femoral head fractures are a rare injury with well-known complications. Early diagnosis and concentric reduction are the prerequisites for successful treatment. This study adds to the growing literature on femoral head fractures associated with hip dislocations in effort to define treatment plans and to guide patient expectations.

Cam-Type Femoroacetabular Impingement – Correlations Between Alpha Angle Versus Volumetric Measurements and Surgical Findings

Dessouky R, Chhabra A, Zhang L, Gleason A, Chopra R, Chatzinoff Y, Fey NP, Xi Y, Wells J

Eur Radiol. 2019 Jul;29(7):3431-3440. doi: 10.1007/s00330-018-5968-z. Epub 2019 Feb 11.

Aim: Determine correlations of 3D CT cam-type femoroacetabular impingement (FAI) measurements with surgical findings of labral tear and cartilage loss.

Methods: Digital search of symptomatic cam-type FAI from July 2013 to August 2016 yielded 43 patients. Two readers calculated volumes of femoral head, bump, and alpha angles on 3D CT images. Correlations between CT, surgical findings, and inter- and intra-reader reliabilities were assessed using Spearman rank correlation and intraclass correlation coefficients (ICC).

Results: Thirteen men and 14 women aged 37 ± 10 (mean \pm SD) years were included. Most common clinical finding was positive flexion-adduction-internal rotation (70.4%). Twenty-seven labral tears and 20 cartilage defects were surgically detected. Significant correlations existed between femoral bump, head volumes, and extent of the labral tear ($p = 0.008$ and 0.003). No significant correlations were found between the alpha angles at 12 to 3 o'clock and the extent of labral tear ($p = 0.2, 0.8, 0.9,$ and 0.09) or any measurement with the cartilage loss (p values for alpha 12 to 3, bump, and head volumes = $0.7, 0.3, 0.9, 0.9, 0.07,$ and 0.2). Inter- and intra-reader reliabilities were excellent to moderate for femoral head and bump volumes (ICC = $0.85, 0.52,$ and $0.8, 0.5$) and moderate to poor for alpha angles (ICC = $0.48, 0.40, 0.05, 0.25$ and $0.3, 0.24, 0.29, 0.49$).

Conclusion: Three-dimensional volumetric measurements of cam-type FAI significantly correlate with the extent of intraoperative labral tears. Superior inter- and intra-reader reliability to that of alpha angles renders it a more clinically relevant measurement for quantifying cam morphology.

Patients' Perceptions of Breast Asymmetry Improve After Spinal Fusion for Adolescent Idiopathic Scoliosis

Duri R, Brown K, Johnson M, McIntosh A
Spine Deform. 2019 Jan;7(1), 80-83. doi:10.1016/j.jspd.2018.06.011.

Study Design: Adolescent idiopathic scoliosis (AIS) patients undergoing spine fusion (SF) had their data prospectively collected. The SRS Spine Appearance Questionnaire (SAQ) was the primary outcome measure. The data were reviewed in a retrospective manner.

Objectives: Patient concerns about breast/chest wall asymmetry in AIS is high. This study sought to determine the improvement after spinal fusion (SF). Breast/chest wall asymmetry is a significant physical deformity associated with AIS. No literature exists on patient satisfaction related to improved breast/chest wall appearance after SF surgery.

Methods: 474 patients undergoing SF for AIS from 2006 to 2014 completed the SRS SAQ preoperation and at two years postoperation. Data were prospectively collected and reviewed in a retrospective manner. The SAQ includes two statements regarding breast/chest wall asymmetry (19 and 20). Statistical analysis was performed to determine a relationship between improved SAQ responses and any clinical/radiographic or surgical parameters.

Results: 395 females and 79 males (14.4 ± 2.0 years) with preoperation and two-year postoperation Cobb angle 60.6 ± 11.5 and 26.6 ± 12.1 were reviewed. Before surgery, 68.0% of patients identified with the statement "I want to have more even breasts" compared with 37.0% at two years postoperation. In addition, 78.9% identified with the statement "I want to have a more even chest in the front" preoperatively compared with 34.0% at two years postoperation. Positive preoperative responses correlated with scoliometer ($p = .029$ and $p = .044$) and Cobb angle of the major curve ($p = .048$ and $p = .006$). At two years postoperation, there was a significant number of patients (76%) who had at least a two-point decrease in their response to either statement ($p < .0001$).

Conclusion: Breast asymmetry is a significant concern of many AIS patients, including males, and correlates with preoperative curve magnitude. SF results in significant improvement in patient perception of breast/chest wall asymmetry, with 76% of patients reporting good outcomes at two years postoperation.

Level of Evidence: Level II.

Distraction-Based Surgeries Increase Spine Length for Patients with Nonidiopathic Early-Onset Scoliosis – 5-Year Follow-Up

EIBromboly Y, Hurry J, Padhye K, Johnston C, McClung A, Samdani A, Glotzbecker M, Attia A, Hilaire T, El-Hawary R; Children's Spine Study Group; Growing Spine Study Group
Spine Deform. 2019 Sep;7(5):822-828. doi:10.1016/j.jspd.2019.02.001.

Study Design: Retrospective, comparative.

Objectives: To determine if distraction-based surgeries will increase spine length in patients with non-idiopathic EOS and whether etiology affects final spine length. Because early-onset scoliosis (EOS) has many etiologies, it is unclear whether etiology affects the spine length achieved with distraction-based surgeries. Because distraction may produce kyphosis, sagittal spine length (SSL; curved arc length of the spine in the sagittal plane) should be utilized.

Methods: Patients with nonidiopathic EOS treated with distraction-based systems (minimum five-year follow-up, five lengthenings) were identified from two EOS registries. Radiographic analysis preoperation, postimplant (L1), and after each lengthening (L2-L5, L6-L10, L11-L15) was performed with primary outcome of T1-S1 SSL.

Results: We identified 126 patients (67 congenital, 38 syndromic, 21 neuromuscular) with a mean preoperative age of 4.6 years, scoliosis 75 degrees, kyphosis 48 degrees, and a mean of 12 lengthenings. After initial correction ($p < .05$), scoliosis remained constant (58 degrees at L11-L15) and kyphosis increased (38 degrees at L1 to 60 degrees at L11-L15) ($p < .05$). SSL increased for the entire group from 27.1 cm preoperation to 35.3 cm at L11-L15 ($p < .05$) and during the distraction phase (29.2 cm at L1 to 35.3 cm at L11-L15) ($p < .05$). Preoperative SSL was higher in neuromuscular compared with congenital patients and maintained that difference until the 10th lengthening. Preoperative SSL did not differ between syndromic and congenital patients (28.0 cm vs. 25.6 cm); however, syndromic patients had greater SSL after implantation (L1: 30.5 cm vs. 26.8 cm) ($p < .05$) and maintained that difference until the 15th lengthening (37.1 cm vs. 34.3 cm) ($p < .05$).

Conclusion: At minimum five-year follow-up, distraction-based surgeries increased spine length for all patients with nonidiopathic EOS; however, neuromusculars had higher preoperative spine length compared with congenital patients and maintained that difference until the 10th lengthening. Although congenital and syndromic patients had similar preoperative spine length, syndromic patients had greater SSL after implantation (L1) and maintained that difference until the 15th lengthening.

Level of Evidence: Level III.

The Importance of a Standardized Screening Tool to Identify Thromboembolic Risk Factors in Pediatric Lower Extremity Arthroscopy Patients

Ellis HB Jr., Sabatino MJ, Clarke Z, Dennis G, Fletcher AL, Wyatt CW, Zia A, Wilson PL
J Am Acad Orthop Surg. 2019 May 1;27(9):335-343. doi:10.5435/JAAOS-D-18-00390.

Introduction: Deep vein thrombosis and pulmonary embolism are major complications that can occur in common orthopaedic procedures such as knee arthroscopy. The purpose of this study is to determine the incidence of venous thromboembolism (VTE) risk factors in adolescent patients undergoing elective lower extremity arthroscopy. A second objective is to determine whether a targeted, standardized screening tool is both cost- and clinically effective in the identification of VTE risk factors in adolescents.

Methods: A standardized VTE screening tool was prospectively administered to all elective arthroscopic procedures in a pediatric sports medicine practice. A comparison cohort that did not complete the screening tool was isolated through a retrospective chart review identifying VTE risk factors. The incidence and cost between the two cohorts were compared.

Results: Of 332 subjects who did not receive a targeted screening (TS) tool, 103 risk factors were noted. One pulmonary embolism case was identified with a total incidence of 0.15% over three years. With TS, we identified 325 subjects with 134 identifiable risk factors. Six patients (1.8%) were noted to be very high risk, requiring consultation with hematology. No VTEs were reported. When compared with the retrospective review, TS identified 30% more risk factors. A significant increase in the identification of family history of blood clots ($P < 0.001$), history of previous blood clot ($P = 0.059$), recurrent miscarriages in the family ($P = 0.010$), and smoking exposure ($P = 0.062$) was found. Additionally, the total cost of screening was less than the cost of prophylaxis treatment with no screening (\$20.98 versus \$23.51 per person, respectively).

Discussion: Risk factors for VTE may be present in 32.5% of elective adolescent arthroscopic patients. A TS model for VTE identified 30% more risk factors, especially a significant family history, and was shown to be a cost-effective way to safely implement a VTE prevention program.

Level of Evidence: Level II.

Distal Junctional Failure Following Pediatric Spinal Fusion

Flocari LV, Su Aw, **McIntosh AL**, Rathjen K, Shaughnessy WJ, Larson AN
J Pediatr Orthop. 2019 Apr;39(4):202-208. doi: 10.1097/BPO.0000000000000898.

Background: Adjacent segment pathology is a known complication after spinal fusion, but little has been reported on junctional failure. A series of adolescent patients presented with acute distal junctional failure (DJF). We sought to determine any common features of these patients to develop a prevention strategy.

Methods: A retrospective review was conducted of pediatric patients who developed DJF after instrumented spinal fusion was performed at two institutions from 1999 to 2013. Patients with proximal junctional failure or junctional kyphosis without failure were excluded.

Results: Fifteen subjects were identified with a mean follow-up of 38 months. Distal failure occurred at a mean of 60 days after index surgery, with history of minor trauma in four patients. Failures included 3-column Chance fracture (11) or instrumentation failure (four). Thirteen patients presented with back pain and/or acute kyphosis, whereas two asymptomatic patients presented with healed fractures. Two patients also developed new onset of severe lower extremity neurological deficit after fracture, which improved but never resolved after revision. A total of 13/15 subjects required revision surgery, typically within one week. Complications associated with revision surgery were encountered in eight patients (62%). Major complications that required return to the operating room included two deep infections, two instrumentation failures, and dense lower extremity paralysis that improved after medial screw revision and decompression. At final follow-up, 10 patients are asymptomatic, two have a persistent neurological deficit, two have chronic pain, and one has an altered gait with gait aid requirement.

Conclusion: This study analyzes a heterogenous cohort of spinal fusion patients who developed DJF from 3-column Chance fracture or instrumentation failure. Revision surgery is typically required but has a high complication rate and can result in severe neurological deficit, highlighting the morbidity of this complication. It is unclear whether the level of the lowest instrumented vertebra contributes to DJF. Increased awareness of junctional failure in children may prompt additional studies to further characterize risk factors and preventive strategies.

Surgery for the Diabetic Foot: A Key Component of Care

Frykberg RG, **Wukich DK**, Kavarthapu V, Zgonis T, Dalla Paola L; Board of the Association of Diabetic Foot Surgeons
Diabetes Metab Res Rev. 2019 Dec;36(S1):e3251.

Abstract: Surgery for acute and chronic diabetic foot problems has long been an integral component of care. While partial foot amputations remain as important diabetic limb-salvaging operations, foot-sparing reconstructive procedures have become equally important strategies to preserve the functional anatomy of the foot while addressing infection, chronic deformities, and ulcerations. A classification of types of diabetic foot surgery is discussed in accordance with the soft tissue status and acuity of the presenting foot problem. This brief overview from the Association of Diabetic Foot Surgeons describes common conditions best treated by surgical interventions, as well as specific indications. While techniques and indications continue to evolve, effective surgical management of the diabetic foot remains an integral component of care as well as for the prevention of recurrent ulceration.

Proceedings from the 2018 International Consensus Meeting on Orthopedic Infections: Evaluation of Periprosthetic Shoulder Infection

Garrigues GE, Zmistowski B, Cooper AM, Green A; ICM Shoulder Group
J Shoulder Elbow Surg. 2019 Jun;28(6S):S32-S99.

Abstract: The Second International Consensus Meeting on Orthopedic Infections was held in Philadelphia, Pennsylvania, in July 2018. More than 800 experts from all nine subspecialties of orthopedic surgery and allied fields of infectious disease, microbiology, and epidemiology were assembled to form the International Consensus Group. The shoulder workgroup reached consensus on 27 questions related to culture techniques, inflammatory markers, and diagnostic criteria used to evaluate patients for periprosthetic shoulder infection. This document contains the group's recommendations and rationale for each question related to evaluating periprosthetic shoulder infection.

Ultrasound-Guided Suprainguinal Fascia Iliaca Compartment Block Versus Periarticular Infiltration for Pain Management After Total Hip Arthroplasty: A Randomized Controlled Trial

Gasanova I, Alexander JC, Estrera K, **Wells J**, Sunna M, Minhajuddin A, Joshi GP
Reg Anesth Pain Med. 2019 Feb;44(2):206-211. doi: 10.1136/rapm-2018-000016.

Background: Fascia iliaca compartment block (FICB) has been shown to provide excellent pain relief in patients undergoing total hip arthroplasty (THA). However, the analgesic efficacy of FICB, in comparison with periarticular infiltration (PAI) for THA, has not been evaluated. This randomized, controlled, observer-blinded study was designed to compare suprainguinal FICB (SFICB) with PAI in patients undergoing THA via posterior approach.

Methods: After institutional review board approval, 60 consenting patients scheduled for elective THA were randomized to one of two groups: ultrasound-guided SFICB block or PAI. The local anesthetic solution for both groups included 60 mL ropivacaine 300 mg and epinephrine 150 µg. The remaining aspects of perioperative care, including general anesthetic and non-opioid multimodal analgesic techniques, were standardized. An investigator blinded to group allocation documented pain scores at rest and with movement and supplemental opioid requirements at various time points. Patients were evaluated for sensory changes and quadriceps weakness in the operated extremity.

Results: There were no differences between the groups with respect to demographics, intraoperative opioid use, duration of surgery, recovery room stay, nausea scores, need for rescue antiemetics, time to ambulation, and time to discharge readiness as well as 48 hours postoperative opioid requirements. The

pain scores at rest and with movement also were similar at all time points. Significantly more patients in the SFICB group experienced muscle weakness at six hours after surgery.

Conclusions: Under the circumstances of our study, in patients undergoing THA, SFICB provided similar pain relief compared with PAI but was associated with muscle weakness at six hours postoperation.

Outcomes of Posterior Glenoid Bone Grafting in Anatomic Total Shoulder Arthroplasty: A Systematic Review

Gates ST, Cutler H, Khazzam MS

JBJS Rev. 2019 Sep;7(9):e6. doi: 10.2106/JBJS.RVW.19.00005.

Background: Total shoulder arthroplasty offers a reliable means with which to treat glenohumeral joint arthritis. Posterior glenoid bone loss presents a unique challenge with an increased risk of glenoid component failure. The use of posterior bone-grafting is one method to address glenoid bone loss in patients undergoing anatomical total shoulder arthroplasty. The purpose of the present study was to assess the outcome and survival of the glenoid component following the use of bone graft to address posterior glenoid bone loss in patients undergoing anatomical total shoulder arthroplasty.

Methods: A systematic review of posterior glenoid bone-grafting in patients undergoing anatomical total shoulder arthroplasty was performed. Studies evaluating patient-reported outcomes, complications, and imaging assessments of the glenoid component as well as of bone graft structural healing and integrity following posterior glenoid bone-grafting were included. Data extracted included demographic characteristics, Walch classification, bone-grafting method, clinical outcomes measures, complications, radiolucency around the glenoid component, graft failure, posterior humeral head subluxation, and time of the latest follow-up.

Results: Six studies met the inclusion and exclusion criteria. Ninety-four patients from these six studies underwent posterior glenoid bone-grafting with anatomical total shoulder arthroplasty. The mean age was 59.7 years, and the mean duration of follow-up was 5.7 years. Overall, 57% of the patients had an excellent postoperative Neer score. At the time of the latest follow-up, 28.7% had evidence of radiolucency and 35% had humeral head subluxation or instability. Thirteen patients (14%) underwent revision of the glenoid component by the time of the latest follow-up.

Conclusions: The present study demonstrated a 28.7% complication rate, a 14% revision rate, a 17% graft failure rate, and a 35% rate of recurrence of posterior humeral head subluxation. Posterior glenoid bone-grafting to correct bone loss is associated with a substantial risk of postoperative complications. The treatment of posterior glenoid bone loss remains a challenge in patients undergoing anatomical total shoulder arthroplasty.

Incidence and Predictors of Positive Intraoperative Cultures in Primary Shoulder Arthroplasty Following Prior Ipsilateral Shoulder Surgery

Gates ST, Nguyen I, Del Core MA, Nakonezny P, Bradley H, Khazzam MS

Journal of Shoulder and Elbow Surgery open access pending December 27, 2019.

Background: To our knowledge, the rate of positive intraoperative cultures in patients undergoing primary shoulder arthroplasty with prior ipsilateral non-arthroplasty shoulder surgery is unknown. The aim of this study was to determine the incidence and predictors of positive cultures in these patients.

Methods: We performed a retrospective review of patients with prior ipsilateral shoulder surgery with intraoperative cultures taken at the time of primary shoulder arthroplasty. We evaluated culture results, demographics, and number of prior surgeries. Regression analysis was used to determine patient-related risk factors that predict positive cultures.

Results: Of the 682 study patients who underwent primary shoulder arthroplasty, 83 had at least one prior ipsilateral shoulder surgery (65.1% male; mean age 64.2 ± 10.9 years). For the cohort of 83 patients, an average 20 of 3.2 ± 1.2 tissue samples were obtained for each patient, with a mean of 0.84 ± 1.14 tissue cultures being positive (range 0-5). 44.5% had at least one positive culture (37/83), with *Cutibacterium acnes* (83.4%, 31/37) the most frequent organism. An average of 1.9 ± 0.96 tissue cultures resulted positive (range 1-5) for the 37 patients who had positive cultures; 40.5% (15/37) had only one positive tissue culture (12/15 *C. acnes* and 2/15 *Staphylococcus epidermidis*, 1/15 *Vancomycin-resistant enterococcus*). Male sex and history of prior shoulder infection were predictive of culture positivity (odds ratios: 2.5 and 20.9, respectively). Age, race, medical comorbidities, number of prior shoulder surgeries, and time from index shoulder surgery were not predictive of culture positivity.

Conclusion: More than half of patients with no clinical signs of infection and a history of prior ipsilateral shoulder surgery undergoing primary shoulder arthroplasty grew positive intraoperative cultures. Similar to unexpected positive cultures found during revision shoulder arthroplasty, the significance of these findings remains unclear in regard to risk of progression to clinically meaningful infection and how these patients should be managed.

Surgically Relevant Anatomy of the Axillary and Radial Nerves in Relation to the Latissimus Dorsi Tendon in Variable Shoulder Positions: A Cadaveric Study

Gates ST, Sager BW, Collett GA, Khazzam MS

Shoulder Elbow. 2020 Feb;12(1):24-30. doi: 10.1177/1758573218825476. Epub 2019 Feb 5.

Background: The purpose of this study was to define the relationship of the axillary and radial nerves, particularly how these are affected with changing arm position.

Methods: Twenty cadaveric shoulders were dissected, identifying the axillary and radial nerves. Distances between the latissimus dorsi tendon and these nerves were recorded in different shoulder positions. Positions included adduction/neutral rotation, abduction/neutral rotation for the axillary nerve, adduction/internal rotation, adduction/neutral rotation, adduction/external rotation, and abduction/external rotation for the radial nerve.

Results: Width of the latissimus tendon at its humeral insertion was 29.3 ± 5.7 mm. Mean distance from the latissimus insertion to the axillary nerve in adduction/neutral rotation was 24.2 ± 7.1 mm; the distance increased to 41.1 ± 9.8 mm in abduction/neutral rotation. Mean distance from the latissimus insertion to the radial nerve was 15.3 ± 5.5 mm with adduction/internal rotation, 25.8 ± 6.9 mm in adduction/neutral rotation, and 39.5 ± 6.8 mm in adduction/external rotation. Mean distance increased with abduction/external rotated 51.1 ± 7.4 mm.

Conclusions: Knowing the axillary and radial nerve locations relative to the latissimus dorsi tendon decreases the risk of iatrogenic nerve injury. Understanding the dynamic nature of these nerves related to different shoulder positions is critical to avoid complications.

Preoperative Glenoid Considerations for Shoulder Arthroplasty: A Review

Gates ST, Sager BW, Khazzam MS

EFORT Open Reviews. 2019 Nov 25;5(3). doi.org/10.1302/2058-5241.5.190011. Published online 2 Mar 2020.

Abstract: Preoperative assessment of the glenoid in the setting of shoulder arthroplasty is critical to account for variations in glenoid morphology, wear, version, inclination, and glenohumeral subluxation. Three-dimensional computed tomography (3D CT) scan assessment of the morphology of glenoid erosion allows for a more accurate surgical decision-making process to correct deformity and restore the joint line. Newer technology has brought forth computer-assisted software for glenoid planning in shoulder arthroplasty and patient-specific instrumentation. There have been promising early findings, although further evaluation is needed to determine how this technology impacts implant survivorship, function, and patient-reported outcomes.

Latissimus Dorsi Tendon Rupture

George MS, Khazzam M

J Am Acad Orthop Surg. 2019 Feb 15;27(4):113-118.

Abstract: Isolated injury to the latissimus dorsi is rare. Partial tendon tears may be successfully treated nonsurgically. Complete tendon ruptures require surgical repair. Tendon repair can be approached either through an anterior deltopectoral incision with a secondary small posterior axillary incision or through a long posterior axillary incision. Suture anchors can be used to repair the latissimus dorsi to the humeral attachment. Although the literature is limited to single-patient case series, most patients have returned to full athletic activity after surgical repair.

Serum Vitamin D and Diabetic Foot Complications

Greenhagen RM, Frykberg RG, Wukich DK

Diabet Foot Ankle. 2019 Feb 19;10(1):1579631. doi:10.1080/2000625X.2019.1579631.

Background: Foot complications such as ulceration and neuropathy are common complications of diabetes mellitus (DM). Previous reports have demonstrated a possible increased risk of these complications in diabetic patients with low levels of serum vitamin D.

Objective: The purpose of this study is to compare serum vitamin D levels in diabetic patients with and without Charcot neuroarthropathy (CN), peripheral arterial disease (PAD), infection (DFI), ulceration (DFU), and peripheral neuropathy (DPN).

Design: A retrospective chart review of all patients undergoing foot and ankle surgery with a history of DM over a 13-month period was performed. From this cohort, 50 subjects with CN were matched with 50 without CN, and preoperative lab values were compared. A secondary evaluation was performed on the subjects' other comorbidities including PAD, DFI, DFU, and DPN.

Results: Seventy-eight percent of our patients had vitamin D deficiency or insufficiency. Preoperative serum vitamin D levels were not significantly different between diabetic patients with and without CN ($p = 0.55$). Diabetic patients with PAD ($p = 0.03$), DFI ($p = 0.0006$), and DFU ($p = 0.04$) were all found to have significantly lower serum vitamin D levels than diabetic patients without these complications. Lower levels of serum albumin and higher serum creatinine were also noted with subjects with PAD, DFI, DPN, and DFU. While seasonal serum vitamin D level fluctuation was noted, this difference did not reach statistical significance with the numbers available.

Conclusion: We found various lower-extremity complications to be associated with low serum vitamin D including PAD, DFI, and DFU. While other studies have questioned the role of vitamin D and CN, we were unable to identify any significant difference between diabetic patients with and without Charcot neuroarthropathy.

Level of Evidence: Level II.

Pain Catastrophizing, Anxiety, and Depression in Hip Pathology

Hampton SN, Nakonezny PA, Richard H, Wells JE

Bone Joint J. 2019 Jul;101-B(7):800-807. doi: 10.1302/0301-620X.101B7.BJJ-2018-1309.R1.

Aims: Psychological factors play a critical role in patient presentation, satisfaction, and outcomes. Pain catastrophizing, anxiety, and depression are important to consider, as they are associated with poorer outcomes and are potentially modifiable. The aim of this study was to assess the level of pain catastrophizing, anxiety, and depression in patients with a range of hip pathology and to evaluate their relationship with patient-reported psychosocial and functional outcome measures.

Methods: Patients presenting to a tertiary-center specialist hip clinic were prospectively evaluated for outcomes of pain catastrophizing, anxiety, and depression. Validated assessments were undertaken, including: the Pain Catastrophizing Scale (PCS), the Hospital Anxiety Depression Scale (HADS), and the 12-Item Short-Form Health Survey (SF-12). Patient characteristics and demographics were also recorded. Multiple linear regression modeling, with adaptive least absolute shrinkage and selection operator (LASSO) variable selection, was used for analysis.

Results: A total of 328 patients were identified for inclusion, with diagnoses of hip dysplasia (DDH; $n = 50$), femoroacetabular impingement (FAI; $n = 55$), lateral trochanteric pain syndrome (LTP; $n = 23$), hip osteoarthritis (OA; $n = 184$), and avascular necrosis of the hip (AVN; $n = 16$), with a mean age of 31.0 years (14 to 65), 38.5 years (18 to 64), 63.7 years (20 to 78), 63.5 years (18 to 91), and 39.4 years (18 to 71), respectively. The percentage of patients with abnormal levels of pain catastrophizing, anxiety, or depression was: 22.0%, 16.0%, and 12.0% for DDH, respectively; 9.1%, 10.9%, and 7.3% for FAI, respectively; 13.0%, 4.3%, and 4.3% for LTP, respectively; 21.7%, 11.4%, and 14.1% for OA, respectively; and 25.0%, 43.8%, and 6.3% for AVN, respectively. HADS Anxiety (HADS-A) and Hip Disability Osteoarthritis Outcome Score Activities of Daily Living subscale (HOOS ADL) predicted the PCS total (adjusted $R^2 = 0.4599$). Age, HADS Depression (HADS-D), and PCS total predicted HADS-A (adjusted $R^2 = 0.4985$). Age, HADS-A, patient's percentage of perceived function, PCS total, and HOOS Quality of Life subscale (HOOS QOL) predicted HADS-D (adjusted $R^2 = 0.5802$).

Conclusion: Patients with hip pathology may exhibit significant pain catastrophizing, anxiety, and depression. Identifying these factors and understanding the impact of psychosocial function could help improve patient treatment outcomes. Perioperative multidisciplinary assessment may be a beneficial part of comprehensive orthopaedic hip care.

Transphyseal Humeral Separations: What Can We Learn? – A Retrospective, Multicenter Review of Surgically Treated Cases Over a 25-Year Period

Hariharan AR, Ho CA, Bauer A, Mehlman CT, Sponseller PD, O'Hara N, Abzug JM

J Pediatr Orthop. 2019 Sep 12. doi: 10.1097/BPO.0000000000001455.

Background: Transphyseal humeral separations (TPHS) are rare injuries with only case reports and small series reported in the literature. This multicenter study aimed to assess the various patient characteristics, injury patterns, treatments, outcomes, and complications in a large series of these injuries.

Methods: A retrospective review was conducted at five pediatric institutions to identify TPHS that were treated surgically in patients 0 to 3 years of age over a 25-year period. Patient demographics, mechanisms of injury, Child Protective Services involvement, diagnostic modalities, time to surgery, pin size and configuration, time to fracture union, and complications were recorded.

Results: A total of 79 patients age 0 to 46 months, with a mean of 17.6 months, were identified and followed for a median of 57 days postoperatively. The most common mechanism of injury was accidental trauma (n = 49), followed by nonaccidental trauma (n = 21), cesarean section (n = 6), and vaginal delivery (n = 3). Child Protective Services was involved in 30 cases (38%). Additional injuries were reported in 19 of the patients; most commonly, additional fractures included humerus, rib, and skull fractures. All patients had elbow radiographs, whereas four patients had an elbow ultrasound and/or a magnetic resonance imaging. Time to surgery was greater than 24 hours in 62% of patients (n = 49). Intraoperatively, 87% of patients underwent an arthrogram (n = 69), 78% of patients had lateral pins only (n = 62), averaging utilization of 2.2 pins, and two patients underwent an open reduction. In total, 11 complications (14%) were noted, including decreased range of motion (n = 4), cubitus varus/valgus (n = 6), and need for additional surgery (n = 1). No cases of avascular necrosis or physeal arrest were found. No losses of reduction were noted.

Conclusions: This multicenter review provides the largest-known demographic and outcomes data on TPHS. TPHS have excellent outcomes in the vast majority of patients when treated surgically. Nonaccidental trauma accounted for 27% of these injuries, so it needs to remain high on the differential diagnosis.

Point vs. Traditional Method Evaluation of Hallux Valgus: Inter-Reader Reliability and Intermethod Performance Using X-Ray and MRI

Heineman N, Chhabra A, Zhang L, Dessouky R, Wukich D
Skeletal Radiol. 2019 Feb;48(2):251-257. doi:10.1007/s00256-018-3022-5.

Background: The two most widely used measurements for diagnosing and assessing the severity of hallux valgus are the hallux valgus angle (HVA) and the intermetatarsal angle (IMA). Traditionally, these have been measured by using the midaxial lines approximating the axis of each bone. A new, simpler point method has been recently suggested for measuring these angles by connecting points along the medial corners of each bone. Inter-reader reliability of these measurements on X-ray and MRI as well as intermethod and intermodality differences have not been assessed.

Methods: A series of 56 consecutive patients between 18 and 100 years old with no history of foot trauma or orthopaedic hardware in their feet were included. All had AP and lateral X-rays and MRI performed on the same foot between April 27, 2015, and March 9, 2016. Two readers measured HVA and IMA using both the traditional midaxial and new point methods. ICC correlations were obtained.

Results: The inter-reader reliability for HVA was similar on point method (0.92) and traditional method (0.94). For the IMA, the ICC was 0.77 on point method versus 0.76 on traditional method. The intermodality agreement (between X-ray and MRI) was higher for HVA (ICC = 0.85, 0.88) as compared to IMA (0.58, 0.74), respectively on both methods. The mean difference between the methods was larger on traditional method = 5.5 for HVA and 2.5 degrees for IMA.

Conclusions: HVA is more reliable than IMA on both methods and modalities, and a significant difference exists between the magnitudes of values obtained using the two methods.

Level of Evidence: Level III.

Clinical and Imaging Assessment and Treatment of Hallux Valgus

Heineman N, Liu G, Pacicco T, Dessouky R, Wukich DK, Chhabra A
Acta Radiol. 2020 Jan;61(1):56-66. doi:10.1177/0284185119847675.

Abstract: Hallux valgus is a common condition estimated to affect as many as 23% of adults. The condition is associated with a variety of debilitating symptoms leading to significant morbidity and quality of life issues. Proper evaluation of this deformity and the timely management of its symptoms can improve hallux valgus-related symptomatology and quality of life. The most commonly used and readily reproduced measurements for assessing hallux valgus are the inter-metatarsal angle and the hallux valgus angle. These angles are helpful for choosing and planning surgical intervention for patients who fail initial conservative measures with distal osteotomies reserved for mild or moderate hallux valgus and proximal osteotomies indicated for more moderate to severe deformities. After reading this review article, readers will gain knowledge of the etiopathogenesis of hallux valgus, measurement parameters, and treatment strategies with representative case examples.

Similar Deformity Correction but Limited Spinal Growth and Lower Health-Related Quality of Life in Children with Skeletal Dysplasia Undergoing Growth-Friendly Management for Early-Onset Scoliosis. A Matched Comparison with Idiopathic Early-Onset Scoliosis

Helenius I, Saarinen A, White K, McClung A, Yazici M, Garg S, Thompson G, Johnston C, Pahys J, Vitale M, Akbarnia B, Sponseller P
Spine Deform. 2019 Nov;7(6):1014. doi:10.1016/j.jspd.2019.09.021.

Summary: Children with skeletal dysplasia received similar deformity correction but gained significantly less spinal growth during growth-friendly management of early-onset scoliosis (EOS). The skeletal dysplasia group had significantly worse health-related quality of life preoperatively and at final follow-up than the idiopathic group.

Hypothesis: We hypothesized that children with skeletal dysplasia associated EOS (SKDEOS) would achieve less spinal growth and would improve less in terms of HRQoL after growth-friendly spinal management than children with idiopathic EOS (IEOS).

Introduction: The value of growth-friendly spinal instrumentation has remained unclear in patients with skeletal dysplasia-associated EOS.

Methods: A review of two prospective multicenter EOS databases identified 33 children (mean age 5.3 years, follow-up 5.6 years) with SKDEOS (major curve $\geq 30^\circ$) who were treated with growth-friendly instrumentation at younger than 10 years of age, had a minimum of two years of postoperative follow-up, and ≥ 3 lengthening procedures. Seven had OI, six diastrophic dysplasia, four camptomelic dysplasia, three spondyloepiphyseal dysplasia, three achondroplasia, two cleidocranial dysplasia, two atelosteogenesis type III, one each chondrodysplasia punctata and bent bone dysplasia, and in four children unknown SD. From the same registries, 33 age, gender, and type of index surgery matched controls (mean 5.4 years, follow-up 7.1 years) with IEOS were identified. In each group, the index surgery was carried out using growing rods in 20 patients and VEPTR instrumentation in 13 patients.

Results: Preoperative major curves were 76° in SKDEOS group and 75° in IEOS group ($p = 0.55$), which were corrected at final follow-up to 49° and 46° ($p = 0.68$). T1-S1 increased by a mean of 36 mm in SKDEOS and 38 mm in IEOS at index surgery ($p = 0.40$), and by 21 mm and 46 mm, respectively, during the distraction period ($p = 0.0085$). The SKDEOS group had significantly worse scores in the physical function, daily living, financial impact, and parent satisfaction preoperatively and financial impact and child satisfaction domains of the 24-item Early-Onset Scoliosis Questionnaire at final follow-up than the IEOS ($p < 0.05$).

Conclusion: Children with skeletal dysplasia gained significantly less spinal growth during growth-friendly management of their EOS, and their health-related quality of life was significantly lower than in children with idiopathic EOS.

Results of Growth-Friendly Management of Early-Onset Scoliosis in Children with and without Skeletal Dysplasias. A Matched Comparison

Helenius IJ, Saarinen AJ, White KK, McClung A, Yazici M, Garg S, Thompson GH, **Johnston CE**, Pahys JM, Vitale MJ, Akbarnia BA, Sponseller PD
Bone Joint J. 2019 Dec;101-B(12):1563-1569. doi: 10.1302/0301-620X.101B12.BJJ-2019-0735.R1.

Aim: The aim of this study was to compare the surgical and quality-of-life outcomes of children with skeletal dysplasia to those in children with idiopathic early-onset scoliosis (EOS) undergoing growth-friendly management.

Methods: A retrospective review of two prospective multicenter EOS databases identified 33 children with skeletal dysplasia and EOS (major curve $\geq 30^\circ$) who were treated with growth-friendly instrumentation at younger than 10 years of age, had a minimum two years of postoperative follow-up, and had undergone three or more lengthening procedures. From the same registries, 33 matched controls with idiopathic EOS were identified. A total of 20 children in both groups were treated with growing rods, and 13 children were treated with vertical expandable prosthetic titanium rib (VEPTR) instrumentation.

Results: Mean preoperative major curves were 76° (34° to 115°) in the skeletal dysplasia group and 75° (51° to 113°) in the idiopathic group ($p = 0.55$), which were corrected at final follow-up to 49° (13° to 113°) and 46° (12° to 112° ; $p = 0.68$), respectively. T1-S1 height increased by a mean of 36 mm (0 to 105) in the skeletal dysplasia group and 38 mm (7 to 104) in the idiopathic group at the index surgery ($p = 0.40$) and by 21 mm (1 to 68) and 46 mm (7 to 157), respectively, during the distraction period ($p = 0.0085$). The skeletal dysplasia group had significantly worse scores in the physical function, daily living, financial impact, and parent satisfaction preoperatively, as well as on financial impact and child satisfaction at final follow-up, than the idiopathic group (all $p < 0.05$). The domains of the 24-Item Early-Onset Scoliosis Questionnaire (EOSQ24) remained at the same level from preoperative to final follow-up in the skeletal dysplasia group (all $p > 0.10$).

Conclusion: Children with skeletal dysplasia gained significantly less spinal growth during growth-friendly management of their EOS, and their health-related quality of life was significantly lower both preoperatively and at final follow-up than in children with idiopathic EOS.

Surgical and Health-Related Quality-of-Life Outcomes of Growing Rod 'Graduates' with Severe Versus Moderate Early-Onset Scoliosis

Helenius IJ, Sponseller PD, McClung A, Pawelek JB, Yazici M, Emans JB, Thompson GH, **Johnston CE**, Shah SA, Akbarnia BA
Spine (Phila Pa 1976). 2019 May 15;44(10):698-706. doi: 10.1097/BRS.0000000000002922.

Objective: The aim of this study was to compare surgical and quality-of-life outcomes at the end of growing rod treatment in patients with severe versus moderate early-onset scoliosis (EOS).

Methods: We identified 40 children with severe EOS (major curve $\geq 90^\circ$) treated with growing rods before age 10 with minimum two-year follow-up after last lengthening or final fusion. From the same registry, we matched 40 patients with moderate EOS (major curve $< 90^\circ$). Twenty-seven patients in the severe group and 12 in the moderate group underwent final fusion ($P < 0.001$).

Results: Mean preoperative curves were 102° (range, 90° - 139°) in the severe group and 63° (range, 33° - 88°) in the moderate group ($P < 0.001$). At final follow-up, mean curves were 56° (range, 10° - 91°) and 36° (range, 12° - 89°), respectively ($P < 0.001$). Fourteen (35%) children in the severe group and 32 (80%) in the moderate group had scoliosis of $< 45^\circ$ at final follow-up [risk ratio (RR), 0.44; 95% confidence interval (95% CI), 0.20-0.57]. At final follow-up, 30 (75%) children in the severe group and 35 (88%) in the moderate group had achieved T1-T12 length of ≥ 18 cm (RR, 0.86; 95% CI, 0.70-1.09). Thirty-five children in the severe group and 26 in the moderate group had at least one complication (RR, 1.35; 95% CI, 1.05-1.73). Mean 24-Item Early-Onset Scoliosis Questionnaire scores were similar between groups at final follow-up.

Conclusion: Delaying surgery until the major curve has progressed beyond 90° is associated with larger residual deformity and more complications than treating at a lesser curve magnitude. Quality-of-life outcomes were similar between those with severe and moderate EOS.

Pediatric Cervical Spine Clearance: A Consensus Statement and Algorithm from the Pediatric Cervical Spine Clearance Working Group

Herman MJ, Brown KO, Sponseller PD, Phillips JH, Petrucelli PM, Parikh DJ, Mody KS, Leonard JC, Moront M, Brockmeyer DL, Anderson RCE, Alder AC, Anderson JT, Bernstein RM, Booth TN, Braga BP, Cahill PJ, Joglar JM, Martus JE, Nesiama JO, Pahys JM, **Rathjen KE**, **Riccio AI**, Schulz JF, Stans AA, Shah MI, Warner WC Jr., Yaszay B
J Bone Joint Surg Am. 2019 Jan 2;101(1):e1. doi: 10.2106/JBJS.18.00217.

Abstract: Pediatric cervical spine injury (CSI) that is related to blunt trauma occurs in 1% to 2% of all children who are admitted to the hospital after blunt trauma. Cervical spine clearance for potential injury is performed daily in emergency departments (EDs) throughout the world. However, in a recent survey of level-1 pediatric trauma centers in North America, only 46% of institutions had a written pediatric cervical spine clearance protocol. In pediatric centers, an algorithmic approach or protocol for cervical spine clearance reduces time to cervical collar removal and limits patient exposure to ionizing radiation by reducing the use of radiography and computed tomography (CT). Published protocols and clinical guidelines for pediatric cervical spine clearance differ in criteria for clinical clearance and the use of imaging. The Pediatric Cervical Spine Clearance Working Group (PCSCWG), a subgroup of the Pediatric Cervical Spine Study Group, recognized the need for a consensus on comprehensive standardized guidelines for pediatric cervical spine clearance based on the best available evidence. We established a multidisciplinary group of practitioners with expertise in cervical spine clearance for injured children and applied the Delphi method and the nominal group technique to create consensus statements regarding pediatric cervical spine clearance in young patients who have experienced blunt trauma. The consensus statements were used to develop an algorithm to guide institutional protocols for cervical spine clearance.

The Community Pediatric Orthopaedic Surgeon Taking Trauma Call: Lateral Humeral Condyle Fracture Pearls and Pitfalls

Ho CA, Mehlman CT
J Orthop Trauma. 2019 Aug;33 Suppl 8:S12-S16. doi: 10.1097/BOT.0000000000001543.

Abstract: Lateral condyle fractures are second only to supracondylar humeral fractures when it comes to pediatric elbow fractures. Whether minimally displaced or substantially displaced, these growth plate fractures may present significant treatment challenges. These include nonunion, malunion, avascular necrosis, and growth disturbance. It must be remembered that lateral condyle fractures often represent significantly displaced intra-articular fractures involving the epiphysis that demand anatomic reduction and stable internal fixation. This article focuses on some of the pertinent pearls and pitfalls regarding these common elbow injuries using ample clinical examples.

Pathologic Arterial Changes in Neurovascularly Intact Gartland Type III Supracondylar Humerus Fractures: A Pilot Study

Ho CA, Podeszwa DA, Riccio AI, Wimberly RL, Yang M, Patel S

J Pediatr Orthop B. 2020 Mar;29(2):137-144. doi: 10.1097/BPB.0000000000000697.

Abstract: This pilot study was performed to describe changes in arterial flow in completely displaced neurovascularly intact Gartland III pediatric supracondylar humerus fractures using Duplex ultrasonography. This is a prospective study of 11 Gartland type III supracondylar humerus fractures with no cortical continuity but with palpable radial pulse and normal neurologic examination. Duplex ultrasonography was performed on injured and uninjured arms, both preoperatively and postpinning, and interpreted by a board-certified pediatric radiologist. Degree of artery stenosis and peak systolic velocity (PSV) of arterial flow were recorded from the duplex. Ultrasound wrist/brachial indexes (WBI) were calculated using the higher value of the radial/brachial or the ulnar/brachial index. Only three patients had normal Duplexes without stenosis and with flow comparable in the brachial, radial, and ulnar arteries of the affected arm, compared to the unaffected arm, both preoperatively and postpinning. One group of six patients had brachial artery stenosis at the fracture site when compared to the artery proximal to the fracture site, increased PSV at the fracture site compared to proximal to the fracture site, and variable WBI when compared to the contralateral side. A third group of two patients also had brachial artery stenosis at the fracture site but had decreased PSV and decreased WBI compared to the contralateral side. Type III supracondylar humerus patients with a normal neurovascular examination may have abnormal Duplex ultrasonography with brachial artery stenosis and elevated peak systolic velocity preoperatively although distal flow remains comparable to the contralateral side.

Suboptimal Age-Adjusted Lumbo-Pelvic Mismatch Predicts Negative Cervical-Thoracic Compensation in Obese Patients

Horn SR, Bortz CA, Ramachandran S, Poorman GW, Segreto F, Siow M, Sure A, Vasquez-Montes D, Diebo B, Tishelman J, Moon J, Zhou P, Beaubrun B, Vira S, Jalai C, Wang C, Shenoy K, Behery O, Errico T, Lafage V, Buckland A, Passias PG

Int J Spine Surg. 2019 Jun;13(3):252-261. doi: 10.14444/6034.

Background: Given the paucity of literature regarding compensatory mechanisms used by obese patients with sagittal malalignment, it is necessary to gain a better understanding of the effects of obesity on compensation after comparing the degree of malalignment to age-adjusted ideals. This study aims to compare baseline alignment of obese and nonobese patients using age-adjusted spino-pelvic alignment parameters, describing associated spinal changes.

Methods: Patients \geq 18 years with full-body stereoradiographs were propensity-score matched for sex, baseline pelvic incidence (PI), and categorized as nonobese (body mass index $<$ 30kg/m²) or obese (body mass index \geq 30). Age-adjusted ideals were calculated for sagittal vertical axis, spino-pelvic mismatch (PI-LL), pelvic tilt, and T1 pelvic angle using established formulas. Patients were stratified as meeting alignment ideals, being above ideal, or being below. Spinal alignment parameters included C0-C2, C2-C7, C2-T3, cervical thoracic pelvic angle, cervical sagittal vertical axis SVA, thoracic kyphosis, T1 pelvic angle, T1 slope, sagittal vertical axis, lumbar lordosis (LL), PI, PI-LL, and pelvic tilt. Lower-extremity parameters included sacrofemoral angle, knee flexion (KA), ankle flexion (AA), pelvic shift (PS), and global sagittal angle (GSA). Independent t tests compared parameters between cohorts.

Results: The study included 800 obese and 800 nonobese patients. Both groups recruited lower-extremity compensation: sacrofemoral angle ($P = .004$), KA, AA, PS, and GSA (all $P < .001$). Obese patients meeting age-adjusted PI-LL had greater lower-extremity compensation than nonobese patients: lower sacrofemoral angle ($P = .002$), higher KA ($P = .008$), PS ($P = .002$), and GSA ($P = .02$). Obese patients with PI-LL mismatch higher than age-adjusted ideal recruited greater lower-extremity compensation than nonobese patients: higher KA, AA, PS, and GSA (all $P < .001$). Obese patients showed compensation through the cervical spine: increased C0-C2, C2-C7, C2-T3, and cervical sagittal vertical axis (all P

$< .001$), high T1 pelvic angle ($P < .001$), cervical thoracic pelvic angle ($P = .03$), and T1 slope ($P < .001$), with increased thoracic kyphosis ($P = .015$) and decreased LL ($P < .001$) compared to nonobese patients with PI-LL larger than age-adjusted ideal.

Conclusions: Regardless of malalignment severity, obese patients recruited lower-limb compensation more than nonobese patients. Obese patients with PI-LL mismatch larger than age-adjusted ideal also develop upper-cervical and cervicothoracic compensation for malalignment.

Level of Evidence: Level III.

Clinical Relevance: Clinical evaluation should extend to the cervical spine in obese patients not meeting age-adjusted sagittal alignment ideals.

Predictors of Hospital-Acquired Conditions Are Predominately Similar for Spine Surgery and Other Common Elective Surgical Procedures, with Some Key Exceptions

Horn SR, Pierce KE, Oh C, Segreto FA, Egers M, Bortz C, Vasquez-Montes D, Lafage R, Lafage V, Vira S, Steinmetz L, Ge DH, Buza JA 3rd, Moon J, Diebo BG, Alas H, Brown AE, Shepard NA, Hassanzadeh H, Passias PG

Global Spine J. 2019 Oct;9(7):717-723. doi: 10.1177/2192568219826083.

Study Design: Retrospective review of a prospectively collected database.

Objective: To predict the occurrence of hospital-acquired conditions (HACs) 30 days postoperatively and to compare predictors of HACs for spine surgery with other common elective surgeries.

Methods: Patients \geq 18 years undergoing elective spine surgery were identified in the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database from 2005 to 2013. Outcome measures included any HACs: superficial or deep surgical site infection (SSI), venous thromboembolism (VTE), and urinary tract infection (UTI). Spine surgery patients were compared with those undergoing other common procedures. Random forest followed by multivariable regression analysis was used to determine risk factors for the occurrence of HACs.

Results: A total of 90,551 elective spine surgery patients, of whom 3,021 (3.3%) developed at least 1 HAC, 1.4% SSI, 1.3% UTI, and 0.8% VTE. The occurrence of HACs for spine patients was predicted with high accuracy (area under the curve [AUC] 77.7%) with the following variables: female sex, baseline functional status, hypertension, history of transient ischemic attack (TIA), quadriplegia, steroid use, preoperative bleeding disorders, American Society of Anesthesiologists (ASA) class, operating room duration, operative time, and level of residency supervision. Functional status and hypertension were HAC predictors for total knee arthroplasty (TKA), bariatric, and cardiothoracic patients. ASA class and operative time were predictors for most surgery cohorts. History of TIA, preoperative bleeding disorders, and steroid use were less predictive for most other common surgical cohorts.

Conclusions: Occurrence of HACs after spine surgery can be predicted with demographic, clinical, and surgical factors. Predictors for HACs in surgical spine patients, also common across other surgical groups, include functional status, hypertension, and operative time. Understanding the baseline patient risks for HACs will allow surgeons to become more effective in their patient selection for surgery.

Hoverboard Injuries in Children and Adolescents: Results of a Multicenter Study

Hosseinzadeh P, Devries C, Saldana RE, Scherl SA, Andras LM, Schur M, Shuler FD, Mignemi M, Minaie A, Chu A, Fornari ED, Frick SL, Caird MS, **Riccio AI**, Pierz K, Plakas C, Herman MJ
J Pediatr Orthop B. 2019 Nov;28(6):555-558. doi:10.1097/BPB.0000000000000653.

Abstract: With the increasing popularity of hoverboards in recent years, multiple centers have noted associated orthopaedic injuries of riders. We report the results of a multicenter study regarding hoverboard injuries in children and adolescents who presented with extremity fractures while riding hoverboards; 12 paediatric orthopaedic centers during a two-month period were included in the study. Circumstances of the injury, location, severity, associated injuries, and the required treatment were recorded and analyzed using descriptive analysis to report the most common injuries. Between-group differences in injury location were examined using chi-squared statistics among (1) children versus adolescents and (2) males versus females. Seventy-eight patients (M/F ratio: 1.8) with average age of 11 +/- 2.4 years were included in the study. Of the 78 documented injuries, upper extremity fractures were the most common (84.6%) and the most frequent fracture location overall was at the distal radius and ulna (52.6%), while ankle fractures comprised most of the lower extremity fractures (66.6%). The majority of the distal radius fractures (58.3%) and ankle fractures (62.5%) were treated with immobilization only. Seventeen displaced distal radius fractures and three displaced ankle fractures were treated with closed reduction in the majority of cases (94.1% versus 66.7%, respectively). The distal radius and ulna are the most common fracture location. Use of appropriate protective gear such as wrist guards, as well as adult supervision, may help mitigate the injuries associated with the use of this device; however, further studies are necessary to demonstrate the real effectiveness of these preventions.

Pediatric Acute Leg Compartment Syndrome After Peroneus Longus Rupture: A Case Series

Hull BR, Wingfield J, Stall A, Birch CM, **Ho CA**
J Pediatr Orthop B. 2019 Sep 9. doi: 10.1097/BPB.0000000000000674.

Abstract: We present the case of three pediatric patients who presented with non-fracture acute lateral compartment syndrome after "minor trauma." All patients were male and sustained the inciting event during football. Two of the patients were able to resume play after their injury. All patients sustained intramuscular proximal avulsion ruptures of the peroneus longus muscle. At final follow-up, all but one patient had documented full neurologic recovery. A seemingly innocuous event may cause acute compartment syndrome in the adolescent male. Compartment syndrome in the absence of fracture should be promptly recognized to prevent delay in surgical treatment.

Hallux Valgus Assessment on X-Ray and Magnetic Resonance Imaging (MRI): Correlation with Qualitative Soft Tissue and Internal Derangement Findings on MRI

Hummel J, Skweres J, **Heineman N**, Dessouky R, Xi Y, Zhang L, **Wukich DK**, **Chhabra A**
Eur J Radiol. 2019 Apr;113:24-31. doi:10.1016/j.ejrad.2019.01.035.

Aim: Radiographs (X-rays) are used for the preoperative assessment of hallux valgus (HV). Our purpose was to determine how well quantitative measurements of HV on radiographs and MRI correlate with the qualitative soft tissue and internal derangement findings on MRI.

Materials and Methods: After IRB approval, 56 consecutive patients with MRI and radiographs of the foot were retrospectively reviewed. Two trained readers independently evaluated radiographs, measuring hallux valgus angle (HVA) and intermetatarsal angle (IMA). Two separate readers assessed qualitative MRI data by evaluating 21 different soft tissue and bony features. Statistical analysis included inter-reader reliability (IRR) and correlation of quantitative and qualitative findings.

Results: Excellent IRR (ICC = 0.89-0.96) was observed for radiograph and MRI measurements of the hallux valgus severity. For qualitative assessments on MRI, IRR was good to excellent for all features (ICC = 0.63-0.9). No significant difference was found for HVA or IMA between normal and abnormal qualitative MRI features. No statistically significant correlation between the severity of hallux valgus and injury to hallux joints and supporting structures was found.

Conclusion: Hallux valgus measurements are reliable on X-rays and MRI, and qualitative findings of the first MTP joint show good to excellent inter-reader agreement on MRI. No statistically significant correlations exist between the severity of hallux valgus and qualitative MRI findings.

Rapid Regeneration of Vascularized Bone by Nanofabricated Amorphous Silicon Oxynitrophosphide (SiONP) Overlays

Ilyas A, Velton M, Shah A, Monte F, **Kim HKW**, Aswath PB, Varanasi VG
J Biomed Nanotechnol. 2019 Jun 1;15(6):1241-1255. doi:10.1166/jbn.2019.2779.

Abstract: Fracture healing is a complex biological process. Severe bone loss and ischemia from traumatic fractures lead to inflammation and accumulation of damaging reactive oxygen species (ROS). Fixative devices that not only provide mechanical support but also stimulate antioxidants such as superoxide dismutase (SOD1) and influence signaling pathways for extracellular matrix (ECM) mineralization are critical for normal healing of such fractures. In this study, we report a novel biomaterial, silicon oxynitrophosphide (SiONP) that provides sustained release of ionic silicon (Si(+4)) and phosphorous (P) over a few weeks under physiological conditions. The antioxidant role of Si(+4) and augmented ECM mineralization by P ions lead to enhanced osteogenesis coupled with quick revascularization for rapid bone regeneration. Plasma-enhanced chemical vapor deposition (PECVD) provided a conformal, well adherent and highly reproducible surface chemistry overlaid onto nanofabricated bioinspired surfaces. The Nitrogen to P and O content ratio was observed to change the dissolution rate and the release kinetics of the overlaid film. The SiONP films with optimal release kinetics promoted antioxidant expression via enhanced SOD1, which downstream upregulated other osteogenic markers with MC3T3-E1 cells. These surfaces also promoted angiogenesis evident by formation of thicker tubules by human umbilical vein endothelial cells (HUVEC). In-vivo evaluation using a rat critical-sized calvarial defect model showed rapid bone regeneration for these nanofabricated biomaterials as compared to control groups and opens new horizons for future clinical trials of new antioxidant materials on biomedical devices that can reduce healing time, lower medical care costs, and increase the quality of newly formed bone in critical size defects.

Erbium:Yttrium Aluminum Garnet Laser Accelerates Healing in Indolent Diabetic Foot Ulcers

Johnson MJ, Crisologo PA, Truong DH, **Wukich DK**, Oz OK, **La Fontaine J**, **Lavery LA**
J Foot Ankle Surg. 2019 Nov;58(6):1077-1080. doi: 10.1053/j.jfas.2019.07.023.

Abstract: The objective of the study was to evaluate the effect of the erbium:yttrium aluminum garnet (YAG) laser on diabetic foot ulcers (DFUs) that had not responded to standard care. We retrospectively evaluated 22 nonhealing DFUs that received at least four weeks of standard wound care, demonstrated poor healing response, and subsequently were treated with an erbium:YAG laser. We measured the percent wound area reduction (PWAR) for the four weeks before initiating laser therapy and the PWAR for four weeks after the initiation of laser therapy. Erbium:YAG laser treatment consisted of two components: debridement and resurfacing. The laser settings were the same for all treatments. We used the paired t test to compare pretreatment with posttreatment wound area reduction. During the four-week period before the initiation of laser therapy, the average PWAR was -33.6%. Four weeks after initiating treatment with the erbium:YAG laser, the average PWAR was 63.4% (p = .002) and 72.7% of wounds had ≥ 50% PWAR. By 12 weeks, 50% of wounds had healed. Erbium:YAG laser therapy accelerated DFU healing in a cohort of patients with ulcers that had been unresponsive to standard-of-care therapy.

Outcomes of Limb-Sparing Surgery for Osteomyelitis in the Diabetic Foot: Importance of the Histopathologic Margin

Johnson MJ, Shumway N, Bivins M, Bessesen MT

Open Forum Infect Dis. 2019 Sep 10;6(10). doi: 10.1093/ofid/ofz382. eCollection 2019 Oct.

Background: Diabetes mellitus affects up to 14% of Americans. Infection of the diabetic foot is a common complication, which can lead to amputation. If infection extends to involve bone, the risk of amputation is increased fourfold. Presence of osteomyelitis at the histopathologic margin of resection portends a poor prognosis in osteomyelitis outside the setting of the diabetic foot. We aimed to assess the association of a positive histopathologic margin with the outcome of osteomyelitis in the diabetic foot.

Methods: Medical records were reviewed for all patients who underwent below-ankle amputation for osteomyelitis of the diabetic foot. Patients who had at least one year of follow-up, a histopathologic diagnosis of osteomyelitis, and a comment on whether the margin was involved were included.

Results: Thirty-nine of 66 (59%) cases had remission of osteomyelitis at 12 months. When comparing cases with remission with those who experienced recurrence in the 12 months of follow-up, there were no statistically significant differences in age, glycosylated hemoglobin, duration of antimicrobial therapy, Infectious Diseases Society of America class, or presence of osteomyelitis at the histopathologic margin. Among cases with a negative histopathologic margin, 29/48 (60.4%) were free of disease at one year, compared with 10/18 (55.6%) cases with a positive histopathologic margin ($P = .72$). Remission was significantly more frequent in cases undergoing amputation at the digit level (66.7%) compared with amputation at the metatarsal level (40.7%) ($P = .045$).

Conclusions: Osteomyelitis of the diabetic foot at the histopathologic margin of resection was not associated with increased risk of treatment failure. Resection at the level of the digit was associated with a lower risk of failure than at the metatarsal level.

The Natural History of Early-Onset Scoliosis

Karol LA

J Pediatr Orthop. 2019 Jul;39(6,Suppl 1):S38-S43. doi: 10.1097/BPO.0000000000001351.

Background: Early-onset scoliosis (EOS) is defined as the diagnosis of a spinal deformity before the age of 5 years. It can be divided into idiopathic, neuromuscular/syndromic, and congenital etiologies.

Methods: The literature on the natural history of EOS is summarized.

Results: The natural history varies with the etiology of EOS. Idiopathic curves might benefit from early serial casting. The natural history of neuromuscular and syndromic scoliosis is highly dependent on the natural history of the underlying disorder. Congenital scoliosis has a variable prognosis depending on the location and extent of the congenital malformations.

Conclusions: Treatment of children with EOS is customized to the particular disorder. While lack of treatment has been shown to lead to increased mortality, extensive early definitive fusion may lead to thoracic insufficiency. Delaying definitive surgery and the use of growing instrumentation may provide benefit in maintaining pulmonary health.

The Influence of Body Habitus on Documented Brace Wear and Progression in Adolescents with Idiopathic Scoliosis

Karol LA, Wingfield JJ, Virostek D, Felton K, Jo C

J Pediatr Orthop. 2020 Mar;40(3):e171-e175. doi: 10.1097/BPO.0000000000001420.

Background: Although studies have been published stating obese patients are less compliant with brace use, no objective studies measuring hours of daily brace wear have been performed to correlate brace wear and success with body mass index (BMI). The purpose of this study was to establish the relationship between BMI and brace compliance, and between BMI and progression to surgical magnitude of 50 degrees or more.

Methods: A total of 175 adolescents were prescribed thoracolumbarsacral orthosis for the treatment of an adolescent idiopathic scoliosis and followed to completion of treatment. BMI was measured at brace prescription and divided into: (1) underweight (< 5th percentile), (2) normal (> 5th, < 85%), (3) overweight (> 85%, < 95%), and (4) obese (> 95%). Thermochron sensors were used to measure compliance. Radiographs were measured at brace prescription and at time of brace discontinuation or surgery. An outcome was classified as successful if curve magnitude was < 50 degrees and no surgery was performed.

Results: The underweight group wore their braces more hours than the other groups (15.7 h low, 12.5 h normal, 11.7 h high, and 9.0 h obese BMI (low vs. normal $P = 0.031$, low vs. high $P = 0.01$, low vs. obese $P = 0.01$). The underweight group had the highest rate of surgical progression (60%), compared with 27.7% of normal BMI teens, 28.6% of overweight patients, and 55.6% of obese patients. The low BMI group had a significantly higher rate of surgery than the normal BMI group ($P = 0.01$).

Conclusion: Although overweight and obese patients wear orthoses the least hours daily, the highest surgical risk is in underweight adolescents despite good compliance.

Comparison of Implant Density in the Management of Lenke 1B and 1C Adolescent Idiopathic Scoliosis

Kilinc BE, Tran DP, Johnston C

Acta Orthop Bras. 2019 Jan-Feb;27(1):33-37. doi:10.1590/1413-785220192701189400.

Objective: To compare radiographic and surgical outcomes of Lenke 1B and 1C patterns.

Methods: One hundred twenty patients with Lenke 1B and 1C scoliosis were grouped according to implant density as follows: low density (LD) of ≤ 1.4 and high density (HD) of > 1.4 . Matched subgroups (30 patients each) based on age, curve magnitude, and body mass index (BMI) were analyzed. Radiographic parameters were evaluated before operation, immediately after operation (ipo), and at two years' follow-up. SRS-30 was administered before operation and at two years' follow-up.

Results: The major curves of the LD ($n = 82$) and HD groups ($n = 38$) were respectively 59.1 degrees and 65.6 degrees before operation ($p < .001$), 26.3 degrees and 22.9 degrees ipo ($p = .05$), and 29.9 degrees and 19.8 degrees at two years' follow-up ($p < .001$). No significant differences in postoperative trunk shift and coronal balance were found ($p = .69$ and $p = .74$, respectively). The HD group had higher blood loss ($p = .02$), number of implants ($p < .001$), levels fused ($p = .002$), and surgical time ($p < .001$). The HD group had a higher prevalence of hypokyphosis from before operation to follow-up ($p < .001$). No significant differences were observed in the SRS-30 scores before operation and at two years' follow-up. The matched groups had similar preoperative major curves ($p = .56$), ages ($p = .75$), and BMIs ($p = .61$). Significantly longer surgical time ($p = .009$), higher density ($p < .001$), and better correction ($p = .0001$) were found in the HD group at two years' follow-up. No significant differences were found in the SRS-30 scores before operation and at two years' follow-up.

Conclusion: LD constructs included fewer segments fused, lower intraoperative estimated surgical blood loss, shorter operation time, and potentially decreasing complication risks due to fewer implants.

Level of Evidence: Level III-retrospective cohort study.

Endoscopic Versus Open Carpal Tunnel Release: A Detailed Analysis Using Time-Driven Activity-Based Costing at an Academic Medical Center

Koehler DM, Balakrishnan R, Lawler EA, Shah AS

J Hand Surg Am. 2019 Jan;44(1):62.e1-62.e9. doi: 10.1016/j.jhsa.2018.04.023. Epub 2018 Jun 11.

Purpose: In order to effectively improve value in health care delivery, providers must thoroughly understand cost drivers. Time-driven activity-based costing (TDABC) is a novel accounting technique that may allow for precise characterization of procedural costs. The purpose of the present study was to use TDABC to characterize costs in a high-volume, low-complexity ambulatory procedure (endoscopic vs. open carpal tunnel release [CTR]), identify cost drivers, and inform opportunities for clinical improvement.

Methods: The costs of endoscopic and open CTR were calculated in a matched cohort investigation using TDABC. Detailed process maps including time stamps were created accounting for all clinical and administrative activities for both the endoscopic and the open treatment pathways on the day of ambulatory surgery. Personnel cost rates were calculated accounting for capacity, salary, and fringe benefits. Costs for direct consumable supplies were based on purchase price. Total costs were calculated by aggregating individual resource utilization and time data and were compared between the two surgical techniques.

Results: Total procedural cost for the endoscopic CTR was 43.9% greater than the open technique (\$2,759.70 vs. \$1,918.06). This cost difference was primarily driven by the disposable endoscopic blade assembly (\$217), direct operating room costs related to procedural duration (44.8 vs. 40.5 minutes), and physician labor.

Conclusions: Endoscopic CTR is 44% more expensive than open CTR compared with a TDABC methodology at an academic medical center employing resident trainees. Granular cost data may be particularly valuable when comparing these two procedures, given the clinical equipoise of the surgical techniques. The identification of specific cost drivers with TDABC allows for targeted interventions to optimize value delivery.

Characterization of Hand Anomalies Associated with Möbius Syndrome

Koehler DM, Goldfarb CA, Snyder-Warwick A, Roberts S, Wall LB

J Hand Surg Am. 2019 Jul;44(7):548-555. doi: 10.1016/j.jhsa.2019.02.020. Epub 2019 Apr 25.

Purpose: To investigate the distinguishing morphological characteristics of the upper extremities in children with Möbius syndrome.

Methods: Twenty-seven involved extremities in 14 patients with a diagnosis of Möbius syndrome were identified at two institutions. Medical records, radiographs, and clinical photographs were evaluated. Congenital hand differences were classified according to the Oberg, Manske, and Tonkin classification, and hands with symbrachydactyly were classified by the Blauth and Gekeler classification. The presence of other congenital anomalies was catalogued.

Results: There was bilateral involvement in 93% of patients with congenital hand anomalies. Twelve patients demonstrated congenital hand anomalies and two patients had been diagnosed with arthrogryposis. Among the 12 patients with congenital hand anomalies, 21 hands were classifiable as symbrachy-

dactyly by the Oberg, Manske, and Tonkin classification and could be categorized by the Blauth and Gekeler classification. Short finger type was the most common subtype of symbrachydactyly, present in 13 hands. Eleven of these 13 patients (85%) were primarily affected on the radial side of the hand. Proximal arm involvement was identified in two patients with symbrachydactyly, both of whom had Poland syndrome and an absent pectoralis major.

Conclusion: Symbrachydactyly in Möbius syndrome differs from the typical presentation of symbrachydactyly. Characteristically, there is a bilateral presentation with a strong predilection for radially based brachydactyly. These described characteristics may help the hand surgeon appropriately assess patients, especially those with radial-sided symbrachydactyly.

Radiographic, Pulmonary, and Clinical Outcomes with Halo Gravity Traction

LaMont LE, Jo C, Molinari S, Tran D, Caine H, Brown K, Wittenbrook W, Schochet P, Johnston CE, Ramo B

Spine Deform. 2019 Jan;7(1):40-46. doi: 10.1016/j.jspd.2018.06.013. Epub 2019 Dec 30.

Study Design: Single-center retrospective chart review. Halo gravity traction (HGT) is a safe and effective intervention to improve spinal deformity prior to corrective instrumentation. Our study aimed to report on a large series of patients undergoing HGT, demonstrate the correlation between thoracic height achieved and pulmonary function, and evaluate the efficacy of nutritional assessment and intervention while in HGT for these often malnourished or nutritionally compromised patients.

Methods: 107 patients underwent HGT for severe spinal deformity. Major coronal and sagittal Cobb angles, T1-T12 ht, and T1-S1 ht were collected pre-HGT, during HGT, postoperation, and two years postoperation. Pulmonary function tests (PFTs) recorded forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV1). Nutritional interventions such as formal nutrition consult, resulting nutritional supplementation, or interventions were recorded.

Results: Patients were in HGT for a mean of 82.1 days, and the mean maximum percentage body weight in traction was 49.5%. Mean major coronal Cobb angle prior to HGT was 92.6°, improving to 65.8° in maximal traction and to 47° after surgical intervention. Traction accounted for 78% of T1-T12 height and 79% of T1-S1 length gains from pre- to postoperation. We showed a positive correlation between gain in T1-T12 height and percentage predicted changes in FVC and FEV1. Weight Z score for the entire cohort of patients improved from -2.8 pre-traction to -2.4 in traction and then to -2.3 postoperative.

Conclusions: Our study again demonstrated that HGT achieves radiographic improvement safely and effectively in severe spinal deformity. We demonstrated a positive correlation between improvement in PFTs and increase in thoracic height seen with HGT. Additionally, improvement in weight Z score was seen in the entire population and the most at-risk patients for malnutrition, results that have not been shown before.

Recurrence After Surgical Intervention for Infantile Tibia Vara: Assessment of a New Modified Classification

LaMont LE, McIntosh AL, Jo CH, Birch JG, Johnston CE

J Pediatr Orthop. 2019 Feb;39(2):65-70. doi: 10.1097/BPO.0000000000000933.

Background: To propose a modified classification of infantile tibia vara based on the morphology of the metaphyseal/epiphyseal tibial slope that better correlates with treatment outcomes than the traditional Langenskiöld classification.

Methods: We performed a retrospective review of 82 patients and 115 limbs that underwent surgery for infantile tibia vara over a 22-year period (1990 to 2012) at a single institution. A modified Langenskiöld classification was applied to all patients preoperatively, and the outcomes were assessed. The modified system created a three-stage classification (types A, B, and C): Type A has a partially lucent medial metaphyseal defect, with or without “beaking”; type B deformity has downward-sloping curvature of the lateral and inferior rim of a completely lucent metaphyseal defect, which then has an upslope at the medial rim, resembling a ski-jump, with no epiphyseal downward slope; type C has vertical, down-sloping deformity of both the epiphysis and metaphysis, with no upward curvature projecting medially at the inferior extent, while the epiphysis slopes downward into the metaphyseal defect.

Results: Sixty-seven limbs did not develop recurrence following corrective osteotomy, whereas 48 limbs required at least one repeat surgery for recurrent deformity. Preoperative mechanical axis deviation, medial proximal tibial angle, lateral distal tibial angle, and body mass index did not differ significantly between those with recurrence and those without. Mean age at surgery was significantly different for those who developed recurrence compared with those who did not. Patients without recurrence were 4.3 years of age (range, 2.4 to 10.3 y) compared with 6.2 years of age (range, 2.9 to 10.1 y) for those who recurred ($P < 0.01$). Of patients who developed recurrent deformity, there were significantly more patients with type C changes (71.7%, $P < 0.01$) than either type A (22.5%) or type B (20.7%). High rates of recurrence were seen for both Langenskiöld stage III (50%) and stage IV (69.6%).

Conclusions: Consistent with prior studies, age 5 seems to be a critical transition in the risk for recurrent deformity after tibial osteotomy. Extreme vertical sloping of the medial metaphyseal defect, as in some classic Langenskiöld III lesions and more precisely described by type C in a newer, modified classification, carries a poor prognosis for successful correction by high tibial osteotomy alone or in combination with epiphysiodesis.

Challenges Encountered Using Fassier-Duval Rods in Osteogenesis Imperfecta

Landrum M, Birch C, Richards BS
Current Orthopaedic Practice. 2019;30(4):319-322.

Background: Intramedullary fixation remains a mainstay in the management of deformity and fracture in patients with osteogenesis imperfecta (OI). Fassier-Duval telescoping intramedullary rods were introduced in 2003 and have substantially replaced the use of Bailey-Dubow rods in the treatment of OI patients. The purpose of this study was to identify limitations, if any, of the Fassier-Duval rod in this condition.

Methods: A retrospective chart and radiograph review was performed of all OI patients treated with Fassier-Duval telescoping rods between the years 2005 and 2017 at a single institution. The clinical records and radiographic studies were reviewed to identify technical challenges intraoperatively and problems postoperatively.

Results: Twenty procedures were identified in which Fassier-Duval rods were placed in nine patients. Intraoperative technical challenges occurred in six (distal migration of epiphyseal fixation, rod prominence in the knee, distal guidewire protrusion, and fracture). Postoperatively, nine of the 20 Fassier-Duval rods (45%) had failure of epiphyseal fixation and lost their telescoping feature. Three (15%) long bones fractured with the device in place with the rods bending and subsequently requiring revision. One (5%) long bone fractured distal to the rod after loss of epiphyseal fixation. There were no infections.

Conclusions: In OI long bone deformities, the goal of the Fassier-Duval rod is to provide realignment with intramedullary stabilization, reduce the number of fractures, and limit reoperations due to the expansion of the telescoping devices. Although the FD rod has the potential to accomplish these goals, challenges remain in this condition.

Talectomy as Part of Chronic Foot and Ankle Deformity Correction Procedure: A Retrospective Study

Langan T, Lalli TAJ, Smith CN, Wukich DK
J Foot Ankle Surg. 2020 Jan;59(1):16-20.

Abstract: Severe foot and ankle deformities can be associated with high complication rates and impaired quality of life in patients. Surgical correction using a talectomy procedure has previously been described in many lower extremity pathologies and is a powerful tool for the correction of severe foot and ankle deformity. This study aimed to describe the role of talectomy and the outcomes of this procedure in patients presenting with severe foot and ankle deformity. A review of 45 patients undergoing talectomy by a single surgeon was completed. Data extracted included the cause of deformity, history of infection, body mass index, and relevant comorbidities. Outcome measures of interest were minor or major complications and limb functionality at final follow-up. Statistical analysis was performed by using a Wilcoxon rank sum test and a Fisher exact test looking at variables affecting selected outcome measures. Limb salvage occurred in 38 of 45 patients (84.4%). Patients with an infection history had 89% lower odds of a functional limb at final follow-up ($p = .0389$). Six of seven patients (85.7%) who ultimately underwent amputation had a history of prior infection. Women had 8.25 times higher odds of having a functional limb compared with men ($p = .047$). All 13 patients with major complications had neuropathy ($p = .024$). Patients with chronic lower extremity deformities can successfully be treated with a talectomy as a part of the reconstructive procedure. This is a challenging patient population that is associated with a high complication rate. Patients with a history of infection should be counseled on the possibility of requiring major amputation.

What Are the Optimal Cutoff Values for ESR and CRP to Diagnose Osteomyelitis in Patients with Diabetes-Related Foot Infections?

Lavery LA, Ahn J, Ryan EC, Bhavan K, Oz OK, La Fontaine J, Wukich DK
Clin Orthop Relat Res. 2019 Jul;477(7):1594-1602. doi:10.1097/CORR.0000000000000718.

Background: Distinguishing osteomyelitis from soft-tissue infection of the foot is important because osteomyelitis is associated with more operations, amputation, and prolonged antibiotic exposure. Both erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are routinely ordered inflammatory biomarkers for evaluating foot infection. When initial evaluation is inconclusive, advanced imaging is indicated, and high clinical or radiographic suspicion of osteomyelitis may indicate bone biopsy to identify organisms and antibiotic sensitivity. Although ESR and CRP levels are helpful for distinguishing osteomyelitis from soft-tissue infections in patients with diabetes-related foot infections, parameters regarding optimal cutoff values for those tests have not, to our knowledge, been defined.

Questions/Purposes: (1) What are the optimal cutoff values for ESR and CRP to differentiate osteomyelitis from soft-tissue infection in patients with diabetes-related foot infection? (2) Can a diagnostic algorithm be derived to guide interpretation of ESR and CRP to improve recognition of osteomyelitis in the setting of diabetic foot infection?

Methods: The medical records of 1,842 patients between 18 and 89 years of age treated at our institution between January 1, 2010, and February 6, 2017, for foot infection were reviewed. For inclusion, patients must have had a diagnosis of diabetes mellitus, moderate or severe infection, ESR and CRP values within 72 hours of admission, either advanced imaging (MRI or single-positron emission computed tomography/computed tomography [SPECT/CT]) or bone biopsy during admission, and must not have had comorbidities that could affect ESR and CRP, such as autoimmune disorders. As such, 1,489 patients were excluded, and 353 patients were included in the study. Osteomyelitis was diagnosed by positive bone culture or histopathology. Osteomyelitis was considered to be absent if there was a negative MRI or SPECT/CT result, or negative bone culture and histology findings if imaging was inconclusive. We identified 176 patients with osteomyelitis and 177 with soft-tissue infection. A blinded

investigator performed the statistics. Optimal cutoffs of ESR and CRP were determined using receiver operative characteristic (ROC) analysis. A diagnostic algorithm was determined using epidemiologic principles of screening evaluations.

Results: An ESR of 60 mm/h and a CRP level of 7.9 mg/dL were determined to be the optimal cutoff points for predicting osteomyelitis based on results of the ROC analysis. The ESR threshold of 60 mm/h demonstrated a sensitivity of 74% (95% confidence interval [CI], 67-80) and specificity of 56% (95% CI, 48-63) for osteomyelitis, whereas the CRP threshold of 7.9 mg/dL had a sensitivity of 49% (95% CI, 41-57) and specificity of 80% (95% CI, 74-86). If the ESR is < 30 mm/h, the likelihood of osteomyelitis is low. However, if ESR is > 60 mm/h and CRP level is > 7.9 mg/dL, the likelihood of osteomyelitis is high, and treatment of suspected osteomyelitis should be strongly considered.

Conclusions: While ESR is better for ruling out osteomyelitis initially, CRP helps distinguish osteomyelitis from soft-tissue infection in patients with high ESR values. Further prospective studies addressing the prognostic value of ESR and CRP are needed, and a more comprehensive diagnostic algorithm should be developed to include other diagnostic tests such as probe-to-bone and imaging.

Level of Evidence: Level III-diagnostic study.

Biofilm and Diabetic Foot Ulcer Healing: All Hat and No Cattle

Lavery LA, Bhavan K, Wukich DK

Ann Transl Med. 2019 Apr;7(7):159. doi:10.21037/atm.2019.03.33.

Abstract: Is there evidence that biofilm has an important role in the etiology of non-healing diabetic foot ulcers? Biofilm is touted as the new reason for wound chronicity that has until recently been an unrecognized cause of our failures in wound healing. The term biofilm is not new. Historically, it has been associated with recalcitrant infections in patients with orthopaedic implants. Recently, the wound healing literature has proposed that biofilm essentially acts as a protector of bacteria resulting in colonization, infection, and impaired healing. Many pharmaceutical companies tout new antibiofilm products. There is a new focus on animal studies with biofilm infections and clinical studies with antibiofilm products. However, there is very little real clinical evidence that biofilm impedes diabetic wound healing.

Diabetic Foot Syndrome in the Twenty-First Century

Lavery LA, Oz OK, Bhavan K, Wukich DK

Clin Podiatr Med Surg. 2019 Jul;36(3):355-359. doi:10.1016/j.cpm.2019.02.002.

Abstract: Diabetes mellitus is an international epidemic. In the United States, the prevalence of diabetes has increased from estimates in 1990 when 6.5% of the population was affected and 6.2 million people had diabetes compared with the estimates in 2017 of 24.7 million people with diabetes, accounting for 9.6% of the adult population. The diabetic foot syndrome manifests as a combination of diabetes-related diseases, including diabetic sensory neuropathy, limited joint mobility, immunopathy, peripheral arterial disease, foot ulceration, and Charcot arthropathy. The culmination of these provides an ideal environment for unrecognized tissue injury that leads to ulceration, infection, infection, and amputation.

The Infected Diabetic Foot: Re-Evaluating the IDSA Diabetic Foot Infection Classification

Lavery LA, Ryan EC, Ahn J, Crisologo PA, Oz OK, La Fontaine J, Wukich DK

Clin Infect Dis. 2019 Jun 8. doi:10.1093/cid/ciz489.

Background: Our goal is to provide evidence to revise the IDSA diabetic foot infection classification. We

propose adding a separate tier for osteomyelitis and evaluating if moderate and severe infection criteria improves the classification's ability to direct therapy and determine outcomes.

Methods: We included 294 patients in this retrospective cohort study of moderate and severe diabetic foot infections. Diabetic foot osteomyelitis was confirmed by bone culture or histopathology. Soft tissue infection (STI) was based on negative bone culture, MRI, or SPECT CT. We stratified STI and osteomyelitis based on the IDSA criteria for moderate and severe infections and compared outcomes and post-discharge complications.

Results: Osteomyelitis patients had worse outcomes than STI: antibiotic duration (32.5 +/- 46.8 vs. 63.8 +/- 55.1 days, $p < 0.01$), need for surgery (55.5% vs. 99.4%, $p < 0.01$), number of surgeries (2.1 +/- 1.3 vs. 3.3 +/- 2.3, $p < 0.01$), amputation (26.3% vs. 83.4%, $p < 0.01$), re-infection (38.0% vs. 56.7%, $p < 0.01$), acute kidney injury (AKI) (37.2% vs. 49.7%, $p = 0.04$), and length of stay (14.5 +/- 14.9 vs. 22.6 +/- 19.0 days, $p < 0.01$). There were no differences in moderate and severe STI outcomes except for infection re-admissions (46.2% vs. 25.0%, $p = 0.02$), and AKI (31.2% vs. 50.0%, $p = 0.03$). There were no differences in moderate and severe osteomyelitis except the number of surgeries (2.8 +/- 2.1 vs. 4.1 +/- 2.5, $p < 0.01$), and length of stay (18.6 +/- 17.5 vs. 28.2 +/- 17.7, $p < 0.01$).

Conclusions: The IDSA diabetic foot infection classification better reflects outcomes, opposed to current criteria, if risk categories were stratified by infection type (STI or osteomyelitis) and moderate and severe infections are not categorized separately.

Rebound Deformity After Growth Modulation in Patients with Coronal Plane Angular Deformities About the Knee: Who Gets It and How Much?

Leveille LA, Razi O, Johnston CE

J Pediatr Orthop. 2017 May 18;39(7):353-358. doi:10.1097/BPO.0000000000000935.

Background: With observed success and increased popularity of growth modulation techniques, there has been a trend toward use in progressively younger patients. Younger age at growth modulation increases the likelihood of complete deformity correction and need for implant removal before skeletal maturity, introducing the risk of rebound deformity. The purpose of this study was to quantify the magnitude of and identify risk factors for rebound deformity after growth modulation.

Methods: We performed a retrospective review of all patients undergoing growth modulation with a tension band plate for coronal plane deformity about the knee with subsequent implant removal. Exclusion criteria included completion epiphysiodesis or osteotomy at implant removal, ongoing growth modulation, and < 1-year radiographic follow-up without rebound deformity. Mechanical lateral distal femoral angle, mechanical medial proximal tibial angle, hip-knee-ankle angle (HKA), and mechanical axis station were measured before growth modulation, before implant removal, and at final follow-up.

Results: In total, 67 limbs in 45 patients met the inclusion criteria. Mean age at growth modulation was 9.8 years (range, 3.4 to 15.4 y), and mean age at implant removal was 11.4 years (range, 5.3 to 16.4 y). Mean change in HKA after implant removal was 6.9 degrees (range, 0 to 23 degrees). In total, 52% of patients had > 5 degrees rebound and 30% had > 10 degrees rebound in HKA after implant removal. Females below 10 years and males below 12 years at time of growth modulation had a greater mean change in HKA after implant removal compared with older patients (8.4 vs. 4.7 degrees, $P = 0.012$). Patients with initial deformity > 20 degrees had an increased frequency of rebound > 10 degrees compared with patients with less severe initial deformity (78% vs. 22%, $P = 0.002$).

Conclusions: Rebound deformity after growth modulation is common. Growth modulation at a young age and large initial deformity increase risk of rebound. However, rebound does not occur in all at-risk patients; therefore, we recommend against routine overcorrection.

Level of Evidence: Level IV-retrospective study.

Financial Analysis of Closed Femur Fractures in 3- to 6-Year-Olds Treated with Immediate Spica Casting Versus Intramedullary Fixation

Lewis RB, Hariri O, Elliott ME, Jo CH, Ramo BA

J Pediatr Orthop. 2019 Feb;39(2):e114-e119. doi:10.1097/BPO.0000000000001253.

Background: Health care in America continues to place more importance on providing value-based medicine. Medicare reimbursements are increasingly being tied to this, and future policy changes are expected to reinforce these trends. Recent literature has shown pediatric femur fractures in pre-school-age children have equivalent clinical and radiographic outcomes when treated with spica casting or flexible intramedullary nails (IMN). We compared hospital care statistics including charges for nonoperative versus operative treatment for closed femur fractures in 3- to 6-year-olds.

Methods: An IRB-approved retrospective chart review was performed of 73 consecutive 3- to 6-year-olds treated at a regional level-1 pediatric hospital from January 1, 2009, to December 31, 2013, with an isolated, closed femoral shaft fracture. Exclusion criteria included open fractures, bilateral injury, and polytrauma. Immediate spica casting was performed in the emergency department or Anesthesia Procedure Unit versus IMN in the operating room.

Results: A total of 41 patients were treated with spica casting, and 32 patients were treated operatively with flexible IMNs; three patients failed nonoperative care. After analysis of final treatment groups, significant differences included age at injury: 3.7 years for cast versus 5.3 years for IMN ($P < 0.001$), time to discharge 21 versus 41 hours ($P < 0.001$), 3.2 versus 4.4 clinic visits ($P < 0.001$), follow-up 3.5 versus 9.4 months ($P < 0.001$). Orthopaedic surgeon charges were \$1,500 for casted patients versus \$5,500 for IMN ($P < 0.001$). Total hospital charges were \$19,200 for cast versus \$59,700 for IMN ($P < 0.001$). No difference was found between clinic charges or number of radiographs between groups. In total, 76% of cast group was discharged < 24 hours from admission versus 8.6% in operative group. In the operative group, 83% had implant removal with no statistically significant charge difference between those who had implant removal versus retention.

Conclusions: Treatment of pediatric femur fractures in 3- to 6-year-olds with IMN is associated with longer hospital stays, significantly greater hospital charges, longer follow-up, and more clinic visits compared with spica casting. These findings are at odds with previous literature showing shorter hospital stays and decreased cost with nailing compared to traction and casting. This shows a clear difference between two treatments that yield similar clinical and radiographic outcomes.

Level of Evidence: Level III-retrospective comparative study.

Case Series: Amniotic Band Sequence with Craniofacial Abnormalities

Lies S, Beckwith T, Mills J, Butler L, Ezaki M, Oishi S

Birth Defects Res. 2019 Nov 15;111(19):1494-1500. doi:10.1002/bdr2.1576.

Background: To objectively describe craniofacial, visual, and neurological features associated with amniotic band syndrome (ABS) and discuss likely associated multifactorial etiology.

Methods: A retrospective review of patients identified with ABS and concomitant limb involvement and craniofacial features was conducted. The following data were collected from the patients' medical records: demographic information, past medical history including birth history, surgical history, previous clinic visits/physical exams, description of craniofacial features and ABS, family history, any noted obstetric complications, visceral features, visual features, craniofacial features, intracranial features, neurological symptoms, developmental features, diagnostic tests (including radiographs, IQ testing, EEG findings, chromosomes), photographs, and treatment history.

Results: Seven patients were included in the final cohort, all of whom had a cleft lip with six having both cleft lip and palate. Other craniofacial abnormalities seen were facial clefts that were vertical oblique in nature, tear duct involvement, cranial deformities that required surgical correction with cranial reconstruction, recorded hypertelorism with vision and gaze abnormalities, coloboma, lagophthalmos, and optic nerve dysplasia.

Conclusions: This case series presents seven children with craniofacial involvement associated with amniotic band sequence and attempts to categorize the salient dysmorphology and neurocognitive development. Major craniofacial anomalies in patients with ABS are rare clinical findings that cannot be completely explained on the basis of premature amniotic layer disruption alone. This study supports that the dysmorphology seen in cases of ABS with craniofacial involvement is complex and most likely multifactorial.

Level of Evidence: Level IV-case series.

Congenital Tibial Deficiency

Litrenta J, Young M, Birch JG, Oetgen ME

J Am Acad Orthop Surg. 2018;27(6):e268-e279. doi:10.5435/JAAOS-D-16-00838.

Abstract: Congenital tibial deficiency is a rare condition characterized by partial to complete absence of the tibia, an intact but frequently overgrown fibula, variable degrees of knee deformity and function, and an abnormal equinovarus foot. It can occur in isolation but also presents concurrently with other orthopaedic anomalies and syndromic conditions. Among these, congenital abnormalities of the hand and femur are most commonly observed. Many theories exist regarding its etiology, and some genetic mutations have been identified; however, the underlying mechanism remains unknown. The prognosis and treatment differ based on the clinical severity. The goal of treatment is always to create a stable, functional limb, most commonly with amputation and use of prosthetics. Controversy exists over the level of amputation and the usefulness of reconstructive procedures to preserve the foot and limb length. Current investigation on this complex disorder is focused on identifying its origins and further developing a classification-based treatment algorithm to improve patient outcomes.

Trauma in the Diabetic Limb

Liu GT, Sanders DT, Raspovic KM, Wukich DK

Clin Podiatr Med Surg. 2019 Jul;36(3):499-523. doi: 10.1016/j.cpm.2019.02.012. Epub 2019 Apr 8.

Abstract: Poorly controlled diabetes with comorbid manifestations negatively affects outcomes in lower extremity trauma, increasing the risk of short-term and long-term complications. Management strategies of patients with diabetes that experience lower extremity trauma should also include perioperative management of hyperglycemia to reduce adverse and serious adverse events.

Surgical Management of Displaced Intra-Articular Calcaneal Fractures: What Matters Most?

Liu GT, VanPelt MD, Lalli T, Raspovic KM, Wukich DK

Clin Podiatr Med Surg. 2019 Apr;36(2):173-184. doi:10.1016/j.cpm.2018.10.002.

Abstract: Displaced intra-articular calcaneal fractures are severe, complex injuries that can cause significant long-term functional impairment. Despite the controversies of whether these fractures should be treated operatively or nonoperatively, functional improvement can be seen with confounding variables that can be controlled by the surgeon. This article reviews prognostic factors that are associated with good functional outcomes following operatively treated displaced intra-articular calcaneal fractures.

Increased Rates of Readmission, Reoperation, and Mortality Following Open Reduction and Internal Fixation of Ankle Fractures Are Associated with Diabetes Mellitus

Liu JW, Ahn J, Raspovic KM, Liu GT, Nakonezny PA, Lavery LA, Wukich DK

J Foot Ankle Surg. 2019 May;58(3):470-474. doi:10.1053/j.jfas.2018.09.023.

Abstract: The purpose of this study was to compare the rates of readmission, reoperation, and mortality in patients with and without diabetes mellitus during the 30-day postoperative period after ankle fracture surgery. Patients who underwent operative management for ankle fractures between 2006 and 2015 were identified in the American College of Surgeons National Surgical Quality Improvement Program® database by using Current Procedural Terminology codes for ankle fracture surgery. A total of 17,464 patients undergoing ankle fracture surgery were identified. Of these patients, 2,044 (11.7%) had diabetes and 15,420 (88.3%) did not have diabetes. We excluded patients older than 90 years or with inadequate perioperative data. Patients with diabetes had significantly higher rates of readmission (2.84% vs. 1.05%, $p < .0001$), significantly higher rates of unplanned reoperation (2.3% vs. 0.74%, $p < .0001$), and significantly higher rates of mortality (0.7% vs. 0.2%, $p < .0001$) compared with patients without diabetes. Additionally, patients with diabetes had significantly greater age-adjusted odds ratios (ORs) of unplanned readmission (OR 2.40, 95% confidence interval [CI] 1.74 to 3.31, $p < .0001$), unplanned reoperation (OR 2.56, 95% CI 1.44 to 3.27, $p < .0001$), and mortality (OR 2.01, 95% CI 1.08 to 3.62, $p = .0432$) than did patients without diabetes after ankle surgery. In this large-scale retrospective study, we demonstrated that the presence of diabetes significantly increases the risk of unplanned readmission, unplanned reoperation, and mortality during the 30-day postoperative period after ankle fracture surgery.

Criteria for Surgical Reduction in High-Grade Lumbosacral Spondylolisthesis Based on Quality of Life Measures

Mac-Thiong JM, Hresko MT, Alzakri A, Parent S, Sucato DJ, Lenke LG, Marks M, Labelle H

Eur Spine J. 2019 Sep;28(9):2060-2069. doi:10.1007/s00586-019-05954-x.

Purpose: Although surgical reduction in high-grade lumbosacral spondylolisthesis is often performed in young patients, criteria for defining adequate reduction leading to optimal outcomes have yet to be defined. The purpose of this study is to determine if surgical reduction in pelvic balance, slip grade, lumbosacral angle, and L5 incidence are associated with quality of life after surgery, based on specific criteria proposed previously in the literature.

Methods: A prospective cohort of 61 patients (14.4 +/- 2.7 years) with high-grade lumbosacral spondylolisthesis was followed for a minimum of two years after surgery. SRS-22 scores, slip grade, lumbosacral angle, pelvic balance, and L5 incidence were assessed before surgery and at the latest follow-up. Multivariable regression analyses were performed using postoperative SRS domain and total scores as the dependent variables. Independent variables consisted of the preoperative SRS scores, and specific criteria of pelvic balance, slip grade, lumbosacral angle, and L5 incidence. The influence of slip grade, lumbosacral angle, and L5 incidence on pelvic balance was also assessed.

Results: Obtaining a balanced pelvis postoperatively was mainly predictive of improved satisfaction with surgery and self-image and also tended to be associated with higher scores for other domains. Improved mental health was associated with reduction to a low-grade slip. Reduction in lumbosacral angle was not predictive of quality of life. Postoperative pelvic balance was mainly associated with preoperative pelvic balance, but there was a tendency for achieving normal pelvic balance when the postoperative L5 incidence was 60 degrees or smaller.

Conclusions: When performing surgery in young patients with high-grade lumbosacral spondylolisthesis, achieving normal pelvic balance is the key because it is associated with improved quality of life. Reduction to a low-grade slip is predictive of improved mental health, but reduction in lumbosacral angle is not associated with postoperative quality of life. There was a tendency for obtaining normal postoperative balance in patients with postoperative L5 incidence 60 degrees or smaller. These slides can be retrieved under Electronic Supplementary Material.

A Randomized Controlled Trial Comparing rhBMP-2/Absorbable Collagen Sponge Versus Autograft for the Treatment of Tibia Fractures with Critical Size Defects

Major Extremity Trauma Research Consortium (METRC)

J Orthop Trauma. 2019 Aug;33(8):384-391. doi: 10.1097/BOT.0000000000001492.

Objectives: To compare radiographic union of tibia fractures with bone defects treated with recombinant bone morphogenetic protein-2 (rhBMP-2) with allograft to autogenous iliac crest bone graft (ICBG).

Design: FDA-regulated multicenter randomized trial.

Setting: Sixteen U.S. trauma centers.

Patients/Participants: Thirty patients (18-65 years of age) with Type II, IIIA, or IIIB open tibia fracture and bone defect treated with an intramedullary nail.

Intervention: rhBMP-2 (n = 16) versus ICBG (n = 14).

Main Outcome Measurements: Radiographic union within 52 weeks. Secondary outcomes included clinical healing, patient-reported function, major complications, and treatment cost. Equivalence was evaluated by testing whether a 90% two-sided confidence interval for the difference in the probability of radiographic union between rhBMP-2 or ICBG is contained within the interval (220% to +20%). A post hoc Bayesian analysis, using data from a previous trial, was also conducted.

Results: Twenty-three patients had union data at 52 weeks: 7/12 (58.3%) rhBMP-2 were radiographically united compared with 9/11 (81.8%) ICBG, resulting in a treatment difference of -0.23 (90% CI: -0.55 to 0.10). Patients treated with rhBMP-2 had lower rates of clinical healing at 52 weeks (27% vs. 54%), higher mean Short Musculoskeletal Function Assessment scores (dysfunction: 33.3 vs. 23.7; bother score: 32.8 vs. 21.4) and experienced more complications (5 vs. 3). Mean treatment cost for rhBMP-2 was estimated at \$14,155 versus \$9,086 for ICBG.

Conclusion: These data do not provide sufficient evidence to conclude that ICBG and rhBMP-2 are equivalent regarding radiographic union.

Short-Term Radiographic and Patient Outcomes of a Novel Biplanar Plating System for Hallux Valgus Correction

Manchanda K, Wallace SB, Ahn J, Liu G, VanPelt M, Raspovic K, Wukich D, Lalli T

Foot & Ankle Orthopaedics. 2019 October 28; 4(4).

Introduction: Hallux valgus is a complex deformity of the great toe and is a major cause of pain for patients. Despite the variety of techniques, traditional osteotomies often do not address rotational deformities. A novel biplanar plating system was used to perform correction of metatarsal rotation at our institution starting in 2017. The purpose of this study was to determine the correction of rotational deformity and of radiographic parameters, maintenance of this correction (versus recurrence of hallux valgus), complication rates, and patient-reported objective survey scores. We sought to determine prognostic factors for successful correction, including age, gender, and time of surgery.

Methods: By retrospective chart review, we identified all patients treated by the novel biplanar plating at our institution. We recorded patient demographics, preoperative range of motion and maltracking, surgical details, operative complications, and any subsequent surgery. Imaging was reviewed at preoperative and postoperative visits to approximate the hallux valgus angle (HVA), intermetatarsal angle (IMA), and tibial sesamoid position (TSP). Outcome scores (AOFAS, FAAM, SF12 PCS, and MCS) preoperatively

and postoperatively at three months, six months, and 12 months were also recorded. The changes in these radiographic parameters and scores were then computed and analyzed to determine if there was an improvement with surgery.

Results: Fifty-seven procedures (in 55 patients) were performed and evaluated. There were eight complications and average follow-up time was 27.1 weeks (+13.8 weeks). Older age was significantly associated with more complications ($p = 0.018$). Gender and time of surgery did not show any significant association with complications. Radiographic parameters including HVA, IMA, and TSP were analyzed. At three and six months postoperatively, these parameters were significantly reduced from preoperative values. At 12 months, there was a trend toward significant reduction (p values of 0.06, 0.06, and 0.053, respectively); however, there were fewer patients who maintained follow-up during this period. The outcome scores showed improvement postoperatively, but only the AOFAS score showed statistical significance at three and six months.

Conclusion: Although statistical analysis was limited due to our population size and the retrospective nature of the study, there was an overall improvement in both radiographic parameters and clinical outcome scores. Older patients are also at higher risk of complications. Malrotation correction with this biplanar plating system is a novel technique and does require meticulous training. With continued expansion of our patient database and further longitudinal analysis, we hope to determine not only if correction is maintained over time but also if the steepness of the learning curve affects the number of complications earlier versus later in each individual surgeon's experience.

The Dimension of the Press Ganey Survey Most Important in Evaluating Patient Satisfaction in the Academic Outpatient Orthopedic Surgery Setting

Martinez JR, Nakonezny PA, Batty M, Wells J
Orthopedics. 2019 Jul 1;42(4):198-204. doi: 10.3928/01477447-20190625-03.

Abstract: Many studies have examined modifiable and nonmodifiable patient factors influencing patient satisfaction scores. The objective of this study was to evaluate which of the six domains making up the Press Ganey Survey had a greater magnitude of relative importance in the expected relationship with patient satisfaction in outpatient orthopedic surgery encounters. Press Ganey Survey satisfaction scores from 4,737 clinical encounters from adult reconstructive surgery, sports medicine, hand, foot and ankle, trauma, and general orthopedic clinics at a single academic center from November 2010 to May 2017 were reviewed. Multiple patient factors, modifiable and nonmodifiable, were recorded. The Press Ganey Survey was divided into six domains to evaluate the relative importance of each to total patient satisfaction. The standardized parameter estimates from the multiple linear regression revealed that of the six domains making up the Press Ganey Survey, care provider had the greatest magnitude of relative importance in the expected relationship with total patient satisfaction ($\beta = 0.53972$). Approximately 80% of the variance in total patient satisfaction was accounted for by the care provider. The relative importance of the remaining five domains was as follows: access ($\beta = 0.23483$), personal issues ($\beta = 0.16796$), moving through the visit ($\beta = 0.16795$), nurse/assistant ($\beta = 0.10010$), and special services/valet ($\beta = 0.06302$). A principal components analysis suggested a six-factor solution for the Press Ganey total satisfaction scale; care provider was the most dominant factor, and valet parking services was the least. The care provider had the most influence on the patient's overall satisfaction. Altogether, access, personal issues, moving through the visit, nurse/assistant, and special services/valet accounted for only approximately 20% of the total variance in patient satisfaction. This knowledge can be used by providers in the current health care climate, where patient consumerism is developing into the driver of care. This could allow resources to be focused on areas of influence, yielding a greater impact on patient satisfaction scores.

Sleep Quality and Nocturnal Pain in Patients with Hip Osteoarthritis

Martinez R, Reddy N, Mulligan EP, Hynan LS, Wells J
Medicine (Baltimore). 2019 Oct;98(41):e17464. doi: 10.1097/MD.0000000000017464.

Abstract: Osteoarthritis (OA) is a common condition of the hip. Patients with hip OA often report nocturnal pain, yet little is known how it affects sleep quality. The purpose of this paper was to assess how hip arthritis affects sleep quality. We hypothesized that hip pain caused by hip OA affects sleep quality in adult patients. This is a prospective, cross-sectional study of patients who were diagnosed with hip OA. Patients were evaluated using Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), hip outcome score (HOS), and modified Harris hip score (mHHS). Sleep quality was assessed using Pittsburgh Sleep Quality Index (PSQI). A multiple regression model was used to assess factors associated with poor sleep quality. A total of 106 patients were analyzed. All patients had a Tonnis grade of 2 or 3 and American Society of Anesthesiologists (ASA) classification of 2. WOMAC, HOS, and mHHS were significantly and negatively correlated with PSQI. The multiple regression model, WOMAC, short-form health survey vitality, ASA classification, and history of obstructive sleep apnea were associated with poor sleep quality ($R = 0.60$, $P < .001$). Patients with hip OA, who report a symptomatic hip, are susceptible to reduced sleep quality. There is a correlation between worsening HOSs and sleep quality. The WOMAC score is a significant predictor of poor sleep quality. Patients with poor hip metrics should be screened for sleep disturbance.

Is Anteromedial Drilling Safe in Transphyseal Anterior Cruciate Ligament Reconstruction in Adolescents with Growth Remaining?

Mathew S, Ellis HB, Wyatt CW, Sabatino MJ, Zynda AJ, Dennis G, Wilson PL
J Pediatr Orthop. 2019 Apr;39(4):e278-e283. doi:10.1097/BPO.0000000000001289.

Background: Previous reports of transphyseal drilling in anterior cruciate ligament (ACL) reconstruction have demonstrated good clinical outcomes without subjective changes in further skeletal development. The purpose of this study is to evaluate radiographic changes during continued growth following a transphyseal ACL reconstruction using an anteromedial femoral (AM) drilling technique in patients with > 18 months of growth remaining.

Methods: A review of consecutive adolescents who underwent a soft tissue transphyseal ACL reconstruction using an AM drilling technique was performed. Inclusion criteria was 18 months of growth remaining based on radiographic bone age and standing radiographs at least one year from the index procedure. Demographic, preoperative, and postoperative data, and follow-up three-foot standing lower extremity radiographs were reviewed. Radiographic data included femoral length, tibial length, total lower extremity length, mechanical axis deviation (MAD), lateral distal femoral angle (LDFA), and medial proximal tibial angle (MPTA).

Results: In total, 12 adolescent patients with a mean age of 13.4 years (range, 12.3 to 14.4) and bone age of 13.4 years (11.5 to 14) at the time of surgery were included. At an average of 2.27-year follow-up (412 to 1058 d), there was no difference in the total growth of the operative and nonoperative limb (48.5 mm vs. 47 mm; $P = 0.36$). In addition, the average increases in femoral length (23.4 mm) and tibial length (25.8 mm) were not statistically different between the operative and the nonoperative limb ($P = 0.12$; $P = 0.75$). There was no statistical difference in mechanical axis deviation, LDFA, or MPTA between preoperative and postoperative radiographs. Mean differences in operative and nonoperative coronal angular changes were all < 1.5 degrees.

Conclusions: With at least two years of growth remaining, transphyseal ACL reconstruction with anteromedial drilling did not significantly affect the physis or residual growth compared with the contralateral extremity. Although this technique may create a larger defect in the physis, standing radiographs demonstrate there is no change in limb length or angulation in growing adolescents approximately two years after surgery.

Level of Evidence: This is a case series; level IV evidence.

Validation of Pediatric Self-Report Patient-Reported Outcomes Measurement Information System (PROMIS) Measures in Different Stages of Legg-Calvé-Perthes Disease

Matsumoto H, Hyman JE, Shah HH, Sankar WN, Laine JC, Mehlman CT, Schrader T, Kelly DM, Rosenfeld SB, Janicki JA, Thacker MM, Trupia E, McGuire MF, Kim HKW; International Perthes Study Group *J Pediatr Orthop*. 2019 Jul 16. doi:10.1097/BPO.0000000000001423.

Objectives: Patient-reported outcomes (PRO) assessing health-related quality of life (HRQoL) are important outcome measures, especially in Legg-Calvé-Perthes disease (LCPD), where symptoms (pain and limping), activity restrictions, and treatments vary depending on the stage of the disease. The purpose of this study was to investigate the validity of the Patient-Reported Outcomes Measurement Information System (PROMIS) for measuring HRQoL of patients with LCPD in various stages of the disease.

Methods: This is a multicenter validity study. Patients with LCPD between 4 and 18 years old were included and classified into modified Waldenstrom stages of disease: Early (1 or 2A), Late (2B or 3), or Healed (4). Seven PROMIS domains were collected, including Pain Interference, Fatigue, Mobility, Depression, Anger, Anxiety, and Peer Relationships. Convergent, discriminant, and known group validity was determined.

Results: A total of 190 patients were included (mean age: 10.4+/-3.1 y). All seven domains showed the worst scores in patients in the Early stage (known group validity). Within each domain, all domains positively correlated to each other (convergent validity). Patients who reported more anxiety, depression, and anger were associated with decreased mobility and increased fatigue and pain. Peer relationships had no to weak associations with other domains (discriminant validity).

Conclusions: PROMIS has construct validity in measuring the HRQoL of patients in different stages of LCPD, suggesting that PROMIS has potential to serve as a patient-reported outcome tool for this population.

Level of Evidence: Diagnostic, Level III.

Halo Gravity Traction for Severe Pediatric Spinal Deformity: A Clinical Concepts Review

McIntosh AL, Ramo BS, Johnston CE

Spine Deform. 2019 May;7(3):395-403. doi: 10.1016/j.jspd.2018.09.068. Epub 2019 Dec 30.

Abstract: For the past 35 years, we have used halo gravity traction (HGT) to treat patients with a wide variety of underlying spinal deformities. This clinical concepts review covers the indications, contraindications, HGT technique details, and our preferred method of dynamic HGT. Emphasis is placed on our protocol and on recommendations that help to avoid complications. HGT is best applied by a standardized team approach intending to medically and nutritionally optimize the patient in preparation for an operative or medical/interventional treatment that will maintain and improve on the deformity correction achieved while avoiding peri- and postoperative complications.

Sport Participation and Specialization Characteristics Among Pediatric Soccer Athletes

McLeod TV, Israel M, Christino MA, Chung JS, McKay SD, Lang PJ, Bell DR; PRISM Sports Specialization Research Interest Group, Chan CM, Crepeau A, Davis E, Fletcher AL, Laniak J, McCaffrey K, Pacicca D, Riederer M, Rizzone K, Rush JK, Zaslow T *Orthop J Sports Med*. 2019 Mar 27;7(3):2325967119832399. doi: 10.1177/2325967119832399. eCollection 2019 Mar.

Background: Soccer is an increasingly popular sport for children and adolescents in the United States. Little is known about participation patterns related to sport specialization.

Purpose: To investigate soccer participation levels and sport specialization characteristics among youth soccer athletes.

Methods: Adolescent athletes aged between 12 and 18 years completed an online survey addressing participant demographics, sports and soccer participation history, and level of specialization. Descriptive analyses characterized participation, while chi-square and Kruskal-Wallis tests assessed the influence of specialization, sex, and grade on survey variables.

Results: Overall, 83.7% of 746 respondents participated in an organized soccer league outside of school, and 37% played in multiple leagues concurrently. Nearly three-quarters of respondents trained in soccer more than eight months of the year, with those who participated in club soccer being more likely to train more than eight months of the year. More respondents were classified as high specialization (37.5%), followed by moderate (35.6%) and low (28.6%) specialization. No differences between sexes were noted for level of specialization or quitting other sports to specialize in soccer, but male athletes were more likely to train more than eight months per year compared with female athletes. Respondents in older grades (9th-10th and 11th-12th grades) were more likely to be highly specialized and quit other sports to focus on soccer. No differences between grade levels were found among respondents training more than eight months per year.

Conclusion: The study findings suggest that many youth soccer athletes participated in multiple teams or leagues at the same time and trained more than eight months of the year. Characteristics including participation on a club team, level of specialization, and male sex were associated with a greater likelihood of exceeding the eight-month training recommendation.

Symbrachydactyly: Finger Nubbins Are Not Always Amniotic Band Disruption Sequence

Mills JK, Butler L, Mills EM, Oishi SN

JAAPA. 2019 Apr;32(4):32-37. doi:10.1097/01.JAA.0000553383.75260.0c.

Abstract: Although congenital hand anomalies associated with finger nubbins may be produced by amniotic band disruption sequence (ABDS), symbrachydactyly should be considered in the differential diagnosis. ABDS usually affects more than one limb, but symbrachydactyly largely is limited to one upper extremity and has five distinct clinical presentations: short-fingered, atypical cleft, monodactylous, peromelic, and a forearm proximal transverse deficiency. This article discusses the diagnosis of symbrachydactyly compared with ABDS and outlines plans for managing patients with symbrachydactyly.

Pediatric Gartland Type-IV Supracondylar Humeral Fractures Have Substantial Overlap with Flexion-Type Fractures

Mitchell SL, Sullivan BT, Ho CA, Abzug JM, Raad M, Sponseller PD

J Bone Joint Surg Am. 2019 Aug 7;101(15):1351-1356. doi: 10.2106/JBJS.18.01178.

Background: Knowledge is limited about the diagnosis and treatment of modified Gartland type-IV supracondylar humeral fractures. We determined the prevalence of type-IV fractures, identified preoperative characteristics associated with these injuries, and assessed operative treatment characteristics.

Methods: We retrospectively identified patients < 16 years of age who underwent operative treatment of a supracondylar humeral fracture at two centers between 2008 and 2016. We compared patient, injury, and treatment characteristics between type-IV and type-III fracture groups (1:4, cases:controls). Preoperative radiographs were assessed by four pediatric orthopaedists blinded to fracture type. The odds of a fracture being type IV were assessed using univariate logistic regression for individual radiographic parameters. Significance was set at alpha = 0.05.

Results: Type-IV fractures accounted for 39 (1.3%) of the supracondylar humeral fractures treated operatively during the study period. A type-IV fracture was associated with the following radiographic parameters: flexion angulation (odds ratio [OR] = 17; 95% confidence interval [CI] = 4.9 to 59), valgus angulation (OR = 5.6; 95% CI = 1.6 to 20), and lateral translation (OR = 4.1; 95% CI = 1.6 to 11) of the distal fragment; osseous apposition between the proximal and distal fragments (OR = 4.0; 95% CI = 1.8 to 9.0); and propagation of the fracture line toward the diaphysis of the proximal segment (OR = 9.2; 95% CI = 1.6 to 53). We found no significant differences in patient or injury characteristics between the groups. Compared with type-III fractures, type-IV fractures were treated more frequently with open reduction and percutaneous pinning (13% compared with 3.8%; $p = 0.04$) and were associated with longer mean operative time (82 ± 42 compared with 63 ± 28 minutes; $p = 0.001$).

Conclusion: We identified 5 preoperative radiographic parameters associated with greater odds of a supracondylar humeral fracture being type IV rather than type III. No patient or injury characteristic differed significantly between the groups. Substantial overlap likely exists between type-IV and flexion-type fractures. Type-IV fractures were associated with longer operative time and were treated with open reduction more frequently than were type-III fractures.

Amorphous Silicon Oxynitrophosphide-Coated Implants Boost Angiogenic Activity of Endothelial Cells

Monte FAD, Awad KR, Ahuja N, Kim HKW, Aswath P, Brotto M, Varanasi VG
Tissue Eng Part A. 2020 Jan.;26(1-2):15-27. doi:10.1089/ten.TEA.2019.0051.

Abstract: Lack of osteointegration is a major cause of aseptic loosening and failure of implants used in bone replacement. Implants coated with angiogenic biomaterials can improve osteointegration and potentially reduce these complications. Silicon- and phosphorus-based materials have been shown to upregulate expression of angiogenic factors and improve endothelial cell functions. In the present study, we hypothesize that implants coated with amorphous silica-based coatings in the form of silicon oxynitrophosphide (SiONP) by using the plasma-enhanced chemical vapor deposition (PECVD) technique could enhance human umbilical vein endothelial cell angiogenic properties in vitro. The tested groups were: glass coverslip (GCS), tissue culture plate, SiON, SiONP1 (O: 7.3 at %), and SiONP2 (O: 14.2 at %) implants. The SiONP2 composition demonstrated 3.5-fold more fibronectin deposition than the GCS ($p < 0.001$). The SiONP2 group also presented a significant improvement in the capillary tubule length and thickness compared with the other groups ($p < 0.01$). At 24 h, we observed at least a twofold upregulation of vascular endothelial growth factor A, hypoxia-inducible factor-1alpha, angiopoietin-1, and nesprin-2, more evident in the SiONP1 and SiONP2 groups. In conclusion, the studied amorphous silica-coated implants, especially the SiONP2 composition, could enhance the endothelial cell angiogenic properties in vitro and may induce faster osteointegration and healing.

Impact Statement: In this study, we report for the first time the significant enhancement of human umbilical vein endothelial cell angiogenic properties (in vitro) by the amorphous silica-based coatings in the form of SiONP. The SiONP2 demonstrated 3.5-fold more fibronectin deposition than the glass coverslip and presented a significant improvement in the capillary tubule length and thickness. At 24 h, SiONP reported twofold upregulation of vascular endothelial growth factor A, hypoxia-inducible factor-1alpha, angiopoietin-1, and nesprin-2. The studied amorphous silica-coated implants enhance the endothelial cell angiogenic properties in vitro and may induce faster osteointegration and healing.

Analysis of Trabecular Microstructure and Vascular Distribution of Capital Femoral Epiphysis Relevant to Legg-Calvé-Perthes Disease

Morris WZ, Liu RW, Chen E, Kim HK
J Orthop Res. 2019 Aug;37(8):1784-1789. doi:10.1002/jor.24311.

Abstract: Legg-Calvé-Perthes disease is characterized by the capital femoral epiphyseal collapse, which occurs more reliably in the anterior quadrant than the more weight-bearing lateral quadrant. The purpose of this study was to determine whether there is a vascular or microstructural predisposition for anterior femoral epiphyseal collapse in Perthes disease. Thirty-two cadaveric proximal femoral epiphyses from 17 subjects (age 4-14 years old) underwent microcomputed tomography at 10- μ m resolution. Each quadrant was analyzed for four markers of trabecular architecture: bone volume fraction (BV/TV), trabecular thickness, trabecular separation (TbSp), and trabecular number (TbN). Vascular channels were then mapped in each quadrant, identified by correlating surface topography with cross-sectional imaging. One-way analysis of variance revealed an overall difference between quadrants ($p < 0.001$) in BV/TV, TbN, and TbSp. However, post hoc analysis revealed there was no significant difference between the anterior and lateral quadrants for any of the four markers of trabecular architecture. Vascular channel mapping illustrated a predominance of vessels in the posterior half of the epiphysis compared to the anterior half (8.7 ± 4.0 vs. 3.4 ± 3.1 vascular channels, $p < 0.001$). The lack of microstructural differences between the anterior and lateral quadrants, and the predominance of vascular channels in the posterior half of the epiphysis with posteriorly-based medial femoral circumflex and ligamentum teres vessels, suggests that the anterior femoral epiphysis may be a relative vascular watershed region, which predisposes it to collapse after the vascular insult of Perthes disease. Clinical significance: Improved understanding of the pathophysiology of anterior femoral epiphyseal collapse may inform future treatments aimed at revascularization.

Comparison of Pavlik Harness Treatment Regimens for Reduced but Dislocatable (Barlow Positive) Hips in Infantile DDH

Neal D, Beckwith T, Hines A, Lee WC, Kilinc BE, Jo C, Kim H
J Orthop. 2019 Jul 2;16(5):440-444. doi:10.1016/j.jor.2019.06.027.

Objective: Although the Pavlik Harness (PH) is the most utilized treatment for developmental dysplasia of the hip (DDH), the ideal treatment protocol (frequency of clinic visits in the first month and daily wear duration) for Barlow + hips (reduced but dislocatable) has yet to be defined.

Methods: This study compared DDH patients with Barlow hips who were treated with 23 vs. 24h per day PH wear and weekly vs. every-other-week visits. Clinical success was defined as a stable hip that did not require closed or open reduction, or the use of an abduction orthosis prior to achieving clinical stability. Radiographic success was based on the acetabular index at two-year follow up.

Results: Sixty-five patients (75 hips/58 females) with Barlow hips had a mean age of presentation of 15 ± 12 days (range 4-70) and mean follow-up of 33 ± 17 months (range 6-90). There was no difference in clinical or radiographic success rates between 23h vs. 24h wear groups ($p > 0.99$ both) or the Frequently vs. Infrequent visit groups ($p = 0.49$ both). Overall clinical success rate was 97% (73/75 hips), and radiographic success rate at two years was 97% (58/60 hips).

Conclusion: A strict, weekly clinic visit and 24-h PH regimen may not be necessary to obtain good clinical and radiographic outcomes in infants presenting < 6 months of age with Barlow-positive hips.

Level of Evidence: Therapeutic, Level III.

Treatment and Outcomes of Arthrogyposis in the Upper Extremity

Oishi S, Agranovich O, Zlotolow D, Wall L, Stutz C, Pajardi G, Novelli C, Abdel Ghani H, Jester A, Vuillermier C, James M, Manske MC, Beckwith T
Am J Med Genet C Semin Med Genet. 2019 Sep;181(3):363-371. doi:10.1002/ajmg.c.31722.

Abstract: Upper extremity involvement in patients with arthrogyposis multiplex congenita is quite frequent. Treatment initially consists of stretching and splinting as significant gains can be seen in the first years of life. The goal of any surgical procedure is to improve upper extremity function and performance of daily living activities, yet it is important to treat each patient individually and understand that areas do not always need to be addressed surgically. Despite overall lower functioning scores in this patient population, quality of life scores are comparable to the general aged adjusted population. This article discusses the clinical presentation, treatment procedures, and outcomes when addressing the upper extremities of patients presenting with arthrogyposis.

Quality Improvement of Magnetic Resonance Imaging for Musculoskeletal Infection in Children Results in Decreased Scan Duration and Decreased Contrast Use

Ojeaga PO, Hammer MR, Lindsay EA, Tareen NG, Jo CH, Copley LA
J Bone Joint Surg Am. 2019 Sep 18;101(18):1679-1688.

Background: Magnetic resonance imaging (MRI) is a heavily utilized resource to evaluate children suspected to have a musculoskeletal infection. Complex interdisciplinary workflows are involved with decision-making with regard to indications, anesthesia, contrast use, and procedural timing relative to the scan. This study assesses the impact of a quality improvement endeavor on MRI workflows at a tertiary pediatric medical center.

Methods: A registry of consecutively enrolled children for a multidisciplinary musculoskeletal infection program identified those evaluated with MRI from 2012 to 2018. Annual MRI process improvement feedback was provided to the key stakeholders. Demographic characteristics, laboratory parameters, MRI indications, anesthesia use, MRI findings, final diagnoses, scan duration, imaging protocol, surgical intervention following MRI, and length of stay were retrospectively compared between the three cohorts (initial, middle, and final) representing two-year increments to assess the impact of the initiative.

Results: There were 526 original MRI scans performed to evaluate 1,845 children with suspected musculoskeletal infection. Anesthesia was used in 401 children (76.2%). When comparing the initial, middle, and final study period cohorts, significant improvement was demonstrated for the number of sequences per scan (7.5 sequences for the initial cohort, 5.8 sequences for the middle cohort, and 4.6 sequences for the final cohort; $p < 0.00001$), scan duration (73.6 minutes for the initial cohort, 52.1 minutes for the middle cohort, and 34.9 minutes for the final cohort; $p < 0.00001$), anesthesia duration (94.1 minutes for the initial cohort, 68.9 minutes for the middle cohort, and 53.2 minutes for the final cohort; $p < 0.00001$), and the rate of contrast use (87.6% for the initial cohort, 67.7% for the middle cohort, and 26.3% for the final cohort; $p < 0.00001$). There was also a trend toward a higher rate of procedures under continued anesthesia immediately following the MRI (70.2% in the initial cohort, 77.8% in the middle cohort, and 84.6% in the final cohort). During the final six-month period, the mean scan duration was 24.4 minutes, anesthesia duration was 40.9 minutes, and the rate of contrast administration was 8.5%.

Conclusions: Progressive quality improvement through collaborative interdisciplinary communication and workflow redesign led to improved utilization of MRI and minimized contrast use for suspected musculoskeletal infection. There was a high rate of procedural intervention under continued anesthesia for children with confirmed musculoskeletal infection.

Do Psychological Factors or Radiographic Severity Play a Role in the Age of Onset in Symptomatic Developmental Dysplasia of Hip and Femoroacetabular Impingement Syndrome?

Okpara S, Nakonezny P, Wells J
BMC Musculoskelet Disord. 2019 Sep 5;20(1):412. doi: 10.1186/s12891-019-2784-9.

Background: Age of onset in symptomatic developmental dysplasia of the hip (DDH) and femoroacetabular impingement syndrome (FAIS) varies. The purpose of this study was to investigate whether psychological factors, radiographic severity, and clinical variables were related to age of onset of hip pain in DDH and FAIS.

Methods: We collected demographic, clinical, and radiographic data on 56 DDH and 84 FAIS patients. Each was diagnosed based on radiographic findings and clinical history. Age of onset was operationalized by subtracting patient-reported duration of symptoms from patient age at presentation. Pain catastrophizing (PCS) and depression were assessed with the pain catastrophizing scale and hospital anxiety and depression scale (HADS), respectively. Multiple linear regression modeling, with Lasso variable selection, was implemented.

Results: Pain catastrophizing, anxiety, and depression were not significantly related to age of DDH onset (p -values > 0.27) or age of FAIS onset (p -values > 0.29). LASSO-penalized linear regression revealed alpha Dunn angle, Tonnis grade, prior hip surgery, WOMAC pain score, and iHOT total score were associated with age of onset in FAIS (Adjusted $R^2 = 0.3099$). Lateral center edge angle (LCEA), alpha frog angle, Tonnis grade, SF12 physical functioning, and body mass index (BMI) were associated with age of DDH onset (Adjusted $R^2 = 0.3578$).

Conclusions: Psychological factors, as measured by PCS and HADS, were not associated with age of onset in DDH or FAIS. Functional impairment as measured by WOMAC pain and impaired active lifestyle as measured by iHOT were found to affect age of FAIS onset. For DDH, impaired physical functioning and increasing BMI were found to be associated with age of onset. Severity of the disease, as measured radiographically by LCEA and alpha Dunn angle, was also found to be associated with earlier age of onset in DDH and FAIS, respectively. A patient's radiographic severity may have more of a relationship to the onset of pain than physiologic factors.

Recovery Kinetics Following Spinal Deformity Correction: A Comparison of Isolated Cervical, Thoracolumbar, and Combined Deformity Morphometries

Passias PG, Segreto FA, Lafage R, Lafage V, Smith JS, Line BG, Scheer JK, Mundis GM, Hamilton DK, Kim HJ, Horn SR, Bortz CA, Diebo BG, Vira S, Gupta MC, Klineberg EO, Burton DC, Hart RA, Schwab FJ, Shaffrey CI, Ames CP, Bess S; International Spine Study Group
Spine J. 2019 Aug;19(8):1422-1433. doi: 10.1016/j.spinee.2019.03.006.

Background Context: The postoperative recovery patterns of cervical deformity patients, thoracolumbar deformity patients, and patients with combined cervical and thoracolumbar deformities, all relative to one another, are not well understood. Clear objective benchmarks are needed to quantitatively define a "good" versus a "bad" postoperative recovery across multiple follow-up visits, varying deformity types, and guide expectations.

Purpose: To objectively define and compare the complete two-year postoperative recovery process among operative cervical only, thoracolumbar only, and combined deformity patients using area-under-the-curve (AUC) methodology.

Study Design/Setting: Retrospective review of two prospective, multicenter adult cervical and spinal deformity databases.

Patient Sampling: One hundred seventy spinal deformity patients.

Outcome Measures: Common health-related quality of life (HRQOL) assessments across both databases included the EuroQol 5-Dimension Questionnaire and Numeric Rating Scale (NRS) back pain assessment. In order to compare disability improvements, the Neck Disability Index (NDI) and the Oswestry Disability Index (ODI) were merged into one outcome variable, the ODI-NDI. Both assessments are gauged on the same scale, with minimal question deviation. Sagittal Radiographic Alignment was also assessed at pre- and all postoperative time points.

Methods: Operative deformity patients > 18 years old with baseline (BL) to two-year HRQOLs were included. Patients were stratified by cervical only (C), thoracolumbar only (T), and combined deformities (CT). HRQOL and radiographic outcomes were compared within and between deformity groups. AUC normalization generated normalized HRQOL scores at BL and all follow-up intervals (6 weeks, 3 months, 1 year, and 2 years). Normalized scores were plotted against the follow-up time interval. AUC was calculated for each follow-up interval, and total area was divided by cumulative follow-up length, determining overall, time-adjusted HRQOL recovery (Integrated Health State, IHS). Multiple linear regression models determined significant predictors of HRQOL discrepancies among deformity groups.

Results: One hundred seventy patients were included (27 C, 27 T, and 116 CT). Age, BMI, sex, smoking status, osteoporosis, depression, and BL HRQOL scores were similar among groups ($p > .05$). T and CT patients had higher comorbidity severities (CCI: C 0.696, T 1.815, CT 1.699, $p = .020$). Posterior surgical approaches were most common (62.9%) followed by combined (28.8%) and anterior (6.5%). Standard HRQOL analysis found no significant differences among groups until one-year follow-up, where C patients exhibited comparatively greater NRS back pain (4.88 vs. 3.65 vs. 3.28, $p = .028$). NRS Back pain differences between groups subsided by two years ($p > .05$). Despite C patients exhibiting significantly faster ODI-NDI minimal clinically important difference (MCID) achievement (33.3% vs. 0% vs. 23.0%, $p < .001$), all deformity groups exhibited similar ODI-NDI MCID achievement by two years (51.9% vs. 59.3% vs. 62.9%, $p = 0.563$). After HRQOL normalization, similar results were observed relative to the standard analysis (1-year NRS Back: C 1.17 vs. T 0.50 vs. CT 0.51, $p < .001$; 2-year NRS Back: 1.20 vs. 0.51 vs. 0.69, $p = .060$). C patients exhibited a worse NRS back normalized IHS (C 1.18 vs. T 0.58 vs. CT 0.63, $p = .004$), indicating C patients were in a greater state of postoperative back pain for a longer amount of time. Linear regression models determined postoperative distal junctional kyphosis (adjusted beta: 0.207, $p = .039$) and osteoporosis (adjusted beta: 0.269, $p = .007$) as the strongest predictors of a poor NRS back IHS (model summary: $R^2 = 0.177$, $p = .039$).

Conclusions: Despite C patients exhibiting a quicker rate of MCID disability (ODI-NDI) improvement, they exhibited a poorer overall recovery of back pain with worse NRS back scores compared with BL status and other deformity groups. Postoperative distal junctional kyphosis and osteoporosis were identified as primary drivers of a poor postoperative NRS back IHS. Utilization of the IHS, a single number adjusting for all postoperative HRQOL visits, in conjunction with predictive modelling, may pose as an improved method of gauging the effect of surgical details and complications on a patient's entire recovery process.

The Impact of Adult Thoracolumbar Spinal Deformities on Standing to Sitting Regional and Segmental Reciprocal Alignment

Pierce KE, Horn SR, Jain D, Segreto FA, Bortz C, Vasquez-Montes D, Zhou PL, Moon J, Steinmetz L, Varlotta CG, Frangella NJ, Stekas N, Ge DH, Hockley A, Diebo BG, **Vira S**, Alas H, Brown AE, Lafage R, Lafage V, Schwab FJ, Koller H, Buckland AJ, Gerling MC, Passias PG
Int J Spine Surg. 2019 Aug 31;13(4):308-316. doi: 10.14444/6042.

Background: Regional and segmental changes of the lumbar spine have previously been described as patients transition from standing to sitting; however, alignment changes in the cervical and thoracic spine have yet to be investigated. So, the aim of this study was to assess cervical and thoracic regional

and segmental changes in patients with thoracolumbar deformity versus a nondeformed thoracolumbar spine population.

Methods: This study was a retrospective cohort study of a single center's database of full-body stereoradiographic imaging and clinical data. Patients were ≥ 18 years old with nondeformed spines (non-degenerative, nondeformity spinal pathologies) or thoracolumbar deformity (ASD: PI-LL $> 10^\circ$). Patients were propensity-score matched for age and maximum hip osteoarthritis grade and were stratified by Scoliosis Research Society (SRS)-Schwab classification by PI-LL, SVA, and PT. Patients with lumbar transitional anatomy or fusions were excluded. Outcome measures included changes between standing and sitting in global alignment parameters: sagittal vertical axis (SVA), pelvic incidence minus lumbar lordosis (PI-LL), pelvic tilt (PT), thoracic kyphosis, cervical alignment, cervical SVA, C2-C7 lordosis (CL), T1 slope minus CL (TS-CL), and segmental alignment from C2 to T12. Another analysis was performed using patients with cervical and thoracic segmental measurements.

Results: A total of 338 patients were included (202 nondeformity, 136 ASD). After propensity-score matching, 162 patients were included (81 nondeformity, 81 ASD). When categorized by SRS-Schwab classification, all nondeformity patients were nonpathologically grouped for PI-LL, SVA, and PT, whereas ASD patients had a mix of moderately and markedly deformed modifiers. There were significant differences in pelvic and global spinal alignment changes from standing to sitting between nondeformity and ASD patients, particularly for SVA (nondeformed: 49.5 mm versus ASD: 27.4 mm; $P < .001$) and PI-LL (20.12° versus 13.01° , $P < .001$). With application of the Schwab classification system upon the cohort, PI-LL ($P = .040$) and SVA ($P = .007$) for severely classified deformity patients had significantly less positional alignment change. In an additional analysis of patients with segmental measurements from C2 to T12, nondeformity patients showed significant mobility of T2-T3 (-0.99° to -0.54° , $P = .023$), T6-T7 (-3.39° to -2.89° , $P = .032$), T7-T8 (-2.68° to -2.23° , $P = .048$), and T10-T11 (0.31° to 0.097° , $P = .006$) segments from standing to sitting. ASD patients showed mobility of the C6-C7 (1.76° to 3.45° , $P < .001$) and T11-T12 (0.98° to 0.54° , $P = 0.014$) from standing to sitting. The degree of mobility between nondeformity and ASD patients was significantly different in C6-C7 (-0.18° versus 1.69° , $P = .003$), T2-T3 (0.45° versus -0.27° , $P = .034$), and T10-T11 (0.45° versus -0.30° , $P = .001$) segments. With application of the Schwab modifier system upon the cohort, mobility was significant in the C6-C7 (nondeformed: 0.18° versus moderately deformed: 2.12° versus markedly deformed: 0.92° , $P = .039$), T2-T3 (0.45° versus -0.08° versus -0.63° , $P = .020$), T6-T7 (0.48° versus 0.36° versus -1.85° , $P = .007$), and T10-T11 (0.45° versus -0.21° versus -0.23° , $P = .009$) segments.

Conclusions: Nondeformity patients and ASD patients have significant differences in mobility of global spinopelvic parameters as well as segmental regions in the cervical and thoracic spine between sitting and standing. This study aids in our understanding of flexibility and compensatory mechanisms in deformity patients, as well as the possible impact on unfused segments when considering deformity corrective surgery.

Outcomes After Primary Repair and Staged Reconstruction of Zone I and II Flexor Tendon Injuries in Children

Piper SL, Wheeler LC, Mills JK, **Ezaki M, Oishi SN**
J Pediatr Orthop. 2019 May/Jun;39(5): 263-267. doi:10.1097/BPO.0000000000000912.

Background: Delayed diagnosis of flexor tendon injury in children is common, and consequent flexor sheath scarring may necessitate a two-stage reconstruction. Previous studies show variable outcomes after two-stage flexor reconstruction in children, especially those below 6 years old. We evaluated functional and subjective outcomes of primary repair and staged reconstruction of zone I and II tendon injuries in children under 6 years of age.

Methods: A retrospective chart review identified 12 digits in 10 patients who had undergone surgical treatment of a zone I or II flexor tendon injury. Seven digits had a primary repair and five had a two-

stage reconstruction. Time delay from injury to surgery for primary repairs averaged 18 weeks and for two-stage reconstruction averaged 24 weeks. Outcomes included total active motion, tip pinch and grip strength, sensation, and the Pediatric Outcomes Data Collection Instrument (PODCI).

Results: Average follow-up was 8 years. At final follow-up, mean total active and passive motion of the involved digit was similar between the primary reconstruction and staged groups, and 58% had a "good" or "excellent" American Society for Surgery of the Hand Total Active Motion (ASSH TAM) result (71% in the primary repair group, 40% in the two-stage reconstruction group). All regained grip and pinch strength equal to the contralateral hand. The average PODCI Upper Extremity score was 99 (99 in the primary repair group, 98 in the two-stage reconstruction group) and the PODCI Global Function score was 94 (97 in the primary repair group, 91 in the two-stage reconstruction group). No complications occurred.

Conclusions: Our small study demonstrates that both primary repair and two-stage flexor tendon reconstruction have acceptable long-term functional and subjective outcomes in children under 6 years old, although staged reconstruction had a lower overall ASSH TAM score and subcategorical PODCI scores. Although staged reconstruction has acceptable outcomes in this population, prompt primary repair of flexor tendon injuries in children should always be attempted.

Level of Evidence: Level IV-therapeutic.

What Are the Indications for Spinal Fusion Surgery in Scheuermann Kyphosis?

Polly DW Jr., Ledonio CGT, Diamond B, Labelle H, **Sucato DJ**, Hresko MT, Emans JB, Vitale MG, Erickson MA, Larson AN; Spinal Deformity Study Group
J Pediatr Orthop. 2017 Jan 30;39(5):217-221. doi:10.1097/BPO.0000000000000931.

Background: Surgical indications for Scheuermann kyphosis are variable. We sought to evaluate the characteristics of patients undergoing operative versus nonoperative treatment of Scheuermann kyphosis to better understand current practices and the factors that contribute to the decision for surgical management.

Methods: Multicenter prospective cohort study. We evaluated consecutive patients presenting with Scheuermann kyphosis. Patients underwent either surgical or nonoperative management according to surgeon and patient discretion. Preoperative patient-reported outcome measures (Scoliosis Research Society and Spinal Appearance Questionnaire scores), demographics, and radiographic characteristics were assessed.

Results: Overall, 150 patients with Scheuermann kyphosis were enrolled, with 77 choosing nonoperative treatment and 73 treated operatively. Compared with the nonoperative cohort, patients treated operatively were older (16.3+/-2.0 vs. 15.1+/-2.2, $P = 0.0004$), had a higher body mass index (26.3+/-7.2 vs. 22.7+/-6.5, $P = 0.003$), had greater T2-T12 kyphosis (71+/-14 degrees vs. 61+/-12 degrees, $P < 0.001$), and had increased pelvic incidence (46 vs. 41 degrees, $P = 0.03$) and pelvic tilt (10 vs. 3 degrees, $P = 0.03$). There was no detected difference in maximal sagittal Cobb angle in the operative versus nonoperative patients (73+/-11 vs. 70+/-12 degrees, $P = 0.11$). Functionally, the operative patients had worse Scoliosis Research Society pain scores (3.7+/-0.9 vs. 4.1+/-0.7, $P = 0.0027$) and appearance scores (2.9+/-0.7 vs. 3.4+/-0.8, $P < 0.0001$).

Conclusions: Patients undergoing surgical management of Scheuermann disease were more likely to have a large body mass index and worse pain scores. Other factors beyond radiographic measurement likely contribute to the decision for surgical management of Scheuermann kyphosis.

Level of Evidence: Level II.

Traumatic Fracture of the Pediatric Cervical Spine: Etiology, Epidemiology, Concurrent Injuries, and an Analysis of Perioperative Outcomes Using the Kids' Inpatient Database

Poorman GW, Segreto FA, Beaubrun BM, Jalai CM, Horn SR, Bortz CA, Diebo BG, **Vira S**, Bono OJ, De La Garza-Ramos R, Moon JY, Wang C, Hirsch BP, Tishelman JC, Zhou PL, Gerling M, Passias PG
Int J Spine Surg. 2019 Feb 22;13(1):68-78. doi: 10.14444/6009.

Background: The study aimed to characterize trends in incidence, etiology, fracture types, surgical procedures, complications, and concurrent injuries associated with traumatic pediatric cervical fracture using a nationwide database.

Methods: The Kids' Inpatient Database (KID) was queried. Trauma cases from 2003 to 2012 were identified, and cervical fracture patients were isolated. Demographics, etiologies, fracture levels, procedures, complications, and concurrent injuries were assessed. The t-tests elucidated significance for continuous variables, and chi² for categorical values. Logistic regressions identified predictors of spinal cord injury (SCI), surgery, any complication, and mortality. Level of significance was $P < .05$.

Results: A total of 11,196 fracture patients were isolated (age, 16.63 years; male, 65.7%; white, 65.4%; adolescent, 55.4%). Incidence significantly increased since 2003 (2003 vs. 2012, 2.39% vs. 3.12%, respectively), as did Charlson Comorbidity Index (CCI; 2003 vs. 2012, 0.2012 vs. 0.4408, respectively). Most common etiology was motor vehicle accidents (50.5%). Infants and children frequently fractured at C2 (closed: 43.1%, 32.9%); adolescents and young adults frequently fractured at C7 (closed: 23.9%, 26.5%). Upper cervical SCI was less common (5.8%) than lower cervical SCI (10.9%). Lower cervical unspecified-SCI, anterior cord syndrome, and other specified SCIs significantly decreased since 2003. Complications were common (acute respiratory distress syndrome, 7.8%; anemia, 6.7%; shock, 3.0%; and mortality, 4.2%), with bowel complications, cauda equina, anemia, and shock rates significantly increasing since 2003. Concurrent injuries were common (15.2% ribs; 14.4% skull; 7.1% pelvis) and have significantly increased since 2003. Predictors of SCI included sports injury and CCI. Predictors of surgery included falls, sports injuries, CCI, length of stay, and SCI. CCI, SCIs, and concurrent injuries were predictors of any complication and mortality, all ($P < .001$).

Conclusions: Since 2003, incidence, complications, concurrent injuries, and fusions have increased. CCI, SCI, falls, and sports injuries were significant predictors of surgical intervention. Decreased mortality and SCI rates may indicate improving emergency medical services and management guidelines.

Level of Evidence: Level III.

Clinical Relevance: Clinicians should be aware of increased case complexity in the onset of added perioperative complications and concurrent injuries. Cervical fractures resultant of sports injuries should be scrutinized for concurrent SCIs.

Delaying Surgery in Type-III Supracondylar Humerus Fractures Does Not Lead to Longer Surgical Times or More Difficult Reductions: A Retrospective Case Control Study

Prabhakar P, **Ho CA**
J Orthop Trauma. 2019 Aug;33(8):e285-e290. doi: 10.1097/BOT.0000000000001491.

Objective: To determine if delay in surgical treatment of type-III supracondylar humerus fracture would affect the length of operative time.

Patients/Participants: This is a series of 309 modified Gartland type-III supracondylar fractures treated operatively from 2011 to 2013.

Intervention: Fifteen hours was defined as the cutoff between early and delayed treatment. A total of 53.7% (166/309) fractures were treated early, and 46.4% (143/309) were delayed.

Main Outcome Measurements: Surgical time was defined as “incision start” to “incision close.” Fluoroscopy time was used as a surrogate for difficulty of reduction.

Results: Time from injury to operating room was shorter for high-energy fractures (fractures with soft-tissue or neurovascular injury) versus low-energy fractures (12.9 vs. 15.3 hours, $P < 0.0001$); however, surgical time (37.3 vs. 31.8 minutes, $P = 0.004$) and fluoroscopy time (54.6 vs. 48.6 seconds, $P = 0.027$) were longer in high-energy fractures versus low-energy fractures. Among low-energy fractures, no significant difference was detected in the surgical time between the early and delayed treatment groups or in the fluoroscopy time. In addition, there was no statistically significant difference found in the surgical or fluoroscopy time with the presence of a surgical assistant.

Conclusions: Delay in surgery did not result in a longer surgical time or more difficult reduction for type-III supracondylar humerus fractures. Patients with low-energy fractures still underwent a shorter operative time even with delay from injury to surgery.

A Novel MRI Tool for Evaluating Cortical Bone Thickness of the Proximal Femur

Ramme AJ, Vira S, Hotca A, Miller R, Welbeck A, Honig S, Egol KA, Rajapakse CS, Chang G
Bull Hosp Jt Dis. 2019 Mar;77(2):115-121.

Background: Osteoporotic hip fractures heavily cost the health care system. Clinicians and patients can benefit from improved tools to assess bone health. Herein, we aim to develop a three-dimensional magnetic resonance imaging (MRI) method to assess cortical bone thickness and assess the ability of the method to detect regional changes in the proximal femur.

Methods: Eighty-nine patients underwent hip magnetic resonance imaging. FireVoxel and 3DSlicer were used to generate three-dimensional proximal femur models. ParaView was used to define five regions: head, neck, greater trochanter, intertrochanteric region, and subtrochanteric region. Custom software was used to calculate the cortical bone thickness and generate a color map of the proximal femur. Mean cortical thickness values for each region were calculated. Statistical t-tests were performed to evaluate differences in cortical thickness based on proximal femur region. Measurement reliability was evaluated using coefficient of variation, intraclass correlation coefficients, and overlap metrics.

Results: Three-dimensional regional cortical thickness maps for all subjects were generated. The subtrochanteric region was found to have the thickest cortical bone and the femoral head had the thinnest cortical bone. There were statistically significant differences between regions ($p < 0.01$) for all possible comparisons.

Conclusions: Cortical bone is an important contributor to bone strength, and its thinning results in increased hip fracture risk. We describe the development and measurement reproducibility of an MRI tool permitting assessment of proximal femur cortical thickness. This study represents an important step toward longitudinal clinical trials interested in monitoring the effectiveness of drug therapy on proximal femur cortical thickness.

Delay to Surgery Greater Than 6 Months Leads to Substantial Deformity Progression and Increased Intervention in Immature Adolescent Idiopathic Scoliosis (AIS) Patients: A Retrospective Cohort Study

Ramo B, Tran DP, Reddy A, Brown K, Niswander C, Erickson M, Garg S
Spine Deform. 2019 May;7(3):428-435. doi:10.1016/j.jspd.2018.09.012.

Design: A retrospective, multi-institution series of adolescent idiopathic scoliosis (AIS) patients whose date of surgery exceeded six months from date of surgical recommendation were identified. A case-

matched comparison of surgical outcomes of skeletally immature patients who delayed surgery versus a cohort of nondelayed patients.

Objectives: We sought to identify 1) whether patients at risk for significant curve progression when delaying surgery could be identified with available clinical and radiographic data and 2) whether patients who delay surgery have longer fusions/more complex procedures.

Background: Multiple factors can lead to a delay in treatment of AIS once surgical treatment is recommended, and larger Cobb magnitudes have been associated with a more complex surgery.

Methods: 143 AIS patients who delayed surgery had deformity progression (major Cobb angle change over time) analyzed by Risser grade, triradiate cartilage (TRC) status, and menarche status. Comparison of at-risk patients with regard to surgical outcomes to a cohort of matched patients who had not delayed surgery.

Results: Risser 0 patients ($n = 34$) had a greater major Cobb progression than Risser 1-5 patients ($n = 109$): mean 1.6 degrees/mo versus 0.4 degrees/mo, $p < .001$. Twenty-eight premenarchal patients had significantly greater increases in Cobb angle measures than their postmenarchal counterparts ($n = 86$) (13.2 degrees vs. 4.3 degrees, $p < .001$). An open TRC also conferred increasing rate of progression. Radiographic variables of stable vertebra and last vertebra touched by central sacral vertical line were more likely to change in immature patients, but we did not demonstrate longer fusions or higher estimated blood loss as a result when compared to nondelayed, age-matched peers.

Conclusion: AIS patients who are premenarchal, TRC open, or Risser 0 who delay surgery greater than six months risk clinically significant Cobb angle progression, which is statistically greater than their more mature peers. Clinical ramifications of this remain unclear. Skeletally mature patients do not progress rapidly, allowing elective timing of surgical intervention.

Level of Evidence: Level III.

The Song Classification Is Reliable and Guides Prognosis and Treatment for Pediatric Lateral Condyle Fractures: An Independent Validation Study with Treatment Algorithm

Ramo BA, Funk SS, Elliott ME, Jo CH
J Pediatr Orthop. 2020 Mar;40(3):e203-e209. doi:10.1097/BPO.0000000000001439.

Background: Lateral condyle fractures account for 15% to 20% of pediatric elbow fractures. Among numerous proposed classification systems, the Song classification appears the most comprehensive. The utility of any classification system relies on its ability to be descriptive and reproducible and to guide prognosis/treatment. We assessed the Song classification by applying it to 736 retrospectively treated patients.

Methods: A total of 736 pediatric patients with lateral condyle fractures were identified between 2007 and 2014. In total, 60 patients were selected for a radiographic interclass and intraclass correlation study. Radiographs of the patients were reviewed by six observers, who independently measured radiographs for displacement on radiographs and assigned a Song classification. Treatment and outcomes were then reviewed on all 736 patients and evaluated as a successful outcome when achieving a healed fracture at discharge without significant complication or necessitating a change from initial treatment modality.

Results: Weighted values for intra-rater and inter-rater reliability to assign Song classification indicated excellent agreement. Intraclass correlation coefficients of six observers measuring displacement on radiographs in millimeters indicated good to excellent agreement. In total, 106 Song 1 fractures were primarily treated by casting alone and only 5.5% required conversion to operative intervention. Overall,

139 Song 2 fractures were treated by closed treatment (n = 114, 82% successful nonoperatively, 16% converted to operative management) or surgical means (n = 25, 100% success) without treatment superiority (P > 0.999), and both modalities had high success rates. Song 3 fractures (n = 17) demonstrated a failure rate of 80% with casting (n = 10) and were better managed by closed reduction and percutaneous pinning (n = 7, 100% success, P = 0.002). Song 4 (n = 325) fractures had a low success rate (34%) with casting (n = 35) but achieved higher success rates (P < 0.001) when managed with either closed (n = 57) or open reduction (n = 233) and pin fixation (89.5% and 92.7% success, respectively, P = 0.401). Song 5 fractures (n = 149) generally required an open reduction in our series with good success rates (91.2%).

Conclusion: This study validates the Song classification with high interobserver and intraobserver reliability. The Song classification improves on existing classification systems by better distinguishing fractures at risk for failure of nonoperative treatment and guiding treatment outcomes.

Level of Evidence: Level IV.

Flexible Fixation in Foot and Ankle Surgery

Raspovic KM, Anigian KT, Kapilow JM, Tisano BK

Clin Podiatr Med Surg. 2019 Oct;36(4):553-562. doi: 10.1016/j.cpm.2019.06.003. Epub 2019 Jul 23.

Abstract: Flexible fixation has been described and utilized in various aspects of foot and ankle surgery over the past several decades. In regard to ankle surgery, flexible fixation devices have been used for stabilization of the ankle syndesmosis and augmentation of lateral collateral ankle ligament repair. In the foot, flexible fixation devices have been incorporated into hallux valgus or varus correction, Lisfranc injury repair, and more recently spring ligament repair augmentation. This article reviews the various applications for flexible fixation in foot and ankle surgery, as well as evidence-based literature on surgical applications and clinical outcomes.

Optimizing Results in Diabetic Charcot Reconstruction

Raspovic KM, Liu GT, Lalli T, VanPelt M, Wukich DK

Clin Podiatr Med Surg. 2019 Jul;36(3):469-481. doi:10.1016/j.cpm.2019.02.010.

Abstract: Reconstruction of the diabetic Charcot foot can be a challenge even for the most experienced foot and ankle surgeon. The first portion of this article discusses the preoperative evaluation with an emphasis on factors that can be modified before surgical reconstruction to help optimize surgical results. The second portion of the article focuses on intraoperative methods and techniques to help improve postoperative outcomes. Surgeons should strive to provide high-quality, cost-effective care by optimizing patient selection and perioperative care. Objective measures of patient outcomes will become increasingly important with the transition from volume-based to value-based care.

Comparison of Percutaneous Pin Fixation in Chronic and Acute Pediatric Mallet Fractures

Reddy M, Ho CA

J Pediatr Orthop. 2019 Mar;39(3):146-152. doi: 10.1097/BPO.0000000000000896.

Background: Although pediatric mallet fractures are more common than adult fractures, no techniques have focused on surgical fixation of pediatric mallet fractures. This study aims to describe the technique and results of percutaneous reduction and fixation in acute and chronic pediatric mallet fractures.

Methods: This is a retrospective review of 51 pediatric mallet fractures treated with percutaneous wire fixation from 2007 to 2014; 38 were acute fractures and 13 were chronic (> 4 wks from injury). Surgical technique was identical for all fractures: (1) levering the dorsal fragment into its anatomical bed with a percutaneous towel clip; (2) percutaneously transfixing the distal interphalangeal joint in slight hyperextension; (3) placing 2 percutaneous kirschner wires, 1 radial and 1 ulnar, from the dorsal epiphyseal fragment to the volar metaphyseal cortex. Outcomes were defined by the Crawford classification.

Results: Average age was 14.6 years (range, 11 to 18 y). Mean time from injury to surgery was 16.2 days in the acute group and 50.8 days in the chronic group. Mean joint surface involvement was 50.8% of the articular base with a mean of 2.0 mm of articular gap (acute fractures 1.9 mm, chronic fractures 2.5 mm, P = 0.017). Average preoperative extensor lag was 24.6 degrees. Average operative time was 31 minutes for acute fractures and 40 minutes for chronic fractures. Mean length of follow-up was 78.5 days. At final follow-up, all patients healed with an articular gap of 0.2 mm in the acute group and 0.6 mm in the chronic group (P = 0.037) with no nonunions or volar subluxations. All patients but eight (five acute, three chronic) achieved full extension with an average extensor lag of 1.1 degree for the entire cohort. No patient had > 10-degree extensor lag at final follow-up. All patients achieved full active flexion of 90 degrees at final follow-up. In the acute group, the Crawford classification was excellent in 87% (33/38), good in 13% (5/38). In the chronic group, results were excellent in 77% (10/13), good in 23% (3/13) (P>0.05). There were no fair or poor outcomes in either group. A clinical dorsal bump was noted in 18% of patients (22% in the acute group, 15% in the chronic group, P > 0.05). There were no infections, wire breakages, nail deformities, or unplanned returns to surgery.

Conclusions: This percutaneous surgical technique to treat pediatric mallet fractures achieves favorable clinical and radiographic results with minimal complications, even in chronic fractures. Results are better than reported for adult mallet fractures.

Functional Outcomes Following Operative Treatment of Tibial Tubercle Fractures

Riccio AI, Tulchin-Francis K, Hogue GD, Wimberly RL, Gill CS, Collins D, Karol LA

J Pediatr Orthop. 2019 Feb;39(2):e108-e113. doi: 10.1097/BPO.0000000000001087.

Background: Quantitative evaluation of the functional results of surgically managed tibial tubercle fractures in adolescents is unreported in the orthopaedic literature.

Methods: All patients treated surgically for unilateral tibial tubercle fractures at a single institution from 2007 to 2011 were invited to return for functional evaluation. Fractures were classified using the Ogden classification system. Clinical examination at follow-up included passive knee range of motion and thigh circumference. Side-to-side knee extension strength deficits were evaluated using a Biodex dynamometer. Patient-reported outcomes were assessed using the Pediatric-International Knee Documentation Committee Subjective Knee Form (Pedi-IKDC), Tegner-Lysholm Knee Scoring Scale, and Visual Analog Pain Scale. Chart review was performed to determine postoperative protocols including the use of physical therapy and protected weight bearing. Functional parameters were compared between the involved and uninvolved extremities using the Wilcoxon signed-rank test, and the Spearman correlations were performed to identify any relationships between perioperative factors, functional parameters, and subjective outcomes.

Results: In total, 19 of 42 patients completed clinical and functional testing, and 18 of 19 completed all outcome surveys. Average age at injury was 13.9 years, and average follow-up was 3.0 years. There was no statistical difference in knee range of motion between sides; however, thigh circumference was slightly smaller in the injured extremity (median difference, 1.7 cm at 15 cm above the patella and 4.0 cm at 50% of the length of the thigh). In total 5/19 subjects (26%) had a significant quadriceps extension strength deficit on the involved leg compared with the contralateral side. The median Visual Analog Pain Scale for affected limbs was 8/100 and for unaffected limbs was 6/100 (P = 0.017). The Tegner-Lysholm Scale revealed 9 excellent results, 5 good, 4 fair, and 1 poor (median, 90/100). Results of the Pedi-IKDC

were 11 excellent, 3 good, 2 fair, and 3 poor results (median, 91/100). Outcome scores did not correlate to diminished strength or thigh circumference. No difference in outcome based upon body mass index, postoperative weight-bearing status, Ogden classification, or postoperative physical therapy was noted using regression analysis.

Conclusions: Despite promising objective results, clinical outcomes measured by subjective validated surveys are not all excellent.

Level of Evidence: Level III.

Objective Measurement of Brace Wear in Successfully Ponseti-Treated Clubfeet – Pattern of Decreasing Use in the First Two Years

Richards BS, Faulks S, Felton K, Karacz CM

J Am Acad Orthop Surg. 2019 Aug 19. doi: 10.5435/JAAOS-D-19-00163.

Purpose: Once Ponseti correction of a clubfoot is achieved and three-month full-time bracing treatment is completed, part-time bracing treatment for 12 hours at night for two to four years is considered necessary to maintain a successful outcome. This study objectively documents the amount of daily orthosis wear time in those who maintained correction at age 2 years and, in so doing, determines how well patients' caretakers comply with the prescribed brace program.

Methods: Patients < 3 months old with idiopathic clubfeet when Ponseti treatment was initiated, who successfully maintained correction at age 2 years without surgery and who had complete objective brace wear data, were included. The foot abduction orthoses had a temperature data logger embedded in a shoe. Six three-month time intervals were monitored in every patient as follows: full-time: 0 to 3; nighttime: 4 to 6, 7 to 9, 10 to 12, 13 to 15, and 16 to 18 months. The families were not informed that hours of brace wear were being measured.

Results: One hundred twenty-four patients with 187 clubfeet were included. During the zero- to three-month interval, wear time averaged 19.8 hr/d. After this period of full-time use, the nighttime brace wear decreased over each of the subsequent five intervals: 11.9, 9.6, 8.6, 7.9, and 7.7 hours. By the 18-month period of brace wear, one of three patients wore the orthoses less than six hours per day, and nearly one of two patients wore the orthoses fewer than eight hours per day.

Discussion: In patients evaluated at age 2 years whose clubfeet had successful nonsurgical treatment, nighttime brace wear varied greatly and decreased over each three-month period measured. By the second year of bracing treatment, nearly half of the patients wore the braces eight hours or less.

Patellar-Trochlear Morphology in Pediatric Patients from 2 to 11 Years of Age: A Descriptive Analysis Based on Computed Tomography Scanning

Richmond CG, Shea KG, Burlile JF, Heyer AM, Ellis HB, Wilson PL, Arendt EA, Tompkins MA

J Pediatr Orthop. 2020 Feb;40(2):e96-e102. doi: 10.1097/BPO.0000000000001405.

Background: Despite the critical role the trochlea plays in patellofemoral (PF) pathology, the development of the trochlea is poorly understood. The purpose of this study was twofold: (1) Describe quantitative osseous and soft tissue anatomy of the patella and trochlea in skeletally immature cadaveric specimens utilizing known measurements used in PF instability, and (2) evaluate additional measurement techniques in the sagittal plane as they relate to PF morphologic development.

Methods: Thirty-one skeletally immature fresh frozen cadaveric knees between the ages of 2 and 11 years old were evaluated using 0.625 mm computed tomography scans. In the axial plane, measure-

ments included condylar height asymmetry, trochlear facet asymmetry, trochlear depth, osseous sulcus angle, cartilaginous sulcus angle, patella sulcus angle, and tibial tubercle-trochlear groove distance. In the sagittal plane, measurements included previously undescribed measurements of trochlear length and condylar height asymmetry, which are based on the anterior femoral cortex.

Results: Analysis of trochlear morphology using condylar height asymmetry (both axial and sagittal), trochlear facet asymmetry, and trochlear depth and length demonstrated an increase in the size of the medial and lateral trochlea as age increased. There was more variability in the change of size of the medial trochlea (height, length, and facet length) than the lateral trochlea. The osseous sulcus angle, cartilaginous sulcus angle, and patella sulcus angle decreased (became deeper) with age until after 8 years and then plateaued.

Conclusions: This cadaveric analysis demonstrated that there is an increase in the medial and lateral trochlear height as age increased by all measurements analyzed. The findings also demonstrate that the shape of the patella and trochlea change concurrently, which suggests that there may be interplay between the two during development. These new sagittal measurement techniques evaluating the medial, central, and lateral trochlear height and length with respect to age may help guide clinicians when investigating patellar instability in skeletally immature patients.

Level of Evidence: Level IV

Practice Guidelines (BPG) for Use of Preoperative Halo Gravity Traction (HGT) for Pediatric Spinal Deformity

Roye B, Campbell M, Matsumoto H, Pahys J, Welborn M, Sawyer J, Fletcher N, McIntosh A, Sturm PF, Gomez JA, Lenke L, Vitale M; Children's Spine Study Group
Spine Deform. 2018 Nov;6:798. doi.org/10.1016/j.jspd.2018.09.017.

Summary: Consensus-based BPG including 42 items were developed for the use of preoperative HGT for pediatric spinal deformity using the Delphi and nominal group technique. It encompassed areas of goals, indications, preop evaluations, protocols, and complications.

Hypothesis: Consensus-building using formal techniques will develop BPG for use of HGT.

Introduction: No guidelines for the use of preoperative HGT exist to assist surgeons in their practice.

Methods: This was a consensus-building study. The Delphi process of three iterative surveys asking ideal practices was administered to nationwide experts in pediatric spinal deformity. Final determination of consensus and equipoise was established using the nominal group technique in a facilitated meeting. 80% or higher agreement/disagreement was considered consensus.

Results: Responses were received from 31-40 surgeons for each of the three surveys. The final in-person meeting included 14 experts with an average 10.5 years in practice and average 88 annual spinal deformity cases. Experts reached consensus on 42 items, including goals (four items), indications (10, examples in Table), pre-op evaluations (four), protocols (18, examples in Table), and complications (six). Nine items remained items of equipoise.

Conclusion: Consensus-based BPG including 42 items were developed for the use of preoperative HGT for pediatric spinal deformity. This BPG can give new surgeons a place to begin their practice of HGT and drive future research.

Diagnostic Utility of Erythrocyte Sedimentation Rate and C-Reactive Protein in Osteomyelitis of the Foot in Persons Without Diabetes

Ryan EC, Ahn J, Wukich DK, Kim PJ, La Fontaine J, Lavery LA

J Foot Ankle Surg. 2019 May;58(3):484-488. doi:10.1053/j.jfas.2018.09.025.

Abstract: The aim of this study was to assess the diagnostic value of erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels in differentiating foot osteomyelitis (OM) from soft-tissue infection (STI) in persons without diabetes. We evaluated 102 patients in a retrospective cohort study of nondiabetic patients admitted to our institution with OM (n = 51) and with STI (n = 51). Patient diagnosis was determined through bone culture and/or histopathology for OM and magnetic resonance scan and/or single-photon emission computed tomography for STI. Cutoffs for ESR and CRP to predict OM as identified by receiver operating characteristic were 45.5 mm/h and 3.45 mg/dL, respectively. The ESR cutoff demonstrated a sensitivity and specificity of 49% and 79%, while the values for CRP were 45% and 71%, respectively. The combined sensitivity and specificity for ESR and CRP were 33% and 84%. The positive and negative predictive values were 68% and 60% for ESR and 61% and 56% for CRP, respectively. In conclusion, ESR and CRP demonstrate poor sensitivity and specificity for detecting OM in the nondiabetic foot. These markers have little diagnostic utility in the nondiabetic foot.

Do SIRS Criteria Predict Clinical Outcomes in Diabetic Skin and Soft Tissue Infections?

Ryan EC, Crisolago PA, Oz OK, La Fontaine J, Wukich DK, Lavery LA

J Foot Ankle Surg. 2019 Nov;58(6):1055-1057. doi:10.1053/j.jfas.2019.06.001.

Abstract: The aim of this study was to assess whether systemic inflammatory response syndrome (SIRS) is correlated with outcomes in diabetic foot infections (DFIs). We retrospectively reviewed 137 diabetic patients admitted to the hospital with Infectious Diseases Society of America moderate and severe DFIs. We used SIRS criteria to define severe infection based on the presence of at least two of the following: heart rate > 90 bpm, temperature > 38° C or < 36° C, respiratory rate > 20 breaths per minute, and white blood cell count > 12,000/mm³ or <4,000/mm³. Patients with severe DFI were significantly younger (median 49.6 versus 53.6 years, p = .04), less often had Type 2 diabetes (88.6% versus 98.9%, p = .01), and less often had a history of previous amputation (15.9% versus 40.9%, p < .01). There were no differences in patients with severe infections defined by SIRS versus moderate infections in the need for surgery (47.7% versus 59.1%, p = .27), any amputation (20.5% versus 29.0%, p = .29), leg amputations (6.8% versus 7.5%, p = .88), duration of antibiotics (median +/- standard deviation 34.1 +/- 46.5 versus 31.9 +/- 47.2 days, p = .47), or healing within one year (68.2% versus 66.7%, p = 1.00). Length of hospital stay was the only outcome variable that was significantly different in severe infections (median 12.7 +/- 11.9 versus 7.8 +/- 5.8 days, p = .02). Foot-related readmission was more common in moderate infections (46.2% versus 25.0%, p = .02). In conclusion, SIRS criteria for severe infections in diabetic patients with skin and soft tissue infections were not associated with a difference in outcomes other than longer hospital stay.

An Electronic Patient-Reported Outcomes Measurement System in Paediatric Orthopaedics

Sabatino MJ, Gans CV, Zynda AJ, Chung JS, Miller SM, Wilson PL, Jo CH, Ellis HB

J Child Orthop. 2019 Aug 1;13(4):431-437. doi: 10.1302/1863-2548.13.190053.

Purpose: The purpose of the study was to evaluate the reliability, review differences, and assess patient satisfaction of electronic patient-reported outcome measures (PROMs) compared with paper PROMs.

Methods: Participants between 12 and 19 years of age with a knee-related primary complaint were randomized into two groups. Group 1 completed paper PROMs followed by electronic, while Group 2 received the electronic followed by paper. PROMs included the Pediatric International Knee Documen-

tation Committee (Pedi-IKDC), Hospital for Special Surgery (HSS) Pediatric Functional Activity Brief Scale (HSS Pedi-FABS), Tegner Activity Level Scale, Visual Analogue Scale (VAS), PedsQL Teen, and a satisfaction survey.

Results: In all, 87 participants were enrolled with one excluded due to incomplete PROMs. Of the 86 participants, 54 were female and 32 were male with an average age of 14.3 years (12 to 18). A high degree of reliability was found when comparing the paper and electronic versions of the Pedi-IKDC (0.946; p < 0.001), HSS Pedi-FABS (0.923; p < 0.001), PedsQL Teen (0.894; p < 0.001), Tegner Activity Level Scale before injury (0.848; p < 0.001), and the Tegner Activity Level Scale after (0.930; p < 0.001). Differences were noted between the VAS scores, with paper scores being significantly higher than electronic (5.3 vs. 4.6; p < 0.001). While not significant, a trend was noted in which electronic PROMs took, overall, less time than paper (10.0 mins vs. 11.2 mins; p = 0.096). Of all participants, 69.8% preferred the electronic PROMs, 67.4% felt they were faster, 93.0% stated they would complete forms at home prior to appointments, and 91.8% were not concerned about the safety/privacy of electronic forms.

Conclusion: PROMs captured electronically were reliable when compared with paper. Electronic PROMs may be quicker, will not require manual scoring, and are preferred by patients.

Timing and Risk Factors for Thromboembolism After Rotator Cuff Repair in the 30-Day Perioperative Period

Sager B, Ahn J, Tran J, Khazzam M

Arthroscopy. 2019 Nov;35(11):3011-3018. doi: 10.1016/j.arthro.2019.05.045. Epub 2019 Oct 16.

Purpose: To analyze the American College of Surgeons National Surgical Quality Improvement Program database to evaluate the incidence of deep venous thrombosis and pulmonary embolism in patients undergoing rotator cuff repair surgery. In addition, we aim to identify risk factors associated with the development of thromboembolic events following rotator cuff repair.

Methods: A retrospective review of the American College of Surgeons National Surgical Quality Improvement Program database was performed. Current Procedural Terminology codes were used to identify patients who underwent rotator cuff repair between 2005 and 2017. The presence of deep venous thrombosis or pulmonary embolism during the 30-day perioperative period were the primary outcomes assessed. Logistic regression analysis was performed to identify risk factors for postoperative venous thromboembolic events (VTEs).

Results: In total, 39,825 rotator cuff repairs (RCRs) were performed and 117 (0.3%) VTE events occurred. VTE was identified at a mean of 11.5 ± 7.4 days. A total of 31,615 RCRs were performed arthroscopically. There was no significant difference of VTE between groups comparing arthroscopic RCR VTE 0.3% (94) with open RCR 0.3% (23) (P = .81). RCR in patients with an American Society of Anesthesiologists classification of III or IV was associated with > 1.5-fold increase risk of VTE (odds ratio [OR] 1.68, 95% confidence interval [CI] 1.14-2.45). Increased risks of VTE included surgery > 80 minutes (OR 2.10, 95% CI 1.42-3.15), performed under general anesthesia (OR 4.38, 95% CI 1.18-36.6), and in the outpatient setting (OR 6.09, 95% CI 1.06-243.7), male sex (OR 1.53, 95% CI 1.01-2.33), bleeding disorders (OR 2.87, 95% CI 1.17-7.05), or dyspnea (OR 1.51, 95% CI 1.02-2.23). The biggest risk for VTE was unplanned reoperation OR 16.6 (95% CI 5.13-53.5).

Conclusions: Venous thromboembolism is a rare complication following rotator cuff repair 0.3%. Understanding the risk factors: Duration of surgery > 80 minutes, male sex, body mass index > 30 kg/m², ASA III or IV, RCR as an inpatient under general anesthesia, bleeding disorder, or dyspnea may be useful in guiding treatment to prevent VTE. The largest risk for VTE is a patient with unplanned reoperation. RCR surgery performed in an outpatient setting resulted in a significantly lower incidence of VTE.

Innervation of the Subscapularis: An Anatomical Study

Sager BW, Gates ST, Collett GA, Chhabra A, Khazzam MS

J of Shoulder and Elbow Surgery Open Access. 2019 Apr 26;3(2):65-69.

Background: Successful healing of the subscapularis during anatomic total shoulder arthroplasty surgery is critical to optimize functional outcomes and avoid complications. The purpose of this study was to examine the upper and lower subscapularis nerve insertion in relation to the musculotendinous junction to estimate the risk of nerve injury. Our hypothesis was that arm position changes the risks to these nerves when exposing the anterior glenoid.

Methods: Twenty cadaveric shoulders were dissected, and the subscapular nerves were identified from the posterior cord of the brachial plexus to the muscle insertion. The nerve length from the origin to the muscle insertion and the distance to the myotendinous junction were measured in various shoulder positions, including neutral, external, and internal rotation.

Results: The mean length of the upper subscapular nerve was 51.4 ± 12.8 mm; that of the lower subscapular nerve was 50.5 ± 14 mm. The mean distance from the insertion of the upper subscapular nerve to the myotendinous junction was 53.0 ± 14.7 mm with external rotation, 38.5 ± 9.7 mm with neutral rotation, and 30.0 ± 9.2 mm with internal rotation. The mean distance from the lower subscapular nerve to the myotendinous junction was 44.5 ± 13.8 mm with external rotation, 31.9 ± 9.3 mm with neutral rotation, and 25.4 ± 8.8 mm with internal rotation. The internally rotated position placed these nerves closest to the glenohumeral joint.

Conclusion: The upper and lower subscapular nerves insert in the muscle belly close to the myotendinous junction, putting them at risk of iatrogenic injury. Care must be taken to avoid damage with retractor placement in the anterior glenoid neck because these nerves are at risk of compression or torsional injury.

Isolated Segmental Humeral Shaft Fracture Without Vascular Compromise Complicated by Brachial Compartment Syndrome: A Case Report

Sanders D, Kelly D, Starr A

JBJS Case Connect. 2019 Dec;9(4):e0144. doi: 10.2106/JBJS.CC.19.00144.

Abstract: We report an unusual case of a closed humeral shaft fracture, with no vascular compromise, resulting in brachial compartment syndrome. Our patient was successfully treated with fasciotomy and external fixation, followed by staged open reduction and internal fixation and skin grafting. Although uncommon in the upper arm, suspicion for compartment syndrome should remain high for patients with unrelieved pain and swelling after humeral shaft fracture. Serial physical examination and invasive monitoring can assist in the diagnosis. Fasciotomy and staged fracture repair can yield good results.

Treatment of Pediatric Osteoid Osteomas Not Amenable to Radiofrequency Ablation: A Retrospective Review of Surgical Outcomes

Sanders T, Wenger DE, Ashraf A, McIntosh AL, Stans AA, Shaughnessy WJ, van Wijnen AJ, Larson AN
J Surg Orthop Adv. Winter 2018;27(4):299-302.

Abstract: The purpose of this study is to describe the surgical treatment of osteoid osteomas in a pediatric cohort of patients who were found not to be candidates for percutaneous ablative therapies. Medical records of 29 pediatric patients who were treated surgically for osteoid osteomas were reviewed. Reasons for surgical management included diagnostic uncertainty or lesions that were in close proximity to an articular surface or neurovascular structure. Twenty-eight patients experienced complete symptom resolution. Surgical treatment may still be indicated in a select group of osteoid osteoma patients who are not candidates for percutaneous treatment.

Does Early Proximal Femoral Varus Osteotomy Shorten the Duration of Fragmentation in Perthes Disease? Lessons from a Prospective Multicenter Cohort

Sankar WN, Lavalva SM, McGuire MF, Jo C, Laine JC, Kim HKW; International Perthes Study Group
J Pediatr Orthop. 2019 Sep 12. doi:10.1097/BPO.0000000000001451.

Background: The prognosis of Legg-Calvé-Perthes disease (LCPD) is dependent upon several factors, with the length and severity of the fragmentation stage among the most important. Previous retrospectively collected data from a single center have suggested that early proximal femoral varus osteotomy (PFO) may shorten the length of fragmentation and allow 34% of patients to bypass fragmentation altogether, resulting in less femoral head deformity. The purpose of this study was to validate these findings in a prospectively collected multicenter cohort.

Methods: Patients with LCPD treated with early PFO (during Waldenström stage I) were prospectively followed with serial radiographs at three-month intervals until a minimum of two-year follow-up. Waldenström stages and lateral pillar class were determined by mode assessments from three pediatric orthopaedic surgeons. The duration of fragmentation was defined as the interval between the first radiographs demonstrating features of stage IIa and stage IIIa. "Complete" bypass was defined as the absence of stage IIa or IIb findings on sequential radiographs with no development of femoral head deformity or collapse. "Partial" bypass was defined as the absence of advanced features of fragmentation and femoral head collapse (stage IIb).

Results: Forty-six patients (80% male individuals) with initial-stage LCPD and a mean age of 8.2 ± 1.2 years were identified. The weighted kappa statistics for Waldenström staging and lateral pillar classifications showed excellent (0.833) and substantial (0.707) agreement, respectively. Ninety-eight percent of patients (45/46) underwent some period of fragmentation lasting between 91 and 518 days; the median duration was 206 days (interquartile range, 181 to 280). One patient (2%) bypassed fragmentation completely; eight patients (17%) demonstrated partial bypass. Patients who completely or partially bypassed fragmentation experienced significantly less severe lateral pillar collapse ($P = 0.016$) and shorter fragmentation duration ($P = 0.001$).

Conclusions: In this prospective multicenter cohort, we found a lower rate of fragmentation bypass than previously reported. Nonetheless, our data support the previous contention that early PFO may shorten fragmentation and minimize collapse in LCPD compared with historical controls. Further study with larger cohorts and a more rigorous definition of what constitutes bypass is warranted to clarify the effect of early PFO on the reparative biology of LCPD.

Level of Evidence: Level IV-therapeutic study.

Use of a Novel Tibial Traction Triangle for Intramedullary Nailing of Tibia Fractures

Sathy A, Prabhakar P, Harirah M, Hay M

J Orthop Trauma. 2019 Mar;33(3):e100-e103. doi: 10.1097/BOT.0000000000001354.

Abstract: Malalignment after intramedullary nailing of proximal and distal tibia fractures remains a significant problem. We describe the use of a novel device to ease treatment of tibia fractures that undergo intramedullary nailing. The tibial traction triangle is simple and easy to use and allows for better reductions, leading to lower rates of malalignment. A prospective series of 11 patients is presented.

Impact of Presenting Patient Characteristics on Surgical Complications and Morbidity in Early-Onset Scoliosis

Segreto FA, Vasquez-Montes D, Bortz CA, Horn SR, Diebo BG, **Vira S**, Kelly JJ, Stekas N, Ge DH, Ihejirika YU, Lafage R, Lafage V, Karamitopoulos M, Delsole EM, Hockley A, Petrizzo AM, Buckland AJ, Errico TJ, Gerling MC, Passias PG
J Clin Neurosci. 2019 Apr;62:105-111. doi: 10.1016/j.jocn.2018.12.007.

Abstract: This study sought to assess comorbidity profiles unique to early-onset-scoliosis (EOS) patients by employing cluster analytics and to determine the influence of isolated comorbidity clusters on perioperative complications, morbidity, and mortality using a high-powered administrative database. The KID database was queried for ICD-9 codes pertaining to congenital and idiopathic scoliosis from 2003, 2006, 2009, and 2012. Patients < 10 y/o (EOS group) were included. Demographics, incidence, and comorbidity profiles were assessed. Comorbidity profiles were stratified by body systems (neurological, musculoskeletal, pulmonary, cardiovascular, renal). K-means cluster and descriptive analyses elucidated incidence and comorbidity relationships between frequently co-occurring comorbidities. Binary logistic regression models determined predictors of perioperative complication development, mortality, and extended length-of-stay (>= 75th percentile). 25,747 patients were included (Age: 4.34, Female: 52.1%, CCI: 0.64). Incidence was 8.9 per 100,000 annual discharges. 55.2% presented with pulmonary comorbidities, 48.7% musculoskeletal, 43.8% neurological, 18.6% cardiovascular, and 11.9% renal; 38% had concurrent neurological and pulmonary. Top inter-body system clusters: pulmonary disease (17.2%) with epilepsy (17.8%), pulmonary failure (12.2%), restrictive lung disease (10.5%), or microcephaly and quadriplegia (2.1%). Musculoskeletal comorbidities (48.7%) with renal and cardiovascular comorbidities (8.2%, OR: 7.9 [6.6-9.4], $p < 0.001$). Top intra-body system clusters: epilepsy (11.7%) with quadriplegia (25.8%) or microcephaly (20.5%). Regression analysis determined neurological and pulmonary clusters to have higher odds of perioperative complication development (OR: 1.28 [1.19-1.37], $p < 0.001$) and mortality (OR: 2.05 [1.65-2.54], $p < 0.001$). Musculoskeletal with cardiovascular and renal anomalies had higher odds of mortality (OR: 1.72 [1.28-2.29], $p < 0.001$) and extLOS (OR: 2.83 [2.48-3.22], $p < 0.001$). EOS patients with musculoskeletal conditions were 7.9x more likely to have concurrent cardiovascular and renal anomalies. Clustered neurologic and pulmonary anomalies increased mortality risk by as much as 105%. These relationships may benefit preoperative risk assessment for concurrent anomalies and adverse outcomes.

Level of Evidence: Level III – retrospective prognostic study.

Kingella Kingae Septic Arthritis in an Older-Than-Expected Child

Shahrestani S, Evans A, Tekippe EM, **Copley LA**
J Pediatr Infect Dis Soc. 2019 Mar 28;8(1): 83-86.

Abstract: *Kingella kingae* typically causes musculoskeletal infection in young children between the ages of 6 months and 4 years who may be in close contact with other similarly aged children who are colonized with the organism in their oropharynx. *Kingella* infections have rarely been described in older individuals with chronic medical conditions or immune compromise. This is a case report of a healthy, older child who developed an invasive infection due to *Kingella kingae*. Clinical and laboratory details are provided of an otherwise healthy 11-year-old female who developed an acute onset of septic arthritis of her shoulder. The organism was identified by culture and 16S polymerase chain reaction. Her clinical course necessitated an antibiotic change after the organism was correctly identified. The affected child had close contact with a 2-year-old sibling who recently had a viral upper respiratory infection. This case illustrates the potential for *Kingella kingae* to rarely cause invasive infection in older, healthy children. Supplemental laboratory techniques may be helpful to identify this organism. Although it is reasonable to limit the antibiotic spectrum for older children, clinicians should be aware of this possibility, particularly if there is a history of close contact with young children.

Comparison of Moseley and Rotterdam Straight-Line Graphs in Predicting Leg Lengths and Leg-Length Discrepancy at Maturity

Shahrestani S, Makarov MR, Jo CH, **Birch JG**
J Child Orthop. 2019 Oct 1;13(5):536-542. doi:10.1302/1863-2548.13.190086.

Purpose: One method of predicting leg-length discrepancy at maturity is the Moseley straight-line graph. Beumer et al. developed an alternative graph, using a more modern Dutch population. The purpose of this study was to compare the prediction accuracy of these two graphs in a cohort of patients treated at our institution using epiphysiodesis.

Methods: We identified 76 patients treated using epiphysiodesis for leg-length discrepancy who were followed to maturity and had adequate preoperative radiographic assessment for straight-line graph construction. We compared predicted long leg length (after epiphysiodesis), short leg length, and residual leg-length discrepancy to actual outcome for both methods, using both chronological and skeletal ages.

Results: Both methods were more accurate using skeletal age rather than chronological age. The Rotterdam graph showed modest improved accuracy compared to the Moseley graph in developmental aetiologies and in Hispanic patients. Using a difference of one centimeter in prediction error as clinically relevant (long leg [after epiphysiodesis], short leg, and leg-length discrepancy in each of the 76 patients, 228 predictions), we found comparable predictions in 171, more accurate prediction using the Rotterdam in 32, and using the Moseley in 25 predictions.

Conclusions: Straight-line graphs provide a generally more accurate prediction of leg lengths at maturity by virtue of multiple preoperative evaluations. The Rotterdam straight-line graph was equal to or superior to the Moseley graph in most patients in this cohort. Use of skeletal age resulted in more accurate predictions than chronological age. Clinicians should remain familiar with the concept and use of the straight-line graph.

Level of Evidence: III, case-control study.

Quadriceps Tendon Graft Anatomy in the Skeletally Immature Patient

Shea KG, Burlile JF, Richmond CG, **Ellis HB**, **Wilson PL**, Fabricant PD, Mayer S, Stavinoha T, Troyer S, Dingel AB, Ganley TJ
Orthop J Sports Med. 2019 Jul 11;7(7). doi: 10.1177/2325967119856578. eCollection 2019 Jul.

Background: The quadriceps tendon (QT) is increasingly considered for primary and revision anterior cruciate ligament reconstruction in skeletally immature patients, as it may be harvested as a purely soft tissue graft with considerable tissue volume. Because of distinct rectus tendon (RT) separation from the QT complex, the potential for RT retraction exists and could lead to QT weakness after QT graft harvest.

Purpose: To describe the anatomy of the pediatric QT and clarify decussation of the RT and QT to avoid the risk of delayed RT retraction and QT weakness after QT graft harvest.

Study Design: Descriptive epidemiology study.

Methods: Nine cadaveric knee specimens (aged 4-11 years) underwent gross dissection. Coronal-plane width and depth of the QT were measured at intervals proximal to the superior pole of the patella at distances of 0.0, 0.5, 1.0, and 1.5 times the length of the patella. The distance was measured from the superior patellar pole to the point of RT separation from the remainder of the deeper/posterior QT.

Results: The median patellar length was 28 mm (interquartile range, 26-37 mm). The coronal-plane width of the QT was larger superficially/anteriorly when closest to the patella but wider when measured

deeper/posteriorly as the tendon extended proximally. The median distance between the superior pole of the patella and RT separation from the QT was 0.95 times the patellar length. The distance to widening of the deeper/posterior aspect of the QT was 1.14 times the patellar length proximal to the patella.

Conclusion: The RT begins a distinct separation from the QT above the superior pole of the patella at a median of 0.95 times the patellar length in skeletally immature specimens. The deeper/posterior aspect of the QT begins to increase in coronal-plane width proximally after a distance of 1.14 times the patellar length above the knee, while the superficial/anterior aspect of the tendon continues to narrow. Awareness of the separation of the RT from the QT, and the coronal-plane width variation aspects of the QT proximally, is important for surgeons utilizing the QT as a graft to avoid inadvertent release of the RT from the rest of the QT complex.

Hip Surveillance in Children with Cerebral Palsy

Shrader MW, **Wimberly L**, Thompson R
J Am Acad Orthop Surg. 2019 Oct 15;27(20):760-768. doi:10.5435/JAAOS-D-18-00184.

Abstract: Hip dysplasia is common in children with cerebral palsy (CP), especially in those children with notable functional impairment. Severity of hip dysplasia has been shown to correlate with higher Gross Motor Function Classification System levels. Migration percentage measured on AP pelvis radiographs is the key radiographic measure quantifying hip displacement in CP. Hip surveillance programs for children with CP exist in Europe, Australia, and parts of Canada and have been adopted as standard of care. These programs have demonstrated improved detection of hip subluxation and appropriate early intervention with a resultant decrease in the number of painful dislocations. Hip surveillance programs provide health care providers with guidance for a schedule of obtaining hip radiographs based on patients' age, Gross Motor Function Classification System level, and migration percentage. Although systematic surveillance programs have yet to be adopted in the United States, several centers and organizations are currently investigating the potential and efficacy of hip screening in CP.

Congenital Pseudarthrosis of the Tibia: Results, at Skeletal Maturity, of the Charnley-Williams Procedure

Singer D, **Johnston CE**
JB JS Open Access. 2019 Jun 20;4(2):e0004. doi: 10.2106/JBJS.OA.19.00004. eCollection 2019 Apr-Jun.

Background: This study assessed the outcomes, at skeletal maturity, for 34 patients in whom congenital pseudarthrosis of the tibia (CPT) had been treated with intramedullary (IM) rod fixation.

Methods: The results in skeletally mature patients in whom type-4 CPT had been treated with an IM rod at an average of 11.9 years earlier were reviewed. The rod procedures varied according to whether both the tibia and the fibula were resected and both bones (type A) or just the tibia (type B) were fixed with an IM rod or whether only the tibia was resected and the fibula received no surgery (type C). Outcome grading ranged from unequivocal union with brace-free function (grade 1) to a functional limb with residual angulation or cortical defects (grade 2) to a severely impaired extremity with insufficient union or refracture (grade 3).

Results: Thirty-four patients were evaluated at a mean age of 16.9 years, a mean of 11.9 years after their initial surgical procedure. Seventeen patients had a grade-1 result; 11 patients, grade 2; and six patients, grade 3. Thus, 82% (28) of the 34 patients had a functional extremity at maturity. All patients with a final grade-3 outcome eventually requested amputation. The final outcomes were not affected by the age at the initial fracture or surgery, the presence of neurofibromatosis-1, or cross-ankle fixation. A total of 58 IM rod procedures were performed in the 34 patients. Twenty-four (73%) of the 33 type-A procedures produced grade-1 or grade-2 outcomes, as did 14 (88%) of the 16 type-B procedures. Of

the 9 type-C procedures, none produced a grade-1 result and four produced a grade-2 outcome. The results of types A and B combined were superior to those of type-C procedures ($p = 0.03$). Refracture occurred in 13 of 33 patients with initial stability/union after rod fixation, with three of those fractures remaining ununited at the latest follow-up. A dystrophic fibula had no effect on the eventual achievement of a grade-1 or -2 outcome.

Conclusions: This review, in which all patients had reached skeletal maturity, documents functional (grade-1 or grade-2) outcomes in 82% of cases of IM rod fixation for CPT. This finding was almost identical to the result in our earlier report and confirms the long-term value of permanent IM rod fixation in maintaining union and function in patients with CPT. Procedures not addressing the fibula produced inferior results. Although 13 patients had a refracture following initial union, only three of these fractures failed to heal with additional treatment.

Sesamoid Malalignment in Hallux Valgus: Radiographic and MRI Measurements and Their Correlation with Internal Derangement Findings of the First Metatarsophalangeal Joint

Skweres J, **Chhabra A**, Hummel J, **Heineman N**, Dessouky R, Xi Y, **Wukich D**
Br J Radiol. 2019 Aug;92(1100):20190038. doi:10.1259/bjr.20190038.

Objective: Sesamoid displacement (SD) and rotation are important components in the preoperative assessment of hallux valgus (HV). To date, inter-reader reliability (IRR) of SD on X-rays and MRI, correlations with hallux valgus angle (HVA), and qualitative changes of the hallux-sesamoid complex (HSC) on MRI have not been studied. The aim of this study was to correlate sesamoid malalignment with HV severity and findings of internal joint derangement.

Methods: Two readers analyzed a series of 56 consecutive patients who had X-rays and MRI performed on the same foot within 3 months of each other. Multiple measures of SD on X-rays and MRI and the sesamoid rotation angle (SRA) on MRI were assessed and correlated with HVA and various qualitative features at the HSC, including cartilage, plantar plate, and collateral ligament abnormalities.

Results: We found excellent IRR (ICC = 0.79 - 0.99) for SRA on MR but poor IRR for lateral sesamoid displacement (LDS) and tibial sesamoid position (TSP) scales on both modalities. Good IRR was also seen for morphologic abnormalities of HSC. The absolute value of the SRA on MR positively correlated with HVA ($p < 0.0001$). LDS and TSP on both modalities lacked a significant correlation with HVA ($p > 0.05$). No correlation was found between any measure of SD or rotation with HSC morphologic changes ($p > 0.05$).

Conclusion: Among different measures of sesamoid malalignment, sesamoid rotation angle measured on MRI can be used to judge the severity of HV; however, it does not correlate with qualitative morphologic abnormalities of the HSC.

Advances in Knowledge: The MRI measurement of SRA is a better indicator of sesamoid displacement relative to the HSC than standard AP radiographic measures of non-rotational sesamoid displacement; however, it should not be used to predict qualitative morphologic abnormalities of the HSC.

Significant Reduction of Pulmonary Embolism in Orthopaedic Trauma Patients

Starr A, **Shirley Z**, Sutphin P, **Sanders D**, Eastman A, Au B, **Sathy A**, Hu G, **Gebrelul A**, Minei J, Cripps M
J Orthop Trauma. 2019 Feb;33(2):78-81. doi: 10.1097/BOT.0000000000001346.

Objectives: To report results of a protocol to lessen incidence of pulmonary embolism (PE) among orthopaedic trauma patients.

Design: Retrospective review.

Setting: Level 1 trauma center.

Patients/Participants: Orthopaedic trauma inpatients were included in the study.

Intervention: On arrival, an orthopaedic trauma patient's PE risk is calculated using a previously developed tool. If possible, patients at high risk are given their first dose of enoxaparin before leaving the emergency room. If other injuries preclude enoxaparin, then chemoprophylaxis is held for 24 hours. Twenty-four hours after arrival, the patient's ability to receive enoxaparin is reassessed. If possible, enoxaparin is started, with dosing twice a day. If enoxaparin is still contraindicated, a removable inferior vena cava filter is placed. Adequacy of enoxaparin dosing is tested using anti-factor Xa assay, drawn four hours after the third dose of enoxaparin. If the anti-factor Xa result is less than 0.2 IU/mL, a removable inferior vena cava filter is placed. If the result is 0.2-0.5 IU/mL, enoxaparin dosing is continued. If greater than 0.5 IU/mL, the dose of enoxaparin is reduced.

Outcome Measure: The main outcome measure was rate of PE.

Results: From September 1, 2015, to December 31, 2015, our hospital admitted 420 orthopaedic trauma patients. Fifty-one patients were classed as high risk for PE. In September through December 2015, nine patients sustained PE, one of which was fatal. From September 1, 2016, to December 31, 2016, our hospital admitted 368 orthopaedic trauma patients with comparable age and Injury Severity Score to 2015. Forty patients were at high risk for PE; one sustained a nonfatal PE. PE incidence from September to December 2016 was significantly lower than in 2015 ($P = 0.02$). Overall, 26 patients managed under the new protocol had IVCFs placed, 21 had their filters removed, and three died with filters in place. There were no complications during filter placement or removal. One patient had hemorrhage felt to be attributable to enoxaparin.

Conclusions: Our protocol emphasizes more robust enoxaparin dosing, and more frequent use of IVCF, but only among those at high risk. We lessened the incidence of PE, with a low complication rate.

Compensatory Sagittal Plane Ankle Gait Mechanics: Are They Present in Patients with a Weak or Stiff Hip?

Stevens WR Jr., Podeszwa DA, Tulchin-Francis K

Gait Posture. 2019 Oct;74:250-254. doi: 10.1016/j.gaitpost.2019.09.018. Epub 2019 Sep 20.

Introduction: Simulations suggest that subjects with reduced hip range of motion (ROM) and/or weakness can achieve more normal walking mechanics through compensations at the ankle. The aims of this study were to assess whether subjects with reduced hip ROM (Stiff hip) or hip flexor weakness (Weak hip) exhibit ankle compensations during walking and investigate redistribution of power in the lower extremity joints.

Methods: Retrospective gait data were reviewed (IRB-approved hip registry). Preoperative kinematic/kinetic walking data were collected in patients with: adolescent hip dysplasia (AHD), femoral acetabular impingement (FAI), and Legg-Calvé Perthes disease (Perthes). AHD patients with significantly weak hip flexors on their affected side were included (Weak hip group). The Gait Profile Score (GPS) was calculated on the affected side of the FAI and Perthes groups to identify patients who had a Stiff hip. Patients who had undergone a hip arthrodesis (Fusion) were also included (Stiff hip group). Ankle kinematics/kinetics were compared to healthy participants (Control). The total positive work of sagittal plane hip, knee, and ankle power were compared along with the distribution of power.

Results: Patients in the Weak/Stiff hip groups did not walk with greater ankle plantarflexion, peak push-off power, or positive ankle work on their affected sides compared to Control. Ankle work contribution (percentage of total positive work) on the affected or unaffected sides was greater in the Perthes and Hip Fusion patients compared to Control. Significant gait abnormalities on the unaffected side were observed.

Conclusions: Patients with a weak or stiff hip did exhibit altered ankle mechanics during walking. Greater percent ankle work contribution appeared to correspond with hip stiffness. In patients with hip pathology, the redistribution of power among the lower extremity joints can highlight the importance of preserving ankle function.

Depression and Non-Modifiable Patient Factors Associated with Patient Satisfaction in an Academic Orthopaedic Outpatient Clinic: Is It More Than a Provider Issue?

Tisano BK, Nakonezny PA, Gross BS, Martinez JR, Wells JE

Clin Orthop Relat Res. 2019 Dec;477(12):2653-2661. doi: 10.1097/CORR.0000000000000927.

Background: Patient satisfaction surveys play an increasingly important role in United States health care policy and serve as a marker of provided physician services. In attempts to improve the patient's clinical experience, focus is often placed on components of the health care system such as provider interaction and other experiential factors. Patient factors are often written off as "non-modifiable"; however, by identifying and understanding these risk factors for dissatisfaction, another area for improvement and intervention becomes available.

Questions/Purposes: (1) Do patients in the orthopaedic clinic with a preexisting diagnosis of depression report lower satisfaction scores than those without a preexisting diagnosis of depression? (2) What other non-modifiable patient factors influence patient-reported satisfaction?

Methods: We reviewed Press Ganey Survey scores, which assess patient experiential satisfaction with a single clinical encounter, from 3,044 clinic visits (2,527 patients) in adult reconstructive, sports, and general orthopaedic clinics at a single academic medical center between November 2010 and May 2017, during which time approximately 19,000 encounters occurred. Multiple patient factors including patient age, gender, race, health insurance status, number of previous clinic visits with their physician, BMI, and a diagnosis of depression were recorded. Patient satisfaction was operationalized as a binary outcome as satisfied or less satisfied, and a multiple logistic regression analysis was used to estimate the odds of being satisfied.

Results: After adjusting for all other covariates in the model, we found that patients with a diagnosis of depression were less likely to be satisfied than patients without this diagnosis (odds ratio 0.749 [95% confidence interval, 0.600-0.940]; $p = 0.01$). Medicare-insured patients were more likely to be satisfied than non-Medicare patients (OR 1.257 [95% CI, 1.020-1.549]; $p = 0.03$), patients in the sports medicine clinic were more likely to be satisfied than those seen in the general orthopaedic clinic (OR 1.397 [95% CI, 1.096-1.775]; $p = 0.007$), and established patients were more likely to be satisfied than new patients (OR 0.763 [95% CI, 0.646-0.902]; $p = 0.002$).

Conclusions: Given the association of depression with lower satisfaction with a single visit at the orthopaedic clinic, providers should screen for depression and address the issue during the outpatient encounter. The impact of such comprehensive care or subsequent treatment of depression on improving patient-reported satisfaction offers areas of future study.

Outcomes of Foot Infections Secondary to Puncture Injuries in Patients with and without Diabetes

Truong DH, Johnson MJ, Crisolago PA, Wukich DK, Bhavan K, La Fontaine J, Lavery LA
J Foot Ankle Surg. 2019 Nov;58(6):1064-1066. doi: 10.1053/j.jfas.2019.08.013.

Abstract: It is difficult to compare foot infections in patients with diabetes to those without diabetes because foot infections are uncommon in people without diabetes. The aim of this study is to compare clinical outcomes in people with and without diabetes admitted to the hospital for an infected puncture wound. We evaluated 114 consecutive patients from June 2011 to March 2019 with foot infection resulting from a puncture injury; 83 had diabetes and 31 did not have diabetes. We evaluated peripheral arterial disease (PAD), sensory neuropathy, the need for surgery and amputation, length of hospitalization, and presence of osteomyelitis. Patients with diabetes were 31 times more likely to have neuropathy (91.6% versus 25.8%, $p < .001$, confidence interval [CI] 10.2 to 95.3), eight times more likely to have PAD (34.9% versus 6.5%, $p = .002$, CI 1.7 to 35), and seven times more likely to have kidney disease (19.3% versus 3.2%, $p < .05$, CI 0.9 to 56.5). They also took longer before presenting to the hospital (mean 20.1 ± 36.3 versus 18.8 ± 34.8 days, $p = .09$, CI 13 to 26.5); however, this result was not statistically significant. Patients with diabetes were nine times more likely to have osteomyelitis (37.3% versus 6.5%, $p = .001$, CI 1.9 to 38.8). In addition, they were more likely to require surgery (95% versus 77%, $p < .001$, CI 1.6 to 21.4), required more surgeries (2.7 ± 1.3 versus 1.3 ± 0.8 , $p < .00001$, CI 2.1 to 2.5), were 14 times more likely to have amputations (48.2% versus 6.5%, $p < .0001$, CI 3.0 to 60.2), and had two times longer hospital stays (16.2 ± 10.6 versus 7.5 ± 9 days, $p = .0001$, CI 11.9 to 15.9). Infected puncture wounds in patients with diabetes often fair much worse with more detrimental outcomes than those in patients without diabetes.

Severity Adjusted Risk of Long-Term Adverse Sequelae Among Children with Osteomyelitis

Vorhies JS, Lindsay EA, Tareen NG, Kellum RJ, Jo CH, Copley LA
Pediatr Infect Dis J. 2019 Jan;38(1):26-31.

Background: The purpose of this investigation was to evaluate the risk for long-term, adverse outcomes among children with osteomyelitis.

Methods: Children with osteomyelitis were prospectively enrolled from 2012 to 2014. Care was accomplished by a multidisciplinary team according to an institutional algorithm. Data were collected to define the severity of illness during the initial hospitalization and assess short, intermediate, and long-term outcomes. Clinical examination, radiographic assessment, and functional outcome survey administration were performed at a minimum of two years' follow-up. A comparison cohort analysis was performed according to initial severity of illness score of mild (0-2), moderate (3-6), and severe (7-10).

Results: Of 195 children enrolled, 139 (71.3%) returned for follow-up at an average of 2.4 years (range, 2.0-5.0 years). Children with severe illness were less likely to have normal radiographs (severe, 4.0%; moderate, 38.2%; mild, 53.2%, $P < 0.0001$) and more likely to have osteonecrosis, chondrolysis, or deformity (severe, 32.0%; moderate, 5.9%; mild, 1.3%, $P < 0.0001$). Functional outcome measures did not significantly differ between severity categories. By regression analysis severity of illness score, plus age less than 3 years and Methicillin-resistant *Staphylococcus aureus* predicted severe sequelae with an area under the curve of 0.8617 and an increasing odds ratio of 1.34 per point of increase in severity score.

Conclusion: Long-term severe adverse outcomes among children with osteomyelitis occurred in 11 of 139 (7.9%) children and were predicted by initial severity of illness. Other risks that diminished the likelihood of complete resolution or increased the risk of severe sequelae included Methicillin-resistant *Staphylococcus aureus* etiology and young age. The majority of children with osteomyelitis do not require long-term follow-up beyond the initial treatment period.

Biomechanical Assessment of Torsional Stiffness in a Supracondylar Humerus Fracture Model

Wallace M, Johnson DB, Pierce W, Iobst C, Riccio A, Wimberly RL
J Pediatr Orthop. 2019 Mar;39(3):e210-e215. doi:10.1097/BPO.0000000000001270.

Background: We assessed the effect on the torsional stability by different pin diameters and varied pin configurations in a biomechanical supracondylar humerus fracture model.

Methods: After scanning a model of a pediatric humerus, the image was imported into software. Variable pin trajectories were planned. Acrylonitrile butadiene styrene plastic models were 3-dimensionally printed with predetermined pin trajectories. Models were osteotomized and potted with a polyurethane resin. Five-pin configurations were designed to test coronal and sagittal patterns of pin placement. Each included three lateral pins and a medial pin. Pin diameters of 1.6, 2.0, and 2.4 mm were tested in all configurations. Three models for each pin diameter/configuration were tested to ensure uniformity. Stability of the construct was tested to determine the torque needed to deflect the osteotomy 10 degrees in internal/external rotation. Each model was tested three times.

Results: In all models/configurations, the 2.4 mm pin diameter was statistically stiffer than 1.6 mm diameter pins; this lost statistical significance in certain patterns when comparing 2.0- and 2.4-mm pins. When comparing a divergent to a parallel configuration in the coronal plane, there was no significant difference in stability when pin diameter or number were controlled. The convergent pin configuration was, in general, the least stable pattern. Use of a medial pin conferred statistically significant stiffness throughout most models as demonstrated with pin deletion. Use of two pins was significantly less stiff than most three-pin models.

Conclusions: Larger pin diameters confer greater stiffness among all patterns. The use of three lateral and one medial pin was not statistically different than two lateral and one medial pin in our models. Both patterns were stiffer than three lateral pins only or other fewer pin constructs. The alignment of pins in the sagittal plane did not affect overall construct stiffness.

Can Real-Time Monitoring with a Controlled Advancement Drill Decrease Plunge Depth?

Wallace SB, Cherkashin A, Samchukov M, Wimberly RL, Riccio AI
J Bone Joint Surg Am. 2019 Jul 3;101(13):1213-1218. doi: 10.2106/JBJS.19.00111.

Background: Although drill use is fundamental to orthopaedic surgery, the risk of plunging past the far cortex and potentially damaging the surrounding soft tissues remains unavoidable with conventional drilling methods. A dual motor drill might decrease that risk by providing controlled drill-bit advancement and real-time monitoring of depth and energy expenditure. We hypothesized that using the dual motor drill would decrease plunge depth regardless of the user's level of experience.

Methods: Sixty-six subjects of varying operative experience (20 attending orthopaedic surgeons, 20 orthopaedic surgery residents, and 26 senior medical students) drilled three holes with a conventional drill and three holes with a dual motor drill in a bicortical Sawbones block set in ballistic gel. The depth of drill penetration into the ballistic gel was measured for each hole using a digital caliper.

Results: Overall, subjects plunged less with the dual motor drill (0.9 mm) than with the conventional drill (4.2 mm) ($p < 0.001$). This finding was consistent within each group: attending surgeons (0.9 compared with 3.2 mm; $p = 0.02$), residents (1.0 compared with 3.0 mm; $p < 0.001$), and students (0.7 compared with 6.0 mm; $p < 0.001$). Plunge depths were also stratified into three categories: 0 to < 2 mm, 2 to 5 mm, and > 5 mm. Using the dual motor drill, subjects were more likely to plunge < 2 mm (97% plunged, on average, 0 to < 2 mm and 3% plunged, on average, 2 to 5 mm), whereas subjects were more likely to plunge deeper with the conventional drill (27% plunged, on average, 0 to < 2 mm; 45% plunged, on

average, 2 to 5 mm; and 27% plunged, on average, > 5 mm). Notably, no subject plunged ± 2 mm on the third attempt with the dual motor drill. Attending surgeons ($p = 0.02$) and residents ($p = 0.01$) plunged less than students with the conventional drill. There was no significant difference between attending surgeons and residents with the conventional drill ($p = 0.96$). There was no significant difference in plunge depth between groups using the dual motor drill.

Conclusions: The dual motor drill significantly decreased plunge depth for both surgically experienced and inexperienced subjects. Although inexperienced subjects performed worse with the conventional drill than those with experience, there was no difference in their performance with the dual motor drill.

The Effect of Patient Body Mass Index, Recommendation for Weight Modification, and Non-Modifiable Factors on Patient Satisfaction

Wells J, Batty M, Box H, Nakonezny P

J Am Acad Orthop Surg. 2019 Aug 21. doi: 10.5435/JAAOS-D-19-00330. [Epub ahead of print.]

Introduction: Patient satisfaction serves an increasingly important role in health care. Multiple non-modifiable patient factors have been found to influence patient satisfaction. To the best of our knowledge, however, no study has investigated the influence of body mass index (BMI) on satisfaction scores. The objective of this study was to evaluate whether BMI and provider recommendation for patient weight modification were associated with patient satisfaction.

Methods: We reviewed Press Ganey patient satisfaction survey scores from 3,044 clinical encounters in an academic orthopaedic center between November 2010 and May 2017. Multiple patient factors, BMI, and recommendation for weight loss, or requirement of weight loss, before surgery were recorded. Patient satisfaction was operationalized as a binary outcome of completely satisfied or not completely satisfied, and multiple logistic regression was used to estimate the odds of being completely satisfied from the subset of potential predictors.

Results: White patients (odds ratio [OR] = 1.340, 95% confidence interval [CI]: 1.113 to 1.584, $P = 0.0007$) and Medicare-insured patients (OR = 1.260, 95% CI: 1.044 to 1.521, $P = 0.0164$) were more likely to be completely satisfied, whereas patients being seen by a provider for the first time were less likely to be completely satisfied (OR = 0.728, 95% CI: 0.626 to 0.847, $P < 0.0001$). BMI, recommendation for weight loss, and requirement of weight modification before surgery were not found to be associated with patient satisfaction.

Discussion: Neither patient BMI nor provider recommendation for weight loss, or as a requirement for surgery, was associated with patient satisfaction. Race, insurance status, and previous visits with the care provider were identified as non-modifiable patient factors that influence patient satisfaction.

Size Matters: Which Adolescent Patients Are Most Likely to Require Surgical Decompression for Lumbar Disk Herniations?

Wiley MR, Hee Jo C, Khaleel MA, McIntosh AL

J Pediatr Orthop. 2019 Nov/Dec;39(10):e791-e795. doi:10.1097/BPO.0000000000001371.

Background: Lumbar herniated nucleus pulposis (HNP) occurs infrequently in the pediatric/adolescent population. A minority of patients with radicular symptoms fail to improve with conservative management and require discectomy. The authors hypothesize that children who ultimately require surgical intervention have an underlying lumbar stenosis predisposing them to continued symptoms.

Methods: Pediatric patients with a lumbar HNP on advanced imaging were retrospectively identified at a tertiary pediatric orthopaedic institution. Patients with spondylolisthesis, fractures, previous spine

surgery, or structural thoracolumbar scoliosis were excluded. On sagittal magnetic resonance imaging, measurements were taken of the L4 and L5 vertebral body diameters (VBD) and canal diameters (CD) by two independent reviewers. Statistical analysis was performed using two sample T tests followed by logistic regression analysis. This was utilized to identify significant associations between CD and the need for surgical decompression.

Results: A total of 76 patients (37 males/39 females) were identified with a lumbar HNP from 2001 to 2016. Eleven patients underwent discectomy. Sixty-five patients were managed conservatively. Age at magnetic resonance imaging was not different between groups (15.1 \pm 1.7 vs. 14.9 \pm 2.2 y, $P = 0.82$). VBD at L4 and L5 were not different between groups ($P = 0.2$ and 0.36 , respectively). The reviewers had fair to good (0.584-0.854) inter-rater reliability correlation coefficients. CD was decreased in the surgically treated cohort at L4 (11.6 \pm 1.6 vs. 14.2 \pm 2.1 mm, $P = 0.0002$) and at L5 (10.1 \pm 1.3 vs. 14.2 \pm 2.2 mm, $P < 0.00001$). The ratio of CD:VBD was lower in the surgically treated group at L4 (0.36 \pm 0.06 vs. 0.46 \pm 0.08, $P = 0.0002$) and L5 (0.31 \pm 0.68 vs. 0.45 \pm 0.08, $P < 0.00001$). Patients with an L4 CD < 12.6 mm were 18.8x more likely to require surgical decompression. 100% of patients with an L5 CD < 12.36 mm ultimately underwent surgical decompression.

Conclusions: Adolescent patients with congenital lumbar stenosis that develop a lumbar HNP are significantly more likely to require surgical decompression to relieve persistent radicular symptoms. An L4 CD < 12.6 mm and an L5 CD < 12.36 mm were highly correlated with the need for decompression.

Level of Evidence: Level III-prognostic study.

Combined Transphyseal and Lateral Extra-Articular Pediatric Anterior Cruciate Ligament Reconstruction: A Novel Technique to Reduce ACL Reinjury While Allowing for Growth

Wilson PL, Wyatt CW, Wagner KJ 3rd, Boes N, Sabatino MJ, Ellis HB Jr.

Am J Sports Med. 2019 Dec;47(14):3356-3364. doi:10.1177/0363546519881445.

Background: Treatment of anterior cruciate ligament (ACL) injuries in the adolescent population continues to be complicated by an unacceptably high rate of secondary ACL injury.

Purpose: To describe the failure rate and outcomes after a hybrid pediatric ACL reconstruction (ACLR) employing transphyseal hamstring (TPH) autograft combined with an extra-articular technique using an iliotibial band (ITB) autograft.

Study Design: Case series; Level of evidence, IV.

Methods: Consecutive patients undergoing combined TPH-ITB ACLR between January 2012 and April 2017 with a minimum two-year follow-up were reviewed. With the goal of decreasing ACL graft injury in this high-risk group, this technique employed anteromedial portal drilling for TPH with an extraosseous femoral ITB technique and intra-articular TPH-ITB grafts fixed within the tibial bone tunnel. Demographics, bone age, standing alignment radiograph for growth and mechanical axis grade, return to sport, graft failure, and patient-reported outcome measures were analyzed.

Results: A total of 61 knees in 60 adolescents underwent the combined TPH-ITB ACLR, with 57 knees (93.4%) meeting inclusion criteria with a mean follow-up of 38.5 months (range, 24-78 months). Only three of 57 knees (5.3%) sustained ACL reinjury. The mean age was 13.0 years (range, 11-16 years) with 36 male patients (mean bone age, 14.2 years) and 21 female patients (mean bone age, 13.3 years), and 91% of patients (52 of 57) returned to sport. Participants demonstrated a high functional level at final follow-up, with a mean score of 91.2 (range, 46.7-100) on the Pediatric International Knee Documentation Committee (Pedi-IKDC) Subjective Knee Evaluation Form and mean score of 22.4 (range, 4-30) on the Pediatric Functional Activity Brief Scale (Pedi-FABS). To critically assess growth, a cohort with ≥ 18 months of growth remaining at surgery was evaluated at maturity. No difference was seen in mean

operative and nonoperative leg growth (49.7 mm and 49.8 mm). Although no family reported cosmetic or functional alignment or length concerns, one of 18 (5.5%) had a final limb length discrepancy > 10 mm (12 mm) and a perioperative alignment difference (0-Grade II valgus).

Conclusion: Combined TPH-ITB ACLR in adolescents resulted in high activity levels (Pedi-FABS, 22.4; median, 25) and a low (5.3%) graft failure rate at a mean of 38.5 months.

Temperature as a Causative Factor in Diabetic Foot Ulcers: A Call to Revisit Ulceration Pathomechanics

Yavuz M, Ersen A, Hartos J, Lavery LA, Wukich DK, Hirschman GB, Adams LS
J Am Podiatr Med Assoc. 2019 Sep;109(5):345-350. doi:10.7547/17-131.

Background: Diabetic foot ulcers (DFUs) are a major burden to patients and to the health care systems of many countries. To prevent or treat ulcers more effectively, predictive biomarkers are needed. We examined temperature as a biomarker and as a causative factor in ulcer development.

Methods: Thirty-seven individuals with diabetes were enrolled in this observational case-control study: nine with diabetic neuropathy and ulcer history (DFU), 14 with diabetic neuropathy (DN), and 14 non-neuropathic control participants (DC). Resting barefoot plantar temperatures were recorded using an infrared thermal camera. Mean temperatures were determined in four anatomical regions – hallux and medial, central, and lateral forefoot – and separate linear models with specified contrasts among the DFU, DN, and DC groups were set to reveal mean differences for each foot region while controlling for group characteristics.

Results: The mean temperature reading in each foot region was higher than 30.0° C in the DFU and DN groups and lower than 30.0° C in the DC group. Mean differences were greatest between the DFU and DC groups, ranging from 3.2° C in the medial forefoot to 4.9° C in the hallux.

Conclusions: Increased plantar temperatures in individuals with a history of ulcers may include acute temperature increases from plantar stresses, chronic inflammation from prolonged stresses, and impairment in temperature regulation from autonomic neuropathy. Diabetic foot temperatures, particularly in patients with previous ulcers, may easily reach hazard thresholds indicated by previous pressure ulcer studies. The results necessitate further exploration of temperature in the diabetic foot and how it may contribute to ulceration.

Physical Therapy Scoliosis-Specific Exercises May Reduce Curve Progression in Mild Adolescent Idiopathic Scoliosis Curves

Zapata KA, Sucato DJ, Jo CH
Pediatr Phys Ther. 2019 Jul;31(3):280-285. doi:10.1097/PEP.0000000000000621.

Purpose: To evaluate the curve magnitude in participants with mild adolescent idiopathic scoliosis (AIS) at high risk of progression who received outpatient physical therapy scoliosis-specific exercises (PSSEs).

Methods: Participants with AIS curves 12 degrees to 20 degrees and Risser grade 0 chose either the PSSE or the control group. The PSSE group was instructed in the Barcelona Scoliosis Physical Therapy School. The control group was observed. Cobb angles were measured by one observer masked to group type at baseline, six-month follow-up, and one-year follow-up.

Results: Forty-nine participants were enrolled (26 exercise vs. 23 controls). Thirty-three participants (19 exercise vs. 14 controls) were seen at one-year follow-up. At one-year follow-up, the exercise group had smaller curves than controls (16.3 degrees vs. 21.6 degrees, $P = .04$) and less curve progression (0 degrees vs. 5.6 degrees, $P = .02$). Bracing was performed similarly between groups at one-year follow-up (37% vs. 43%).

Conclusions: In this small prospective series, PSSE resulted in significantly less curve progression compared with controls.

Skeletally Immature Patients with Adolescent Idiopathic Scoliosis Curves 15°-24° Are at High Risk for Progression

Zapata KA, Sucato DJ, Lee MC, Jo CH
Spine Deform. 2019 Nov;7(6):870-874. doi:10.1016/j.jspd.2019.02.012.

Study Design: Retrospective review.

Objectives: To evaluate the incidence of adolescent idiopathic scoliosis (AIS) curve progression and brace prescription in skeletally immature patients (Risser 0 to Risser 1) with curves 15°-24°.

Summary of Background Data: Many skeletally immature patients with mild AIS ask about the likelihood of curve progression. No studies have answered these questions.

Methods: The charts and radiographs of 302 consecutive patients with curves 15°-24° at initial visit, Risser 0 to Risser 1, were reviewed until skeletal maturity (\geq Risser 4) or surgery. Curves averaged 19.1° \pm 2.9° at initial visit. The Risser grade was 0 in 247 patients (82%) and 1 in 55 patients (18%). Patients who were Risser 0 were compared with those who were Risser 1, curves 15°-19° were compared with curves 20°-24°.

Results: The majority of patients demonstrated curve progression \geq 5° (65%). Patients who were Risser 0 did not progress significantly more than patients who were Risser 1 (10° vs. 8°) ($p = .22$). Patients with curves 20°-24° did not progress significantly more than patients with curves 15°-19° (10° vs. 9°) ($p = .65$).

Conclusions: Curve progression for small curves (15°-19°) is similar to curves between 20° and 24°. Close observation or perhaps early intervention for these patients is necessary. These data may suggest a paradigm shift to earlier brace initiation and call for early treatment in small curves.

Level of Evidence: Level II.

A Novel Posterior Rod-Link-Reducer System Provides Safer, Easier, and Better Correction of Severe Scoliosis

Zhang H, Sucato DJ

Spine Deform. 2019 May;7(3):445-453. doi:10.1016/j.jspd.2018.09.001.

Study Design: Retrospective review.

Objectives: To compare the Cobb $> 75^\circ$ scoliosis correction obtained using a novel Rod-Link-Reducer (RLR) system versus traditional corrective techniques (TCT) in patients with severe adolescent idiopathic scoliosis (AIS).

Summary of Background Data: Current implant strategies provide for good correction, especially for moderate curves; however, severe scoliosis continues to be challenging to obtain correction in a safe and effective manner.

Methods: A novel correction device was developed so that two provisional rods are placed on the convex side of the scoliosis proximally and distally, which are then linked to an external reduction device termed the RLR. A retrospective analysis was performed to compare the RLR versus the TCT in patients with curve $> 75^\circ$ with the diagnosis of AIS with respect to the radiographic outcomes, operative time, intraoperative blood loss, complications, and SRS-30 scores of a minimum two-year follow-up.

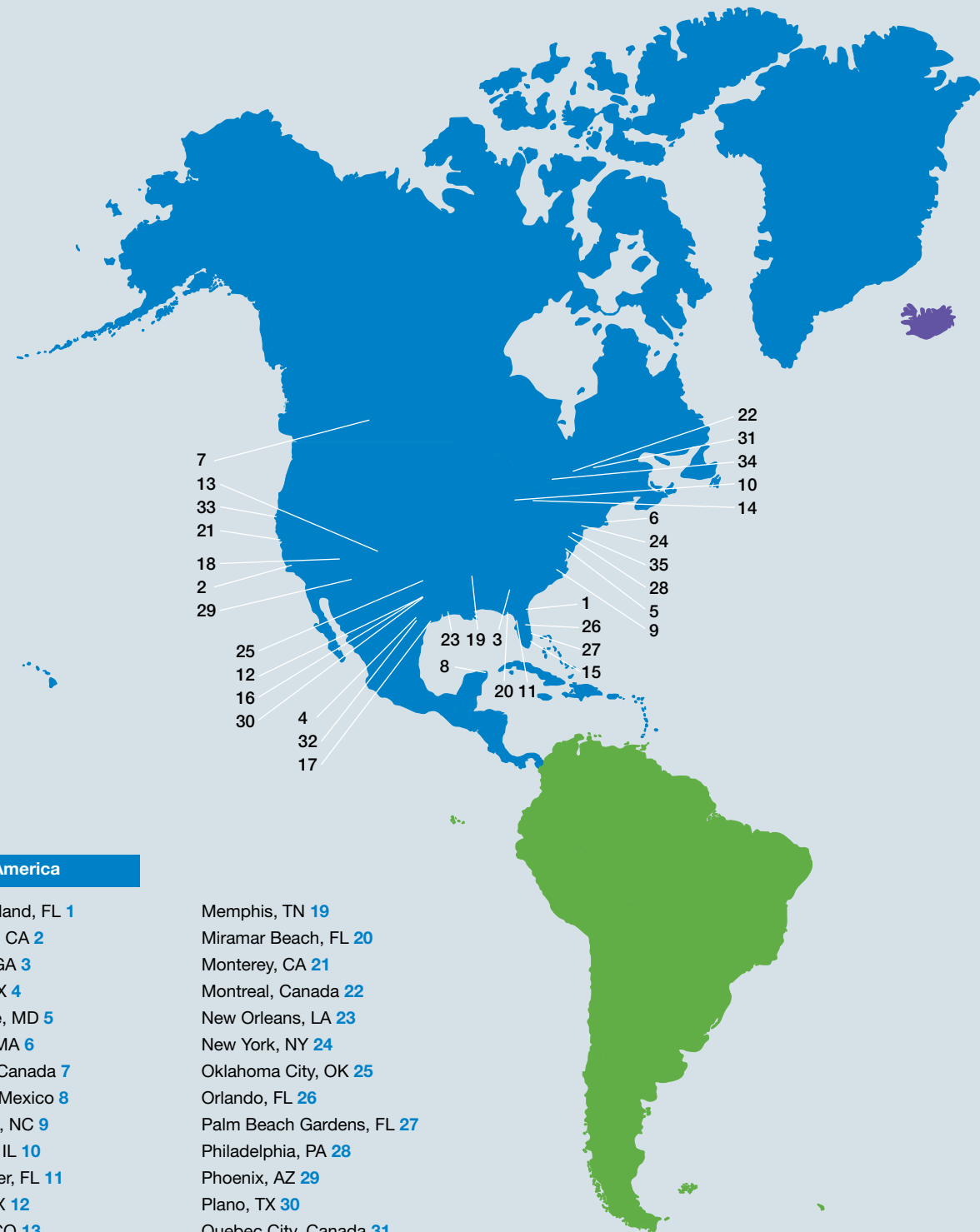
Results: A total of 36 patients were evaluated (RLR-18, TCT-18). The data sets were similar for age, gender, coronal Cobb, curve flexibility, and follow-up period. The mean preoperative Cobb for the RLR group was 91.7° (76° - 113°) and 91.8° (78° - 108°) for the TCT group. The mean coronal Cobb correction rate was significantly greater for the RLR group (73.1% vs. 56.6%, $p < .0001$). The mean operative time was 74.8 minutes shorter in the RLR group (316.6 minutes vs. 391.4 minutes, $p = .03$). There were two late-developing infections and three intraoperative neuro-monitoring changes during the correction maneuvers in the TCT group compared with none in the RLR group ($p = .02$).

Conclusion: In a matched cohort, the use of the RLR exhibited greater coronal Cobb correction and shorter operative time and was less likely to have critical neuro-monitoring changes compared with the TCT group. The RLR provides safer and improved correction for severe curves without adding surgical risk.

Level of Evidence: Level III.

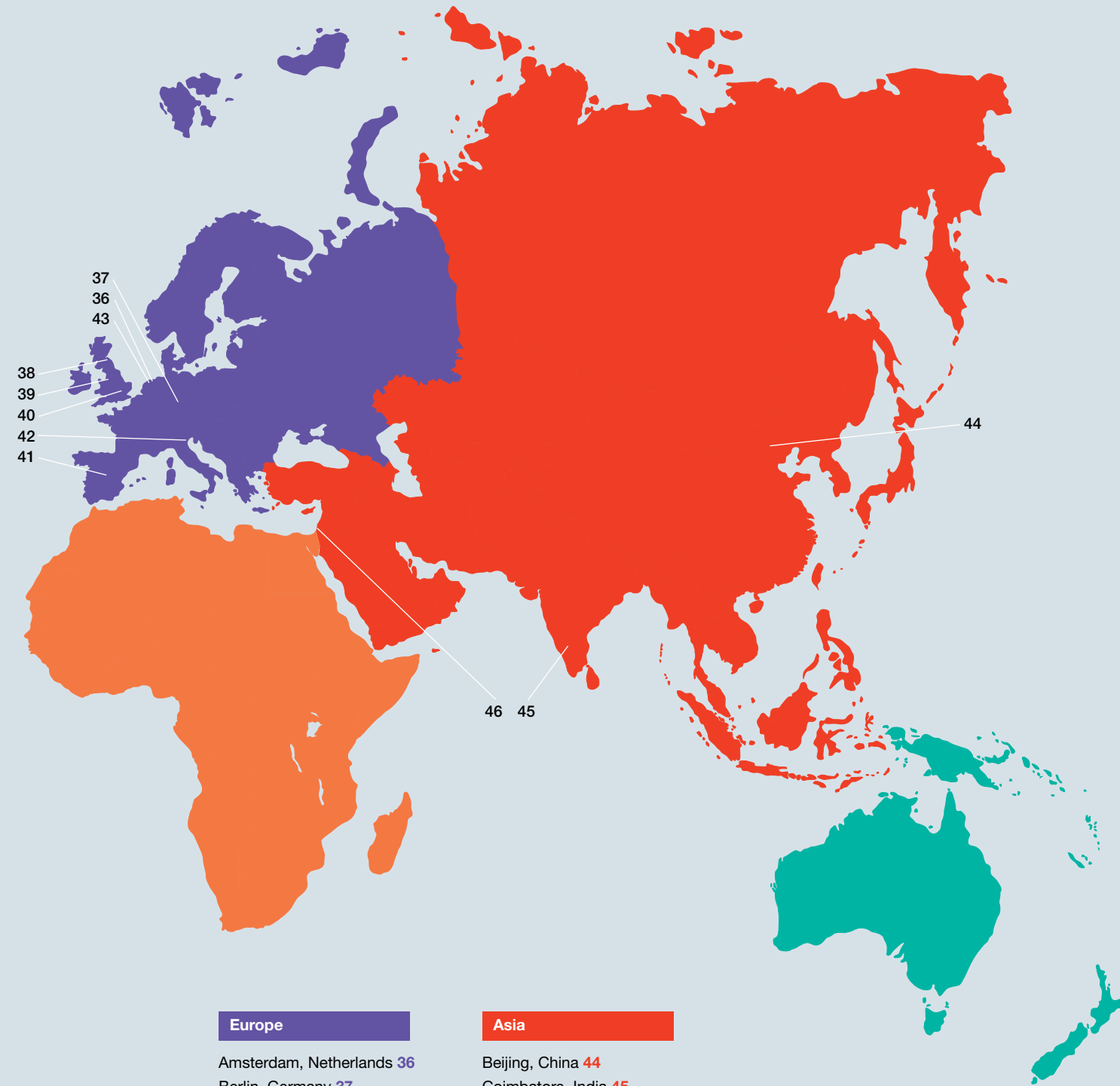


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Department of Orthopaedic Surgery Presentations

The Ability to Obtain Transcranial Spinal Cord Monitoring in CMT Patients Is Similar to Idiopathic Spinal Deformity When the Sweep Length and Stimulation Voltage Are Increased

Daniel Sucato, M.D.

Safety in Spine Surgery Summit; New York, NY

Adolescent Idiopathic Scoliosis: Psychological Implications of Pain in Pre-Surgical Patients

Brandon Ramo, M.D.

POSNA; Charlotte, NC

AAOS; New Orleans, LA

Advances in Pediatric Fracture Management: A Case-Based Review of Common Pediatric Injuries and Current Trends in Management

Christine Ho, M.D.

AAOS; Las Vegas, NV

Age-Adjusted Spinopelvic Alignment and Surgical Invasiveness in Cervical Deformity Correction

Shaleen Vira, M.D., et al.

ISASS19; Anaheim, CA

Allogeneic Blood Transfusion Following AIS Surgery Decreases 50% Using Quality-Improvement Strategies

Brandon Ramo, M.D.; Daniel Sucato, M.D.

SRS; Montreal, Canada

(Almost) Everything I know about Legg-Calvé-Perthes Disease

David Podeszwa, M.D.

Henry Ford Hospital Grand Rounds Invited Lecture; Detroit, MI

Analysis of EOS Cases that Are Resistant to Correction and Length Gain

Charles E. Johnston, M.D., et al.

ICEOS; Atlanta, GA

Analysis of Femoral Head Microstructure and Vasculature Relevant to Legg-Calvé-Perthes Disease

Harry Kim, M.D.; William Morris, M.D.

AAOS; Las Vegas, NV

POSNA; Charlotte, NC

An Analysis of Pelvic Asymmetry Between Different Sexes and Races in a Cadaveric Collection

John G. Birch, M.D.

EPOS; Tel Aviv, Israel

Angular Deformities of the Lower Extremities

Charles E. Johnston, M.D.

SPORC; Montreal, Canada

Anterior Lumbar Interbody Fusion Reduces Thecal Sac Compression in the Setting of Degenerative Spondylolisthesis

Shaleen Vira, M.D., et al.

CNS; San Francisco, CA

Are Self-Reported Pain Scales in Pediatrics Valid?

Henry Ellis, M.D.; Philip Wilson, M.D.

PRiSM; Atlanta, GA

Are They Calling You with a Pediatric Orthopaedic Emergency?

Christine Ho, M.D., et al.

AAOS; Las Vegas, NV

The Association of Hip Osteoarthritis and Sleep Quality

Edward Mulligan, D.P.T., PT; Linda Hynan, Ph.D.; Joel E. Wells, M.D., M.P.H.; et al.

TOA; Houston, TX

Beaming Screw Midfoot Charcot Reconstruction with and without Subtalar Arthrodesis

Stephen Blake Wallace, M.D.

AOFAS; Chicago, IL

SOA; Amelia Island, FL

Below-Knee Amputation Is Not Always a Failure

Dane Wukich, M.D.

TPMA Southwest Foot and Ankle Conference; Frisco, TX

Biomechanical Assessment of Torsional Stiffness After Pinning of Pediatric Supracondylar Humerus Fractures

Anthony Riccio, M.D.

ORS; Austin, TX

Biomechanical Results Following Iliotibial Band Physeal Sparing ACL Reconstruction

Henry Ellis, M.D.; Philip Wilson, M.D.

GCMAS; Frisco, TX

Biomechanically Sound Lisfranc and Chopart Amputations

Dane Wukich, M.D.

Diabetic Limb Salvage Conference; Washington, DC

Blount's Disease: Growth Modulation in Young Patients

Charles E. Johnston, M.D.

Texas Scottish Rite Hospital for Children; Dallas, TX

Borderline Acetabular Dysplasia: Independent Predictors of Hip Instability Versus Impingement

Joel E. Wells, M.D., M.P.H., et al.

PRiSM; Atlanta, GA

AAOS; Las Vegas, NV

Botulinum Toxin May Delay or Prevent Surgery in Spastic Hemiplegic Cerebral Palsy

Anthony Riccio, M.D., et al.

SOMOS; Palm Beach Gardens, FL

Bracket Epiphysis Excision of the First Metatarsal

Anthony Riccio, M.D., et al.

POSNA; Charlotte, NC

Breakout Session: Neuromuscular Challenges

Charles E. Johnston, M.D.

ICEOS; Atlanta, GA

The Burden of Lower Extremity Amputation

Dane Wukich, M.D.

International Symposium on the Diabetic Foot; The Hague, Netherlands

Can Combined Transphyseal and Lateral Extra-Articular Pediatric ACL Reconstruction Techniques Be Employed to Reduce ACL Re-Injury While Allowing for Growth?

Henry Ellis, M.D.; Philip Wilson, M.D.

POSNA; Charlotte, NC

Can Real-Time Monitoring with a Controlled Advancement Drill Decrease Plunge Depth?

Anthony Riccio, M.D.

POSNA; Charlotte, NC

EPOS; Tel Aviv, Israel

Can Real-Time Monitoring with a Dual Motor Drill Decrease Plunge Depth?

Stephen Blake Wallace, M.D.

UTSW Simulation-Based Quality Improvement and Research Forum; Dallas, TX

Capital Femoral Epiphyseal Cupping and Extension May Be Protective in Slipped Capital Femoral Epiphysis: A Multicenter Matching Cohort Study

William Morris, M.D.
POSNA; Charlotte, NC

Case Presentations: Tuesday Night Gymnastics Meet

Christine Ho, M.D., et al.
21st Annual Hand Surgery Symposium; Philadelphia, PA

Cast Treatment for IEOS

Charles E. Johnston, M.D.
Johns Hopkins University; Baltimore, MD

Characteristics Associated with Failure of Y-Balance Testing in the Return to Play Assessment Following ACL Reconstruction

Henry Ellis, M.D.; **Philip Wilson**, M.D.
ISAKOS; Cancun, Mexico

Characterization of Outcomes with Standardized Hip Fracture Care Programs in the United States

Junho Ahn; **Sharon L. Walton**, M.D.; **Dane K. Wukich**, M.D.; **Alexandra K. Callan**, M.D.; **Joel E. Wells**, M.D., M.P.H.; **Drew T. Sanders**, M.D.; **Adam J. Starr**, M.D.; **Ashoke K. Sathy**, M.D.
OTA; Denver, CO

Charcot Case Presentation and Panel Discussion

Dane Wukich, M.D.
TPMA Southwest Foot and Ankle Conference; Frisco, TX

Charcot Master Class for Diabetic Foot Surgeons

Dane Wukich, M.D.
Beijing International Conference on Diabetic Foot and Wounds; Beijing, China

Chiari Malformation Clusters Describe Differing Presence of Concurrent Anomalies Based on Chiari Type

Shaleen Vira, M.D., et al.
ISASS19; Anaheim, CA

Classification and Staging of Charcot

Matthew J. Johnson, D.P.M.
TPMA Southwest Foot & Ankle Conference; Frisco, TX

Clusters of Predicting Factors for Pseudarthrosis: A 10-Year Analysis of 101,929 Thoracolumbar Spine Fusions

Shaleen Vira, M.D., et al.
ISASS19; Anaheim, CA

Comparison of Short-Term Outcomes After Ankle Replacement and Ankle Arthrodesis

Stephen Blake Wallace, M.D.
AOFAS; Chicago, IL
WOA; Monterey, CA

Comparison of the White-Menelaus and Anderson-Green Predictions of Growth Remaining in the Distal Femur and Proximal Tibia

John G. Birch, M.D.
LLRS; Boston, MA
ILLRS; Liverpool, England

Comparison of Two Anatomic Classification Systems for Diabetic Charcot Neuroarthropathy with Multi-Reader Analysis

Dane Wukich, M.D.
International Symposium on the Diabetic Foot; The Hague, Netherlands

Compensatory Sagittal Plane Ankle Gait Mechanics: Are They Present In Patients with a Stiff or Weak Hip?

David Podeszwa, M.D.
GCMAS; Frisco, TX

Complication Analysis of Pediatric and Adolescent ACL Reconstructions in the ABOS Database

Henry Ellis, M.D.
PRISM; Atlanta, GA

Complications of External Fixation

Dane Wukich, M.D.
Diabetic Limb Salvage Conference; Washington, DC

Congenital and Early-Onset Scoliosis

Charles E. Johnston, M.D.
SPORC; Montreal, Canada

Congenital Hand Surgery in 2019

Christine Ho, M.D.
BSCOS Current Concepts Course; Edinburgh, Scotland

Congenital Pseudarthrosis of the Tibia – Overview of Treatment

Charles E. Johnston, M.D.
Johns Hopkins University; Baltimore, MD

Congenital Upper Extremity Overview

Christine Ho, M.D.
IPOS; Orlando, FL

Continued Deterioration in Pulmonary Function at Minimum 18-Year Follow-Up from Early Thoracic Fusion in Non-Neuromuscular Scoliosis

Charles E. Johnston, M.D.; **Lori Karol**, M.D.
AAOS; Las Vegas, NV
PRISM; Atlanta, GA

The Debate Is On: Discussing the Controversies Surrounding Pediatric Fracture Care

Christine Ho, M.D.
AAOS; Las Vegas, NV

Deciding When to Amputate

Dane Wukich, M.D.
Desert Foot Conference; Phoenix, AZ

Diagnosis and Treatment of Charcot Neuroarthropathy

Dane Wukich, M.D.
Diabetic Lower Extremity Symposium; Boston, MA

Distal Radius Growth Arrest

Christine Ho, M.D.
BSCOS Current Concepts Course; Edinburgh, Scotland

The Distance Between Tibial Physis and Coronary Ligament: A Pediatric Cadaveric Study

Henry Ellis, M.D.; **Philip Wilson**, M.D.
PRISM; Atlanta, GA

Do Hospital and Patient Characteristics Predict Extended Length of Stay in Patients Undergoing Primary Spine Procedures?

Shaleen Vira, M.D., et al.
ISASS19; Anaheim, CA

Do Intraoperative Lateral Radiographs During Scheuermann Kyphosis Correction Predict the Standing Radiographic Outcome?

Daniel Sucato, M.D.
POSNA; Charlotte, NC

Do Psychological Factors or Radiographic Severity Play a Role in the Age of Onset in Symptomatic Developmental Dysplasia of Hip and Femoroacetabular Impingement Syndrome?

Paul Nakonezny, Ph.D.; **Joel E. Wells**, M.D., M.P.H.; **Shawn Okpara**, M.D.
ISHA; Madrid, Spain

Do We Really Need to Worry About Calca-
neocuboid Subluxation During Lateral Column
Lengthening?

Anthony Riccio, M.D., et al.

Texas Scottish Rite Hospital for Children; Dallas,
TX

Docosahexaenoic Acid (DHA) for the Treatment
of Pediatric Sport-Related Concussion: Results
of a Feasibility Trial

Henry Ellis, M.D.

PRISM; Atlanta, GA

Docosahexaenoic Acid (DHA) Is Safe and Feasi-
ble for the Treatment of Pediatric Sport-Related
Concussion

Henry Ellis, M.D.

AMSSM; Houston, TX

Does a Combined Intra-Articular and Extra-Ar-
ticular ACL Reconstruction Affect External Knee
Valgus Moment Asymmetry?

Henry Ellis, M.D.; **Philip Wilson**, M.D.

PRISM; Atlanta, GA

Does Early Proximal Femoral Varus Osteotomy
Shorten the Length of Fragmentation in the
LCPD? Lessons from a Prospective Multi-Cen-
ter Cohort

Harry Kim, M.D.

POSNA; Charlotte, NC

Does Hip Rotation in Prone and Supine Position
Correlate with Radiographic Findings in Adoles-
cents?

Henry Ellis, M.D.; **David Podeszwa**, M.D.

ISAKOS; Cancun, Mexico

Does Pain Catastrophizing Predict Age of Onset
in Symptomatic Hip Dysplasia and Femoroace-
tabular Impingement?

Paul Nakonezny, Ph.D.; **Joel E. Wells**, M.D.,
M.P.H.; **Shawn Okpara**, M.D.

National Orthopaedic Symposium; Toronto,
Canada

SBAS; New York, NY

Does Radiographic Severity of Hip Dysplasia
Predict Pain and Functional Impairment in
Symptomatic Patients?

Avneesh Chhabra, Ph.D.; **Joel E. Wells**, M.D.,
M.P.H.; **Shawn Okpara**, M.D.

ISHA; Madrid, Spain

The Duration of Pavlik Harness Wear Following
Successful Reduction of Dislocated Hips Does
Not Seem to Play a Role in Determining Radio-
graphic Dysplasia at Two Years

Daniel Sucato, M.D.

POSNA; Charlotte, NC

Dysplasia Epiphysealis Hemimelica of the Lower
Extremity: A 47-Year Multi-Institutional Review

Anthony Riccio, M.D.

ILLRS; Boston, MA

Economic Burden of Pediatric Musculoskeletal
Infection

Lawson A. Copley, M.D., MBA, FAAOS

AAOS; Las Vegas, NV

Effect of Diabetes and Hemoglobin A1c on
Complications Following Elective Hand Surgery

Michael Del Core, M.D.; **Daniel Koehler**, M.D.

ASSH; Las Vegas, NV

SOA; Amelia Island, FL

The Effect of Lateral Column Lengthening on
Subtalar Motion: Are We Trading Deformity for
Stiffness?

Anthony Riccio, M.D., et al.

SOMOS; Palm Beach Gardens, FL

Texas Scottish Rite Hospital for Children; Dallas,
TX

Elbow and Forearm Malunions

Christine Ho, M.D.

BSCOS Current Concepts Course; Edinburgh,
Scotland

Epiphysodesis – Indications, Techniques, and
Outcomes

David Podeszwa, M.D.

IPOS; Orlando, FL

The Expression of HtrA1 in the Progression of
Osteoarthritis and Its Association with Inter-
grin-Based Adhesions

Paul Nakonezny, Ph.D.; **Joel E. Wells**, M.D.,
M.P.H.; et al.

ORS; Austin, TX

External Fixation for Charcot

Dane Wukich, M.D.

Diabetic Limb Salvage Conference; Washington,
DC

First MTPJ Arthrodesis

Matthew J. Johnson, D.P.M.

TPMA Southwest Foot & Ankle Conference;
Frisco, TX

Flexible Nailing of Forearm Fractures

Christine Ho, M.D.

4th Annual Pediatric Orthopaedic Surgical Tech-
niques Labs; Memphis, TN

Forearm, Wrist, and Hand Fractures

Christine Ho, M.D.

3rd Annual Kaye Wilkins' Pediatric Fracture
Course; Austin, TX

Functional Implications of the Flat-Topped Talus
Following Treatment of Idiopathic Clubfoot
Deformity

Anthony Riccio, M.D., et al.

SOMOS; Palm Beach Gardens, FL

Texas Scottish Rite Hospital for Children; Dallas,
TX

Gait

John A. Herring, M.D.

The Children's Hospital Foundation; Oklahoma
City, OK

Gait Analysis in Children with Proximal Femoral
Focal Deficiency

Lori Karol, M.D.; **Charles Johnston**, M.D.;
John A. Herring, M.D.

POSNA; Charlotte, NC

EPOS; Tel Aviv, Israel

Ganz Periacetabular Osteotomy (Surgical Tech-
nique)

David Podeszwa, M.D.

29th Annual Baltimore Limb Deformity Pre-
Course; Baltimore, MD

Gymnast Fractures About the Elbow – Monteg-
gia Fracture Dislocations

Christine Ho, M.D.

21st Annual Hand Surgery Symposium; Phila-
delphia, PA

Hand Injuries for the Frontline Provider

Christine Ho, M.D., et al.

IPOS; Orlando, FL

Hand or Elbow for Bone Age: Does it Matter?

David Podeszwa, M.D.

IPOS; Orlando, FL

The Hidden Costs of Vancomycin Use During the Treatment of Staphylococcus aureus Bacteremia Concurrent with Acute Hematogenous Osteomyelitis

Lawson A. Copley, M.D., MBA, FAAOS

ID Week; Washington, DC

History and Physical Examination: A Dying Art but Priceless

Matthew J. Johnson, D.P.M.

TPMA Southwest Foot & Ankle Conference; Frisco, TX

Hospital-Acquired Conditions Occur More Frequently in Elective Spine Surgery than for Other Common Elective Surgical Procedures

Shaleen Vira, M.D., et al.

AAOS; Las Vegas, NV

ISASS19; Anaheim, CA

How Different Are Ambulatory Patients with Early-Onset Hereditary Spastic Paraparesis and Spastic, Diplegic Cerebral Palsy?

Anthony Riccio, M.D.

AACPDM; Anaheim, CA

How Does Diabetic Bone Differ from Normal Bone?

Dane Wukich, M.D.

TPMA Southwest Foot and Ankle Conference; Frisco, TX

How Reliable Is the Modified Lateral Pillar Classification When a Large Number of Raters from Multiple Centers Are Involved, and What Factors Affect the Reliability?

Harry Kim, M.D.

EPOS; Tel Aviv, Israel

Impact of Presenting Patient Characteristics on Surgical Complications and Morbidity in Early-Onset Scoliosis

Shaleen Vira, M.D., et al.

ISASS19; Anaheim, CA

Implementation of Standardized Discharge Regimen and Education Reduces Narcotic Prescribing Following Adolescent Idiopathic Scoliosis (AIS) Surgery: A Quality Value Safety Initiative (QVSI)

Brandon Ramo, M.D.

POSNA; Charlotte, NC

Inappropriate Pediatric Orthopaedic Emergency Department Transfers: A Burden on the Health Care System

Anthony Riccio, M.D., et al.

SOMOS; Palm Beach Gardens, FL

TOA; Houston, TX

Incidence of PJK with Pedicle Screws at Upper Instrumented Vertebrae in Posterior Spinal Fusion for Adolescent Idiopathic Scoliosis

Daniel Sucato, M.D.

IMAST; Amsterdam, Netherlands

Incidence of Positive Intraoperative Cultures in Primary Shoulder Arthroplasty Following Prior Ipsilateral Shoulder Surgery

Michael Del Core, M.D.

MAOA; Miramar Beach, FL

Incidence of VACTERL Associations in the United States Pediatric Population and Associated Frequency Among Congenital Spinal Diagnoses

Shaleen Vira, M.D., et al.

ISASS19; Anaheim, CA

Infantile Foot Deformities

Anthony Riccio, M.D.

UT Southwestern Department of Obstetrics and Gynecology Grand Rounds; Dallas, TX

Institutional Process Improvement Leads to Accelerated Real-Time MRI Protocol with Minimal Use of Contrast and Immediate Surgical Decision Support During the Evaluation and Treatment of Children with Suspected Musculoskeletal Infection

Lawson A. Copley, M.D., MBA, FAAOS

AAOS; Las Vegas, NV

Intraoperative Neurophysiological Monitoring During Spine Surgery in Patients with Neurofibromatosis, Type 1

Daniel Sucato, M.D.

AACN; Las Vegas, NV

Safety in Spine Surgery Summit; New York, NY

An Investigation of the Surgical Anatomy of the Pediatric Iliotibial Band

Henry Ellis, M.D.; Philip Wilson, M.D.

PRISM; Atlanta, GA

Is Postoperative Imaging Prior to Discharge Necessary Following Idiopathic Scoliosis Surgery?

Daniel Sucato, M.D.

SRS; Montreal, Canada

Is There a Relationship Between Severity of Radiographic Dysplasia and Patient Reported Pain?

Joel E. Wells, M.D., M.P.H.; Shawn Okpara, M.D.; et al.

National Orthopaedic Symposium; Toronto, Canada

TIOS; Fort Lauderdale, FL

Journal Club: The Best Papers in the Past One Year

Matthew J. Johnson, D.P.M.

TPMA Southwest Foot & Ankle Conference; Frisco, TX

Legg-Calvé-Perthes Disease

John A. Herring, M.D.

The Children's Hospital Foundation; Oklahoma City, OK

Long Cephalomedullary Nails

Drew Sanders, M.D.

TOA Trauma Symposium; Houston, TX

Lower Extremity – Trauma

Christine Ho, M.D.

4th Annual Pediatric Orthopaedic Surgical Techniques Labs; Memphis, TN

Management of Ankle Fractures in Patients with Diabetes Mellitus

Dane Wukich, M.D.

Diabetic Foot Society of India; Coimbatore, India

Management of Pediatric Proximal Femoral AVN

David Podeszwa, M.D.

Limb Lengthening and Reconstruction Society Specialty Day; Las Vegas, NV

Management of the Complex Patient: Too Small and Stiff

Charles E. Johnston, M.D.

ICEOS; Atlanta, GA

A Master Class on Charcot Neuroarthropathy

Dane Wukich, M.D.

Diabetic Foot Society of India; Coimbatore, India

Master Technique: Tendon Transfer for Wrist Extension

Christine Ho, M.D.

IPOS; Orlando, FL

A Matched Cohort of Large AIS Curves: Do Ponte Osteotomies Improve?

Daniel Sucato, M.D.

POSNA; Charlotte, NC

Metaphyseal Fracture Displacement Is Predictive of Intra-Articular Diastasis in Adolescent Triplane Ankle Fractures

Anthony Riccio, M.D.

EPOS; Tel Aviv, Israel

POSNA; Charlotte, NC

Middle and Lower Body Bone Stress Injuries in the Pediatric Population

Henry Ellis, M.D.

PRISM; Atlanta, GA

Midshaft Clavicle Fractures

Christine Ho, M.D.

21st Annual Hand Surgery Symposium; Philadelphia, PA

Minimally Displaced Humeral Lateral Condyle Fractures: Is Prophylactic Stabilization Superior to Surgery After Displacement?

Brandon Ramo, M.D.

POSNA; Charlotte, NC

Motion Simulation of 3D CT Images to Compute Joint Interference Distinguishes Between Multiple Hip Pathologies

Rajiv Chopra, M.D.; Avneesh Chhabra, Ph.D.; Joel E. Wells, M.D., M.P.H.; Nicholas P. Fey, Ph.D.; Yin Xi, Ph.D.; et al.

ISB/ASB Annual Meeting; Calgary, Canada

A Multidisciplinary Approach Leads to More Efficient Magnetic Resonance Imaging, Less Use of Contrast Material, and Improved Clinical Outcomes During Musculoskeletal Infection Evaluation

Lawson A. Copley, M.D., MBA, FAAOS

SPR; San Francisco, CA

Musculoskeletal Demands

Karl E. Rathjen, M.D.

Congressman Pete Sessions' Conference on Childhood Obesity: The Problems, the Medical Issues, and the Solutions; Dallas, TX

My Method of One Stage Hindfoot Reconstruction Using Internal Fixation

Dane Wukich, M.D.

Malvern Diabetic Foot Conference; London, UK

The Natural History of Charcot Foot: From Diagnosis to Operative Treatment

Dane Wukich, M.D.

International Symposium on the Diabetic Foot; The Hague, Netherlands

Neuromonitoring for AIS: A 20-Year Analysis of AIS Patient Incidence of Critical Changes and Predictive Factors to Define Patients at Risk

Daniel Sucato, M.D.

Safety in Spine Surgery Summit; New York, NY

Neuropathic Ankle Fractures in Patients with Diabetes

Dane Wukich, M.D.

UT San Antonio Orthopaedic Grand Rounds; San Antonio, TX

Neuropathic Fractures and Dislocations

Dane Wukich, M.D.

Desert Foot Conference; Phoenix, AZ

Non-Lengthening Reconstruction Options for Severe Congenital Femoral Deficiency

Charles E. Johnston, M.D.

Texas Scottish Rite Hospital for Children; Dallas, TX

A Novel Posterior Rod-Link-Reducer System for Surgical Correction of Severe Scoliosis (SE54)

Daniel Sucato, M.D.

AAOS; Las Vegas, NV

One and Done Surgical Fusion for Juvenile Scoliosis: Leads to Equivalent PROs at 5 Years Despite High Rates of Adding-On

Brandon Ramo, M.D.; Lori Karol, M.D.

POSNA; Charlotte, NC

IMAST; Amsterdam, Netherlands

One and Done Surgical Fusion for Skeletally Immature Idiopathic Scoliosis: Leads to Equivalent PROs at 5 Years Despite High Rates of Adding-On

Lori Karol, M.D.; Brandon Ramo, M.D.

IMAST; Amsterdam, Netherlands

Orthopaedics and the Multidisciplinary Team: A Talk About Leadership

Dane Wukich, M.D.

Desert Foot Conference; Phoenix, AZ

Outcomes and Classification for Dysplasia Epiphysealis Hemimelica in the Lower Extremity

Anthony Riccio, M.D., et al.

LLRS; Boston, MA

The Outcomes We Measure in Charcot Foot Reconstruction

Dane Wukich, M.D.

Malvern Diabetic Foot Conference; London, UK

Pain Catastrophizing, Anxiety, and Depression in Hip Pathology

Savannah Hampton, M.D.; Paul Nakonezny, Ph.D.; Joel E. Wells, M.D., M.P.H.

AAOS; Las Vegas, NV

Panel Discussion: Lower Extremity Reconstruction in Skeletal Dysplasias

David Podeszwa, M.D.

IPOS; Orlando, FL

Panel: Final Fusion After EOS Growth-Sparing Treatment

Charles E. Johnston, M.D.

ICEOS; Atlanta, GA

Patellar Facet Morphology in Early Pediatric Development

Henry Ellis, M.D.; Philip Wilson, M.D.

PRISM; Atlanta, GA

Pediatric Amputees

John A. Herring, M.D.

The Children's Hospital Foundation; Oklahoma City, OK

Pediatric Basketball-Related Injuries: Sex- and Age-Based Trends Over the Last 10 Years

Henry Ellis, M.D.; Philip Wilson, M.D.

AMSSM; Houston, TX

Pediatric Fractures

Christine Ho, M.D.

AAOS; Las Vegas, NV

Pediatric Type II Supracondylar Humerus Fractures: Factors Associated with Successful Closed Reduction and Immobilization

Christine Ho, M.D.; Henry Ellis, M.D.; Philip Wilson, M.D.

POSNA; Charlotte, NC

NESS; Boston, MA

Physeal-Sparing Distal Femoral Trochleoplasty: A Technique Analysis in a Pediatric Model

Henry Ellis, M.D.; Philip Wilson, M.D.

PRISM; Atlanta, GA

Planning for a Multicenter Longitudinal Pediatric Implementation of PROMIS Standard of Care Data Collection

Harry Kim, M.D.

Health Measures Conference; Chicago, IL

Predictors of Failure After Surgical Treatment of Femoroacetabular Impingement: Results of a Multicenter Prospective Cohort of 621 Hips

David Podeszwa, M.D.; Daniel Sucato, M.D.

POSNA; Charlotte, NC

Pre-Op Planning to Handing Over the Knife

Anthony Riccio, M.D.

POSNA; Charlotte, NC

Preoperative Diagnosis of Gartland Type IV Supracondylar Humerus Fractures: Substantial Overlap with Flexion-Type Fractures

Christine Ho, M.D., et al.

AAOS; Las Vegas

Primary Amputation as an Option for Congenital Pseudarthrosis of the Tibia

John A. Herring, M.D.

International Pediatric Orthopaedic Think Tank; Quebec City, Canada

A Primer on Burns, Frostbite, and Infiltrates

Christine Ho, M.D.

IPOS; Orlando, FL

Prolonged Non-Weightbearing Treatment Decreases Femoral Head Deformity in Legg-Calve-Perthes Disease

Harry Kim, M.D.

POSNA; Charlotte, NC

A Prone Thoracoscopic Anterior Release and Fusion as Part of a Combined Anterior/Posterior Surgery: Is There a Role in 2019 and How Does It Compare to Open?

Daniel Sucato, M.D.

IMAST; Amsterdam, Netherlands

Prophylactic Application of Local (Intra-Wound) Antibiotic Does Not Decrease Acute Surgical Site Infections in AIS Patients

Amy McIntosh, M.D.

POSNA; Charlotte, NC

Proximal Humerus Fractures Treated with Reverse Shoulder Arthroplasty Versus Hemiarthroplasty

Stephen Gates, M.D.

SOA; Amelia Island, FL

Psychological Implications of Pain in Pre-Surgical AIS Patients

Brandon Ramo, M.D.

SRS; Amsterdam, Netherlands

Quantifying Differences in Femoral Head and Neck Asphericity in the Common Hip Conditions of Femoroacetabular Impingement (FAI) and Hip Dysplasia Versus Controls Using Radial 3DCT Imaging and Volumetric Segmentation

Yin Xi, Ph.D.; Riham Dessouky, M.D.; Nicholas Fey, Ph.D.; Rajiv Chopra, Ph.D.; Joel E. Wells, M.D., M.P.H.; Avneesh Chhabra, M.D.; et al.

Annual Student Research Forum; Dallas, TX

Quantitative Age-Adjusted Targets for Ideal Cervicothoracic Sagittal Alignment in Asymptomatic Adults

Shaleen Vira, M.D., et al.

ISASS19; Anaheim, CA

The Rate of Mediastinal and Vascular Injury Following Acute Posterior Sternoclavicular Dislocation

Anthony Riccio, M.D.

POSNA; Charlotte, NC

Reconstructive Approaches and Biomechanics of the Diabetic Foot

Dane Wukich, M.D.

International Symposium on Diabetic Foot; Padua, Italy

Redefining the Juvenile Bunion

Anthony Riccio, M.D., et al.

AAP; New Orleans, LA

AOFAS; Chicago, IL

Reliability in Radiographic Review of Tibial Spine Fractures in a Tibial Spine Research Interest Group

Henry Ellis, M.D.

PRISM; Atlanta, GA

The Reliability of the AOSpine Thoracolumbar Spine Injury Classification System: Results of a Multicenter Study

Anthony Riccio, M.D., et al.

NASS; Chicago, IL

Results of Physeal Bar Resection at a Single Pediatric Institution

John G. Birch, M.D.; David Podeszwa, M.D.

AAOS; Las Vegas, NV

POSNA; Charlotte, NC

Risk-Benefit Assessment of Major Versus Minor Osteotomies for Flexible and Rigid Cervical Deformity Correction

Shaleen Vira, M.D., et al.

ISASS19; Anaheim, CA

Safety of Pedicle Screw Placement in a Large Series of AIS Patients: Is Navigation Necessary?

Lori Karol, M.D.; Daniel Sucato, M.D.

IMAST; Amsterdam, Netherlands

Severe Adolescent Idiopathic Scoliosis: Which Approach to Choose?

Daniel Sucato, M.D.

IMAST; Amsterdam, Netherlands

Severe Open Pediatric Tibia Fractures: Challenges and Management Strategies

Anthony Riccio, M.D.

Controversies in Pediatric Limb Reconstruction Symposium; Dallas, TX

Short-Term Radiographic and Patient Outcomes of a Novel Biplanar Plating System for Hallux Valgus Correction

Stephen Blake Wallace, M.D.; Kshitij Manchanda, M.D.

AOFAS; Chicago, IL

SOA; Amelia Island, FL

Significant Variation Exists Between Surgeon's Surgical Time and the Specific Steps When Performing a Posterior Spinal Fusion for Lenke 1A AIS

Daniel Sucato, M.D.

SRS; Montreal, Canada

Simultaneous Treatment of Ipsilateral CDH and CDK

Charles E. Johnston, M.D.

Johns Hopkins University; Baltimore, MD

The Size and Positional Relationship of the Medial Patellofemoral Ligament in Early Pediatric Development

Henry Ellis, M.D.

PRISM; Atlanta, GA

Sleep Quality in Patients with Osteoarthritis of the Hip

Edward Mulligan, D.P.T., PT; Linda Hynan, Ph.D.; Joel E. Wells, M.D., M.P.H.; et al.

MAOA; Miramar Beach, FL

Slipped Capital Femoral Epiphysis: Head Realignment via Surgical Dislocation Approach

David Podeszwa, M.D.

29th Annual Baltimore Limb Deformity Pre-Course; Baltimore, MD

The Song Classification Is Reliable and Guides Prognosis and Treatment for Pediatric Lateral Condyle Fractures: An Independent Validation Study with Treatment Algorithm

Brandon Ramo, M.D.

POSNA; Charlotte, NC

Spinofemoral Muscles Affect Sagittal Alignment and Compensatory Recruitment: A New Look Into Soft Tissues in Adult Spinal Deformity

Shaleen Vira, M.D., et al.

Global Spine Congress; Toronto, Canada

Squatting Mechanics Following an Osteochondroplasty for Idiopathic Femoroacetabular Impingement

Henry Ellis, M.D.; David Podeszwa, M.D.; Daniel Sucato, M.D.

PRISM; Atlanta, GA

SCASB; Plano, TX

Stratification According to Severity of Illness Offers Guidance for the Treatment of Children with Staphylococcus aureus Bacteremia Associated with Acute Hematogenous Osteomyelitis

Lawson A. Copley, M.D., MBA, FAAOS

Children's Medical Center of Dallas Pediatric Residency Scholarly Project Symposium; Dallas, TX

Supracondylar Humerus Fractures

Christine Ho, M.D.

4th Annual Pediatric Orthopaedic Surgical Techniques Lab; Memphis, TN

Surgical Management of Charcot Neuroarthropathy

Dane Wukich, M.D.

Diabetic Foot Society of India; Coimbatore, India

Teaching and Learning in Pediatric Orthopaedics

Christine Ho, M.D., et al.

IPOS; Orlando, FL

3D Ground Reaction Force Asymmetry of Patients with Hip Dysplasia During Walking on Level, Incline, and Decline Surfaces

Joel E. Wells, M.D., M.P.H.; Avneesh Chhabra, M.D.; Nicholas P. Fey, Ph.D.; et al.

GCMAS Annual Conference; Frisco, TX

Tibia Fractures: Multiplanar External Fixation Will Solve All of Your Problems

David Podeszwa, M.D.

IPOS; Orlando, FL

Treatment of Children with Acute Hematogenous Osteomyelitis and Staphylococcus aureus Bacteremia: Impact of Severity of Illness on Antimicrobial Therapy

Lawson A. Copley, M.D., MBA, FAAOS

ID Week; Washington, DC

Treatment of Congenital Dislocation and Instability of the Knee

Charles E. Johnston, M.D.

Johns Hopkins University; Baltimore, MD

Trends in Pediatric Anterior Cruciate Ligament Reconstructions: A Review of Surgeon Fellowship, Geography, and Meniscus Surgery in the ABOS Part 2 Database

Henry Ellis, M.D.

PRISM; Atlanta, GA

Trust Your Instincts (But Don't Bet the Bank) When Referring Pediatric Patients for Spinal MRI

John G. Birch, M.D.; Karl E. Rathjen, M.D.

SRS; Montreal, Canada

Two-Year Functional Outcomes of Operative vs. Nonoperative

Philip Wilson, M.D.

POSNA; Charlotte, NC

Upper Extremity – Trauma

Christine Ho, M.D.

4th Annual Pediatric Orthopaedic Surgical Techniques Labs; Memphis, TN

Upper Limb Cerebral Palsy

Christine Ho, M.D.

BSCOS Current Concepts Course; Edinburgh, Scotland

The Upper Limb in Pediatric Sports

Christine Ho, M.D.

BSCOS Current Concepts Course; Edinburgh, Scotland

The Use of Bone Substitutes in Charcot Reconstruction

Dane Wukich, M.D.

Beijing International Conference on Diabetic Foot and Wounds; Beijing, China

The Use of the Y-Balance Test for Return to Play Assessment Following Adolescent ACL Reconstruction: Exposing the Contralateral Limb

Henry Ellis, M.D.

POSNA; Charlotte, NC

Validation of a Computer-Based System for the Collection of Patient Reported Outcome Measures in Pediatric Sports Medicine

Henry Ellis, M.D.; Philip Wilson, M.D.

PRISM; Atlanta, GA

The Validity and Distribution of the HSS Pedi FABS in Pediatric Athletes with Knee Problems

Henry Ellis, M.D.; Philip Wilson, M.D.

PRISM; Atlanta, GA

Variation Amongst Pediatric Orthopaedic Surgeons Regarding the Use of Preoperative Antibiotics in Percutaneous Pinning Procedures (CRPP) of the Upper Extremity

Christine Ho, M.D., et al.

14th IFSSH/11th IFSHT Triennial Congress – Combined FESSH Congress; Berlin, Germany

Variation in Hemolytic Behavior of Staphylococcus aureus: A Precursor to Severe Illness Among Children with Acute Hematogenous Osteomyelitis

Lawson A. Copley, M.D., MBA, FAAOS

ORS; Austin, TX

What Is the Value of Nonsurgical Interventions in the Treatment of Pediatric Ganglion Cysts?

Christine Ho, M.D., et al.

ASSH; Las Vegas, NV

When Should You Perform Major Amputation Rather than Limb Salvage?

Dane Wukich, M.D.

Diabetic Foot Society of India; Coimbatore, India

Which Psychological Measure Should Be Used to Identify Athletes at Risk for Prolonged Recovery Following ACL Reconstruction?

Henry Ellis, M.D.; Philip Wilson, M.D.

POSNA; Charlotte, NC

Workshop: Infection

Charles E. Johnston, M.D.

SPORC; Montreal, Canada

Workshop: Lower Extremity Deformity

Charles E. Johnston, M.D.

SPORC; Montreal, Canada



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