From the Editor

“Onward and Upward” is the credo behind decades of diligent patient care, robust resident education, and rich tradition demonstrated throughout our UT Southwestern Orthopaedic Surgery Department. Last year we began a new tradition by publishing our first-ever Orthopaedic Journal; this year I am honored to present to you our second edition. Within these pages you will gain insight into our program’s mission, the resident experience, the facilities in which we operate, a new international training opportunity, and our contributions to research.

In July 2018, UT Southwestern Orthopaedics will embark on what we anticipate will become an enduring tradition of sending senior residents to Auckland, New Zealand, for a three-month orthopaedic surgery rotation. Those who had the privilege of training in Norwich, England, understand the value of the international training experience, and although the changing political climate in England will end our U.K. arrangement, we now have a new opportunity in Auckland. Drs. Stewart Walsh, Karl Rathjen, Dane Wukich, and our entire alumni organization have been instrumental in creating this opportunity, and for that we are grateful.

The 2017-2018 academic year marks Dr. Wukich’s second year as the Dr. Charles F. Gregory Distinguished Chair in Orthopaedic Surgery. During this time, he has continued to expand our UT Southwestern Orthopaedics team by hiring Drs. Alexandra Callan (Orthopaedic Oncology), Christopher McCrum (Sports Medicine), David Tietze (Musculoskeletal Medicine), and Katherine Raspovic (Foot and Ankle Surgery). These additions have expanded our resident education experience and contributed to greater patient care for our North Texas community. Dr. Wukich’s commitment to research has been reflected in an increasing presence of UT Southwestern residents at the podium throughout regional, national, and international conferences, garnering awards and recognition of our institution’s accomplishments. I hope each of you finds your hard work outside of the operating room well-represented in the more than 75 publications listed in this issue of the Journal.

Soon, the six members of our graduating class will be fortunate to join the distinguished alumni of men and women who have trained at UT Southwestern, Parkland, and Texas Scottish Rite. We are proud to be part of the UT Southwestern legacy and will carry it with us, wherever our careers take us. On behalf of our graduating class, we would like to extend gratitude to every individual who has put time and effort into teaching us their craft, developing our character, and helping us provide better patient care. Every one of us has made this journey with the support of those who care, and we should be reminded of it daily. To the friends and families of our graduating class, thank you.

I want to take this opportunity to thank my wife, Bridgette, who over the last eight years has been my source of inspiration while providing unwavering support and motivation. Not only are you a wonderful wife, you are the best mother to our children, Carter and Colson; you three are my whole universe. To my parents, thank you for working hard to provide me with opportunities you did not have. Thank you for every life lesson you have taught me and know that without your support and guidance I could not be where I am today.

Thank you to Brenda Colvin and all my co-residents whose contributions have been instrumental to the success of our Journal.

I hope you enjoy this year’s UT Southwestern Orthopaedic Journal and the glimpse it offers into our dynamic Department and the exciting field of medicine in which we are privileged to work.

Joey Romero, M.D.
What a great year it has been for UT Southwestern Orthopaedic Surgery! The Department is pleased to publish the second edition of the UT Southwestern Orthopaedic Journal. This issue would not have been possible without the hard work of many people, but a special note of gratitude to Dr. Joey Romero (Editor), Dr. Michael Khazam (Faculty Advisor), and Brenda Colvin (Department Administrator).

As we draw this academic year to a close, we are fortunate to have with us Dr. James Robert Ficke as our Charles F. Gregory Memorial Visiting Professor. Dr. Ficke is the Robert A. Robinson Professor and Director of Orthopaedic Surgery at The Johns Hopkins University School of Medicine. He serves as the Orthopaedist-in-Chief at Johns Hopkins University Hospital, and he is nationally and internationally recognized as an expert on the treatment of complex foot and ankle problems, lower extremity trauma, and amputations. An expanded version of his career is published elsewhere in this Journal, but suffice it to say that Dr. Ficke has been a leader since graduating from the United States Military Academy at West Point. Prior to assuming his position at Johns Hopkins, Dr. Ficke had a distinguished career in the U.S. Army. It is a great honor for UT Southwestern Orthopaedic Surgery to host Dr. Ficke this year.

New faculty continue to arrive in the Department, complementing the great core faculty who have contributed so much over the years. This year has produced momentum to continue the path to excellence. The quality of medical students applying for our orthopaedic surgery residency remains exceptionally high, and this year we welcome six new outstanding orthopaedic interns into our family. UT Southwestern matched 13 medical students into our orthopaedic residency this year at some of the finest programs in the U.S. The excitement and energy on Match Day was palpable, not only among the 13 students but also among the entire Match Day community. A senior surgeon from another department was overheard to say, “What the heck is going on with orthopaedics?” – prompting a huge smile from more than a few people. The enormous success of these students is a direct reflection of the outstanding efforts of our faculty and residents. Many students who interviewed, but did not rotate on our service, commented that they wished they had done a rotation here.

The scholarly activities of the faculty and residents have grown tremendously over the past two years. The performance of our residents at national and regional meetings has been nothing short of amazing. The quality of medical students applying for our orthopaedic surgery residency remains exceptionally high, and this year we welcome six new outstanding orthopaedic interns into our family. UT Southwestern matched 13 medical students into our orthopaedic residency this year at some of the finest programs in the U.S. The excitement and energy on Match Day was palpable, not only among the 13 students but also among the entire Match Day community. A senior surgeon from another department was overheard to say, “What the heck is going on with orthopaedics?” – prompting a huge smile from more than a few people. The enormous success of these students is a direct reflection of the outstanding efforts of our faculty and residents. Many students who interviewed, but did not rotate on our service, commented that they wished they had done a rotation here.

The performance of our residents at national and regional meetings has been nothing short of amazing. At the recent Mid-America Orthopaedic Association Annual Meeting, UT Southwestern had nine podium presentations, seven poster presentations, and two grant awards. UT Southwestern orthopaedic residents presented nearly 50 percent of all resident papers at the recent Texas Orthopaedic Association Annual Meeting, a remarkable fact considering there are 12 orthopaedic residency programs in Texas! Many people are responsible for creating an environment that promotes success, both clinically and scholastically. A special thank you to Texas Scottish Rite Hospital for Children faculty for helping to jumpstart our research on the university side. The Department continues to benefit from the encouragement and support of senior UT Southwestern leadership, dedicated orthopaedic faculty, committed residents, our affiliated institutions, and our orthopaedic alumni.

This year's academic year has been full of performance and achievements. The quality of medical students applying for our orthopaedic surgery residency remains exceptionally high, and this year we welcome six new outstanding orthopaedic interns into our family. UT Southwestern matched 13 medical students into our orthopaedic residency this year at some of the finest programs in the U.S. The excitement and energy on Match Day was palpable, not only among the 13 students but also among the entire Match Day community. A senior surgeon from another department was overheard to say, “What the heck is going on with orthopaedics?” – prompting a huge smile from more than a few people. The enormous success of these students is a direct reflection of the outstanding efforts of our faculty and residents. Many students who interviewed, but did not rotate on our service, commented that they wished they had done a rotation here.

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This year was a milestone in graduate medical education occurred this year as the Parkland Orthopaedic Trauma Fellowship was granted accreditation by the ACGME. Congratulations to Drs. Adam Starr, Ashoke Sathy, Brigham Au, and Drew Sanders for their efforts. Graduate medical education is a high priority both at this institution and nationally. Under the leadership of Dr. Starr, the long legacy of outstanding orthopaedic trauma education will only reach new heights. Dr. Kevin Gill has done an outstanding job as the Residency Program Director this year. Dr. Sanders has served as Associate Program Director for the residency this past year and will also expand his administrative responsibilities to assist Dr. Starr with the trauma fellowship. Due to increasing complexities of graduate medical education, Dr. Ann Golden has agreed to join the residency leadership team as another Associate Program Director. Access to the UT Southwestern Orthopaedic Surgery Clinic continues to improve with each passing month. Same-day appointments are available in nearly every subspecialty, and patient satisfaction has improved under the leadership of Dr. Rob Bass.

The expansion of Clements University Hospital continues to proceed as expected. When completed, CUH will have more than 700 beds. In anticipation of this expansion, two new orthopaedic initiatives have been implemented. Under the leadership of Dr. Au, CUH is creating a multidisciplinary fracture service concentrating on "fragility and geriatric fractures." This program will be in line with the "Own the Bone" program of the American Orthopaedic Association, not only in treating these complex fractures but also trying to establish a prevention program. Our second initiative is the diabetic limb salvage/amputation prevention program at CUH. Similar to the fracture program, a multidisciplinary team approach to reducing the rate of amputation and length of stay is already underway at CUH.

UT Southwestern Orthopaedics bids farewell to our graduating residents as they begin the next phase of their career. All six have ably assumed leadership positions within the residency program over the past year, and it is difficult to overestimate their contributions to the program. A very special debt of gratitude to our administrative chiefs (Brian Sager and Marcel Wiley), conference chief (Hayden Boo), OIE chief (Craig Birch), vacation chief (Rob Lewis), and Journal editor/research chief (Joey Romero).

Thank you for celebrating the accomplishments of UT Southwestern Orthopaedic Surgery. The future is bright as we move "Onward and Upward."

Sincerely,

Dane K. Wukich, M.D.
Professor and Chair, Department of Orthopaedic Surgery
Holder of the Dr. Charles F. Gregory Distinguished Chair in Orthopaedic Surgery
In July 2018, the Department of Orthopaedic Surgery will begin 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 Auckland City 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 pediatric 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 will work alongside New Zealand residents and will also have the opportunity to work 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 and Residents
Chief Residents … “Onward and Upward”

Marcel Wiley, his wife Heather, son Harrison, and daughter Lizzy will be moving to Louisville, Kentucky, for his fellowship at the Norton Leatherman Spine Fellowship Program.

Hayden Box and his wife, Virginia, will be moving to Boston for his fellowship in adult hip & knee reconstruction at Massachusetts General Hospital.

Brian Sager and his fiancée, Cara, will be moving to Manhattan for his hand fellowship at New York University Hospital.

Brian Sager and his fiancée, Cara, will be moving to Manhattan for his hand fellowship at New York University Hospital.

Craig Birch and his wife, Julie, will be moving to Boston for his fellowship in pediatric orthopaedics at Boston Children’s Hospital.

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Joey Romero, his wife Bridgette, and sons Carter and Colson will be moving to Manhattan for his fellowship in adult hip & knee reconstruction at Weill Cornell’s Hospital for Special Surgery.

Robert Lewis and his wife, Paige, will be moving to Portland, Maine, for his fellowship with New England Foot & Ankle Specialists.
Hallie Bradley, M.D.
Hometown Dallas, TX
Education M.D., Baylor College of Medicine, Houston, TX
B.S., Biomedical Engineering Honors, Cellular and Biomolecular Engineering, University of Texas, Austin, TX
Personal Interests Running, hunting, painting, UT football, friends, family, travel
Clinical Interests Sports, upper extremity, pediatrics, total joints

John Eakin, M.D.
Hometown Hempstead, TX
Education M.D., Baylor College of Medicine, Houston, TX
B.S., Biomedical Engineering, University of Texas, Austin, TX
Personal Interests Running, cycling, triathlons, Texas BBQ, finding the best tacos, friends and family
Clinical Interests Trauma, reconstruction, hand and upper extremity

K. Soraya Heidari, M.D.
Hometown Orange, CA
Education M.D., Keck School of Medicine, University of Southern California, Los Angeles, CA
B.A., Linguistics, New York University, New York, NY
Personal Interests Music, travel, cooking, languages, USC football, Anaheim Ducks hockey
Clinical Interests Undecided

David O’Neill, M.D.
Hometown New City, NY
Education M.D., Vanderbilt University School of Medicine, Nashville, TN
B.A., Public Health, Johns Hopkins University, Baltimore, MD
Personal Interests BBQ, fishing, sailing, snowboarding, my dog
Clinical Interests Trauma, pediatrics, hand

Dietrich Riepen, M.D.
Hometown Dallas, TX
Education M.D., University of Texas Southwestern Medical School, Dallas, TX
B.A., Economics, University of Texas, Austin, TX
Personal Interests Piano, soccer, weightlifting, nature, Steely Dan, classical music
Clinical Interests Arthroplasty, trauma, foot and ankle, spine

Matthew Igbinigie, M.D.
Hometown Dallas, TX
Education M.D., University of Texas Medical Branch, Galveston, TX
B.S., Kinesiology, Texas A&M University, College Station, TX
Personal Interests Hanging out with friends and family, intramural basketball, travel, anime
Clinical Interests Pediatrics, trauma, foot and ankle, reconstruction, sports
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 700 medical students applied to the UT Southwestern Orthopaedic Surgery program, and 80 students formally interviewed on campus for six first-year positions. Applications for fourth-year “subinternships” have also become more competitive. According to Doximity’s rankings of residency programs by reputation, UT Southwestern’s Orthopaedic Surgery program is the top-ranked program in Texas. According to U.S. News & World Report rankings, UT Southwestern Medical School ranks 19th in Primary Care and 26th in Research. In addition, UT Southwestern is the world’s 19th-ranked academic medicine university, according to Academic Rankings of World Universities, published by Shanghai Jiao Tong University.

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
UT Southwestern has two university hospitals: William P. Clements Jr. University Hospital (CUH) – a 12-floor, 460-bed facility opened in 2014 – and Zale Lipshy University Hospital, a 148-bed hospital 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 primary hospitals. Residents gain exposure to hip, knee, and shoulder arthroplasty, as well as to trauma, hand, spine, foot and ankle, and sports cases at these facilities.

Parkland Hospital (Parkland Health & Hospital System)
Parkland 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 7,000 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, junior and senior residents manage joint reconstruction, hand, spine, sports, and oncology cases.

Children’s Medical Center Dallas (Children’s Health)
Children’s Health is a private, not-for-profit system that is the eighth-largest pediatric care provider in the United States. Children’s Medical Center is its flagship hospital. It was also the first Level 1 pediatric trauma center in Dallas. Nearly 850,000 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 nonoperative 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. Resident’s 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 90-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.

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.

Tong University.
Academic Rankings of World Universities, published by Shanghai Jiao Tong University.

UT Southwestern Medical Center’s expertise in a wide variety of disciplines is reflected in the annual rankings of America’s Best Hospitals from U.S. News & World Report. In the 2017-18 listings, UT Southwestern was ranked the No. 1 Best Hospital in Dallas-Fort Worth and the No. 2 Best Hospital in Texas. Orthopaedics was ranked as a High-Performing Specialty.
Colonel James Ficke, M.D., FACS, is the Robert O. Robinson Professor of Orthopaedic Surgery at The Johns Hopkins School of Medicine and Director of the Department of Orthopaedic Surgery. He is also Orthopaedist-in-Chief of The Johns Hopkins Hospital. Dr. Ficke is nationally renowned as an expert on the treatment of complex foot and ankle patients, lower extremity trauma patients, and amputees.

Prior to his current position, Dr. Ficke was Chairman of the Department of Orthopaedics and Rehabilitation at the San Antonio Military Medical Center. He also served the U.S. Army Surgeon General for seven years as the senior advisor on policy and personnel for orthopaedics and extremity injuries.

During his deployment as Deputy Commander of Clinical Services at the 228th Combat Support Hospital in Mosul, Iraq, from 2004 to 2005, he was the senior orthopaedic surgeon, treating more than 600 U.S. soldiers and Iraqi patients for war injuries.

Dr. Ficke has received numerous awards for his skills as a surgeon and educator, as well as two dozen military decorations and awards, including the Bronze Star and Meritorious Service Medals. His service earned him the Society of Military Orthopaedic Surgeons’ prestigious 2010 Colonel Brian Allgood Memorial Leadership Award and the Surgeon General’s 2010 Major General Lewis Mologne Award.

Since 2005, Dr. Ficke has served as the Co-Chair of the Extremity War Injury Symposium sponsored by the American Academy of Orthopaedic Surgeons.
Department of Orthopaedic Surgery Events

The 2017 UT Southwestern Orthopaedic Alumni Dinner was held at the world-famous Antoine’s restaurant in New Orleans, Louisiana, during the annual American Academy of Orthopaedic Surgeons Meeting.

Residents and faculty stay up all night to help spit-roast a pig at the annual pig roast hosted by Dr. Reinert and his wife, Lou, at his ranch in Bowie, Texas.

Residents, faculty, and friends attend the annual Scarborough Renaissance Festival in Waxahachie, Texas.

The 2017 annual Orthopaedic Department Christmas party was held at the Dallas Petroleum Club.

The annual UTSW Orthopaedic Surgery Golf Tournament is one of the Gregory weekend events celebrating graduating seniors.

The annual tacky sweater Christmas party is a great time for residents, friends, and family to get together and celebrate the holidays outside of the hospital.

The St. Martin’s Orthopaedic Book Club meets monthly at Ginger Man Pub to discuss modern and classic novels by authors such as Ernest Hemingway, Paulette Jiles, and Cormac McCarthy.
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.

2017 Annual Resident Awards

W. Brandon Carrell Distinguished Physician Award – Jessica Wingfield, M.D.
G. Truett James Award for Excellence in Teaching – Matthew Swann, M.D.
Vert Mooney Award for Academic Achievement – Matthew Swann, M.D.

Past Hoffman Resident Award Recipients

2016
- W. Brandon Carrell Award – Sheena Black, M.D.
- G. Truett James Award – Ryan Rose, M.D.
- Vert Mooney Award – Timothy Brown, M.D.

2015
- W. Brandon Carrell Award – Kelly Cline, M.D.
- G. Truett James Award – Kelly Cline, M.D.
- Vert Mooney Award – Robert Russell, M.D.

2014
- W. Brandon Carrell Award – Gant Hogue, M.D.
- G. Truett James Award – Drew Sanders, M.D.
- Vert Mooney Award – Kenneth Estrella, M.D.

2013
- W. Brandon Carrell Award – Guillaume Dumont, M.D.
- G. Truett James Award – Paul Chin, M.D.
- Vert Mooney Award – Justin Knight, M.D.

Past Mattson Award Recipients

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.

2017 Reinert Award Recipient
Adam J. Starr, M.D.

Past Reinert Award Recipients

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.

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.

2017 Mattson Award Recipient
Drew T. Sanders, M.D.

Past Mattson Award Recipients

2016 – Adam J. Starr, M.D.
2015 – Robert W. Bucholz, M.D.
2014 – Michael H. Huo, M.D.
2013 – Adam J. Starr, M.D.
Dr. Alexandra Callan, one of UT Southwestern’s 2017 Dedman Family Scholars in Clinical Care, knew she wanted to be a doctor from an early age. She grew up in The Woodlands, Texas, and during a high school internship had the opportunity to shadow an orthopaedic surgeon. The experience changed her life, but still she did not imagine pursuing a career as an orthopaedic oncologist until her sister was diagnosed with a meningioma. Going through a tumor diagnosis and surgery from the family member perspective sparked her aspirations. She became determined to develop the surgical skills necessary to resect tumors and make a meaningful impact on patients’ lives.

Dr. Callan holds an undergraduate degree in science pre-professional studies from the University of Notre Dame. She earned her M.D. at Baylor College of Medicine and completed an orthopaedic surgery residency at Vanderbilt University Medical Center. She then received advanced training in orthopaedic oncology through a fellowship at MD Anderson Cancer Center. The opportunity to start a Multidisciplinary Sarcoma Program and build an Orthopaedic Oncology Division drew Dr. Callan to UT Southwestern, and she joined the faculty in September 2017 as an Assistant Professor of Orthopaedic Surgery.

Dr. Callan will use her Dedman award to develop a prospective sarcoma and musculoskeletal oncology database that incorporates patient-reported outcomes and functional scores utilizing new digital and web-based technology. “Patients always want to know what to expect. By building this database of patients and their surgeries and then tracking their outcomes, we can help design better education so patients know what to expect before surgery, after surgery, and into the future,” she said.

The Dedman Foundation established the Dedman Family Endowed Program for Scholars in Clinical Care in 2009 with a $12 million gift to Southwestern Medical Foundation. The gift was matched to create a $24 million endowment to help recruit the most promising early-career physicians to UT Southwestern and launch their careers under the mentorship of senior clinicians and clinical scientists. The program includes a four-year grant worth up to $150,000 a year for each recipient to cover research expenses and salaries.
Results: There was no soft tissue loss, and union was achieved in all thumbs with no further surgery required in any thumb. Mean flexion-extension arc for the metacarpophalangeal joint was 60° (range, 10° to 70°) and at the interphalangeal joint was 19° (range, 0° to 35°) flexion. Mean percentage of age-matched norms for lateral, tripod, and tip pinch were 47.0%, 45.9%, and 47.8%, respectively. Mean grip strength was 54.2% of age-matched norm. The mean Pediatric Quality of Life Inventory (PedsQL) score for parent questionnaires was 89.0 and for teen/child questionnaires was 89.1. The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire revealed a mean score of 4.3.

Conclusions: For patients with radial polydactyly in which neither thumb possesses adequate distal and proximal components, the on-top plasty is a reliable method of polydactyly reconstruction with durable results at longer than 10 years’ follow-up.

Atraumatic Spine Distraction Induces Metabolic Distress in Spinal Motor Neurons
Bell JES, Serleti JL, Shimizu EN, Sucato DJ, Romero-Ortega MI

Abstract: Corrective forces during spine deformity surgery, including distraction, impart significant stresses to the spinal cord that can result in permanent injury. Intraoperative neuromonitoring is commonly used by surgeons to recognize possible damage to the spinal cord in cases of evident traumatic or vascular damage to the spinal cord. However, mild insult to the spinal cord that does not result in obvious trauma or electrophysiological changes presents a major clinical challenge as the mechanisms of this type of spinal cord injury (SCI) remain largely unknown, and thus preventive strategies are lacking. We used a sustained bidirectional spinal distraction animal model to determine the role of stretch-induced hypoxia in mild SCI. Direct measurement of intraparenchymal oxygen revealed an immediate decrease in partial pressure (47.08 ± 5.79% pO2) distal to the injury site following a 5-mm distraction. This hypoxic insult induced mitochondrial dysfunction as evidenced by an acute increase (216%) in protein oxidation 30 min post-injury, as well as a 37% decrease in perinuclear size and a 42% decrease in nuclear area (pyknosis) in ventral motor neurons at the injury site. These results indicate that hypoxic events during mild spine distraction might lead to cellular metabolic impairments and permanent functional deficits. The development of strategies targeting the prevention of hypoxic injury during distraction might be useful in protecting the cellular metabolic damage that can occur during spine surgery in the absence of overt mechanical or vascular SCI.

Biomechanical Analysis of Retrograde Flexible Intramedullary Nail Constructs in a Simulated Pediatric Femur Fracture Model
Bland DC, Black SR, Pierce WA, Wimberly RL, Riccio AI

Background: Various flexible intramedullary nail (FIMN) constructs for pediatric femur fractures are described; however, no biomechanical study has compared stability of medial-lateral entry versus all-lateral entry retrograde nailing. Our purpose is to compare the rotational and bending stiffness of 2 different FIMN constructs and 2 different materials in a simulated pediatric femur fracture model.

Methods: Eighty adolescent-sized composite femurs were used to simulate transverse (40 femurs) and oblique (40 femurs) mid-diaphyseal fractures. Retrograde FIMN of the femurs was performed using either 3.5 mm titanium (Ti) or 3.5 mm stainless-steel (SS) flexible nails in 2 configurations: 2 “C”-shaped nails (GC) placed through medial and lateral entry sites or 1 “C”-shaped nail (CS) placed through a single lateral entry site. Models were first tested in 10 cycles of axial rotation to ±1 N m of torque at a rate of 0.5 degrees/s under 36 kg of compression. Axial compression was performed and bending stiffness defined as the force required to achieve 10 degrees varus at the fracture site.
Conclusions: Although no conclusion could be drawn about the etiology of the avascular necrosis, we describe a previously undocumented relationship between congenital femoral deficiency and avascular necrosis in the contralateral hip. This occurred in our congenital femoral deficiency population at a rate higher than expected compared with published incidences of avascular necrosis of the hip in children.

Long-Term Follow-Up of Neonatal Brachial Plexopathy: Psychological and Physical Function in Adolescents and Young Adults

Butler L, Mills J, Richard HM, Riddle R, Ezaki M, Oishi S

Purpose: The prevalence of neonatal brachial plexus palsy (NBPP) has been increasing since the early 1980s. No known studies have examined long-term psychological health and quality of life (QOL) in young adults. The purpose of this study was to investigate the psychosocial and intellectual aspects of NBPP during adolescence into young adulthood.

Methods: A total of 31 patients were enrolled in the adolescent group (16 to 18 y) and 25 in the young adult group (23 to 28 y). Clinical assessment included functional ability, range of motion and strength, weight and body mass index, and education level. Patients were administered measures of psychiatric symptomatology, self-concept, QOL, and cognitive function.

Results: Naraku's injury level for the adolescent group included 11 level I, 6 level II, 8 level III, and 6 level IV. The young adult group had 10 level I, 2 level II, 9 level III, and 4 level IV. The degree of physical impairment determined by the Modified Mallet Classification showed persistent impairment in both groups. The average DASH scores were higher than the normal range for the adolescent and young adult groups. Forty-five percent of the adolescents and 68% of the young adults were either overweight or obese. All received high school diplomas, with 20 of the young adults pursuing higher education. Scores on measures of psychiatric symptomatology and self-concept showed that both groups fell within the normal range. QOL for both groups was also within the normal range. All participants scored average to above average on the cognitive assessment. All measurements were patient reported.

Conclusions: Patients with NBPP can adapt and participate in most activities. This patient sample demonstrated persistent functional limitations and a higher rate of comorbid obesity. However, these patients function psychologically and cognitively within the normal range, and many have pursued higher education.

Improving Pain Management and Long-Term Outcomes Following High-Energy Orthopaedic Trauma (PAIN study)

Brown TS, Wimerby RL, Birch JG

Purpose: Pain control after orthopaedic trauma is a predictor of physical disability and numerous negative long-term outcomes. Despite increased awareness of the negative consequences of poorly controlled pain, analgesic therapy among hospitalized patients after orthopaedic trauma remains inconsistent and often inadequate. The PAIN study is designed to evaluate the effect of standard pain management versus standard pain management plus perioperative nonsteroidal anti-inflammatory drugs or pregabalin.

Materials and Methods: The PAIN study is a 3-armed, prospective, double-blind, multicenter randomized trial in patients of ages 18-85 with extremity fractures. The primary outcomes are chronic pain, opioid utilization during the 48 hours after definitive fixation, and surgery for nonunion in the year after
fixation. Secondary outcomes include preoperative and postoperative pain intensity, adverse events and complications, physical function, depression, and post-traumatic stress disorder. One-year treatment costs are also compared between the groups.

Results: This publication is merely a description of the study design including methods, intervention, quality control measures, data collection, and analysis. Further results with raw data from this collaborative study will be published at a later date.

Discussion & Conclusion: The major strength of this study is its prospective, double-blinded, placebo-controlled, randomized design. The study is being conducted in a heterogeneous population, and variability in treatment, rehabilitation timing, and length of medication exposure is expected. It is important to note that there are currently no guidelines for the use of multimodal pharmacy for pain control in the perioperative setting. This study represents an important first step in establishing the evidence base that will inform these guidelines and impact care of orthopaedic trauma patients.

Patient-Reported Outcomes of Periacetabular Osteotomy From the Prospective ANCHOR Cohort Study

Clohisy JC, Ackerman J, Baca G, Baty J, Beaulé PE, Kim YJ, Mills MB, Podeszwa DA, Schoenecker PL, Sierra RJ, Sink EL, Sucato DJ, Trousdale RT, Zaltz I

Background: Current literature describing the periacetabular osteotomy (PAO) is mostly limited to retrospective case series. Larger, prospective cohort studies are needed to provide better clinical evidence regarding this procedure. The goals of the current study were to (1) report minimum 2-year patient-reported outcomes (pain, hip function, activity, overall health, and quality of life), (2) investigate preoperative clinical and disease characteristics as predictors of clinical outcomes, and (3) report the rate of early failures and reoperations in patients undergoing contemporary PAO surgery.

Methods: A large, prospective, multicenter cohort of PAO procedures was established, and outcomes at a minimum of 2 years were analyzed. A total of 391 hips were included for analysis (79% of the patients were female, and the average patient age was 25.4 years). Patient-reported outcomes, conversion to total hip replacement, reoperations, and major complications were documented. Variables with a p value of ≤0.10 in the univariate linear regressions were included in the multivariate linear regression. The backward stepwise selection method was used to determine the final risk factors of clinical outcomes.

Results: Clinical outcome analysis demonstrated major clinically important improvements in pain, function, quality of life, overall health, and activity level. Increasing age and a body mass index status of overweight or obese were predictive of improved results for certain outcome metrics. Male sex and mild acetabular dysplasia were predictive of lesser improvements in certain outcome measures. Three (0.8%) of the hips underwent early conversion to total hip arthroplasty, 12 (3%) required reoperation, and 26 (7%) experienced a major complication.

Conclusions: This large, prospective cohort study demonstrated the clinical success of contemporary PAO surgery for the treatment of symptomatic acetabular dysplasia. Patient and disease characteristics demonstrated predictive value that should be considered in surgical decision-making.

Role of Acute Negative Pressure Wound Therapy Over Primarily Closed Surgical Incisions in Acetabular Fracture ORIF: A Prospective Randomized Trial

Crist BD, Oladeji LO, Khazzam M, Della Rocca GJ, Muntha YM, Stannard JP

Background & Purpose: Negative pressure wound therapy use over closed surgical incisions (NPWT) has proven to be effective at reducing hematoma, wound drainage, and infection in high-risk wounds. The purpose of this study was to determine if NPWT decreased the risk of infection in patients undergoing open reduction internal fixation (ORIF) for acetabular fractures.

Materials & Methods: 71 patients who underwent operative intervention for an acetabular fracture between March 2008 and September 2012 consented and were prospectively randomized to NPWT or a standard postoperative (dry gauze) dressing. The primary endpoint was deep infection, i.e. necessitating surgical debridement. Patients were followed until fracture union.

Results: 33 patients were randomized to treatment with a standard gauze dressing, and 33 patients were randomized to the NPWT cohort. There were no statistically significant differences between the groups with respect to patient demographics or clinical or surgical characteristics. Overall, seven patients (10.6%) were diagnosed with infections – two patients (6.1%) in the placebo group and 5 (15.2%) in the treatment group.

Discussion & Conclusion: In this randomized prospective trial, NPWT did not decrease the incidence of deep infections when compared to gauze dressings in patients with acetabular fractures. Although not statistically significant, patients in the NPWT cohort were 2.77 times more likely to develop a deep infection.
Background & Purpose: Our goal was to study the role of MRN of lumbosacral plexus in management of patients with FBSS. Failed back surgery syndrome (FBSS) is one of the major problems in health care, affecting up to 40% of patients following spine surgery. To date, no imaging modality has been used to effectively classify nerve compression because nerve injuries are challenging to detect on conventional lumbar spine MRI. To our knowledge, no previous studies have addressed the use of MR neurography (MRN) in FBSS or compared it to lumbar spine MRI.

Materials & Methods: From 203 consecutive 3T MRN studies of lumbosacral plexus in one year, 12% (25/203) presented as FBSS. Demographic data, number of previous lumbar MRIs and their findings, MRN findings, interval between MRI and MRN, pre- and post-MRN diagnosis, pain levels, and treatments were recorded. Changes in diagnosis, treatment, and outcomes following MRN were determined.

Results: The final sample of 25 patients had a mean age 62 ± 15 and male to female ratio 1:1.08. 88% (22/25) had previous lumbar MRI, of which 27% had 3 or more. Most common imaging findings were neuroforaminal stenosis 22.6% (7/31) on MRI and neuropathy 22.9% (19/83) on MRN. Mean interval between MRI and MRN was 13.9 ± 28.3 months. Lumbar MRIs were inconclusive in 36% (8/22). MRN detected 63% (52/83) more findings and changed the diagnosis and treatment in 12% and 48% of FBSS cases, respectively. Favorable outcomes were seen in 40-67% of patients following MRN-guided treatments.

Discussion & Conclusion: FBSS is a complex problem, and MRN of lumbosacral plexus impacts its management by better directing source of symptoms.

Sciatic Neuromuscular Variants on MR Neurography: Frequency Study and Interobserver Performance

Eastlack J, Tenorio L, Wadhwa V, Scott K, Starr A, Chhabra A

Background & Purpose: To evaluate the frequency of sciatic neuromuscular variants on MR neurography and determine the interobserver variability.

Materials & Methods: A retrospective evaluation of 137 consecutive lumbosacral plexus magnetic resonance neurography examinations was performed. All examinations were performed using nerve selective 3D imaging and independently reviewed by two readers for the presence of sciatic neuromuscular variants and piriformis muscle asymmetry. Inter- and intraobserver performance were evaluated.

Results: There were a total of 44/268 (16.4%) extremities with sciatic neuromuscular variants. The interobserver performance in the identification of sciatic nerve variants was excellent (kappa values from 0.8-0.9). There was a total of 45/134 (33.6%) patients with piriformis muscle asymmetry. Of these, 7/134 (5.2%) had piriformis muscle atrophy and 38/134 (28.4%) had piriformis muscle hypertrophy. The interobserver performance in the identification of piriformis muscle atrophy and hypertrophy was moderate to good (kappa values from 0.39-0.61). The intraobserver performance revealed kappa values of 0.736 and 0.821 on right and left, respectively.

Discussion & Conclusion: Sciatic neuromuscular variants and piriformis muscle asymmetry are frequent on lumbosacral plexus MRN with moderate to excellent interobserver performance. Advances in knowledge: Sciatic neuromuscular variants and piriformis asymmetry on MR neurography are frequent, and the prevalence is similar to cumulative prevalence from available scientific series. Interobserver performance is excellent for identification of sciatic neuromuscular variants and moderate for piriformis muscle asymmetry.
Results: Glenoid bone loss was seen in 55 patients (48.2%), with 15 of these patients (27%) having critical bone loss. Forty-five percent of appreciated glenoid bone loss was not visualized on plain radiographs. The average age was 15.1 years (range, 6.5 to 18.1) with male to female ratio 3.7:1. Male sex, older age, and taller stature were all statistically associated with glenoid bone loss (P=0.02, 0.01, and 0.02, respectively). Primary dislocations that occurred during sports were more likely to have glenoid bone loss (55.9% vs. 78.2%, P=0.01). The presence of an apprehension sign on physical examination was positively correlated with bone loss (P=0.008).

Conclusions: The presence of glenoid bone loss in primary traumatic glenohumeral instability in the adolescent population is high but not as high as previously reported. Factors associated with glenoid bone loss include male sex, older age, taller stature, sports injuries, and the presence of apprehension on physical examination.

Osteomyelitis Is Commonly Associated With Septic Arthritis of the Shoulder in Children

Purpose: To describe the clinical presentation, management, and outcomes of surgically treated septic arthritis of the shoulder in a pediatric population.

Methods: A retrospective chart review over 5 years of children with operatively managed septic arthritis of the shoulder was completed. Demographics, clinical presentation, symptoms duration, antibiotic regimen and duration, number of surgical procedures, and evaluation of laboratory value improvements were collected. Pretreatment and final radiographs were assessed. Causative organisms were reviewed. Patients were stratified in age groups to determine clinical variability based upon patient age.

Results: A total of 22 children, ages 15 days to 14 years (average 37.3 mo), were treated for septic arthritis of the shoulder from 2006 to 2010 at a single pediatric institution. All patients were managed with open anterior arthrotomy at an average of 1.95 days after initial orthopaedic consultation (range, 0 to 15 d). Multiple presenting signs were noted; the most common was decreased use (59%). Average admission laboratory values include C-reactive protein 10.6 (range, 0.3 to 41.6), erythrocyte sedimentation rate 62.8 (range, 11 to 170), and white blood cell count 14.9 (range, 5.9 to 31.7). Initial radiographs were read as normal in 12 patients, concern for osteomyelitis in 5, cortical irregularity in 3, effusion in 3, and neoplasm in a single child. Nineteen patients had preoperative magnetic resonance imaging and 15 demonstrated an effusion, 15 had evidence of humeral osteomyelitis, 5 had a subperiosteal abscess, and 4 had soft tissue abscesses. Eight patients remained culture negative. The most commonly identified organism was methicillin-resistant Staphylococcus aureus (MRSA) (22.7%). The patients under 12 months of age revealed more diverse organisms at culture and were less likely to have MRSA. All patients averaged 1.55 (range, 1 to 5) surgical procedures and had an average hospital stay of 13.5 days. Intravenous antibiotics averaged 16.3 days followed by an average of 34 days of oral treatment. MRSA patients were significantly more likely to require multiple operations to eradicate the infection (P<0.02) and had a longer duration of intravenous antibiotic use (P<0.003). MRSA patients were more likely to have abnormal radiographs at final follow-up (P<0.05).

Conclusions: Septic arthritis of the shoulder in children is commonly associated with adjacent osteomyelitis. Pediatric septic arthritis of the shoulder due to MRSA bacteria can have a more virulent course than other bacterial causes but is a less commonly identified organism in the youngest patients.

Significance: To our knowledge, this is one of the largest series published concerning the treatment, course, and outcomes of pediatric septic arthritis of the shoulder.

Glenoid Bone Loss in Traumatic Glenohumeral Instability in the Adolescent Population
Ellis HB Jr, Seiter M, Wise K, Wilson P

Background: Glenoid bone loss can affect the outcome and treatment for post-traumatic recurrent anterior glenohumeral instability. Clinical presentation in the adolescent age group with shoulder instability and glenoid bone loss is largely unknown. On the basis of this information, we believe there will be a high incidence of glenoid bone loss in adolescent patients with recurrent glenohumeral instability. We hypothesize that high-impact injuries, sports injuries, and reductions requiring sedation will be factors associated with glenoid bone loss.

Methods: We performed a retrospective cross-sectional cohort study reviewing consecutive adolescent patients (n=114) with recurrent traumatic glenohumeral instability between 2004 and 2012. Chart analysis included demographic, presenting, and radiographic data. Glenoid bone loss was interpreted from plain radiographs, computed tomography (20 and/or 3D), magnetic resonance imaging, and/or arthroscopy. We compared possible risk factors between subjects with and without glenoid bone defects using the χ test or 2 sample t tests.
Obituary: A Personal Remembrance of Robert W. Bucholz, M.D. (1947-2016)

Bucholz EM

Robert (Bob) William Bucholz, M.D., was born in Omaha, NE, USA on July 31, 1947. His father, phy-
sician Donald J. Bucholz, specialized in internal medicine and spearheaded the vaccine program in
Omaha. Bob’s mother, Frances Seiler Bucholz, was a community volunteer while also managing to keep
up with the four Bucholz children. Bob spent his summers in the mountains of Colorado where he would
later send his children to camp. He found every reason to return there with family, friends, or by himself.

After graduating from public high school in 1965, Bob headed to Yale College where, being from
Nebraska, he was convinced that he had been admitted to fulfill a “geographic diversity” quota. The
Vietnam War, along with his father’s influence, nudged Bob toward medicine. He applied to only one
medical school, which could be considered a sign of confidence or arrogance, relying on Yale as his
“safety” school.

Before matriculating to Yale School of Medicine, Bob and several friends traveled in the Soviet Union. It
was a heady time for American kids when the world watched with wonder as Neil Armstrong and Buzz
Aldrin landed on the moon. Even the Soviets were welcoming. Forty years later, Bob discovered that the
CIA had questioned his friends about his motivation for traveling to the USSR.

Bob and his wife, Marybeth Ezaki, met in October 1969 when he started medical school and she entered
Yale College as a freshman. It was the beginning of a relationship that lasted almost 47 years. In medical
school, Bob found that his aptitudes leaned toward surgery. He decided against urology on the advice of
his father, who told him that the specialty “was one drug away from becoming nonoperative.” Always
wise, his dad told him that orthopaedics was a specialty that had job security because it relied on aging
and human stupidity, the former inevitable and the latter endless. Bob chose orthopaedics.

During his surgical internship at the University of Colorado, he realized that he would be happier back
in New Haven. A phone call to Yale Chief Wayne O. Southwick, M.D., was rewarded with a quick check
into his small black notebook in the breast pocket, and the response “I’ll pencil you in.”

Drs. Bucholz and Ezaki had a great time at Yale. Dr. Ezaki tried hard NOT to like orthopaedics, but could
not resist working with friends doing interesting things. Her advisor recommended that she go far away
from New Haven and sample a different flavor of orthopaedics. When asked for a suggestion, he said,
“There’s a place in Dallas called Parkland.” Drs. Bucholz and Ezaki arrived together at Parkland and
UT Southwestern in 1977 – Dr. Ezaki for residency and Dr. Bucholz started on the faculty. Dr. Bucholz
never “rotated off service,” and he championed the orthopaedic care of the patients at Parkland. They
stayed in Dallas, TX, USA for their entire careers.

Distal Junctional Failure Following Pediatric Spinal Fusion
Floccari LV, Su AW, McIntosh AL, Rathjen K, Shaughnessy WJ, Larson AN

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 instru-
mental spinal fusion performed at 2 institutions from 1999 to 2013. Patients with proximal junctional
failure or junctional kyphosis without failure were excluded.

Results: Fifteen subjects were identified with mean follow-up of 38 months. Distal failure occurred
a mean of 60 days after index surgery, with history of minor trauma in 4 patients. Failures included 3-col-
num Chance fracture (11) or instrumentation failure (4). Thirteen patients presented with back pain and/or
acute kyphosis, whereas 2 asymptomatic patients presented with healed fractures. Two patients also
developed new onset of severe lower extremity neurologic deficit after fracture, which improved but
never resolved after revision. A total of 13/15 subjects required revision surgery, typically within 1 week.
Complications associated with revision surgery were encountered in 8 patients (82%). Major complica-
tions that required return to the operating room included 2 deep infections, 2 instrumentation failures,
and dense lower extremity paralysis that improved after medial screw revision and decompression. At
final follow-up, 10 patients were asymptomatic, 2 had persistent neurologic deficit, 2 had chronic pain,
and 1 had altered gait with gait aid requirement.

Conclusions: This study analyzes a heterogeneous 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 neurologic deficit, highlighting the morbidty
of this complication. It is unclear whether level of the lowest instrumented vertebra contributes to DJF.
Increased awareness of junctional failure in children might prompt additional studies to further charac-
terize risk factors and preventive strategies.

Spectrum of Diagnosis and Disposition of Patients Referred to a Pediatric Orthopaedic Center for a Diagnosis of Intoeing
Faulks S, Brown K, Birch JG

Background: Orthopaedic surgeons frequently evaluate otherwise healthy children for concern of intoed
gait. Intoing in otherwise healthy young children due to metatarsus adductus, internal tibial torsion, and
increased femoral anteversion do not typically require orthopaedic treatment. This study reviewed the
actual diagnosis, management, and disposition of patients referred to a pediatric orthopaedic specialty
hospital for a diagnosis of intoeing; the efficacy of an advanced practice provider (APP) assessment pro-
gram to screen and triage patients with a primary complaint of intoeing; and parental satisfaction with
that program.
**A Prospective, Multicenter, Open-Label, Single-Arm Clinical Trial for Treatment of Chronic Complex Diabetic Foot Wounds With Exposed Tendon and/or Bone: Positive Clinical Outcomes of Viable Cryopreserved Human Placental Membrane**

Frykberg RG, Gibbons GW, Walters JL, Wukich DK, Milstein FC

**Background & Purpose:** In recent years, a number of advanced wound care products have become available for the management of recalcitrant and chronic diabetic foot ulcers. Placental membranes have been used in the treatment of wounds for more than 100 years, reportedly from as early as 1910. As a natural source of tissue, fresh placental membranes have low immunogenicity and exhibit important biological properties such as anti-inflammation, anti-microbial, anti-fibrosis, and anti-scarring. The purpose of this study was to assess the impact of the viable cryopreserved human placental membrane to manage complex diabetic foot wounds.

**Materials and Methods:** This was an open-label, prospective multicenter study of chronic and complex diabetic foot ulcers. For the purposes of this study, a complex diabetic foot wound was defined as having exposed tendon, joint, or bone. Patients received weekly application of cryopreserved human placental membrane.

**Results:** Initially, 42 patients were evaluated; however, 9 patients were excluded during the screening process. The reasons for exclusion included active infection, hospitalization, and/or if additional wounds were in close proximity to the study index wound. By 16 weeks after the first application of the viable cryopreserved human placental membrane, 96% of the protocol patients achieved 100% granulation of the index wound. This was defined as complete coverage of the exposed tendon and/or bone with collagen-rich connective tissue. On average, patients required 6.8 active applications to achieve 100% granulation. Complete wound closure occurred in 59% of the patients, which was defined as 100% epithelium covering the study index wound. By the end of the 16-week study, the wound area had been reduced by an average of 92%. No adverse events were determined to be probably or possibly related to the application of the viable cryopreserved human placental membrane.

**Discussion & Conclusion:** The data presented in this study represents the first prospective study ever completed for viable cryopreserved human placental membrane in the management of complex diabetic foot ulcers. Weekly applications resulted in the rapid development of granulation tissue in these large complex wounds, and in more than half of the patients complete wound healing occurred. Placental membranes contain a variety of extracellular matrix proteins, growth factors, and tissue-viable cells including mesenchymal stem cells. These membranes also serve as a barrier to pathogens, create a moist wound environment, and support cell adhesion, all of which are essential for proliferation and differentiation of the new tissue regenerative process. The strength of this prospective study is that it included diabetic patients who were typically excluded from randomized controlled trials because of their depth, large size, and chronicity. Nonetheless, the outcomes of this study are comparable to the data reported for alternative therapies that have been used for less severe ulcers and healthier diabetic patients. This study demonstrates viable cryopreserved human placental membrane is a viable treatment option for complex diabetic foot wounds with exposed tendon, joint, or bone.

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**Acute Hematogenous Osteomyelitis in Children: Pathogenesis, Diagnosis, and Treatment**

Funk SL, Copley LA

**Abstract:** Acute hematogenous osteomyelitis (AHO) in children is an ideal condition to study due to its representation of a wide spectrum of disorders that comprise pediatric musculoskeletal infection. Proper care for children with AHO is multidisciplinary and collaborative. AHO continues to present a significant clinical challenge due to evolving epidemiology and complex pathogenesis. A guideline-driven, multidisciplinary approach has been introduced and shown to effectively reduce hospital stay, improve the timing and selection of empirical antibiotic administration, reduce delay to initial MRI, reduce the rate of readmission, and shorten antibiotic duration.

**Functional Assessment of Children and Adolescents With Symbrachydactyly: A Unilateral Hand Malformation**

Goodell PB, Bauer AS, Oishi S, Amer M, Laurell T, Taylor SL, James MA

**Background:** We studied children and adolescents with symbrachydactyly to determine whether hand function depends on digit opposability and whether scores for function and quality of life measures differ from population norms.

**Methods:** Participants were grouped on the basis of hand morphology: Group A lacked opposable digits, and Group B had ≥2 digits that were opposable. The groups were compared with each other and...
with norms with respect to pinch strength, the performance of bimanual activities and in-hand manipulation, and questionnaires regarding psychosocial status and the ability to perform activities of daily living (ADLs). Participants and parents also rated the appearance and function of the hand.

Results: Pinch strength was higher for participants in Group B (4.1 compared with 2.4 kg; p=0.008), but the groups did not differ with respect to the proportion of participants outside of pinch norms. Participants in Group B were more likely to actively use their affected hand to perform bimanual activities (p ≤ 0.0009), and to use normal or supination strategies to accomplish in-hand manipulation (p=0.031). The groups did not differ in the proportion of ADLs rated “difficult” or “impossible,” and both groups tested within normal limits for psychosocial function. Participants from both groups and their parents rated their satisfaction with hand appearance and function similarly high.

Conclusions: Participants with ≥2 opposable digits incorporated their hand better in bimanual activities and used more effective strategies to accomplish in-hand manipulation than those who did not. These groups reported no difference in the ability to perform ADLs or with psychosocial function, which was within the normal range. Children and adolescents with symbrachydactyly demonstrated and reported a high level of function in all domains of validated function tests. This study provides information to help parents of children with a unilateral hand malformation understand their child’s potential function and to assist surgeons with recommending treatment.

The Pain Disability Questionnaire (PDQ): Evaluating the Efficacy of the Psychosocial and Functional Subscales for 12-month Post-Treatment Outcomes After Total Knee Arthroplasty

Gray A, Ramos S, Howard K, Bryson B, Ellis HB

Background: The Patient Disability Questionnaire (PDQ) has been shown to have good predictive validity for outcomes after total knee arthroplasty (TKA). However, the PDQ subscales (psychosocial and functional disability) have not been assessed independently. This study assesses 1-year surgical outcomes based on the PDQ’s psychosocial and functional disability subscale scores.

Methods: The sample included 130 participants undergoing TKA. Physical and psychosocial measures included the PDQ, Knee Society Score (KSS), Western Ontario McMaster Arthritic Index (WOMAC), and the Short Form-36 Health Inventory (SF-36). Univariate correlations were used to cross-validate all subscales. Multivariate gamma and linear regressions were used to associate PDQ functional and psychosocial disability subscale scores with WOMAC and SF-36, 1 yr after TKA.

Results: Poorer PDQ psychosocial scores were associated with being younger, black or Hispanic, and using Medicaid. Poorer functional disability scores were associated with being younger, female, black or Hispanic, and using Medicaid or without insurance. Multivariate regressions revealed that baseline PDQ psychosocial and functional disability were both significantly associated with 1-year WOMAC total scores and 1-year SF-36 mental composite scores.

Conclusions: The PDQ is useful in predicting 1-year outcomes for patients undergoing TKA. Worse baseline PDQ subscale scores indicated worse quality of life, more pain and stiffness of the joints, as determined by comparative WOMAC and SF-36 scores. Clinical implications from this study suggest screening patients before surgery to identify factors that could hinder recovery time or cause pain or function remission in adults undergoing TKA.

New Concepts of Radiologic Preoperative Evaluation of Anterior Shoulder Instability: On-Track and Off-Track Lesions

Gulati A, Dessouky R, Wadhwa V, Sanders D, Chhabra A

Background & Purpose: The shoulder is the most frequently dislocated joint in the body due to a larger range of motion and a small area of articulation between the humeral and glenoid surfaces. Traumatic shoulder dislocations, especially those associated with injury to the labroligamentous or bony stabilizers of the joint, lead to further reduction of articular surface contact with resultant glenohumeral instability and recurrent shoulder dislocations. Imaging plays an increasingly important role in the preoperative evaluation of patients with traumatic shoulder instability by evaluating glenohumeral bone loss (unipolar), assessing soft tissue injuries, and identifying patients at risk of postoperative recurrence. Quantification of bone loss is key to differentiating engaging vs. nonengaging Hill-Sachs lesions, while newer concepts of “on-track” vs. “off-track” lesions are being discussed that can determine the required surgical approaches.

Discussion & Conclusion: In this article, we review the preoperative imaging approaches and traditional treatments, outline the bone loss measurement strategies, and review these new tracking concepts with relevant case examples.
Severe Burn-Induced Inflammation and Remodeling of Achilles Tendon in a Rat Model


Background & Purpose: Severe burn causes systemic inflammation and hypercatabolism, resulting in damage to multiple organs distant to the burn site, including the musculoskeletal system. Bone mass and muscle loss have been reported. However, tendon that connects bone and muscle has not been studied in comparable detail. Here we aimed to characterize the molecular and functional changes in Achilles tendon triggered by severe burn.

Materials and Methods: 40 adult male Sprague-Dawley rats, 270-300 g, were used with protocol approved by the IACUC at the University of Texas Southwestern. Under anesthesia, dorsal skin amounting to 40% of TBSA was immersed in 95° C-100° C water for 10 seconds. Animals were fluid resuscitated (4 mL/Kg/%TBSA; ~50 mL) with lactated Ringer’s solution and given analgesia. Achilles tendons were collected at 1, 3, 7, and 14 days post-burn. Sham-treated animals served as a control group. We analyzed tendons for changes in expression of IL-6, IL-1β, TNF, MMP9, MMP13, TGFβ1, and Collagens I and III, together with histological H&E and Picrosirius red and biomechanical changes (ultimate force and stiffness).

Results: Gene expression of IL-6 and IL-1β as well as MMP9 and MMP13 increased in rat tendon 3 days after burn. Coll1a1 increased at day 3 and col1a1 at day 7. At day 14, TGFβ1 increased while the protein ratio for collagens I/III decreased, indicating tendon remodeling. Histological analysis with H&E and Picrosirius red staining further revealed a decrease in organized collagen fibers 14 days after burn. Biomechanical analysis showed a decrease in stiffness and ultimate force of tendons in burn rats.

Discussion & Conclusion: We conclude that tendinopathy was observed in Achilles tendon 14 days after severe burn, via the induction of inflammation and remodeling. The current study provides a model of tendinopathy that can be used for the development of therapeutic approaches following burn.

A Comparison of Pavlik Harness Treatment Regimens for Dislocated but Reducible (Ortolani+) Hips in Infantile Developmental Dysplasia of the Hip


Background: Variation exists in the Pavlik harness (PH) treatment regimen for infantile developmental dysplasia of the hip (DDH). The purpose of this study was to determine if the daily PH wear duration (23 vs. 24 h) and frequency of follow-up visits affect the clinical and radiographic outcomes of infants with dislocated but reducible (Ortolani+) hips.

Methods: This study reviewed prospectively enrolled patients with DDH in a single center who presented at age <6 months with Ortolani+ hips and were treated with PH. Recommended daily PH wear duration (23 vs. 24 h) and the frequency of clinic visits in the first 4 weeks after the initiation of PH treatment were analyzed. The clinical success (stable hip that did not require closed or open reduction or the use of an abduction orthosis) and radiographic success based on the acetabular index at 2-year follow-up were compared between different PH regimen groups.

Results: Sixty-two patients (74 hips, 53 females) with Ortolani+ hips had a mean age of presentation of 23±28 days (range, 4 to 128 d) and mean follow-up of 33.2±18.4 months (range, 8 to 85 mo). Overall clinical success rate of PH for Ortolani+ hips was 93% (69/74 hips) and radiographic success rate at 2 years was 84% (48/57 hips). There was no difference in clinical or radiographic success rate between the 23- and 24-hour wear groups (P=0.99, 0.73) or between hips assessed almost weekly compared with once or twice during the first 4 weeks of PH treatment (P=0.99 for both).

Conclusions: The 23- versus 24-hour PH regimen and frequency of clinic visits in the first 4 weeks of PH treatment did not affect the clinical or radiographic success rate of Ortolani+ hips in infantile DDH. A strict weekly clinic visit and 24-hour PH regimen might not be necessary to obtain stable reduced hips in infants presenting <6 months of age with Ortolani+ hips.

Less Invasive Approaches in Total Hip Arthroplasty. Is Anterior Superior?


Abstract: With changes in health care reimbursement, increasing patient education regarding surgical techniques, patient desire for quicker return to function, and shorter hospital stays, the direct anterior approach is gaining traction around the field of total hip arthroplasty. Early reports on the direct anterior approach for total hip arthroplasty cited high complication rates, a steep surgeon learning curve, and no significant difference in patient outcome. In this review, we evaluate the current literature to answer questions about total hip arthroplasty in regard to the direct anterior approach. The direct anterior approach utilizes the plane between the sartorius and tensor fascia lata muscles to form a true interneur and intermuscular plane, theoretically reducing postoperative pain and inflammation and facilitating faster hospital turnover and better patient satisfaction.

Less Invasive Approaches in Total Hip Arthroplasty. Is Anterior Superior?


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Introduction: Research has attempted to predict clinical success in early-onset scoliosis (EOS) patients who undergo spinal fusion and to determine if initial curve magnitude or pulmonary function is predictive of surgical outcome. Despite advances in surgical techniques and postoperative care, the predictive value of pulmonary function has not been well defined.

Methods: Prospectively enrolled AIS patients who underwent spinal fusion, with 2 year follow-up. The study sample was divided into two groups: group A, who underwent growth-sparing treatment and either “final” fusion or observation for ≥2 years since the last lengthening procedure, and group B, who underwent “final” fusion. Demographics, radiographic parameters, pulmonary function test (PFT) values, and scores of patient-reported assessments (Early-Onset Scoliosis Questionnaire [EOSQ] and Scoliosis Research Society [SRS]-30) were obtained. At the most recent follow-up, patients performed 2 additional functional outcome tests: step-activity monitoring and a treadmill exercise-tolerance test.

Results: Thirty-seven patients participated. Vo2max was predicted in 23 patients pre- and postoperation. There was a significant reduction in Vo2max postfusion (39.5 ± 6.5 mL/kg/min vs 42.1 ± 8.1 mL/kg/min, p < .003); however, compared with controls (40.5 ± 6.5 mL/kg/min), all data were within the normal range (p > .05). AIS patients reporting high activity had significantly greater Vo2max than those reporting low activity both pre- and postoperatively, but this difference met statistical significance only preop (p < .05). Curve magnitude and PFT measures were not found to correlate with Vo2max (p > .05).

Conclusions: Vo2max in patients with AIS is within normal range both pre- and postfusion. Pulmonary limitations are accommodated for with a slightly increased breathing rate and a slightly reduced overall workload. Activity level rather than curve severity affects Vo2max outcomes following fusion in AIS.

Functional and Radiographic Outcomes Following Growth-Sparing Management of Early-Onset Scoliosis

Johnston CE, Tran DP, McClung A

Background: In this study, we sought to evaluate radiographic, functional, and quality-of-life outcomes of patients who have completed growth-sparing management of early-onset scoliosis.

Methods: This prospective study involved patients with early-onset scoliosis who underwent growth-sparing treatment and either “final” fusion or observation for ≥2 years since the last lengthening procedure. Demographics, radiographic parameters, pulmonary function test (PFT) values, and scores of patient-reported assessments (Early-Onset Scoliosis Questionnaire [EOSQ] and Scoliosis Research Society [SRS]-30) were obtained. At the most recent follow-up, patients performed 2 additional functional outcome tests: step-activity monitoring and a treadmill exercise-tolerance test.

Results: Twelve patients were evaluated as “graduates” of growth-sparing management of early-onset scoliosis (mean of 37 months since the most recent surgery). The major scoliosis curve measurement averaged 88° before treatment and 47° at the most recent follow-up. T1-S1 height increased from a mean of 22.3 cm to 34.7 cm and T1-T12 height, from 13.3 to 22.3 cm. At the most recent follow-up, the mean forced expiratory volume in 1 second (FEV1) and forced vital capacity (FVC) values were 1.95 L (52.1%) and 2.54 L (55.3%), respectively, and were essentially unchanged from the earliest PFT that patients could perform (FEV1=53.8% of predicted and FVC=53.5% of predicted). There was no difference between graduates and controls with respect to activity level or total steps in step-activity monitoring, and in the exercise-tolerance test, graduates walked at the same speed but at a higher heart rate and at a significantly higher (p <0.001) VO2 cost (rate of oxygen consumed per distance traveled). The EOSQ mean score was 102.2 of a possible 120 points, and the SRS mean score was 4.1 of a possible 5 points.

Conclusions: A realistic long-term goal for the management of early-onset scoliosis appears to be spine elongation and maintenance of pulmonary function at a level that is no less than the percentage of normal at initial presentation. Functional testing and patient-reported outcomes at a mean of 3 years from the last surgery suggest that activity levels were generally equal to those of controls but required greater physiologic demand. General health and physical function outcomes revealed continued impairment in these domains.
Comparison of Pegged and Keeled Glenoid Components for Total Shoulder Arthroplasty: A Systematic Review

Khazzam M, Argo M, Landrum M, Box H

Background & Purpose: Limited evidence exists regarding the relative rates of glenoid loosening after total shoulder arthroplasty utilizing pegged or keeled cemented all-polyethylene glenoid components.

Materials & Methods: A systematic review of level I, II, and III studies comparing the development of radiolucent lines and glenoid failure after total shoulder arthroplasty with pegged or keeled glenoid components was conducted. Four articles were included in the final analysis with a total of 203 total shoulder arthroplasties comprising 107 pegged and 96 keeled glenoid components.

Results: Development of radiolucent lines was less likely with pegged glenoid components with a risk difference of −0.32 (95% CI −0.62, −0.03) favoring the pegged design. There was no statistically significant difference in the rate of radiographically at-risk glenoids, clinical glenoid failure, or the composite endpoint.

Discussion & Conclusion: Although the development of radiolucent lines was less likely around pegged glenoid components, there was no significant difference in the rate of radiographic or clinical glenoid failure between pegged and keeled components. More high-quality studies are needed to determine the relative rates of glenoid loosening with pegged and keeled glenoid components.

Role of Diffusion-Weighted Imaging in Musculoskeletal Infections: Current Perspectives

Kumar Y, Khaleel M, Boothe E, Awdeh H, Wadhwa V, Chhabra A

Background & Purpose: Accurate diagnosis and prompt therapy of musculoskeletal infections are important prognostic factors. In most cases, clinical history, examination, and laboratory findings help one make the diagnosis, and routine magnetic resonance imaging (MRI) is useful to identify the extent of the disease process. However, in many situations, a routine MRI might not be specific enough, especially if the patient cannot receive contrast intravenously, thereby delaying the appropriate treatment. Diffusion-weighted imaging (DWI) can help in many such situations by providing additional information and accurate characterization and by defining the extent of the disease so that prompt treatment can be initiated. In this article, we illustrate the imaging findings of the spectrum of musculoskeletal infections, emphasizing the role of DWI in this domain.

Discussion & Conclusion: Abscess in background cellulitis is detected on DWI. Infectious tenosynovitis shows diffusion restriction as compared to mechanical tenosynovitis. Pyomyositis with abscess can be differentiated from diabetic myonecrosis on DWI. Intraosseous abscess is bright on DWI versus devitalized tissue, sequestrum, and air. DWI can be used to differentiate spine infection from simple modic changes.

Pre- and Postoperative High-Resolution US and MR Imaging

Kumar Y, Ahlan A, Ahlawat S, Wukich DK, Chhabra A

Background & Purpose: Peroneal tendon pathology is an important cause of lateral ankle pain and instability. Typical peroneal tendon disorders include tendinitis, tenosynovitis, partial and full thickness tendon tears, peroneal retinacular injuries, and tendon subluxations and dislocations. Surgery is usually indicated when conservative treatment fails. Familiarity with the peroneal tendon surgeries and expected postoperative imaging findings is essential for accurate assessment and to avoid diagnostic pitfalls. Cross-sectional imaging, especially ultrasound and MRI, provide accurate preoperative and postoperative evaluation of the peroneal tendon pathology.
Recurrent Deformity After Growth Modulation in Patients With Coronal Plane Angular Deformities About the Knee: Who Gets It and How Much?


Abstract: 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 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 epiphysiosis or ostectomy 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 greater mean change in HKA after implant removal compared with older patients (8.4 vs. 4.7 degrees, P=0.013). 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 increases risk of rebound. However, rebound does not occur in all at-risk patients; therefore, we recommend against routine overcorrection.
Reliability of Radiographic Assessments of Adolescent Midshaft Clavicle Fractures by the FACTS Multicenter Study Group


Li Y, Donohue KS, Robbins CB, Pennock AT, Ellis HB Jr, Nepple JJ, Pandya N, Spence DD, Willimon SC, Heyworth BE; Function After Adolescent Clavicle Trauma and Surgery (FACTS) Multicenter Study Group

Objectives: There is a recent trend toward increased surgical treatment of displaced midshaft clavicle fractures in adolescents. The primary purpose of this study was to evaluate the intrarater and interrater reliability of clavicle fracture classification systems and measurements of displacement, shortening, and angulation in adolescents. The secondary purpose was to compare 2 different measurement methods for fracture shortening.

Methods: This study was performed by a multicenter study group conducting a prospective, comparative, observational cohort study of adolescent clavicle fractures. Eight raters evaluated 24 deidentified anteroposterior clavicle radiographs selected from patients 10-18 years of age with midshaft clavicle fractures. Two clavicle fracture classification systems were used, and 2 measurements for shortening, 1 measurement for superior-inferior displacement, and 2 measurements for fracture angulation were performed. A minimum of 2 weeks after the first round, the process was repeated. Intraclass correlation coefficients were calculated.

Results: Good to excellent intrarater and interrater agreement was achieved for the descriptive classification system of fracture displacement, direction of angulation, presence of comminution, and all continuous variables, including both measurements of shortening, superior-inferior displacement, and degrees of angulation. Moderate agreement was achieved for the Arbeitsgemeinschaft für Osteosynthesefragen classification system overall. Mean shortening by 2 different methods were significantly different from each other (P < 0.0001).

Conclusions: Most radiographic measurements performed by investigators in a multicenter, prospective cohort study of adolescent clavicle fractures demonstrated good to excellent intrarater and interrater reliability. Future consensus on the most accurate and clinically appropriate measurement method for fracture shortening is critical.

Seasonal Variation and Weather Changes Related to the Occurrence and Severity of Acute Hematogenous Osteomyelitis in Children


Lindsay EA, Tareen N, Jo CH, Copley LA

Background: Acute hematogenous osteomyelitis (AHO) demonstrates regional variability in incidence and severity. In this study, we evaluated seasonal variations of AHO and assessed the effects of weather trends on the occurrence and severity of illness in affected children.

Methods: National Weather Service data from the dates of symptom onset and of admission of children with AHO were gathered. Seasonal occurrence rates and the weather patterns were studied according to severity-of-illness category. Statistical analysis was performed with Pearson and Spearman correlations and analysis of variance.

Results: A total of 209 children with AHO were admitted within 21 days of symptom onset (average, 5.0 ± 3.8 days). Severity-of-illness scores ranged from 0 to 10 (average, 3.2 ± 3.2). Symptom onset occurred most commonly in summer (73 [34.9%]) or spring (54 [25.8%]). We found a significant correlation between severity of illness and minimum temperature at symptom onset during the summer season (P=0.029). A significant change in average humidity (21.6%) occurred during the winter between the date of symptom onset and the date of admission for children with severe illness (P=0.020).

Discussion: This study identified seasonal variation in the occurrence of AHO in children; summer was the most common season for occurrence. To our knowledge, this is the first detailed evaluation of weather parameters and trends in weather changes from symptom onset to admission with consideration of the effects of weather on the occurrence of infection and severity of illness.
Mobius Syndrome: A 35-Year Single Institution Experience
McClure PK, Kilinc E, Oishi S, Riccio AI, Karol LA

Background: Mobius syndrome is a rare syndrome that is known to be associated with a variety of orthopaedic conditions, including scoliosis, clubfoot, transverse limbficiencies, Poland syndrome, and a myriad of hand conditions. To date, no large series exists to characterize the orthopaedic manifestations of Mobius syndrome.

Methods: Medical records at a single tertiary pediatric institution were reviewed for all patients diagnosed with Mobius syndrome from Jan. 1, 1980, to Dec. 31, 2015. Records and radiographs were reviewed for associated orthopaedic conditions and their management.

Results: In total, 44 patients with Mobius syndrome were identified. Age at presentation ranged from 6 days to 14 years. When compared with the general population, patients with Mobius syndrome had an increased incidence of clubfoot (41%), Poland syndrome (20%), and scoliosis (14%). Clubfoot treated both before and after the institution of Ponseti casting had a high rate of requiring posteroanterior release, with a significant rate of subsequent revision. Hip dysplasia was noted in 1 patient and required surgical correction. Other associated syndromes included arthrogryposis, Pierre Robin syndrome, and chromosome 10 defect.

Conclusions: Mobius syndrome is accompanied by an increased rate of several orthopaedic problems, most notably clubfoot, scoliosis, and upper extremity differences that often require surgical treatment. The management of clubfoot in the setting of Mobius syndrome often requires surgical intervention due to failure of casting and seems to have a higher rate of need for revision. Early involvement of orthopaedists in the care of patients with Mobius syndrome is often necessary. Orthopaedists should counsel families that treatment might be more complex than that of idiopathic disease.

Growth Modulation in Achondroplasia
McClure PK, Kilinc E, Birch JG

Introduction: Achondroplasia is the most common skeletal dysplasia with a rate of nearly 1/10,000. The development of lower extremity deformity is well documented, and various modes of correction have been reported. There are no reports on the use of growth modulation to correct angular deformity in achondroplasia.

Methods: Medical records from 1985 to 2015 were reviewed for the diagnosis of achondroplasia and growth modulation procedures. Patients who had been treated for angular deformity of the legs by growth modulation were identified. A detailed analysis of their medical record and preoperative and final lower extremity radiographs was completed.

Results: Four patients underwent growth modulation procedures, all to correct existing varus deformity of the legs. Three of the 4 patients underwent bilateral distal femoral and proximal tibial growth modulation. The remaining patient underwent tibial correction only. Two of the 4 patients had a combined proximal tibial epiphysesdesis. All limbs had some improvement of alignment; however, 1 patient went on to bilateral osteotomies. Only 1 limb corrected to a neutral axis with growth modulation alone at last follow-up; initial implantation was done before 5 years of age.

Conclusions: Growth modulation is an effective means for deformity correction in the setting of achondroplasia. However, implantation might need to be done earlier than would be typical for patients without achondroplasia. Osteotomy might still be required after growth modulation for incomplete correction.

Variation in National ACGME Case Log Data for Pediatric Orthopaedic Fellowships: Are Fellow Coding Practices Responsible?
McClure PK, Wozczek M, Karol L, Sankar WN

Background: The introduction of the 80-hour workweek for Accreditation Council for Graduate Medical Education (ACGME) accredited fellowship programs initiated many efforts to optimize surgical training. One particular area of interest is on recording and tracking surgical experiences. The current standard is by logging cases based on Current Procedural Terminology codes, which are divided into three main categories: Surgical Procedure Codes, Anesthesia Codes, and Facility Codes. Proposed guidelines from the ACGME regarding logging exist, but their implementation is unknown, as is the variation in case volume across fellowship programs. The purpose of this study was to investigate variability in the national case log data and explore potential sources of variation using fellow surveys.

Methods: National ACGME case log data for pediatric orthopaedic fellowships from 2012 to 2015 were reviewed, with particular attention to the domains of spine, pelvis/hip, arthroscopy, trauma, and other (which includes clubfoot casting). To explore potential sources of case log variability, a survey on case logging behavior was distributed to all pediatric orthopaedic fellows for the academic year 2015 to 2016.

Results: Reported experiences based on ACGME case logs varied widely between fellows with percentage difference of up to 100% in all areas. Similarly, wide variability is present in coding practices of pediatric orthopaedic fellows, who often lack formal education on the topic of appropriate coding/logging. In the survey, hypothetical case scenarios had an absolute difference in recorded codes of up to 13 and a percentage difference of up to 100%.

Conclusions: ACGME case log data for pediatric orthopaedic fellowships demonstrates wide variability in reported surgical experiences. This variability might be due, in part, to differences in logging practices by individual fellows. This observation makes meaningful interpretation of national data on surgical volume challenging. Proposed surgical experience minimums should be interpreted in light of these data and might not be advisable unless accompanied by standardized and specific guidelines for case log entry. Efforts to optimize training in the post 80-hour era will require accurate data to serve as a starting point for future educational efforts.

In Vivo Analysis of Biceps Tendon Characteristics in Subpectoral Tenodesis
Mirzayan R, Takara T, Batech M, McMcrum CL

Background & Purpose: To report the in vivo characteristics of the long head of the biceps tendon (LHBT); to evaluate the relation of age, gender, height, weight, and body mass index to the length and sutured and tubularized diameter of the LHBT; and to determine the smallest possible tunnel diameter for a subpectoral biceps tenodesis (SPBT) that can accommodate most patients.

Materials and Methods: The study included 66 patients (33 men and 33 women) with an average age of 54 years (range, 29-73 years) undergoing SPBT. After tenotomy, the length from the biceps musculotendinous junction to the released end was measured. The tendon was transected 3 cm proximal to the musculotendinous junction and sutured, and the diameter was measured. The depth of the reamed tunnel was recorded.

Results: The average tendon length was 84.0 mm, measuring 91.9 mm in men and 76.2 mm in women (P < .001), and the average tendon diameter was 4.4 mm, varying slightly between men (4.5 mm) and women (4.3 mm) (P < .001). Mean bone tunnel depth was 17.5 mm, with 19 mm in men and 16.1 mm in women (P < .001). Patient height showed a significant relation to both tendon length and tendon diameter. Weight was not correlated with tendon diameter but did show a significant relation to tendon length.
Discussion & Conclusion: We have characterized the in vivo length and diameter of the LHBT at the time of an SPBT. Our findings have shown that there was a statistically significant gender difference in tendon length and diameter, but the diameter of the sutured tendon, which was placed into the tunnel, averaged 4.4 mm and ranged from 3.5 to 5 mm for all ages, both genders, all heights, and all weights. This finding is clinically relevant in that a small tunnel measuring 5.5 mm or less is insufficient to perform an SPBT.

Adolescent Idiopathic Scoliosis: Update on Bracing, Surgical Techniques, and Patient Safety
Nemani VM, Blakemore LC, Karol LA, Green DW, Widmann RF
Purpose: The primary goal in the management of adolescent idiopathic scoliosis is to prevent the progression of spinal deformity either with the use of a brace or with surgery. The goals of surgery, if indicated, are to correct the spinal deformity safely and to preserve overall spinal balance and as many motion segments as possible, which maximizes the long-term health of a patient’s spine. Recently, tremendous advances have been made in the surgical techniques that are used to correct adolescent idiopathic scoliosis, and improved tools have allowed surgeons to perform spinal deformity surgery as safely and with as few complications as possible. Surgeons should be aware of recent evidence that demonstrates the efficacy of bracing in patients who have adolescent idiopathic scoliosis. In addition, surgeons should understand recent advances in spinal deformity surgery with regard to fusion level selection, implant placement, three-dimensional deformity correction, and techniques that are used to minimize perioperative complications.

Three Patterns of Acetabular Deficiency Are Common in Young Adult Patients With Acetabular Dysplasia
Background & Purpose: Detailed recognition of the three-dimensional (3D) deformity in acetabular dysplasia is important to help guide correction at the time of reorientation during periacetabular osteotomy (PAO). Common plain radiographic parameters of acetabular dysplasia are limited in their ability to characterize acetabular deficiency precisely. The 3D characterization of such deficiencies with low-dose CT might allow for more precise characterization.

The purposes of this study were (1) to determine the variability in 3D acetabular deficiency in acetabular dysplasia; (2) to define subtypes of acetabular dysplasia based on 3D morphology; (3) to determine the correlation of plain radiographic parameters with 3D morphology; and (4) to determine the association of acetabular dysplasia subtype with patient clinical characteristics including sex, range of motion, and femoral version.

Materials and Methods: Using our hip preservation database, we identified 153 hips (148 patients) that underwent PAO from October 2013 to July 2015. Among those, we noted 103 hips in 100 patients with acetabular dysplasia (lateral center-edge angle < 20°) and who had a Tönnis grade of 0 or 1. Eighty-six patients (86%) underwent preoperative low-dose pelvic CT scans at our institution as part of the preoperative planning for PAO. It is currently our standard to obtain preoperative low-dose pelvic CT scans (0.75-1.25 mSv, equivalent to three to five AP pelvis radiographs) on all patients before undergoing PAO unless a prior CT scan was performed at an outside institution. Hips with a history of a neuromuscular disorder, prior trauma, prior surgery, radiographic evidence of joint degeneration, ischemic necrosis, or Perthes-like deformities were excluded. Fifty hips in 50 patients met inclusion criteria and had CT scans available for review. These low-dose CT scans of 50 patients with symptomatic acetabular dysplasia undergoing evaluation for surgical planning of PAO were then retrospectively studied. CT scans were analyzed quantitatively for acetabular coverage, relative to established normative data for acetabular coverage, as well as measurement of femoral version. The cohort included 45 females and five males with a mean age of 26 years (range, 13-49 years).

Results: Lateral acetabular deficiency was present in all patients, whereas anterior deficiency and posterior deficiency were variable. Three patterns of acetabular deficiency were common: anterosuperior deficiency (15 of 50 [30%]), global deficiency (18 of 50 [36%]), and posterosuperior deficiency (17 of 50 [34%]). The presence of a crossover sign or posterior wall sign was poorly predictive of the dysplasia subtype. With the numbers available, males appeared more likely to have a posterosuperior deficiency pattern (four of five [80%]) compared with females (13 of 45 [29%]), p=0.040. Hip internal rotation in flexion was significantly greater in anterosuperior deficiency (23° versus 18°, p=0.05), whereas external rotation in flexion was significantly greater in posterosuperior deficiency (43° versus 34°, p=0.018). Acetabular deficiency pattern did not correlate with femoral version, which was variable across all subtypes.

Discussion & Conclusion: Three patterns of acetabular deficiency commonly occur among young adult patients with mild, moderate, and severe acetabular dysplasia. These patterns include anterosuperior; global, and posterosuperior deficiency and are variably observed independent of femoral version. Recognition of these distinct morphologic subtypes is important for diagnostic and surgical treatment considerations in patients with acetabular dysplasia to optimize acetabular correction and avoid femoroacetabular impingement.
Simulated Radiographic Bone and Joint Modeling From 3D Ankle MRI: Feasibility and Comparison With Radiographs and 2D MRI

Background & Purpose: The purpose of this work is to simulate radiographs from isotropic 3D MRI data, compare relationship of angle and joint space measurements on simulated radiographs with corresponding 2D MRIs and real radiographs (XR), and compare measurement times among the three modalities.

Materials & Methods: Twenty-four consecutive ankles were included, eight males and 16 females, with a mean age of 46 years. Segmented joint models simulating radiographs were created from 3D MRI data sets. Three readers independently performed blinded angle and joint space measurements on the models, corresponding 2D MRIs, and XRs at two time points. Linear mixed models and the intraclass correlation coefficient (ICC) were ascertained, with p values less than 0.05 considered significant.

Results: Simulated radiograph models were successfully created in all cases. Good agreement (ICC > 0.65) was noted among all readers across all modalities and among most measurements. Absolute measurement values differed between modalities. Measurement time was significantly greater (ICC > 0.65) was noted among all readers across all modalities and among most measurements. Absolute measurement values differed between modalities. Measurement time was significantly greater (p < 0.05) on 2D versus simulated radiographs for most measurements and on XR versus simulated radiographs (p < 0.05) for nearly half the measurements.

Discussion & Conclusion: Simulated radiographs can be successfully generated from 3D MRI data; however, measurements differ. Good inter-reader and moderate-to-good intra-reader reliability was observed, and measurements obtained on simulated radiograph models took significantly less time compared to measurements with 2D and generally less time than XR.

Discussion & Conclusion: This is the first large multicenter, randomized, controlled trial evaluating the efficacy of locally administered vancomycin powder in an extremity trauma patient population. There are several major strengths associated with this study. First, the randomized design of this study should provide a definitive answer to scientific questions addressed by the primary aim. The study is both rigorous in design and adequately powered to answer the clinical questions it poses. In addition, this study draws on patients treated at multiple level 1 trauma centers across the United States, so the results should have strong generalizability given the representativeness of the enrolled patients and the facilities that treat these injuries.

Local Antibiotic Therapy to Reduce Infection After Operative Treatment of Fractures at High Risk of Infection: A Multicenter, Randomized, Controlled Trial (VANCO Study)
O'Toole RN, Joshi M, Carlini AR, Murray CK, Allen LE, Scharstein DO, Gary JL, Bosse MJ, Castillo RC; METRC study collaborators including Sathy AK

Background & Purpose: A number of clinical studies in the spine literature suggest that the use of local vancomycin powder might substantially reduce surgical site infections (SSIs). These studies are primarily retrospective and observational, and few focus on orthopaedic trauma patients. The purpose of this study is to assess the efficacy of locally administered vancomycin powder in the prevention of SSI after fracture surgery. The primary goal of the VANCO Study is to compare the proportion of deep SSI 6 months after fracture fixation surgery. A secondary objective is to compare species and antibacterial susceptibilities among study patients who develop SSI. An additional objective is to build and validate a risk prediction model for the development of SSI.

Materials and Methods: This is a phase III, prospective, randomized, multicenter clinical trial. The study population consists of patients ages 18-80 years with tibial plateau or pilon (tibial plafond) fractures, at higher risk of infection, and definitively treated with plate and screw fixation. Participants are block randomized (within center) in a 1:1 ratio to either treatment group (local vancomycin powder up to a maximum dose of 1000 mg, placed immediately before wound closure) or control group (standard of care) for each study injury location, and return to the clinic for evaluations at 2 weeks, 3 months, and 6 months after fixation. The targeted sample size for the study is 500 fractures per study arm.

Results: This publication is merely a description of the study design including methods, intervention, quality control measures, data collection, and analysis. Further results with raw data from this collaborative study will be published at a later date.

Discussion & Conclusion: This is the first large multicenter, randomized, controlled trial evaluating the efficacy of locally administered vancomycin powder in an extremity trauma patient population. There are several major strengths associated with this study. First, the randomized design of this study should provide a definitive answer to scientific questions addressed by the primary aim. The study is both rigorous in design and adequately powered to answer the clinical questions it poses. In addition, this study draws on patients treated at multiple level 1 trauma centers across the United States, so the results should have strong generalizability given the representativeness of the enrolled patients and the facilities that treat these injuries.
Adolescent Clavicle Nonunions: Potential Risk Factors and Surgical Management

Background: Clavicle nonunions in adolescent patients are exceedingly rare. The purpose of this study was to evaluate a series of clavicle nonunions from a pediatric multicenter study group to assess potential risk factors and treatment outcomes.

Methods: A retrospective review of all clavicle nonunions in patients younger than 19 years was performed at 9 pediatric hospitals between 2006 and 2016. Demographic and surgical data were documented. Radiographs were evaluated for initial fracture classification, displacement, shortening, angulation, and nonunion type. Clinical outcomes were evaluated, including rate of healing, time to union, return to sports, and complications. Risk factors for nonunion were assessed by comparing the study cohort with a separate cohort of age-matched patients with a diaphyseal clavicle fracture.

Results: There were 25 nonunions (mean age, 14.5 years; range, 10.0-18.9 years) identified, all of which underwent surgical fixation. Most fractures were completely displaced (88%) initially, but 21% were partially displaced and 11% were nondisplaced. Bone grafting was performed in 24 of 25 cases, typically using the hypertrophic callus. Radiographic healing was achieved in 96% of cases. One patient (4%) required 2 additional procedures to achieve union. The primary risk factor for development of a nonunion was a previous history of an ipsilateral clavicle fracture.

Conclusions: Clavicle nonunions can occur in the adolescent population but are an uncommon clinical entity. The majority occur in male patients with displaced fractures, many of whom have sustained previous fractures of the same clavicle. High rates of union were achieved with plate fixation and the use of bone graft.

Intra-Articular Physeal Fractures of the Distal Femur: A Frequently Missed Diagnosis in Adolescent Athletes

Background: Intra-articular physeal fractures of the distal femur are an uncommon injury pattern, with only a few small case series reported in the literature.

Purpose: To pool patients from 3 high-volume pediatric centers to better understand current practices and the factors that contribute to the decision for surgical management.

Study Design: Case series; level of evidence, 4.

Methods: A multicenter retrospective review of all patients presenting with an intra-articular physeal fracture between 2006 and 2016 was performed. Patient demographic and injury data, surgical data, and postoperative outcomes were documented. Radiographs were evaluated for fracture classification (Salter-Harris), location, and displacement. Differences between patients with and without complications were compared by use of analysis of variance or chi-square tests.

Results: A total of 49 patients, with a mean age of 13.5 years (range, 7-17 years), met the inclusion criteria. The majority of fractures were Salter-Harris type III fractures (84%) involving the medial femoral condyle (88%). Football was responsible for 50% of the injuries. The initial diagnosis was missed in 39% of cases, and advanced imaging showed greater mean displacement (6 mm) compared with radiographs (3 mm). All patients underwent surgery and returned to sport with “good to excellent” results after 2 years. Complications were more common in patients with wide-open growth plates, patients with fractures involving the lateral femoral condyle, and patients who were casted (P < .05).

Conclusion: Clinicians evaluating skeletally immature athletes (particularly football players) with acute knee injuries should maintain a high index of suspicion for an intra-articular physeal fracture. These fractures are frequently missed, and advanced imaging might be required to establish the diagnosis. Leg-length discrepancies and angular deformities are not uncommon, and patients should be monitored closely. Surgical outcomes are good when fractures are identified, with high rates of return to sport.

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

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: In this 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=0.004), had higher body mass index (26.3±7.2 vs. 22.7±5.5, P=0.003), had greater T2-T12 kyphosis (71±14 degrees vs. 61±12 degrees, P<0.001), and had increased pelvic incidence (46±41 degrees, P=0.03) and pelvic tilt (10±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=0.027) and appearance scores (2.9±0.7 vs. 3.4±0.8, P<0.001).

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

End-Stage Renal Disease Negatively Affects Physical Quality of Life in Patients With Diabetic Foot Complications

Background & Purpose: The aim of this study was to evaluate the impact of end-stage renal disease (ESRD) on health-related quality of life (HRQOL) in patients with diabetic foot disease.

Materials and Methods: We compared a group of 30 diabetic patients with ESRD requiring dialysis to a group of 60 diabetic patients without ESRD. Both groups consisted of patients with active diabetic foot graphs (3 mm). All patients underwent surgery and returned to sport with “good to excellent” results after 2 years. Complications were more common in patients with wide-open growth plates, patients with fractures involving the lateral femoral condyle, and patients who were casted (P < .05).

Conclusion: Clinicians evaluating skeletally immature athletes (particularly football players) with acute knee injuries should maintain a high index of suspicion for an intra-articular physeal fracture. These fractures are frequently missed, and advanced imaging might be required to establish the diagnosis. Leg-length discrepancies and angular deformities are not uncommon, and patients should be monitored closely. Surgical outcomes are good when fractures are identified, with high rates of return to sport.

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

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Materials and Methods: We compared a group of 30 diabetic patients with ESRD requiring dialysis to a group of 60 diabetic patients without ESRD. Both groups consisted of patients with active diabetic foot disease.
Results: Diabetic foot patients with ESRD requiring dialysis were found to have significantly higher creatinine levels, lower hemoglobin levels, lower albumin levels, higher rates of peripheral arterial disease, and lower rates of Charcot neuroarthropathy than patients without ESRD. The median PCS was significantly lower in the ESRD group; however, no significant difference was found when comparing the median MCS and FAAM. Patients who ultimately died had a tendency to report lower PCS scores at baseline compared with those patients who did not die (P=.07). Patients who ultimately required major amputation also reported lower PCS scores at baseline.

Discussion & Conclusion: ESRD negatively affects physical QOL to a greater degree than mental QOL in patients with diabetic foot disease. The SF-36 might not be sensitive enough to capture impaired mental QOL because both groups had relatively high MCS scores. Low physical QOL might be associated with mortality and the eventual need for major amputation.


Background & Purpose: Many patients with rotator cuff tears suffer from nocturnal shoulder pain, resulting in sleep disturbance. Our purpose was to determine whether rotator cuff tear size correlated with sleep disturbance in patients with full-thickness rotator cuff tears.

Materials & Methods: Patients with a diagnosis of unilateral full-thickness rotator cuff tears (diagnosed via magnetic resonance imaging [MRI]) completed the Pittsburgh Sleep Quality Index (PSQI), a visual analog scale (VAS) quantifying their shoulder pain, and the American Shoulder and Elbow Surgeons (ASES) functional outcomes questionnaire. Shoulder MRI scans were analyzed for anterior-posterior tear size (mm), tendon retraction (mm), Goutallier grade (0-4), number of tendons involved (1-4), muscle atrophy (none, mild, moderate, or severe), and humeral head rise (present or absent). Bivariate correlations were calculated between the MRI characteristics and baseline survey results.

Results: A total of 209 patients with unilateral full-thickness rotator cuff tears were included in this study: 112 (54%) female and 97 (46%) male (mean age 64.1 years). On average, shoulder pain had been present for 24 months. The mean PSQI score was 9.8, and the mean VAS score was 5.0. No significant correlations were found between any of the rotator cuff tear characteristics and sleep quality. Only tendon retraction had a significant correlation with pain.

Discussion & Conclusion: Although rotator cuff tears are frequently associated with nocturnal pain and sleep disruption, this study demonstrated that morphological characteristics of full-thickness rotator cuff tears, such as size and tendon retraction, do not correlate with sleep disturbance and have little to no correlation with pain levels.

Reyes BA, Birch JG, Hootnick DR, Cherkashin AM, Samchukov ML

Background: Absent lateral osseous structures in congenital fibular deficiency, including the distal femur and fibula, have led some authors to refer to the nature of foot ray deficiency as “lateral” as well. Others have suggested that the ray deficiency is in the central portion of the midfoot and forefoot. We sought to determine whether cuboid preservation and/or cuneiform deficiency in the feet of patients with congenital fibular deficiency implied that the ray deficiency is central rather than lateral in patients with congenital fibular deficiency.

Methods: We identified all patients with a clinical morphologic diagnosis of congenital fibular deficiency at our institution over a 15-year period. We reviewed the records and radiographs of patients who had radiographs of the feet to allow determination of the number of metatarsals, the presence or absence of a cuboid or calcaneocuboid fusion, the number of cuneiforms present (if possible), and any other osseous abnormalities of the foot. We excluded patients with 5-rayed feet, those who had not had radiographs of the feet, or whose radiographs were not adequate to allow accurate assessment of these radiographic features. We defined the characteristic “lateral (fifth) ray present” if there was a well-developed cuboid or calcaneocuboid coalition with which the lateralmost preserved metatarsal articulated.

Results: Twenty-six patients with 28 affected feet met radiographic criteria for inclusion in the study. All affected feet had a well-developed cuboid or calcaneocuboid coalition. The lateralmost ray of 25 patients with 26 affected feet articulated with the cuboid or calcaneocuboid coalition. One patient with bilateral fibular deficiency had bilateral partially deficient cuneiforms, and the lateral-most metatarsal articulated with the medial remnant of the deformed cuboids. Twenty-one of 28 feet with visible cuneiforms had 2 or 1 cuneiform.

Conclusions: Although the embryology and pathogenesis of congenital fibular deficiency remain unknown, based on the radiographic features of the feet in this study, congenital fibular deficiency should not be viewed as a global “lateral lower-limb deficiency” nor the foot ray deficiency as “lateral.”

Reyes BA, Ho CA

Background: To describe treatment methods and complication rates of all open Seymour fractures (Salter-Harris I/II or juxta-epiphysial fractures of the distal phalanx of the hand with associated nailbed laceration) treated at or referred to a pediatric level 1 trauma center over a 10-year time period. We hypothesized that delayed treatment of Seymour fractures results in higher infectious complication rates.

Methods: We identified all patients treated for open Seymour fractures at the orthopaedic hand clinic at our level 1 pediatric trauma center between August 2002 and December 2012. All charts were reviewed retrospectively. Patients were divided into groups based on timing and completeness of treatment. “Appropriate” treatment was defined as irrigation and debridement, fracture reduction, and antibiotic administration. “Partial” treatment was defined as any type of incomplete treatment. “Acute” treatment was defined as management within 24 hours of the injury; and “Delayed” as having received treatment after 24 hours from the time of injury. Statistical comparisons were performed using the Fisher exact test.
Infants thought to be normal with idiopathic clubfeet when nonoperative treatment begins
Richards BS, Faulks S

They Do With Nonoperative Treatment?
Clubfoot Infants Initially Thought to Be Idiopathic but Later Found Not to Be. How Do
were not helpful in predicting future relapse.

Conclusions: The timing and quality of treatment of open Seymour fractures significantly influences
infection rates. This study highlights the importance of timely and appropriate treatment of this seemingly innocuous fracture.

Nonoperatively Corrected Clubfoot at Age 2 Years: Radiographs Are Not Helpful in Predicting Future Relapse
Richards BS, Faulks S, Razi O, Mouulu A, Jo CH

Background: Nonoperative treatment of idiopathic clubfoot is standard. The purpose of this study was to
determine if measurements made on standing lateral radiographs of successfully treated clubfeet made
at 18 to 24 months of age were predictive of late recurrence.

Methods: Inclusion criteria were idiopathic clubfoot with an age at presentation of ≤3 months, nonoperative
treatment resulting in a clinically plantigrade foot at 2 years of age, standing lateral radiographic of the involved foot made at 18 to 24 months of age, and a minimum age of 4 years at the time of follow-up. The radiographs were assessed for the talocalcaneal angle and the tibialcalcaneal angle, with measurements made by 2 trained practitioners. The average values of the 2 raters were used. The interobserver reliability was calculated using intraclass correlation coefficients (ICCs). A total of 211 patients with 312 clubfeet were evaluated. The average age at the time of follow-up was 8.0 years (range, 4.0 to 13.3 years). Results at the time of follow-up were rated as good (maintained plantigrade foot), fair (required limited surgery to maintain, or return to, a plantigrade position), or poor (required postero medial release).

Results: Over time, 75% of the feet had a good result, 19% had a fair result, and 6% had a poor result. With regard to radiographic assessment, the ICCs were 0.97 (talocalcaneal angle) and 0.98 (tibialcalcaneal angle), demonstrating excellent agreement between the raters. The mean talocalcaneal angle differed significantly between the feet with a good clinical outcome and those with a fair outcome (28° versus 24°; p < 0.02) but did not differ significantly between those with a good versus poor outcome (28° versus 26°), or a fair versus poor outcome (24° versus 26°). There were no significant differences in the mean tibialcalcaneal angle among the groups (80°, 90°, and 84°, respectively) (p=0.17).

Conclusions: Most clubfeet that were clinically plantigrade at 2 years of age remained so, while one-fourth subsequently required some surgery for late recurrence, primarily limited procedures. The tibialcalcaneal angle and talocalcaneal angle from standing lateral radiographs made at 18 to 24 months of age were not helpful in predicting future relapse.

Clubfoot Infants Initially Thought to Be Idiopathic but Later Found Not to Be. How Do They Do With Nonoperative Treatment?
Richards BS, Faulks S

Background: Infants thought to be normal with idiopathic clubfoot when nonoperative treatment begins might later be found to have other complicating diagnoses. The purpose of this study was to determine the incidence of this occurrence and to compare the clinical outcomes of these “nonidiopathic” patients with idiopathic clubfoot patients.

Methods: Infants below 3 months old with clubfoot who were thought to be normal (idiopathic) at presentation and had ≥2-year follow-up were studied. Treatment consisted of either the Ponseti method or the French physical therapy method. In total, 789 patients with 1174 clubfeet were identified. Those who were idiopathic (group 1) were compared with those later found to be nonidiopathic (group 2). The outcomes at 2 years were assessed as good (plantigrade foot, heelcord tenotomy only), fair (limited procedures), or poor (full-posterior-medial release). For those feet rated good at age 2 years, outcomes were again assessed at age 5 years and above.

Results: In total, 70 patients (8.8%) of the 789 enrolled patients were eventually found to have another disorder including neurological, syndromic, chromosomal, or spinal abnormalities. The remaining 719 idiopathic patients with 1062 clubfeet (group 1) were compared with these 70 nonidiopathic patients with 112 clubfeet (group 2). At age 2 years, in group 1, 81% of the feet were rated good, 11% fair, and 8% poor, whereas in group 2, 70% of the feet were rated good, 11% fair, and 19% poor (p=0.004). With follow-up exceeding age 5 years in those rated good at age 2 years: In group 1, 73% continued to do well, but 22% rated fair and 5% poor. In group 2, 59% continued to do well, but 31% rated fair and 10% poor (p=0.046).

Conclusions: For infants with clubfoot who were initially thought to be idiopathic, nearly 9% were later found to have a complicating disorder. Despite this, these patients’ clubfeet can be expected to respond favorably to nonoperative treatment. However, they will require more surgical intervention early (by age 2 years) and later (age 5 years and above) when compared with normal infants with idiopathic clubfoot.

Peri-Operative Care Considerations for Primary Total Knee Arthroplasty in the Obese Patient
Romero J, Jones D, Brown T

Background & Purpose: In the United States, 34.9% of adults are currently obese (BMI > 30) and recent studies have suggested more than half of patients seeking hip or knee replacement are obese. A worsening obesity epidemic within a health care environment moving toward value-based care reimbursement (i.e., bundled payments) requires improved strategies to optimize arthroplasty outcomes in the obese patient. The purpose of this article is to provide an up-to-date review of the literature identifying peri-operative care factors influencing outcomes in the obese total knee arthroplasty population.

Materials & Methods: Medline, Embase Host, and Pubmed databases were searched for studies identifying elective primary total knee arthroplasty outcomes and complication rates in the obese patient. Discussion & Conclusion: The increasing prevalence of obese patients undergoing TKA continues to grow and present unique challenges and considerations for the arthroplasty surgeon. Current literature suggests increasing levels of obesity correlate with increasing complications including infection, aseptic loosening, and wound complications. Special consideration should be given to surgical exposure, component positioning, and implant selection in the obese TKA population to minimize risk of aseptic loosening. Appropriate weight-adjusted antibiotic dosing, sterile surgical techniques early, and wound closure and coverage are essential in reducing infection in this susceptible population.

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Reliable Method for Avoiding Malrotation Deformity After Intramedullary Nailing of Comminuted Femur Fractures: Clinical Validation of a Previously Described Technique

Sathy A, Barnwell J, Shahrestani S, Moore D

Background & Purpose: To evaluate a previously described technique using the inherent antever sion of intramedullary nail (IMN) to avoid malrotation in comminuted femur fractures and describe the use of magnetic resonance imaging (MRI) as an alternative method for assessing postoperative femoral version.

Materials and Methods: This prospective consecutive cohort involved 25 patients with comminuted femur fractures (Winquist III/IV, OTA/AO 32-B/32-C) treated by a single surgeon with IMN between Sept. 1, 2011, and Feb. 28, 2015, on a fracture table with intraoperative femoral version set by the inherent version of the implant. All patients received a postoperative CT or MRI to assess femoral version. Mean difference in postoperative femoral antever sion (DFA) between injured limb and uninjured limb as measured by CT or MRI. Mean difference in postoperative femoral version of the injured femur from the inherent version of the implant (12 degrees) was measured with CT or MRI.

Results: The mean postoperative DFA was 9.1 ± 5.6 degrees. Postoperative DFA greater than 15 degrees was found in 2 (8.0%) patients. Mean difference in postoperative version of the injured femur from the inherent 12 degrees of the implant was 7.1 ± 5.4 degrees. Patients tolerated MRI studies well.

Discussion & Conclusion: Our previously described technique using the inherent antever sion of an IMN is effective and leads to a very low rate of malrotation, even in highly comminuted fractures. MRI can be used safely and effectively to assess antever sion after fixation of femur fractures to decrease radiation exposure.

Key Concepts of Musculoskeletal Infection

Rosenfeld SB, Copley LA, Migone M, An T, Bienvenut M, Schoenecker J

Abstract: Over the past few decades, musculoskeletal infections have increased in both incidence and severity. The clinical manifestations of musculoskeletal infections range from isolated osteomyelitis to multisite infections with systemic complications. Although this increased incidence of musculoskeletal infections correlates with the increased incidence of methicillin-resistant Staphylococcus aureus infections, other nonresistant infectious organisms have been associated with severe musculoskeletal infections; this finding supports the likelihood that an antibiotic resistance profile is not a major factor in bacterial virulence. Instead, a multitude of virulence factors allows infectious organisms to manipulate and evade the immune response of the host. Organisms such as S. aureus and Streptococcus pyogenes are able to hijack the acute phase response of the host, which allows for protected proliferation and dissemination. The serum factors produced by the acute phase response, including interleukin-6, C-reactive protein, erythrocytes/fibrinogen, and platelets, can be used to assess musculoskeletal infection severity and monitor treatment. Bacterial genome sequencing has identified virulence factors in a wide variety of clinical manifestations of musculoskeletal infections and might help identify targets for clinical therapy. Currently, however, the management of musculoskeletal infections relies on accurate organism identification and a thorough recognition of the sites of infection and the tissues that are involved. MRI aids in the localization of musculoskeletal infection and identification of sites that require surgical débridement.

Descriptive Epidemiology of Acetabular Dysplasia: The Academic Network of Conservational Hip Outcomes Research (ANCHOR) Periacetabular Osteotomy

Sankar WN, Duncan ST, Baca GR, Beaulé PE, Mills MB, Kim YJ, Peters CL, Podeszwa DA, Schoenecker PL, Sierra RJ, Srik EL, Sucato DJ, Trousdale RT, Zaltz I, Clohisy JC

Background: Periacetabular osteotomy (PAO) is an established treatment for symptomatic acetabular dysplasia, which is a well-recognized cause of hip pain, functional limitations, and secondary osteoarthritis. The purpose of this study was to describe the demographics of patients undergoing PAO, the baseline patient-reported outcome measures for this population, and the types of adjunctive procedures performed at the time of PAO surgery.

Methods: Demographics, disease characteristics, and patient-reported functional measures were prospectively collected from all patients who underwent PAO performed by 12 surgeons from 2008 to 2013.

Results: We enrolled 950 consecutive patients (982 hips) in the study; 83% were female and 17% were male, with an average age of 25.3 years and an average body mass index (BMI) of 24.6 kg/m². Most patients were Caucasian (87%), and 15% had undergone previous hip surgery. Before PAO was performed, most patients had had symptoms for 1 to 3 years. Baseline modified Harris Hip and University of California Los Angeles activity scores (61.8 and 6.6, respectively) indicated that patients had considerable functional limitations.

Discussion: Patients undergoing PAO for symptomatic dysplasia were predominantly young, female, and Caucasian with a normal BMI. Many patients had undergone prior hip surgery, and most had had symptoms for several years before treatment. Baseline patient-reported functional scores demonstrated marked functional limitations. Adjunctive procedures for intra-articular pathology, especially femoral osteochondroplasty and hip arthroscopy, are commonly performed at the time of PAO.

involvement is crucial to improve limb alignment and preserve function.

approximately half of patients with linear morphea of an extremity have orthopedic disease. Early orthopedist intervention is critical to prevent the progression of orthopedic complications in these patients, followed by limb atrophy, angular deformity, and limb length discrepancy; 14% required surgical intervention. Joint contractures were most common, affecting 88% of children were evaluated for linear morphea of an extremity. Twenty-six (51%) had documented orthopedic complications in this population. We sought to improve the understanding of orthopedic complications in linear morphea of the limb. Between 1999 and 2014, 51 fellow graduates participating in Accreditation Council for Graduate Medical Education and non-Accreditation Council for Graduate Medical Education programs increased from 39 to 50 (29%), with a peak of 67 fellows (71%) in 2009.

Discussion: Although predicting the exact need for pediatric orthopedic surgeons (POS) is impossible because of the complex interplay among macroeconomic, governmental, insurance, and local factors, some trends were identified: The supply of POS has increased, which might offset the expected number of experienced surgeons who will be leaving the workforce in the next 10 to 15 years; macroeconomic factors influencing demand for physician services, driven by gross domestic product and population growth, are expected to be stable in the near future; expansion of the scope of practice for POS is expected to continue; and further similar assessments are warranted.

Orthopedic Complications of Linear Morphea: Implications for Early Interdisciplinary Care

Schoch JJ, Schoch BS, Werthel JD, McIntosh AL, Davis DMR

Abstract: Linear morphea of the limb primarily affects children, and extracutaneous manifestations are common. Orthopedic surgeons are often essential in the care of patients with linear morphea, yet there are few reports outlining specific orthopedic complications in this population. We sought to improve the understanding of orthopedic complications in linear morphea of the limb. Between 1999 and 2014, 51 children were evaluated for linear morphea of an extremity. Twenty-six (51%) had documented orthopedic manifestations. Outcome measures included limb length discrepancy, angular malalignment, limb atrophy, and orthopedic surgical intervention. Joint contractures were most common, affecting 88% of patients, followed by limb atrophy, angular deformity, and limb length discrepancy; 14% required surgical intervention. Despite the use of systemic immunosuppressive therapy in many patients, approximately half of patients with linear morphea of an extremity have orthopedic disease. Early orthopedist involvement is crucial to improve limb alignment and preserve function.

Pain Management After Hip Arthroscopy: Systematic Review of Randomized Controlled Trials and Cohort Studies

Shin JJ, McCrum GL, Mauro CS, Vyas D

Abstract: Hip arthroscopy is often associated with significant postoperative pain and opioid-associated side effects. Effective pain management after hip arthroscopy improves patient recovery and satisfaction and decreases opioid-related complications. The purpose of this study was to collect, examine, and provide a comprehensive review of the available evidence from randomized controlled trials and comparative studies on pain control after hip arthroscopy.

Materials and Methods: Using the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines, a systematic review of the literature for postoperative pain control after hip arthroscopy was performed using electronic databases. Only comparative clinical studies with level 1 to 3 evidence comparing a method of postoperative pain control with other modalities or placebo were included in this review. Case series and studies without a comparative cohort were excluded.

Results: Several methods of pain management have been described for hip arthroscopy. A total of 14 studies met our inclusion criteria: 3 on femoral nerve block, 3 on lumbar plexus block, 3 on fascia iliaca block, 4 on intra-articular injections, 2 on soft tissue surrounding surgical site injection, and 2 on celecoxib (4 studies compared 2 or more methods of analgesia). The heterogeneity of the studies did not allow for pooling of data. Single-injection femoral nerve blocks and lumbar plexus blocks provided improved analgesia, but increased fall rates were observed. Fascia iliaca blocks do not provide adequate pain relief when compared with surgical site infiltration with local anesthetic and are associated with increased risk of cutaneous nerve deficits. Patients receiving lumbar plexus block experienced significantly decreased pain compared with fascia iliaca block. Portal site and periacetabular injections provide superior analgesia compared with intra-articular injections alone. Preoperative oral celecoxib, compared with placebo, resulted in earlier time to discharge and provided significant pain relief up to 24 hours.

Discussion & Conclusion: Perioperative nerve blocks provide effective pain management after hip arthroscopy but must be used with caution to decrease risk of falls. Intra-articular and portal site injections with local anesthetics and preoperative celecoxib can decrease opioid consumption. There is a lack of high-quality evidence on this topic, and further research is needed to determine the best approach to manage postoperative pain and optimize patient satisfaction.

Definition of Periprosthetic Joint Infection of the Hip and New Tools for Diagnosis

Shirley Z, Romero J, Estrella K

Abstract: A diagnosis of periprosthetic joint infection after total hip arthroplasty remains a challenge without a simple solution. It can be difficult to distinguish from aseptic failure of a total hip but is a significantly worse complication. Recent research has gone into attempting to find a cost-effective laboratory test or imaging modality that can assist in definitive diagnosis or periprosthetic joint infection, but there is no single most effective test as of yet. There are several promising possibilities arising from a variety of serum and synovial laboratory values, including alpha-defensin and leukocyte elastase tests. This review provides information on the most recent advances in the literature with regard to diagnosis of periprosthetic joint infection after total hip arthroplasty.
Automated Event Detection Algorithm for Two Squatting Protocols

Stevens WR Jr., Kokoszka AV, Anderson AM, Tulchin-Francis K

Introduction: Squatting biomechanics assessed using motion analysis relies on the identification of specific events: start of descent, transition between descent/ascent, and end of ascent. Automated identification reduces the time needed to process trials while allowing consistency across studies. The purpose of this study was to develop criteria for the identification of events and apply them to two squatting protocols in pathological patient and typically developing (TD) groups.

Methods: Thirty-four subjects with hip dysplasia and 41 TD subjects were enrolled in this study. While instrumented with a full-body Plug-in-Gait marker set, participants performed two squatting protocols: a high-squat, where subjects paused for a count of three at their lowest squat depth, and a traditional squat, where the descent phase was immediately followed by the ascent phase. Reviewers analyzed the kinematic/kinetetic waveforms of a subset of trials to develop criteria for events. Sagittal plane knee and vertical center of mass velocities were used to identify events, and absolute vs. relative thresholds of the peak knee velocity were compared. These criteria were incorporated into an automated event detection code.

Results: Using a relative threshold algorithm, events were automatically identified in 244 of 259 total trials (94%). For the trials requiring manual placement of events (n=15 trials), there was perfect inter-rater reliability between research personnel.

Conclusions: The criteria developed for the automatic detection of squatting events was highly successful for both protocols in each participant group and was also highly reliable for research personnel to follow in the few instances where manual placement was necessary.

Interval Setting Selection Affects Ambulatory Activity Outputs in Children With Cerebral Palsy

Stevens WR Jr., Tulchin-Francis K

Introduction: Accelerometer-based devices have been widely used to assess the ambulatory activity of children with and without functional disabilities. Many researchers who utilize the StepWatch Activity Monitor (SAM) collect at a 60-second (60sec) interval setting. The purpose of this study was to assess the effect of SAM interval settings on ambulatory activity outputs in children with cerebral palsy (CP) and typically developing youth.

Methods: Twenty-eight children with CP (14 boys; avg. 12 yrs. 4 mths.; GMFCS Level I n=4, Level II n=19, Level III n=6) completed testing, and 28 age-matched, typically developing youth (14 boys; avg. 12 yrs. 6 mths.) were included. Using the 10sec interval, ~80% of walking bouts in both groups were identified. The rate of surgery or progression of the curve ≥50° was 34.5% (29 of 84) in mLenke-I curves, 54.5% (6 of 11) in mLenke-II curves, 29.4% (10 of 34) in mLenke-III curves, 17.6% (3 of 17) in mLenke-V curves, and 13.6% (3 of 22) in mLenke-V curves. There were no mLenke-N curves at the time of brace initiation. The rate of surgery or progression to ≥50° was 34.1% (44 of 129) in the combined thoracic group and 15.4% (6 of 39) in the combined lumbar group (p=0.0277). In brace-compliant patients (>12.9 hours/day), the rate of surgery or progression to ≥50° was 30.3% (20 of 66) in main thoracic curves and 5.3% (1 of 19) in main lumbar curves (p=0.0239). One-tenth of curves changed morphology during bracing. The rate of surgery or progression to ≥50° was 35.8% (43 of 120) in persistent main thoracic curves, 20.0% (6 of 30) in persistent main lumbar curves, 12.5% (1 of 8) in main thoracic curves that became main lumbar curves, and 0% (0 of 9) in main lumbar curves that became main thoracic curves (p=0.0383).

Conclusions: Thoracic curves are at greater risk for brace failure than lumbar curves are despite similar initial curve magnitudes and average amount of daily brace wear. A change in curve pattern can imply flexibility and is associated with brace success. Patients with thoracic curves should be counseled accordingly.

Vancomycin Powder Regimen for Prevention of Surgical Site Infection in Complex Spine Surgeries

Van Hal M, Lee J, Lauderthílch D, Nwasike C, Kang J

Background & Purpose: Vancomycin powder might not decrease an already low rate of infection. Therefore, use of vancomycin powder in high-risk patients with a higher rate of infection would potentially show benefit of vancomycin powder. The objective of this study was to describe and compare the rates of infection in high-risk patient populations while using vancomycin powder.

Materials and Methods: In total, 496 patient charts were collected from a database of cases. Patients were included in the cohort if they had revision spinal operation or if they were diabetic. Patients in the time period July 2010 to August 2013 were included in the vancomycin protocol where 1 g of vancomycin powder was added to the wound before wound closure. Cases were considered positive if there was a positive culture or if there was sufficient clinical suspicion to treat. As a control to this cohort, 692 charts were reviewed from an earlier time period of the same surgeon and institution.
Results: In total, 28 patients of 496 (5.6%) patients in the cohort returned to the operating room for seroma, hematoma, draining wound, or infection. Sixteen of these patients (16/496, 3.2%) had a culture positive infection or were treated as an infection. This rate was significantly lower than the historical rate before the protocol.

Discussion & Conclusion: Although vancomycin does seem to be useful in decreasing SSIs, it is not a panacea. SSIs in high-risk patients were not completely eliminated by the vancomycin protocol.

Kinematic Magnetic Resonance Imaging of Peroneal Tendon Subluxation With Intraoperative Correlation

Vanpelt MD, Landrum MR, Igbinigie M, Wadhwa V, Chhabra A

Background & Purpose: Magnetic resonance imaging (MRI) is a noninvasive modality of choice for the detection of static peroneal tendon pathologic features. The depiction of peroneal tendon subluxation using real-time kinematic MRI has not been previously reported.

Discussion & Conclusion: We describe the MRI and intraoperative correlation of peroneal tendon and retinacular pathologic findings and the novel use of kinematic MRI in the illustration of peroneal tendon subluxation.

Limb Salvage After Failed Initial Operative Management of Bimalleolar Ankle Fractures in Diabetic Neuropathy

Vaudreuil NJ, Fourman MS, Wukich DK

Background & Purpose: Ankle fractures are one of the most common orthopaedic injuries in patients with diabetes mellitus and are commonly associated with increased morbidity, infections, and total complications. In this study we examined our outcomes following the attempted limb salvage of patients with diabetic peripheral neuropathy who sustained an unstable bimalleolar ankle fracture and failed initial operative management.

Materials and Methods: We identified 17 patients with diabetes mellitus complicated by peripheral neuropathy who sustained a bimalleolar ankle fracture. All patients were initially diagnosed and managed operatively with open reduction internal fixation or placement of an external fixator. All of the reconstructed patients were treated by a single orthopedic foot and ankle surgeon. For the purposes of this study, limb salvage was defined as preservation of the ankle joint – in other words, avoidance of a major amputation.

Results: 14 patients achieved successful limb salvage, resulting in an overall rate of limb salvage of 82%. The primary reasons attributed to the failed initial operative management included mechanical failure in 11 patients, septic nonunion in four patients, aseptic nonunion in one patient, and osteomyelitis in one patient. The reconstructive management of the 17 cases included the following: Three patients underwent revision open reduction internal fixation, eight patients underwent closed reduction and application of external fixation, and six patients underwent primary arthrodesis. All 14 patients who achieved successful limb salvage in this study ended up with a clinically fused ankle joint.

Discussion & Conclusion: The treatment of unstable ankle fractures in patients with diabetic neuropathy is difficult and frequently leads to complications, poor outcomes, and limb loss. Complication rates have been reported to be as high as 42%. In the setting of failed initial operative management for unstable ankle fractures in diabetic patients, the treatment algorithm becomes even more complex for the reconstructive surgeon. This small retrospective study demonstrates that in those patients who fail initial operative management of an unstable bimalleolar fracture, it is difficult to achieve an end result with a functional ankle joint. All of our successful patients ended up with a stable and clinically fused ankle joint. Consequently, there was a relatively high rate of limb salvage for patients who underwent a primary fusion to manage their problem.
Femoral version subgroups were defined as normal (5°-20°), decreased (≤ 5°), or increased (> 20°). Groups included severity of lateral dysplasia: mild (LCEA 15°-20°) and moderate/severe (LCEA < 15°). Assessed using an entire clockface and an alpha angle ≥ 55° defined coexisting cam morphology. Sub-center height, trochanteric height, and alpha angle. The maximum head and neck offset deformity was shaft angle, femoral head diameter, head and neck offset, femoral neck length, femoral offset, head.

Hips were analyzed with Dyonics Plan software and characterized with regard to version, neck-shaft angle, femoral head diameter, head and neck offset, femoral neck length, femoral offset, head-center height, trochanteric height, and alpha angle. The maximum head and neck offset deformity was assessed using an entire clockface and an alpha angle ≥ 55° defined coexisting cam morphology. Subgroups included severity of lateral dysplasia: mild (LCEA 15°-20°) and moderate/severe (LCEA < 15°). Femoral version subgroups were defined as normal (0°-20°), decreased (≤ 5°), or increased (> 20°).

Results: The mean LCEA was 14° (±4°), whereas the mean femoral anteverision was 19° (±12°). Eight hips (16%) demonstrated relative femoral retroversion (≤ 5°), whereas 26 (52%) showed excessive femoral anteverision (> 20°). Four hips (8%) had ≥ 35° of femoral anteverision. The mean neck-shaft angle was 136° (±5°). The mean maximum alpha location was 2 o’clock (±45 minutes) and the mean maximum alpha angle was 52° (±6°). Minimum head-neck offset ratio was located at 1:30 with a mean of 0.14 (±0.03). An anterior head-neck offset ratio of ≤ 0.17 or an alpha angle ≥ 55° was found in 43 (86%) of hips. Twenty-one dysplastic hips (42%) had an alpha angle ≥ 55°. Mildly dysplastic hips had decreased femoral head and neck offset (9 ± 1) and head and neck offset ratio (0.20 ± 0.03) at 12 o’clock compared with moderate/severe dysplasias (10 ± 1 and 0.22 ± 0.03, respectively; p=0.04 and p=0.01). With the numbers available, we found that hips with excessive femoral anteverision (>20°) had no difference in the alpha angle at 3 o’clock (42 ± 7) compared with hips with relative femoral retroversion (≤ 5°; 48 ± 4; p=0.06). No other differences in femoral morphology were found between hips with mild or moderate/severe dysplasia or in the femoral version subgroups with the numbers available. Anterior impingement test was positive in 76% of hips with an alpha angle ≥ 55° and 83% of the hips with an alpha angle ≥ 55°. No correlation was found between proximal femoral morphology and preoperative ROM.

Discussion & Conclusion: In this subset of dysplastic hips, cam deformity of the femoral head and neck was present in 42% of hips with maximal head-neck deformity at 2 o’clock, and 82% had reduced head-neck offset at the 1:30 point. We conclude that cam-type deformities and decreased head-neck offset in developmental dysplasia of the hip are common. Patients should be closely assessed for need of a head and neck osteochondroplasty, especially after acetabular correction. Future prospective studies should evaluate the influence of proximal femoral anatomy on surgical results of PAO for dysplastic hips.
Survivorship of the Bernese Periacetabular Osteotomy: What Factors are Associated With Long-Term Failure?

Wells J, Mills M, Kim Y, PhD, Balut E, Miller P, Matheny T

Background & Purpose: The Bernese periacetabular osteotomy (PAO) continues to be a commonly performed nonarthroplasty option to treat symptomatic developmental hip dysplasia, but there are few long-term follow-up studies evaluating results after PAO.

Questions Investigated: (1) What is the long-term survivorship of the hip after PAO? (2) What were the validated outcomes scores among patients who had PAO more than 14 years ago? (3) What factors are associated with long-term failure?

Methods: One hundred fifty-eight dysplastic hips (133 patients) underwent PAO between May 1991 and September 1998 by a single surgeon. Of those, 37 hips (34 patients [26%]) were lost to follow-up; an additional seven patients (6% [eight hips]) had not been seen in the last 5 years. The 121 hips (in 99 patients) were retrospectively evaluated at a mean of 18 years (range, 14-22 years). Survivorship was assessed using Kaplan-Meier analysis with total hip arthroplasty (THA) as the endpoint. Hips were evaluated for activity, pain, and general health using the UCLA Activity Score, modified Harris hip score, WOMAC, and Hip-disability and Osteoarthritis Outcome Score (HOOS). Failure was defined as a WOMAC AC pain subscale score ≥ 10 or having undergone THA. Hips were divided into three groups: asymptomatic (did not meet any failure criteria at any point in time), symptomatic (met WOMAC pain failure criteria at previous or most recent follow-up), and replaced (having undergone THA). A multinomial logistic regression model using a general estimating equations approach was used to assess factors associated with failure.

Results: Kaplan-Meier analysis with THA as the endpoint revealed a survival rate (95% confidence interval [CI]) of 74% (66%-83%) at 18 years. Twenty-six hips (21%) underwent THA at an average of 9 ± 5 years from the surgery. Sixty-four hips (53%) remained asymptomatic and did not meet any failure criteria at most recent follow-up. Thirty-one hips (26%) were symptomatic and considered failed based on a WOMAC pain score of ≥ 10 with a mean ± SD of 11 ± 4 out of 20 at most recent follow-up. Although some failed initially by pain, their most recent WOMAC score may have been <10. Of the 16 symptomatic hips that failed early by pain (reported a WOMAC pain subscale score ≥ 10 in the prior study), two were lost to follow-up, two underwent THA at 16 and 17 years, four still failed because of pain at most recent follow-up, and the remaining eight had WOMAC pain scores <10 at most recent follow-up. Asymptomatic hips reported better UCLA Activity Scores (asymptomatic: mean ± SD, 7 ± 2; symptomatic: 6 ± 2; p = 0.001), modified Harris hip scores (pain, function, and activity sections; asymptomatic: 60 ± 11; symptomatic: 50 ± 15, p < 0.001), WOMAC (asymptomatic: 2 ± 2, symptomatic: 11 ± 4, p < 0.001), and HOOS (asymptomatic: 87 ± 11, symptomatic: 52 ± 20, p < 0.001) compared with symptomatic hips at long-term follow-up. Age older than 25 years at the time of PAO (asymptomatic: odds ratio [OR], 3.6; 95% CI, 1.3-9.6; p = 0.01; replaced: OR, 8.9; 95% CI, 2.6-30.9; p < 0.001) and a preoperative joint space width ≤ 2 mm (replaced: OR, 0.3; 95% CI, 0.12-0.71; p = 0.007) or ≥ 5 mm (replaced: OR, 0.121; 95% CI, 0.03-0.56; p = 0.007) were associated with long-term failure while controlling for poor or fair preoperative joint congruency.

Conclusions: This study demonstrates the durability of the Bernese PAO at long-term follow-up. In a subset of patients, there was progression to failure over time. Factors of progression to THA or more severe symptoms include age older than 25 years, poor or fair preoperative hip congruency, and a preoperative joint space width that is less than 2 mm or more than 5 mm. Future studies should focus on evaluating the two failure groups that we have identified in our study: those that failed early and went on to THA and those that are symptomatic at long-term follow-up.

Quengel Casting for the Management of Pediatric Knee Flexion Contractures: A 26-Year Single Institution Experience

Wiley MR, Riccio AI, Rodgers JA, Felton K, Wimberly RL, Johnston CE

Background & Purpose: Quengel casting was introduced in 1902 for nonsurgical treatment of knee flexion contractures (KFC) associated with hemophilic arthropathy. It consists of an extension-desubluxation hinge fixed to a cast allowing for gradual correction of a flexion deformity while preventing posteri- or tibial subluxation. The purpose of this study is to report 1 center’s experience with this technique for the treatment of pediatric KFC.

Materials and Methods: A retrospective review was conducted over a 26-year period. All patients with KFC treated with Quengel casting were included. Demographic data, associated medical conditions, adjunctive soft tissue releases, complications, and the need for late surgical intervention were recorded. Tibiofemoral angle measurements in maximal extension were recorded at initiation and termination of casting, 1-year follow-up, and final follow-up. Success was defined as no symptomatic recurrence of KFC or need for subsequent surgery.

Results: Eighteen patients (26 knees) were treated for KFC with Quengel casting. Average age at initiation of casting was 8.1 years with average follow-up of 59.9 months. Fifteen knees (58%) underwent soft tissue releases before casting. An average of 1.5 casts per knee were applied over an average of 23.9 days. Average KFC before casting was 50.6 degrees (range, 15 to 100 degrees) which improved to 5.96 degrees (0 to 40 degrees) at cast removal (P = 0.00001). Sixteen patients (22 knees) had 1-year follow-up or failed casting before 1 year. Of these, 11 knees (50%) had a successful outcome. Residual KFC of those treated successfully was 6.8 degrees (range, 0 to 30 degrees) at 1 year and 8.2 degrees (range, 0 to 30 degrees) at final follow-up, averaging 71.4 months (P = 0.81). Of the 11 knees deemed failures, all had recurrence of deformity within an average of 1 year from cast removal. Surgical release before Quengel casting did not improve the chances for success (P = 0.09).

Discussion & Conclusion: Quengel casting can improve pediatric KFC an average of 44.2 degrees with minimal complications. Although 50% of treated patients will demonstrate significant recurrence or need later surgery, the majority of those treated successfully have durable results at intermediate term follow-up.
Comparison of Transtibial Amputations in Diabetic Patients With and Without End-Stage Renal Disease


Wukich DK, Ahn J, Raspovic KM, Gottschalk FA, La Fontaine J, Lavery LA

Background & Purpose: The primary purpose of this retrospective study was to report on a consecutive series of 102 patients with diabetes mellitus (DM) who underwent transtibial amputation (TTA) for chronic infections and nonreconstructable lower extremity deformities. A secondary aim was to compare the outcomes of TTA patients with end-stage renal disease on dialysis (ESRD) to patients without ESRD, and to identify risk factors for mortality after TTA.

Materials and Methods: This cohort included a consecutive series of patients who were treated by a single surgeon. The TTA patients were divided into 2 groups for analysis. The study group included those patients with ESRD who underwent TTA, and the control group included those patients who did not have ESRD.

Results: At the time of final follow-up, 64 of 102 patients were ambulatory with a prosthesis. There was a significant improvement in ambulatory status after amputation (preoperatively 45.1%, postoperatively 62.7%, P<0.02). Wound healing complications (infection and/or dehiscence) occurred in 31 of 102 patients and led to a transfemoral amputation in 4 patients. After TTA patients with ESRD were significantly more likely to die (52.4% vs. 23.5%, p<0.05) and significantly less likely to ambulate (42.9% vs. 67.9%, p<0.05) than patients without ESRD. Contralateral foot problems after the TTA occurred in 33 of 97 patients and resulted in 10 patients undergoing a contralateral transtibial amputation. Excluding patients with bilateral amputations (6 prior to and 10 after the index amputation), 64 of 87 patients with successful unilateral transtibial amputations were able to ambulate with a prosthesis. Thirty of 102 patients (29.4%) died during the follow-up period, and 6 of these deaths occurred during the perioperative period (within 30 days of surgery). There were no significant differences between the 2 groups with regard to the use of staged TTA, need for transfemoral amputation, or wound healing problems at the amputation site. Patients who were unable to walk postoperatively had a calculated 5-year survival rate of 30.1%, whereas those who were ambulatory had a 5-year survival rate of 68.8%. Cox proportional hazards model demonstrated a 62% reduced risk of mortality in patients who were able to ambulate after LEA compared with those patients who were not able to ambulate.

Discussion & Conclusion: TTA in patients with diabetes was associated with substantial morbidity and mortality. Risk factors that were significantly associated with an increased rate of mortality were the presence of ESRD, age ≥56 years, and inability to ambulate postoperatively.

Improved Quality of Life After Transtibial Amputation in Patients With Diabetes-Related Foot Complications


Wukich DK, Ahn J, Raspovic KM, La Fontaine J, Lavery LA

Background & Purpose: The purpose of this study was to evaluate health-related quality of life after major lower-extremity amputation in a cohort of patients with diabetes mellitus.

Materials and Methods: We evaluated 81 patients with diabetes and transtibial amputation (TTA) who had a minimum of 1 year of follow-up. Of these 81 patients, 50.6% completed the Short Form Survey (SF-36) and the Foot and Ankle Ability Measure (FAAM) preoperatively and postoperatively.

Results: Outcome measures before and after TTA were compared using Welch’s ANOVA for continuous variables and Fisher’s exact test for categorical variables. There was significant improvement in all 8 subscales of the SF-36, physical component summary (PCS) score, mental component summary (MCS) score, and the FAAM. The median SF-36 PCS score improved from 26.2 to 36.6 preoperatively versus postoperatively (P<0.005). The postoperative PCS score improved in 75.6% of patients and worsened in 24.4%. The median SF-36 MCS score improved from 43.7 to 56.1 preoperatively versus postoperatively (P<0.005). Both the FAAM activities of daily living (ADL; P<0.005) and FAAM sports scores (P<0.05) improved significantly. The postoperative FAAM general/ADL score improved in 75.6% of patients and worsened in 24.4%. Patients who were nonambulatory postoperatively had significantly lower SF-36 general health subscale scores and lower FAAM scores than patients who were ambulatory postoperatively.

Discussion & Conclusion: In select patients with nonfunctional lower extremities resulting from instability and/or chronic infection, TTA can result in significant improvement in quality of life and lower-extremity function. We acknowledge that 25% of patients had a reduction in self-reported quality of life; however, 75% of patients improved their quality of life.

Comparison of Diabetic Charcot Patients With and Without Foot Wounds


Wukich DK, Sadoskas D, Vaudreuil NJ, Fouman M

Background & Purpose: Charcot neural arthropathy affects between 0.2% and 3% of all patients with diabetes mellitus, and the management continues to be a challenge to the reconstructive surgeon. The primary aim of this study was to evaluate the outcomes of a series of patients with Charcot neuropathology (CN) who were evaluated in a tertiary care setting. We hypothesized that those patients with CN who presented with a Charcot-related foot wound would have lower rates of successful limb salvage than patients who presented without a wound.

Materials and Methods: Two hundred forty-five patients (280 feet) were identified with diabetic CN during the time period from Jan. 1, 2005, to June 1, 2015. This consecutive cohort of patients were treated by a single surgeon and had a mean age of 57.9 ± 10.0 years. Our CN patients were divided into two groups for purposes of analysis. Our study group included those patients who presented to our clinic with a Charcot-related foot wound. Our control comprised CN patients who presented without a Charcot-related foot wound.

Results: Overall, 78 feet (27.9%) were successfully treated nonsurgically and 202 feet (72.1%) required some type of surgery. Of the 202 feet that underwent surgery, 22 limbs (10.9%) were not felt to be suitable for reconstruction and underwent a definitive transfemoral amputation without an attempt at reconstruction. An additional 18 patients underwent soft tissue surgery, which included drainage of infections, posterior muscle group lengthening, or soft tissue reconstructive flap surgery. The remaining 162 feet underwent osseous surgery, which included osteotomies for osteomyelitis, exostectomies, osteotomies, and arthrodesis. Eighteen of the 180 limbs (10.0%) that underwent soft tissue or osseous reconstruction ultimately required a transfemoral amputation, resulting in a successful limb salvage rate of 90.0%. Thirty-five amputations were performed in 164 feet (21.3%) with Charcot-related foot wounds compared to five amputations in 116 feet (4.5%) without Charcot-related foot wounds [OR 6.02 (95% CI 2.28-15.91), P<0.0001].

Discussion & Conclusion: The presence of a Charcot-related foot wound at presentation increased the likelihood of an LEA major lower extremity amputation by a factor of six. Other risk factors that were associated with major amputation in patients included active infection at presentation, nonunion/instability after reconstruction, and a postoperative wound problem. The overall rate of successful limb salvage in patients deemed reconstructive candidates was 90%. The findings of this study are consistent with a review of the Veterans Affairs patients in 2003 that demonstrated a 12 times higher likelihood of major lower extremity amputation in Charcot patients with an ulcer compared to patients with Charcot and no ulcer. The goal of every physician treating patients with Charcot should be to prevent the formation of a diabetic foot ulcer. By preventing the occurrence of foot ulcers, infections and amputations can be minimized.
Background & Purpose: Plantar shear stress has been held accountable as a causative factor in diabetic foot ulcers (DFU) [1, 2]. Delbridge et al. recognized shear stress as a major causative factor by stating that it is shear rather than vertical load that is responsible for tissue breakdown that occurs deep to the skin [2]. Historically, research in this area has been hampered by an underestimation of importance of shear stress and the lack of technology to measure it. Emerging evidence within the past decade has demonstrated the clinical significance of shear to foot ulceration [3, 4, 5]. We previously revealed that individuals with diabetic neuropathy (DN) experience higher plantar shear compared to control subjects [5]. However, to our knowledge, no study has compared peak shear in individuals with a history of DFU to those patients with diabetic neuropathy but no history of DFU.

Materials and Methods: We quantified peak plantar shear (PS) in 9 subjects with (DFU) and 16 subjects without (DN) previous ulcers using the Cleveland Clinic shear plate [5]. Ulcer history was confirmed by the collaborating physicians (A.G.G. and L.A.L.). We collected peak pressure (PP) and shear data while barefoot subjects walked across the device at self-selected speeds. Two-sample t-tests were used to analyze the group differences.

Results: PP was not significantly different between the two groups (DFU: 738.6 kPa ± 322.3, DN: 568.0 kPa ± 123.8, p=0.2075); however, PS was significantly higher in the DFU group (DFU: 135.3 kPa ± 60.6, DN: 86.4 kPa ± 30.3, p=0.0465).

Discussion & Conclusion: This study revealed, for the first time, that PS is significantly higher in patients with a history of DFU, representing a risk factor for development of DFU. Although the study was underpowered to detect a significant difference in PP between the two groups, we believe that the higher PP in DFU subjects is clinically meaningful. The difference in PS was sufficient to generate an effect size > 0.8, and hence a small sample size was sufficient to capture the statistical significance. Emerging evidence suggests that peak shear can be utilized jointly with pressure to better predict risk for developing a DFU. Future research should investigate the clinical implications of shear in a large, longitudinal cohort study. With better biomechanical markers at hand, engineers and clinicians can work together to identify developing ulcers and design novel methods/devices to effectively prevent them.