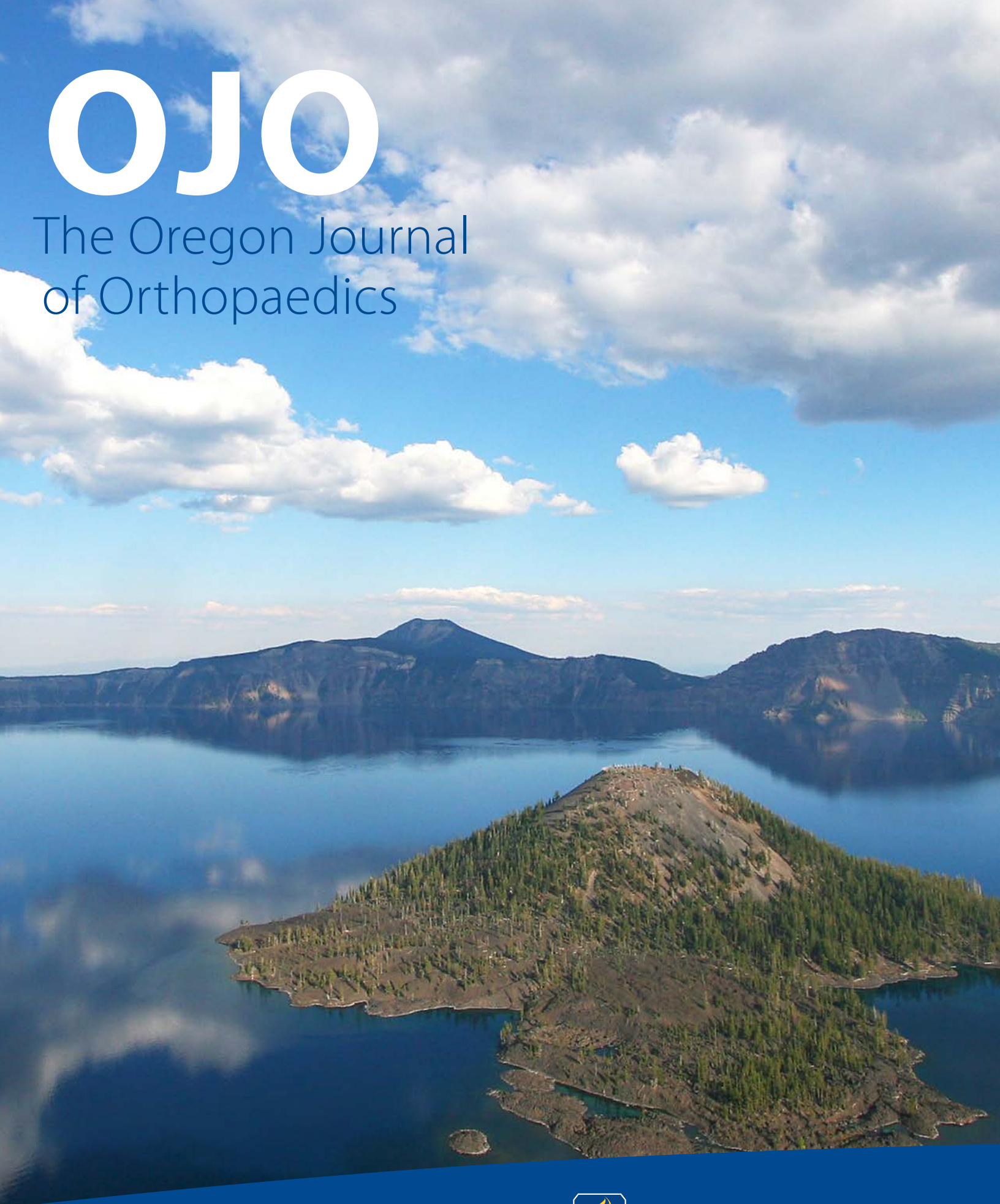


OJO

The Oregon Journal
of Orthopaedics



Volume III May 2014



SCHOOL OF MEDICINE
Oregon Health & Science University

Dedication of OJO Volume 3



[Michael Gerald Durkan](#)

1987–2012

On behalf of the editors of *The Oregon Journal of Orthopaedics*, the residents, and the faculty of the OHSU Department of Orthopaedics & Rehabilitation, we would like to dedicate this volume of the *OJO* to Michael Gerald Durkan. Michael was a native Oregonian, who lived a short but brilliant life from January 11, 1987, until September 5, 2012. He dedicated himself unselfishly to the advancement of orthopaedics, medical science, clinical care and fishing. Mike was a remarkably productive member of our orthopaedic family at OHSU for nearly four years, initially as a research volunteer and then a research assistant. Several examples of his outstanding efforts are represented in this 2014 volume of the *OJO*. He will be missed but not forgotten.

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Faculty Editor: Darin Friess, MD

Senior Editors: Thomas Kowalik, MD, and Jared Mahylis, MD

Junior Editors: Ryland Kagan, MD, and Ryan Wallenberg, MD

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1. Dai, et al., ORS 2013, San Antonio, TX, Influence of Ethnicity on Coverage of the Tibia in Total Knee Arthroplasty
2. Data on file at Zimmer



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Letter from the Editors

Welcome to the third volume of *The Oregon Journal of Orthopaedics*. We would like to thank the numerous contributions from faculty, residents and our alumni. The third installment of this publication continues to demonstrate the outstanding accomplishments of the OHSU Department of Orthopaedics & Rehabilitation. The aim of this journal is to not only highlight the research endeavors of the department, but also continue our outreach to alumni, community orthopaedic surgeons and other health care providers in Oregon and the region.

In this volume, our program director, Darin Friess, MD, comments about the new developments of the residency program throughout this year. The Hand and Upper Extremity and St. Vincent's services also provide updates on progression of resident education since the last volume.

Featured editorials in this issue include an interview with new faculty member, James Meeker, MD, who is eight months into his first year as the foot and ankle specialist of the department. Dr. Meeker has not only settled into his new role, but has expanded his practice to include coverage of the ever-busy orthopaedic trauma service.

Also highlighted in this issue are the continued accomplishments of our residents and faculty to expand the practice of orthopaedics to international communities. Dustin Larson, MD, describes his experiences in the small Peruvian town of Pucallpa where he was an integral member of a mission to provide orthopaedic surgical care to underserved patients. Continuing with the theme of international outreach, we hear from resident physician Joseph Langston, MD, and Legacy Emanuel faculty member Richard Gellman, MD, about the continued efforts, success and international outreach of the SIGN Fracture Care International organization. The SIGN organization is a consortium of surgeons, engineers and citizens who have worked to bring comprehensive orthopaedic trauma care to the underserved international community since 1999.

Several changes have occurred within our department over the past year. Class of 2012 graduate, Jacqueline Munch, MD, has accepted a position as the new sports medicine orthopaedic surgeon in the department. She is currently completing her fellowship at The Hospital for Special Surgery in New York City and will join the faculty in the fall of 2014. It is with regret that we bid farewell to Alex Herzberg, MD, and Amer Mirza, MD. Dr. Herzberg has been a member of the department for more than 15 years and has been an integral part of resident education during his tenure. Dr. Herzberg entered into private practice in Washington state during the spring of 2014. Dr. Mirza served as co-director of the orthopaedic trauma service beginning in 2007. Dr. Mirza helped to advance and foster resident education and our surgical skills during his time at OHSU. He will be completing an adult reconstructive fellowship and entering private practice in the early summer of 2014. We wish them both the best in their future endeavors.

Please enjoy the third volume of *The Oregon Journal of Orthopaedics*.

The Editors:

Faculty Editor: Darin Friess, MD

Senior Editors: Thomas Kowalik, MD, and Jared Mahylis, MD

Junior Editors: Ryland Kagan, MD, and Ryan Wallenberg, MD

Editors Emeriti: Rich Myers, MD, Brent Roster, MD, Alex DeHaan, MD, John Seddon, MD

Letter from the Chair



It seems that the world is so quickly changing around us that many orthopaedic surgeons seem bewildered and even discouraged. Every year there are new things to incorporate into our practice and new terms we have to learn: Affordable Health Care Act, Value Based Purchasing, Meaningful Use...etc. It does give one pause as to the profession that we have chosen and to our ability to deliver quality care to our patients.

Like everyone else, I have worried about these changes. However, when I came to a realization that the changes are an inevitable part of progress, most of my concerns started to disappear. We may have been able to give great care to our individual patients, but who cared for the millions who were not insured? Did they not deserve to be mended of broken bones, to walk without pain or to have the best chance of surviving their osteosarcoma? Whether we like or hate any particular aspect of the Affordable Health Care Act, there is no argument that the society and we as the physicians have some responsibility to care for all. Is it not the responsibility and right of those who pay for the treatment to ask if we are providing worthwhile care?

Life is about choice, and I choose to remain optimistic. No matter how many changes have occurred, my mission and my compact with society have not changed. I am grateful for the fact that I have the privilege of helping my patients regain their life and function, the honor of training the next generation of talented and caring surgeons and the joy of discovering new knowledge that enriches all our lives. I hope that every one of us commit ourselves as an engaged leader of these changes because without our optimism and involvement, these changes will surely fail. Henry Ford once said, "The man who thinks he can and the man who thinks he can't are both right. Which one are you?"

Sincerely,

Jung Yoo, MD
Chair and Professor
Department of Orthopaedics & Rehabilitation
OHSU School of Medicine

Letter from the Program Director



The OHSU Orthopaedics Residency Program continues to strive for excellence in 2014. We proudly graduated five excellent chief residents last spring who have moved on to fantastic fellowships. All five residents passed their Step 1 Board examination and are now looking to move on to independent practices. We have been working with a wonderful group of five new interns who should pick up this mantle of orthopaedic excellence during the next five years of their residency program.

As previously described, we have implemented significant changes to the intern year for our orthopaedic residents. They now spend six months on the orthopaedic service and fewer months on general surgery services. These changes have been well received by our interns, although I do believe the general surgery service has missed having our intelligent and hardworking interns on their services. The other major change enacted for the internship year is a new curriculum from the American Board of Orthopaedic Surgery on surgical skills simulation. We have adopted a once monthly skills lab here at OHSU to teach surgical skills from basic knot-tying, fracture fixation, joint aspiration all the way through the basics of arthroplasty. These sessions have been very popular with the interns, and we used the opportunity to start developing some skills training for the other junior and senior level residents. Our initial efforts this year have focused on open surgical procedures and implants, but we will be moving forward with arthroscopic skills modules over the next academic year. Please contact me if you have any interest in assisting with surgical skills training.

The residents still rotate twice through most subspecialty services in two-and-a-half month blocks. We have happily maintained long-term rotations at the Shriners Hospital, Legacy Emanuel Hospital and the Portland Veterans Affairs Medical Center. Our newer rotation at Providence St. Vincent Medical Center continues to be highly rated by the PGY4 residents.

Our residents continue to formulate great research questions and develop them into wonderful research projects. The five chief residents presented their projects at the Beals Day lectureship last year to visiting professor Vern Tolo, the editor of the Journal of Bone and Joint Surgery. Our visiting professor this year, Seth Leopold, the editor of Clinical Orthopaedics and Related Research, promises to provide an opportunity for another day of orthopaedic inquiry. Please attend to support our residents. If you are unable to attend Beals Day, another opportunity may be to attend our bimonthly Orthopaedic Grand Rounds held on Monday mornings. These sessions are a nice opportunity to connect with other orthopaedic surgeons, and we offer Continuing Medical Education credits applicable to your Maintenance of Certification.

In short, we continue to be blessed by very smart and talented residents. Teaching them the science and art of orthopaedics takes hard work and dedication. I am grateful to everyone who has taken the time and effort to assist with their education.

Darin Friess, MD
Residency Program Director

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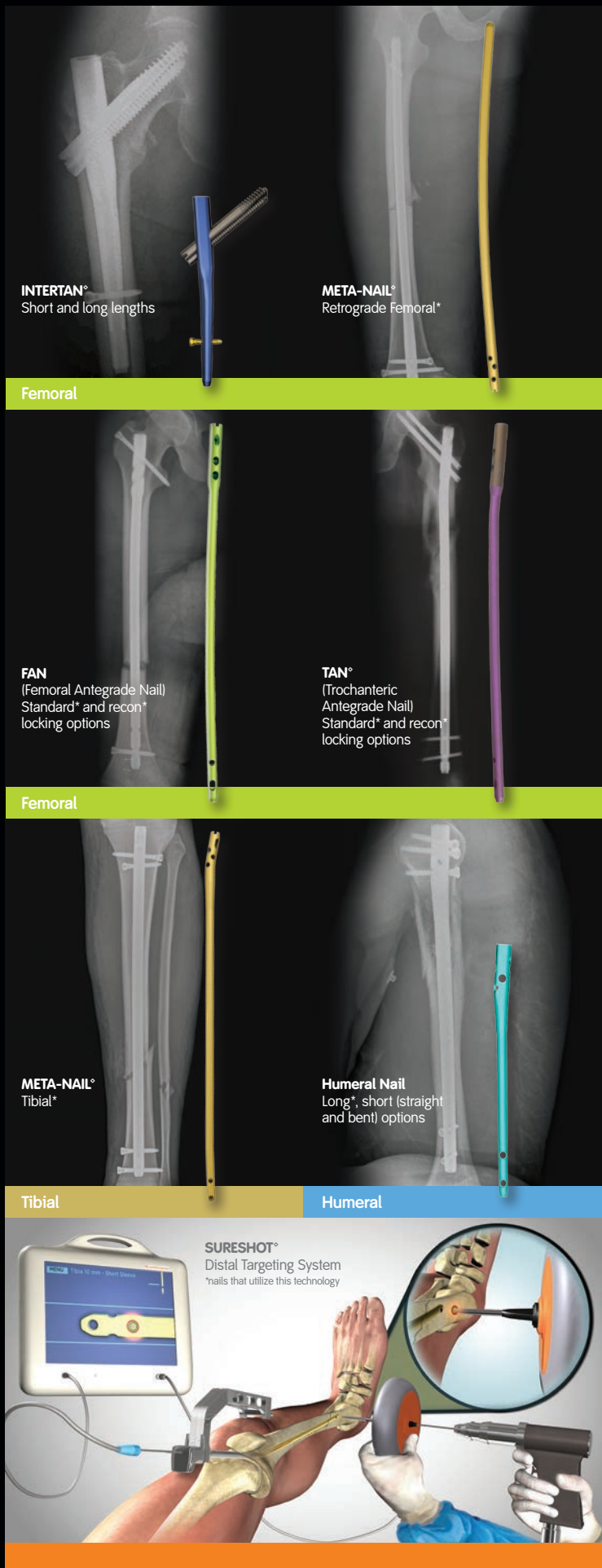
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Adult Reconstruction



Thomas Huff, MD



Kathryn Schabel, MD

Foot & Ankle



James Meeker, MD

General Orthopaedics



Alex Herzberg, MD

Infectious Disease



**Penelope Barnes, MBBS,
MRCP, FRCPath, PhD**

Pediatrics



Matthew Halsey, MD

Physical Medicine & Rehabilitation



Hans Carlson, MD



Nels Carlson, MD

Podiatry



Trish Ann Marie Otto, DPM

Research / Basic Science



Jamie Fitzgerald, PhD



Brian Johnstone, PhD
Director, Orthopaedic Research



Lynn Marshall, ScD

Spine



Alex Ching, MD



Robert Hart, MD
Director, Spine Fellowship



Jayme Hiratzka, MD



Jung Yoo, MD
Chair

Sports Medicine (Primary Care)



Rachel Bengtzen, MD



James Chesnutt, MD
Associate Program Director



Melissa Novak, DO



Ryan Petering, MD
Co-Program Director,
Sports Medicine Fellowship



Charles Webb, DO
Director,
Sports Medicine Fellowship

Sports Medicine (Surgical)



Dennis Crawford, MD, PhD
Director, Sports Medicine



Andrea Herzka, MD

Trauma



Darin Friess, MD
Residency Program Director



Amer Mirza, MD

Orthopedic Oncology



Yee-Cheen Doung, MD

Assistant Residency
Program Director



James Hayden, MD, PhD

Upper Extremity



Adam Mirarchi, MD

Co-Director of OHSU
Hand Fellowship



Robert Orfaly, MD



Jesse McCarron, MD
Chief of VA Orthopaedics



Ted Vigeland, MD



Michael Aiona, MD
Chief of Staff, Program Director



Jeremy Bauer, MD



Charles d'Amato, MD
Director, Spinal Deformity



**Ivan J. Krajbich, MD,
FRCS(C)**



Ellen Raney, MD



Dennis Roy, MD
Director, Education



Michael Sussman, MD



Doug Beaman, MD
Foot and Ankle Specialist



Britton Frome, MD
Hand/Upper Extremity Specialist



Richard Gellman, MD
Orthopaedic Traumatologist
Foot and Ankle Specialist



Steve Madey, MD
Hand/Upper Extremity



Corey Vande Zandschulp, MD
Orthopaedic Traumatologist

Directory 2013–2014

Orthopedic + Fracture Specialists



Brett Andres, MD



McPherson Beall III, MD



J. Brad Butler, MD



James Davitt, MD



Alec Denes Jr, MD



Paul Duwelius, MD



Joyce Jenkins, DPM



Edwin Kayser, MD



Jason Kurian, MD



Edward Lairson, MD



Hans Moller III, MD



Rosalyn Montgomery, MD



Linda Okereke, MD



Rolf Sohlberg, MD



Venessa Stas, MD



Robert Tennant, MD



Stephen Renwick, MD



Ronald Turker, MD

Sports Medicine, Primary Care



Sean Robinson, MD



Christopher Nelson, MD

Spine



Satoshi Kawaguchi, MD

Hand



Laura Bonneau, MD

PGY-5 Class

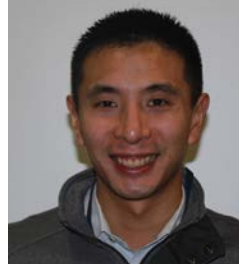


Zach Domont, MD

Hometown: Chicago, IL

Medical School: Northwestern University, The
Feinberg School of Medicine

Fellowship Plans: Sports Medicine –
University of Pennsylvania; Philadelphia, PA



Kevin Ko, MD

Hometown: Lancaster, PA

Medical School: University of Virginia School of
Medicine

Fellowship Plans: Shoulder and Elbow –
Thomas Jefferson University; Philadelphia, PA



Trevor McIver, MD

Hometown: Washington, DC

Medical School: Georgetown University School of
Medicine

Fellowship Plans: Spine – Spine Institute of Arizona;
Scottsdale, AZ



Richard Myers, MD

Hometown: Philadelphia, PA

Medical School: Brown Medical School

Fellowship Plans: Trauma – R. Adams Cowley Shock
Trauma Center; Baltimore, MD



Brent Roster, MD

Hometown: Klamath Falls, OR

Medical School: SUNY Upstate Medical University at Syracuse

Fellowship Plans: Foot and Ankle – UC Davis Medical Center;
Sacramento, CA

PGY-4 Class



Alex DeHaan, MD

Hometown: Portland, OR

Medical School: Boston University School of Medicine

Fellowship Plans: Adult Reconstruction



Dustin Larson, MD

Hometown: Port Angeles, WA

Medical School: Oregon Health & Science University

Fellowship Plans: Hand



Troy Miles, MD

Hometown: Chico, CA

Medical School: Albert Einstein College of
Medicine of Yeshiva University

Fellowship Plans: Adult Reconstruction



Vivek Natarajan, MD

Hometown: Marlboro, NJ

Medical School: Emory University School of Medicine

Fellowship Plans: Pediatrics



John Seddon, MD

Hometown: Eugene, OR

Medical School: Saint Louis University School of Medicine

Fellowship Plans: Foot and Ankle

1) Tim Schneider, MD, Melbourne Orthopaedic Group, Melbourne, Australia

2) Douglas Beaman, MD, Summit Orthopaedics, Portland, OR

PGY-3 Class



Jake Adams, MD

Hometown: Elkridge, UT

Medical School: University of Utah School of Medicine

Fellowship Plans: Adult Reconstruction



Kirsten Jansen, MD

Hometown: Florissant, MO

Medical School: University of Missouri - Kansas City School of Medicine

Fellowship Plans: Adult Reconstruction



Tom Kowalik, MD

Hometown: Seattle, WA

Medical School: Dartmouth Medical School

Fellowship Plans: Undecided



Jared Mahylis, MD

Hometown: Gillette, WY

Medical School: University of North Dakota Medicine and Health Sciences

Fellowship Plans: Shoulder & Elbow



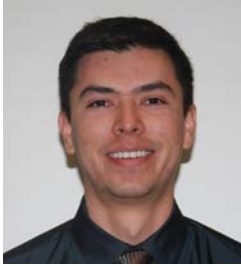
Farbod Rastegar, MD

Hometown: San Diego, CA

Medical School: University of Chicago, The Pritzker School of Medicine

Fellowship Plans: Undecided

PGY-2 Class



John Cox, MD

Hometown: Gallup, NM

Medical School: University of New Mexico
School of Medicine

Fellowship Plans: Undecided



Ryland Kagan, MD

Hometown: Portland, OR

Medical School: Albany Medical College

Fellowship Plans: Undecided



Joseph Langston, MD

Hometown: Dallas, TX

Medical School: Texas Tech University Health Science
Center

Fellowship Plans: Undecided

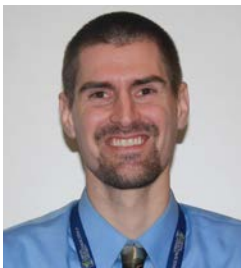


Michael Rose, MD

Hometown: Mansfield, TX

Medical School: Duke University
School of Medicine

Fellowship Plans: Undecided



Ryan Wallenberg, MD

Hometown: Medford, OR

Medical School: Creighton University
School of Medicine

Fellowship Plans: Undecided

PGY-1 Class

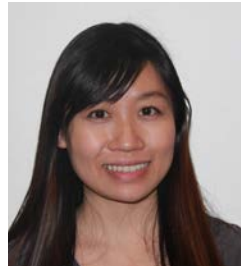


Hannah Aultman, MD

Hometown: Portland, OR

Medical School: Tufts University
School of Medicine

Fellowship Plans: Undecided



Karlee Lau, MD

Hometown: Plano, TX

Medical School: University of Texas
Southwestern School of Medicine

Fellowship Plans: Undecided



Dayton Opel, MD

Hometown: Sheboygan, WI

Medical School: University of Wisconsin
School of Medicine

Fellowship Plans: Undecided



Derek Smith, MD

Hometown: Topana, CA

Medical School: Columbia University
School of Medicine

Fellowship Plans: Undecided



Benjamin Winston, MD

Hometown: Denver, CO

Medical School: University of Colorado
School of Medicine

Fellowship Plans: Undecided

Orthopedic Surgery Residents



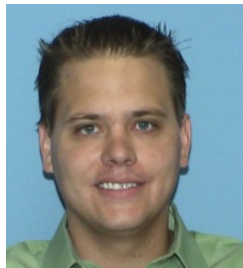
Seth Criner, DO
PGY-4



Brian Hodges, DO
PGY-4



Jason Malone, DO
PGY-3



Blake Obrock, DO
PGY-3



Kelli Spencer, DO
PGY-3



Ryan Callahan, DO
PGY-2



Craig Gillis, DO
PGY-2



Andrew Nelson, DO
PGY-2



Doug Blaty, DO
PGY-1



Jun Kim, DO
PGY-1



Stefan Yakel, DO
PGY-1



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Orthopaedic Surgery in the Peruvian Amazon

By Dustin L. Larson, MD

In late November 2013, I had the unique opportunity and privilege to participate in an orthopaedic outreach project to Pucallpa, Peru. Pucallpa is a low-lying port city in the Peruvian Amazon along Brazil's western border. A growing population of more than 200,000 people lives in Pucallpa. The residents eke out an existence as loggers, farmers, fishermen or vehicle drivers. Many of them live in slums of plywood and corrugated metal along the banks of the Ucayali River, a major Amazon River tributary.

Their shantytowns routinely arise and wash away with the natural ebb and flow of the river as it fluctuates 30 feet or more in a matter of days during the rainy season.

Orthopaedic trauma in Pucallpa is a prototypical example of an epidemic in the developing world that Dr. Lewis Zirkle describes as a disease conferred by emerging prosperity¹. The microeconomic expansion of jobs and personal income is far outpacing the macroeconomic development of public infrastructure such as health care, roads or transportation and workplace safety measures. In the confluence of these suboptimal circumstances are numerous individuals exposed



Ucayali River

1 Zirkle, LG. Injuries in Developing Countries—How Can We Help?: The Role of Orthopaedic Surgeons. *Clin Orthop Relat Res*. 2008 October; 466(10): 2443–2450.

Common family mode of transportation



to significant risk for orthopaedic trauma. In spite of several well-trained, diligent and tirelessly working surgeons in Pucallpa, the health care system is inadequately equipped to treat the number of patients and complexity of some of the problems they present with. During the slow process of improving education and the development of public infrastructure to help reduce the risk of orthopaedic trauma, there remains a necessity for timely and effective treatment of orthopaedic injuries and conditions.

With an appreciation for that need and as an expression of sincere personal faith, Dr. Peter A. Cole, MD (Professor, Orthopaedic Trauma, University of Minnesota), and his family founded a medical and surgical ministry in the Peruvian Amazon in 2004, *Scalpel at the Cross* (www.scalpelatthecross.org). He relates that this was the result of a series of providential events beginning in his childhood growing up in Venezuela and a developing relationship with a mission aviation family in the 1980s who had a presence in the Pucallpa region since 1966. For years, Dr. Cole invested in developing relationships within the local health system by joining surgeons and staff on hospital rounds and

(continued)

in clinic and providing teaching and education in various forums. The product of those relationships and collaboration was an understanding of the unique needs of the population and health system and ultimately, close integration of his group with local providers. This permits them to support, rather than undermine, the local health infrastructure with education, technical expertise and materials to address the unmet need of overflow capacity and complexity that is overburdening the system.

I first met Dr. Cole and learned about his project in Peru at the SIGN Fracture Care Annual Meeting in Richland, Washington. "Scalpel at the Cross" was presented there as a novel and model clinical outcomes program for short-term orthopaedic mission care in the developing world. Dr. Cole states, "I couldn't live with championing evidence-based medicine in my career, while going to the Amazon, operating, and then never knowing how my patient's did." The essential organizational structure involves a volunteer US-based medical and surgical team that travels to Pucallpa twice annually and a Peruvian General Surgeon who has full-time presence in Lima and Pucallpa and is compensated for post-operative care, follow-up, and data collection including x-rays and a standardized form. From 2007-2012, the group managed 127 operative patients (151 surgeries) and achieved an 81.9% follow-up rate over an average of 11.8 months and 3.7 follow-up encounters. In terms of post-operative clinical outcomes, the infection rate is 2%; wound healing rate 97.1%, fracture union rate 95.5%, and non-



Tibia-fibula non-union, untreated for 21 years.

union and mal-union rates are 3% and 1.5% respectively. It is important to remember that the majority of these patients have extremely limited means and highly unstable

living situations. These outcomes are remarkable if not only for the fact that follow-up requires the Peruvian surgeon to track down the patients in the jungle and shantytowns by moto-taxi, boat, and even float plane².



Jungle transportation

During the November 2013 trip, we worked at the facilities of Hospital Amazonico, a small government hospital in Pucallpa. The hospital donated clinic space and 2 operating rooms for our use. They also provided nursing support staff, anesthesia, basic equipment, and sterile processing for equipment and supplies brought by our group.

Clinic was organized to see between 80-100 patients per day. Patients with medical complaints and non-operative orthopaedic conditions were triaged for evaluation and treatment by a multi-disciplinary team that was able to provide joint injections, splinting, bracing, crutches, vitamins, over-the-counter medications, and help coordinating additional care. After clinic we compiled a list of patients with operative indications and triaged them according to the availability of time and resources to treat. These patients had problems as complex as any that we see at our Level I Trauma and tertiary centers in the States, including acute skeletal trauma, complex fracture non-union and mal-unions, osteomyelitis, gunshot wounds, chronic joint dislocations, advanced degenerative arthritis, symptomatic hardware, and brachial plexus palsy. Pre-operative

2 Torchia, MT. A Surgical Follow-up Program for Short Term Medical Mission Trips in a Developing Country. Presentation: from 2013 SIGN Annual Meeting, Richland, WA.



Clinic

planning occurred at the dinner table in Dr. Cole's jungle home. Central supply was a large storeroom also in Dr. Cole's compound filled with containers of donated and purchased equipment through which we carefully sorted to find every plate, screw, drill bit, guide, and suture that we would need for our planned cases.

Though reasonably equipped by any standard, the operating room was an austere environment. The patients were awake, having received



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excellent spinal anesthesia for lower extremity procedures, for example. There was one halogen operative light, no fluoroscopy, and limited access to many basic and routine instruments and equipment that we are accustomed to in the States. I had the great privilege and opportunity to learn from and work with a Peruvian surgeon, Dr. Cahua. Our work in the operating room was supported by a Canadian Missionary who provided assistance interpreting and a trauma equipment representative from Minnesota who coordinated all logistics of the operating room and personnel, and significantly improved the efficiency and productivity of the



OR 2 Hospital Amazonico, SIGN nail for femur nonunion

operative days. Routine team rounds occurred at the bedside each post-operative day. I have rarely observed patient fortitude and gratitude to that degree, especially in the midst of such suffering and poverty.

This was the richest educational and most personally rewarding experience in my medical career. The opportunities may be few in training or practice that truly consolidate your knowledge, technical capacity, and creativity in an environment like this where time and resources are so precious and limited. My heart for the underserved was deeply affected and my perspective on short-term orthopaedic work in the developing world was changed. It was my privilege to work with Dr. Cole

and his team.

Not a single day has gone by that I do not think about the patients I cared for in Peru. Thankfully, due to the organization of Scalpel at the Cross' follow-up program, I get to learn about



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their progress. This kind of educational opportunity was a significant complement to my training as an orthopaedic surgeon and should be promoted and supported during residency.



Sign Fracture Care International

By Joseph Langston, MD and Richard Gellman, MD

The Surgical Implant Generation Network (SIGN) is a nonprofit humanitarian organization that specializes in serving the international community with orthopaedic fracture care. Created in 1999 by Dr. Lewis Zirkle after 40 years of working in underserved international communities, SIGN has partnered with surgeons and hospitals in more than 50 countries with the goal of creating equality in fracture care on a global scale. SIGN surgeons have already treated more than 124,000 patients worldwide and their innovative approach continues to change the course of orthopaedic surgery.

SIGN independently designs and manufactures orthopaedic implants that meet demanding U.S. Food and Drug Administration (FDA) standards with the unique intention for use in facilities without available power equipment or intra-operative fluoroscopy. Implants and instruments are either donated or provided on a cost-reimbursement basis as the majority of patients are from impoverished, underserved populations. The SIGN intramedullary nail system is the flagship product they produce which utilizes a surgeon's tactile senses for both implantation and interlocking screw placement. The implant is slightly different than traditional cannulated nails used in the United States; however, the quality of the implant is no different than those with which we use to treat patients in our own hospitals.

While creating a stable supply of surgical implants is undoubtedly an integral component of SIGN, orthopaedic education is the foundation of their vision and the concept that makes the organization truly sustainable. Many of the international surgeons treating orthopaedic injuries in developing nations do not have traditional orthopaedic training but are true general surgeons who perform operations ranging from obstetrics to

general surgery to orthopaedics. By training these international surgeons in SIGN techniques while abroad, SIGN empowers the local orthopaedic programs to support their own communities and spread their knowledge to others in need.

Each September, SIGN holds their international orthopaedic conference on trauma and wound care in Richmond, WA, where surgeons from around the world gather to discuss management of complex adult and pediatric orthopaedic problems using SIGN instrumentation and implants. Thanks to the generosity of Drs. Richard Gellman and Lewis Zirkle, OHSU residents have had the privilege to attend the annual SIGN conference at no cost. The goals of the conference are not only to provide a global network of orthopaedic surgeons, but also to stimulate international collaboration and discussion on complex fracture care.

For more information on SIGN and their philanthropy, please visit signfracturecare.org.

Reflections on the Oregon Association of Orthopaedic Surgeons

By Robert Orfaly, MD, Past President of the OAOS

Having recently completed my two-year term as president of the Oregon Association of Orthopaedic Surgeons (OAOS), I reflect on both the accomplishments of this organization and the needs of our profession in the coming years. For those unfamiliar with the OAOS, the association serves to provide education and also represent the orthopaedic surgeons in the state in a variety of advocacy venues.

The past two years have had very well attended annual meetings with excellent faculty of national and international prominence. I am particularly proud of the association's move to facilitate the attendance of Oregon orthopaedic residents. This provides a high value educational venue for them and introduces those who represent the future of our profession to the many benefits of becoming active within their state societies. We have further expanded educational offerings planned for 2014, including a spring course in ICD-10. No matter what one's perception of the new system of diagnostic coding, it is fair to say that its introduction later this year will fundamentally change many of the business practices we rely on. Hopefully, all readers are already aware that this major change is only a few short months away and have started to prepare and educate themselves accordingly. This course will be an opportunity to reinforce this in a specialty-specific manner.

All of us who are concerned for peace and triumph of reason and justice must be keenly aware how small an influence reason and honest good will exert upon events in the political field.

– Albert Einstein

Politicians are people who, when they see light at the end of the tunnel, go out and buy some more tunnel.

– John Quinton

The other main function of the OAOS is to advocate on behalf of the orthopaedic profession and our patients. It is not hard to understand why some would place little emphasis on such activity. Many of us would simply like to use the skills we learned in medical school to take care of patients. However, each of us is just one part of a much bigger picture of keeping our population healthy. As a politician would see it, all of health care is also but one of an almost endless list of needs they must serve. In order to keep moving our profession forward, we must be ever vigilant of the tides of change not only in our specialty but in the world and assess how that will affect our ability to simply take care of our patients.

"There are three kinds of people: Those who make things happen, those who watch things happen, and those who ask, 'What happened?'"

– Casey Stengel

"Whether you think you can or think you can't--you are right."

– Henry Ford

I did not grow up with any preordained destiny to work in political advocacy. Until a few short years ago, I was as skeptical as anyone that physicians have any business talking about policy issues. However, working for an association like OAOS serves many critical purposes. It is also important to realize that not everyone needs to be a society president to have an impact. Joining forces brings us together as a profession to prioritize issues and present a united front. As an example of our team in action, Andrea Herzka, MD, was instrumental over the past two years in advocating for hip arthroscopy patients. Her

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efforts helped preserve access to this technology, which was at risk of being de-listed as a covered service by state-sponsored health insurance plans. The fact that two of our board members have been appointed to key committee positions on the Health Evidence Review Commission also helped make sure that our views were heard.

At the same time, our advocacy needs to include active engagement in discussions with other health providers. My advocacy for the OAOS has been very synergistic with my work for the Oregon Medical Association. As the current OMA vice president, I hope to maintain strength in the “house of medicine” by looking for common ground and shared interests that can improve all practices. By being active in a state society, we can also contribute to dialogue at the national level. Oregon has been at the forefront of health care reform and I have had the opportunity to speak at the AAOS about our experiences and compare solutions tried in other regions of the country.

I close by thanking all those I have worked with for their support over the past two years and encourage everyone to commit to doing one additional thing over the coming year to support the advocacy needs of our profession. This could be donating money to a PAC, writing an editorial on a health care issue, speaking to your local elected officials or simply joining the OAOS. As our Oregonian American Academy of Orthopaedic Surgeons president, Dr. John Tongue, has been known to say: “If you’re not at the table, you may be on the menu!”

Clinical Face-off:

New Technology: Safety, Effectiveness and Learning Curves

By Laura Matsen Ko, MD

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Introduction

The subspecialty of arthroplasty experiences the mixed blessing that is new technology: new imaging approaches, new bearing surfaces, new navigation systems, new implant designs and the list goes on. While these technologies may benefit patients, they almost always come with a substantial cost over existing approaches, and often hit the market with little or no documented clinical benefits. To the extent that healthcare costs are rising unsustainably, we need to reckon with important practical and ethical considerations.

To try to bring some clarity to this difficult topic, for this month's Clinical Faceoff I have invited two experts on the subject, Dr. Paul Duwelius and Dr. Javad Parvizi to discuss their thoughts about integrating new technology into practice. Dr. Duwelius is a well-respected private-practice surgeon in Portland, Oregon, with extensive experience in adult reconstruction and orthopedic traumatology. During his years in practice, he has developed contoured plates for periarticular fractures as well as a modular total hip system. Dr. Parvizi is a recognized thought leader on many related subjects, including joint reconstruction outcomes research, prosthetic joint infections, and hip conditions affecting the young patients. I am most grateful to them for their participation here.

Dr. Matsen Ko: *Let us begin by considering how we decide when the incremental value of a new technology (defined as increase in benefit over the increase in cost) merits widespread adoption. Please talk a bit about some examples where you have made this calculation.*

Dr. Duwelius: As surgeons we want to develop better methods of helping patients and this

often leads us to consider new implant designs. I have had the opportunity to participate in the development of anatomically contoured plates as well as a modular hip stem with a major goal of improved recreation of the femoral head center. But the incremental value, as you define it, is a challenge to measure.

Pre-contoured plates seem to make surgery easier in cases of difficult periarticular fractures, and they allow the choice of nonlocked, locking or lag screws, which can improve fracture fixation. Although it remains to be proven whether superior clinical outcomes justify the increased cost, I suspect it will.

By contrast, with respect to the modular stem, there are problems with corrosion, fretting and mechanical problems with the trunion^{1,10}. In addition, the improvement in head center placement was not tremendous, and might not have even been clinically important⁵. In this case, the increased benefit did not justify the incremental expense, especially if the cost of the revisions were to be considered. As this instance shows, demonstrating increased value is challenging because some of the costs (i.e. those associated with complications and revisions) are not evident until months or years later^{3, 9, 10, 11, 12}.

We need to recognize the balance that exists between the desire for an early general release of a new product and the need to make sure that the product adds substantial benefit to the patient in the long run – an assessment that requires long term follow-up in well-conducted clinical trials before general release.

Dr. Parvizi: An innovation or a novel technology needs to bring with it a promise of improving outcome. Medicine has witnessed numerous

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innovations that have transformed delivery of care. Introduction of a new technology must be developed around the solution to a specific problem. I agree with Dr. Duwelius in that striking the right balance in timing the introduction of particular technology to the general orthopedic community is a difficult one.

In my opinion, prior to introduction, any innovation or new technology needs to demonstrate its intended benefits in both the preclinical and clinical setting. There are numerous technologies that have been introduced on the platform of addressing a particular issue but lacked concrete data to demonstrate their benefit in addressing the issue or introduced a new problem with disastrous consequences. As suggested by Dr. Duwelius, the introduction of metal on metal bearing surfaces, modular femoral stems for primary hip arthroplasty, and the two-incision technique for total hip arthroplasty (THA) are such examples.

Dr. Matsen Ko: *Your last example, Dr. Parvizi, leads nicely into my next question. We know that the effectiveness and the safety of a technology are related to the surgeon's experience in using it. What is the surgeon's obligation to disclose to the patient where (s)he is on the learning curve for the new technology? It seems relevant to a patient's decision whether (s)he is the first patient to have a particular procedure or the hundredth. Is it?*

Dr. Duwelius: We are obligated to disclose all relevant risks to our patients, and for sure there are many – even without considering the increased risks inherent to new technology. These universal risks include everything from a delayed return to activities of daily living to more serious health risks such as corrosion, soft tissue destruction from wear, nerve or vessel injury, muscle damage, or periprosthetic fracture. On top of this is the added risk of the learning curve, that is, the incremental risk of applying a new technique or a new implant before one is entirely facile with the new tool. The learning curve applies to every surgeon who attempts a

new method. Even with extensive educational courses, dry labs, and cadaveric sessions, surgeons experience unique challenges when they try a new technique in the operating room.

We do not know how long it takes to get on top of a new technique – is it 10 cases or 50, and it probably depends to a large degree on other factors, such as the complexity of the new approach and the surgeon's experience with similar techniques – or do we get better with each case without limit (our 200th is safer and better than our 100th). In any event, we have all seen complications when surgeons try a new method (the vendor says try this new device, you'll like it!). And it surely is our duty to disclose our best estimate of this risk in our own hands.

On a personal note, when I adopted the two-incision technique for total hip arthroplasty, I experienced a steep learning curve. I had a few periprosthetic fractures and I was devastated. I also noted that the lateral femoral cutaneous nerve has a variable course and so is at risk; patients do not like having loss of sensation to their thighs. I then performed a study and compared the two-incision to the posterior approach to a total hip and found that there was no difference in the outcomes such as Harris Hip Scores, MOS SF-36 Physical Health and Physical Function scores, as well as similar improvement in WOMAC pain, stiffness, and physical function. The cost of the learning curve was not worth it⁴.

I now feel comfortable with the methods I'm using. As I move forward in my practice, prior to considering a new technique or a new implant, I would need to be convinced that it has the potential to be a whole lot better than my status quo. I would then be sure to disclose to my patients that, while I've done many thousand hip and knee replacements, I'm not sure of the benefit or the risks of this new method in my hands. Our patients need to know and hear the true risks from us as surgeons. We have to be the champions who dispel nebulous internet claims or blatant advertisements or marketing statements that have no merit at the very least and at most are false and misleading to our patients.

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Dr. Parvizi: I agree with Dr. Duwelius. Any novel surgical technique introduced will provide new challenges to the surgeon, even the most skilled. It is the duty of the surgeon embracing a new technique not only to disclose the issue of learning curve to their patients but also to take concrete steps to reduce the risk to the patients. This includes attending and performing cadaveric surgery, observing other surgeons who have overcome the learning curve, and learning from each case performed.

The issue of the learning curve not only applies to any new technique but also to any surgeon in the beginning of his or her career. Surgeons who have performed a particular procedure numerous times and have a high volume of practice are likely to have a lower complication rate and better results than those with less experience. The latter not only applies to surgery but to any other task that requires skill. As Malcolm Gladwell states in his book (*"Outliers"*), the transition from less experienced to refined may come at the 10,000 hours stage.

Dr. Matsen Ko: *We can all think of examples of technologies that were released without adequate study, and in some of those instances, patients paid a big price for the problems we discovered later. How has our specialty learned from these events, and how can we improve the process so that the risk of such 'surprises' is minimized?*

Dr. Parvizi: Medicine is a truly fluid scientific field. The flow is created by the efforts of clinicians and scientists whose mission is to enhance patient care. This mission has been accomplished in numerous areas; for example life expectancy in the United States has doubled in just over a century.

Advances in medicine have come from two main sources: Observation and innovation. Observations by Louis Pasteur, Ignaz Philipp Semmelweis, Alexander Fleming, and Joseph Lister lead to extraordinary discoveries and transformed medicine. The observations of Marshall Urist and the discovery of bone morphogenetic proteins are an orthopedic example. Innovation is the other

source of advancement in the field. The innovations in minimally invasive surgery, for example, have transformed the patient experience and outcome of patients undergoing cholecystectomy, abdominal aortic aneurysm, and heart valve surgery in the modern era of medicine. Orthopedic surgery also has benefitted from these innovations. Innovations in our specialty include the introduction of arthroscopic surgery, and advances in pain management. But advances can also expose patients to risk; mitigating that risk is critical.

The Food and Drug Administration in the US and similar organizations in other countries seek to do this. In my opinion, and based on the available data, the FDA has been for the most part successful in preventing harm to patients. The problem arises when the data presented to the FDA or to the orthopedic community on a particular innovation appear to be compelling based on laboratory or preclinical studies, or on the experience of innovator-surgeons, but the innovation does not deliver the same results in the general orthopedic community. Although one may be tempted to place the blame on the regulatory approval process, the fact is that any innovation is likely to bring with it a potential exposure to risks and this may never be totally avoidable.

Strategies to minimize these risks may involve introduction of a specific technology or innovation through a more systematic approach, where the innovation is made available to a select group of surgeons who will monitor the outcome in their patients very closely prior to introduction into the general community. Post-market surveillance of a particular technology that is being increasingly mandated by the FDA is another strategy that may limit the risks. Finally, there are many authorities among us who believe that registries will be able to limit this exposure by detecting early failures of a particular device.

Dr. Duwelius: Dr. Parvizi cites great examples of medical advances that have improved health. Orthopedic advancements must continue and I believe they will, as our field continues to attract the best minds in the field of medicine. A recent example

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of an important advance was Dr. Parvizi's study that proved Foley catheters for routine total joints were not indicated⁶. This randomized prospective study convincingly demonstrated the superiority of one approach over another. But this level of scientific rigor, unfortunately, is not the norm.

Total joint surgery has come a long way since Charnley's pioneering work. Yes, new technologies should be subjected to sound outcomes-research at a few centers before being brought to the larger orthopedic community. This would minimize the risk to the general population. Even brief reflection on the experience with metal on metal hips would emphasize this point. But importantly, some problems may not become evident until many years down the line, and so typical post-marketing surveillance probably is not enough for our specialty. Thus, total joint registries may be the best way to conduct surveillance on new technologies in the hands of multiple surgeons. I strongly support the formation of the American Total Joint Registry for this reason.

A disturbing trend in this country is the direct to consumer marketing claims being made by industry without scientific merit. Typically these are attempts to attract patients to demand new technologies before they have stood the test of time. Again, new innovations should have demonstrated increased value – greater benefit to the patient divided by the cost – before they are released for widespread use. Otherwise health care becomes more expensive without improving the quality of care of our patients.

Dr. Matsen Ko: *In that bundled payments may soon be upon us, how should new technologies be introduced and managed in a bundled payment reimbursement system, given that these technologies almost always come with increased costs of development, introduction, and unanticipated complications?*

Dr. Parvizi: Because innovation does indeed come at an added cost, and the time horizons of the benefits may be long while the costs of bundled payments will be evaluated over short term, this

issue promises to be a real challenge. One example that comes to mind is the introduction of 90-day episode of care bundling. It will be difficult for an ACO (Accountable Care Organization) to justify paying a premium for a bearing surface that may improve longevity of a hip arthroplasty, with the benefit of the technology not being recognized for decades, when all financial modeling will concentrate on short-term savings for that episode of care. We will be under pressure to demonstrate that the ACO, orthopedic community, and most importantly the patients who stand to benefit from the technology being introduced, that the premiums paid for the technology will eventually return dividends. In my opinion, moving into the future we will witness a real change in the manner in which technologies are introduced. Industry recognizes the challenging times ahead and will need to re-strategize their approach to the introduction of technologies. The medical community will share the challenges that lie ahead and it is possible that our patients may be deprived of benefits of innovations that come at added cost but fail to demonstrate short-term gains.

Dr. Duwelius: Bundled payments represent an attempt to change the way we deliver health care from fee for service model to an episode of care practice. I think we as surgeons can see this as either another outside influence or burden in our practice or as a tremendous opportunity to be part of the solution to our impending health care crisis. Between 2005 and 2030, the demand for primary knee arthroplasty in the United States is projected to grow by 673 percent, or 3.48 million procedures annually. In 2005, medical expenditures for the treatment of arthritis were \$353 billion, and they are expected to rise because of increases in the number of people with osteoarthritis, due in part to the aging of the U.S. population^{2,7,8}.

When we think about having to care for this volume of patients, and incorporating innovation (and its costs) into a bundled payment system, life gets complicated quickly. My feeling is that bundled payments will force the advocates of 'innovations' to demonstrate increased value before

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the bundled payment will be increased to cover its cost. An example might be the new highly cross-linked polyethylene with enhanced vitamin E. Is this product better? How does it justify a higher expense? How will we learn of the long-term benefit to the patient?

The principal accountable care provider (PAP) for the hip and knee replacement surgical episode is the orthopedic surgeon who controls the procedure. In our hospital we are looking at the value of targeting same-day or next-day discharge for healthy patients having hip and knee replacement. This requires consistent patient education, consistent messaging in Physical Therapy/ Occupational Therapy, advance discharge planning, day-of-surgery physical therapy, and rapid rehabilitation protocols. We hope this will reduce the cost of the care episode without reducing the benefit to the patient. Through these optimizations, we may improve value without depending on the creation of any new technology; rather it is the result of doing a better job with the current technology.

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Question and Answer Session with James Meeker, MD

Dr. Meeker is the newest member of the OHSU Orthopaedic Faculty. Prior to joining OHSU, he completed fellowships in both Foot & Ankle and Orthopaedic Trauma.

How have the first six months of your practice gone?

It is exciting to be at OHSU, and with this comes the challenge of building a new practice. I have enjoyed getting to know many new people throughout the hospital and department. It is a distinct pleasure to work in a teaching environment, and I feel privileged to work with residents.

How has the completion of a trauma fellowship affected your scope of practice?

Having a background in orthopaedic trauma lends perspective to my focus on foot and ankle surgery. The study of orthopaedic trauma concerns itself with optimizing alignment, stability and function while preserving joint motion. Being able to frame problems of the foot and ankle in this light helps offer meaningful solutions to those in need.

Considerable demands are placed across the foot, and this calls for mechanically sound stabilization constructs. Consequently, I find that having a background in managing fractures is particularly valuable; this is especially true for foot function since alignment and stability are major determinants of outcome.

What have been the greatest challenges of your practice thus far?

The challenges of beginning a new practice test a person's adaptability and resolve. Many aspects of being new to a practice can be difficult to anticipate and have little to do with a surgeon's technical capability. Remaining open to see patients at short notice and to embrace difficult cases is particularly important. Equally important is maintaining the resolve to set high personal standards: To identify practice habits that work well and to build upon them, and conversely to have the courage to acknowledge when efforts aren't working and then to take meaningful corrective measures.

What aspects of foot and ankle are you most interested in?

Leonardo DaVinci said, "The human foot is a masterpiece of engineering and a work of art." The foot has a structurally similar composition to the hand, but is asked to do something completely different. The hand permits dexterity and fine movements; meanwhile the foot absorbs, stores and releases energy as it provides forward propulsion. I believe that anything that can preserve or improve foot function is entirely worthwhile, and this often involves a wide variety of procedures including fracture care, ligamentous stabilization, joint realignment, arthrodesis and even replacement.

What are your goals for the foot and ankle service at OHSU?

My role at OHSU is to build a busy practice that serves the people of Oregon. An important byproduct of this is the opportunity to teach residents and to provide them with an understanding of how to manage foot and ankle disorders. Additionally, it is important for me to engage in scholarly investigation and in doing so contribute meaningfully to the understanding of foot and ankle disorders.

What are your favorite things about Portland or what attracted you to the Northwest?

Making a home in Portland has been wonderful. The people of the Pacific Northwest are energetic, hardworking and independent-minded. Personally, I have enjoyed seeing more of my brother and his family. It has also been wonderful to explore the city, and I look forward to seeing much more of the state.

Orthopaedics Has Changed

By Kenneth Singer, MD, Sports Medicine and Knee Surgery, Slocum Center for Orthopaedics and Sports Medicine, Eugene, OR



I was asked to write a few paragraphs about how orthopedic surgery as a profession has changed during my career. It would perhaps be instructive to have a starting point, so in order to convey

a feeling for some of the significant changes that have occurred in our specialty, here is a snapshot of what orthopaedics was like when I began.

I came to Eugene in 1972, directly out of my residency, to join the practice begun by Dr. Donald Slocum. I was the sixth orthopedist in that group, then one of the larger groups in the state. Forty years ago, all surgical patients were hospitalized. A meniscectomy was an open procedure with an average length of hospital stay of four days. The surgical fee was \$350 and the total hospital bill was under \$2,000. All grade 3 MCL ligament tears were repaired surgically, and most acute ACL tears were not; many thought then that the ACL was not an important ligament. All patients undergoing knee ligament surgery were kept in a cast for at least six weeks. Most tibial fractures were treated in plaster, and many femoral fractures hospitalized for two to six weeks in skeletal traction. Spine fusions were rarely done. There was only one surgeon in Oregon doing total hip replacements, as an FDA permit was required to use cement, and knee replacements, seldom done, were with a fixed hinged device. Hip and knee arthritis was treated with interposition arthroplasty or arthrodesis, and ankle fusions were not uncommon.

Ninety five percent of residents went immediately into practice without fellowship training, as the only ACGME-certified fellowship programs were in pediatrics and hand surgery.

The average orthopedic surgeon's practice was 50 percent trauma, and very few had subspecialties. It was not uncommon to have eight to ten patients in the hospital, and to make rounds twice a day. Physicians wore ties and all nurses wore caps and white nursing dresses.

Sports medicine was in its infancy, and mostly disregarded by university residency programs. The early team physicians were orthopedic surgeons, and we took care of all injuries, including concussions. University athletic departments would often have difficulty finding interested physicians to cover their athletic contests, as few were interested in sports medicine or the hours required. When arthroscopy first appeared it was viewed initially by most with either suspicion or disdain. ("The arthroscope is the instrument of the devil!" according to one well-respected orthopedic department chief in 1978.) It was several years before video was available, so the joint was viewed much as if one were looking through a telescope.

Dynamic changes were occurring, and an example of that rapidity is that five years after I completed my residency, less than 50 percent of my surgical cases were those I had learned how to do in residency; by eight years, less than 20 percent.

Quite a difference in the timespan of one career.

Hand and Upper Extremity

By Adam J. Mirarchi, MD

The hand and upper extremity division continues to do great work in seeing patients and treating all aspects of upper extremity conditions. We are engaged in a billboard marketing campaign to present our names and faces to the general public and let them know about our options and locations. Our west-side and downtown clinic and surgical facilities allow us to see and care for the needs of our patients wherever they live.

We are doing more research than ever with the successful implementation of our biomechanics lab. The microsurgery training lab is going full steam; over two years of residents have taken the course. It is an enjoyable and highly educational experience for both me and the residents as they progress through their training.

Our patient reported outcomes database with iPad implementation is working well and we are expanding its use to other subspecialties within orthopedics. This will allow the Department of Orthopaedics & Rehabilitation to collect valuable data across practitioners in a consistent and reliable fashion. Our hand fellowship continues to attract top-tier applicants from across the country. Recent graduates have taken jobs nearby in the Pacific Northwest, but also in academic and Level 1 facilities in California and Colorado.

We are doing well and staying busy!

St. Vincents Medical Center and Orthopedic + Fracture Specialists

By Jason Kurian, MD

As with most professions, we as orthopedic surgeons spend a significant number of years “training” so that we may eventually become capable and competent to perform the tasks, both physical and cerebral, demanded of us by our patients and peers. Throughout that long process – a process we now realize never really ends – we all come across mentors that collectively mold us into the surgeons and physicians we will ultimately become. We can all recall one, if not several, influential individuals at each step of our journey who have made a significant impact on our understanding of not only the practice of orthopedics, but on our understanding of how to succeed as individuals.

As a group of surgeons comprised almost entirely of sub-specialty, fellowship-trained physicians in fields including total joint reconstruction, trauma, foot and ankle, sports medicine, hand, wrist and elbow and pediatric orthopedics, we at St. Vincent’s and Orthopedic + Fracture Specialists have been the benefactors of knowledge imparted upon us by some of the greatest minds in orthopedics. We all owe a tremendous debt of gratitude to those who came before us and taught us so much. We realize that there is no better way to return the gift of knowledge than to pass it on. It was with this in mind that we were honored to take up the task of introducing the orthopedic residents at OHSU to the unique challenges and opportunities presented to the orthopedic surgeon in private practice.

A funny thing happened, though, on the road to molding young minds. We began learning as much, if not more, from having the residents around than they may have been learning from us. Literally from the day our first resident arrived in the clinic, discussions regarding the options for the treatment of our patient’s injuries not only multiplied, but the

spirit of those discussions became more vibrant and open, and more importantly, more about education. Suddenly the daily quest for knowledge that was so pervasive and exciting during residency was back. It was no longer taboo to admit you didn’t have all the answers, and that our careers need to be a process of lifelong learning.

So, while the initial intent of the rotation was to help “fill the gaps” in the residents’ education, the end result, I hope, will continue to be the fostering of an educational environment for the residents and the faculty that makes the St. Vincent rotation a staple of orthopedic resident education at OHSU for years to come.

Does recombinant human Bone Morphogenetic Protein-2 (rhBMP-2) use in Adult Spinal Deformity (ASD) increase complications and are complications associated with location of rhBMP-2 use?: a prospective, multicenter study of 279 consecutive patients.

Bess S; Line BG; Lafarge V; Schwab F; Shaffrey CI; Hart RA; Boachie-Adjei O; Akbarnia BA; Ames CP; Burton DC; Deverin V; Fu KM; Gupta M; Hostin R; Kebaish K; Klineberg E; Mundis G; O'Brien M; Shelokov A; Smith JS. *Spine* (Phila Pa 1976)2014 Feb 1;39(3):233-42.

STUDY DESIGN

Multi-center, prospective analysis of consecutive ASD patients.

OBJECTIVE

Evaluate complications associated with rhBMP-2 use in ASD.

SUMMARY OF BACKGROUND DATA

Off-label rhBMP-2 use is common, however under-reporting of rhBMP-2 associated complications has been recently scrutinized.

METHODS

ASD patients consecutively enrolled into a prospective, multicenter database, were evaluated for type and timing of acute perioperative complications. Inclusion criteria: age ≥ 18 years, ASD, spinal arthrodesis >4 levels, and ≥ 3 months follow-up. Patients divided into those receiving rhBMP-2 (BMP) or no rhBMP-2 (NOBMP). BMP divided into location of use: posterior (PBMP), interbody (IBMP), and interbody + posterior spine (I+PBMP). Correlations between acute perioperative complications and rhBMP-2 use including total dose, dose/level and location of use were evaluated. Results: 279 patients (mean age 57 years, mean spinal levels fused 12.0, mean follow-up 28.8 months) met inclusion criteria. BMP (n = 172; average posterior dose = 2.5 mg/level, average interbody dose = 5 mg/level) had similar age, smoking history, previous spine surgery, total spinal levels fused, estimated blood loss, and duration of hospital stay as NOBMP (n = 107; $p > 0.05$). BMP had greater Charlson Comorbidity

Index (1.9 vs. 1.2), greater scoliosis (43° vs. 38°), longer operative time (488.2 vs. 414.6 minutes), more osteotomies/patient (4.0 vs. 1.6) and greater percentage of anteroposterior fusion (APSF; 20.9% vs. 8.4%) than NOBMP, respectively ($p < 0.05$). BMP had more total complications/patient (1.4 vs. 0.6) and more minor complications/patient (0.9 vs. 0.2) than NOBMP, respectively ($p < 0.05$). NOBMP had more complications requiring surgery/patient than BMP (0.3 vs. 0.2; $p < 0.05$). Major, neurological, wound, and infection complications were similar for NOBMP, BMP, PBMP, IBMP, and I+PBMP ($p > 0.05$). Multivariate analysis demonstrated small to non-existent correlations between rhBMP-2 use and complications.

CONCLUSIONS

RhBMP-2 use and location of rhBMP-2 use in ASD surgery, at reported doses, does not increase acute major, neurological or wound complications. Research is needed for higher rhBMP-2 dosing and long-term follow-up.

Reoperation rates and impact on outcome in a large, prospective, multicenter, adult spinal deformity database: clinical article. Scheer JK; Tang JA; Smith JS; Klineberg E; Hart RA; Mundis GM Jr; Burton DC; Hostin R; O'Brien MF; Bess S; Kebaish KM; Deviren V; Lafage V; Schwab F; Shaffrey CI; Ames CP. *Neurosurg Spine* 2013 Oct;19(4):464-70.

INTRODUCTION

Complications and reoperation for surgery to correct adult spinal deformity are not infrequent, and many studies have analyzed the rates and factors that influence the likelihood of reoperation. However, there is a need for more comprehensive analyses of reoperation in adult spinal deformity surgery from a global standpoint, particularly focusing on the 1st year following operation and considering radiographic parameters and the effects of reoperation on health-related quality of life (HRQOL). This study attempts to determine the prevalence of reoperation following surgery for adult spinal deformity, assess the indications for these reoperations, evaluate for a relation between specific radiographic parameters and the need for reoperation, and determine the potential impact of reoperation on HRQOL measures.

METHODS

A retrospective review was conducted of a prospective, multicenter, adult spinal deformity database collected through the International Spine Study Group. Data collected included age, body mass index, sex, date of surgery, information regarding complications, reoperation dates, length of stay, and operation time. The radiographic parameters assessed were total number of levels instrumented, total number of interbody fusions, C-7 sagittal vertical axis, uppermost instrumented vertebra (UIV) location, and presence of 3-column osteotomies. The HRQOL assessment included Oswestry Disability Index (ODI), 36-Item Short Form Health Survey physical component and mental component summary, and SRS-22 scores. Smoking history, Charlson Comorbidity Index scores, and American Society of Anesthesiologists Physical Status classification grades were also collected and assessed for correlation with risk of early

reoperation. Various statistical tests were performed for evaluation of specific factors listed above, and the level of significance was set at $p < 0.05$.

RESULTS

Fifty-nine (17%) of a total of 352 patients required reoperation. Forty-four (12.5%) of the reoperations occurred within 1 year after the initial surgery, including 17 reoperations (5%) within 30 days. Two hundred sixty-eight patients had a minimum of 1 year of follow-up. Fifty-three (20%) of these patients had a 3-column osteotomy, and 10 (19%) of these 53 required reoperation within 1 year of the initial procedure. However, 3-column osteotomy was not predictive of reoperation within 1 year, $p = 0.5476$. There were no significant differences between groups with regard to the distribution of UIV, and UIV did not have a significant effect on reoperation rates. Patients needing reoperation within 1 year had worse ODI and SRS-22 scores measured at 1-year follow-up than patients not requiring operation.

CONCLUSIONS

Analysis of data from a large multicenter adult spinal deformity database shows an overall 17% reoperation rate, with a 19% reoperation rate for patients treated with 3-column osteotomy and a 16% reoperation rate for patients not treated with 3-column osteotomy. The most common indications for reoperation included instrumentation complications and radiographic failure. Reoperation significantly affected HRQOL outcomes at 1-year follow-up. The need for reoperation may be minimized by carefully considering spinal alignment, termination of fixation, and type of surgical procedure (presence of osteotomy). Precautions should be taken to avoid malposition or instrumentation (rod) failure.

A standardized nomenclature for cervical spine soft-tissue release and osteotomy for deformity correction: clinical article.

Ames CP; Smith JS; Scheer JK; Shaffrey CI; Lafage V; Deviren V; Moal B; Protopsaltis T; Mummaneni PV; Mundis GM Jr; Hostin R; Klineberg E; Burton DC; Hart R; Bess S; Schwab FJ. *J Neurosurg Spine* 2013 Sep;19(3):269-78.

OBJECTIVE

Cervical spine osteotomies are powerful techniques to correct rigid cervical spine deformity. Many variations exist, however, and there is no current standardized system with which to describe and classify cervical osteotomies. This complicates the ability to compare outcomes across procedures and studies. The authors' objective was to establish a universal nomenclature for cervical spine osteotomies to provide a common language among spine surgeons.

METHODS

A proposed nomenclature with 7 anatomical grades of increasing extent of bone/soft tissue resection and destabilization was designed. The highest grade of resection is termed the major osteotomy, and an approach modifier is used to denote the surgical approach(es), including anterior (A), posterior (P), anterior-posterior (AP), posterior-anterior (PA), anterior-posterior-anterior (APA), and posterior-anterior-posterior (PAP). For cases in which multiple grades of osteotomies were performed, the highest grade is termed the major osteotomy, and lower-grade osteotomies are termed minor osteotomies. The nomenclature was evaluated by 11 reviewers through 25 different radiographic clinical cases. The review was performed twice, separated by a minimum 1-week interval. Reliability was assessed using Fleiss kappa coefficients.

RESULTS

The average intrarater reliability was classified as "almost perfect agreement" for the major osteotomy (0.89 [range 0.60-1.00]) and approach modifier (0.99 [0.95-1.00]); it was classified as "moderate agreement" for the minor osteotomy (0.73 [range

0.41-1.00]). The average interrater reliability for the 2 readings was the following: major osteotomy, 0.87 ("almost perfect agreement"); approach modifier, 0.99 ("almost perfect agreement"); and minor osteotomy, 0.55 ("moderate agreement"). Analysis of only major osteotomy plus approach modifier yielded a classification that was "almost perfect" with an average intrarater reliability of 0.90 (0.63-1.00) and an interrater reliability of 0.88 and 0.86 for the two reviews.

CONCLUSIONS

The proposed cervical spine osteotomy nomenclature provides the surgeon with a simple, standard description of the various cervical osteotomies. The reliability analysis demonstrated that this system is consistent and directly applicable. Future work will evaluate the relationship between this system and health-related quality of life metrics.

Identification of decision criteria for revision surgery among patients with proximal junctional failure after surgical treatment of spinal deformity. Hart R; McCarthy I; O'Brien M; Bess S; Line B; Adjei OB; Burton D; Gupta M; Ames C; Deviren V; Kebaish K; Shaffrey C; Wood K; Hostin R. *Spine* (Phila Pa 1976) 2013 Sep 1;38(19):E1223-7.

STUDY DESIGN

Multicenter, retrospective, consecutive case series.

OBJECTIVE

This study aims to identify demographic and radiographical characteristics that influence the decision to perform revision surgery among patients with proximal junctional failure (PJF). Summary of Background Data: Revision rates after PJF remain relatively high, yet the decision criteria for performing revision surgical procedures are not uniform and vary by surgeon. A better understanding of the factors that impact the decision to perform revision surgery is important in order to improve efficiency of surgical treatment of adult spinal deformity.

METHODS

A cohort of 57 patients with PJF was identified retrospectively from 1218 consecutive patients with adult spinal deformity. PJF was identified on the basis of 10° postoperative increase in kyphosis between upper instrumented vertebra (UIV) and UIV +2, along with 1 or more of the following: fracture of the vertebral body of UIV or UIV +1, posterior osseoligamentous disruption, or pullout of instrumentation at the UIV. Univariate statistical analysis was performed using t tests and Fisher exact tests. Multivariate analysis was performed using logistic regression.

RESULTS

Twenty-seven (47.4%) patients underwent revision surgery within 6 months of the index operation. Regression results revealed that patients with combined posterior/anterior approaches at index were significantly more likely to undergo revision ($P = 0.001$) as were patients with more

extreme proximal junctional kyphosis angulation ($P = 0.034$). Patients sustaining trauma were also significantly more likely to undergo revision ($P = 0.019$). Variables approaching but not reaching significance as predictors of revision included female sex ($P = 0.066$) and higher sagittal vertical axis (SVA) ($P = 0.090$).

CONCLUSIONS

The decision to perform revision surgery is complicated and varies by surgeon. Factors that seem to influence this decision include traumatic etiology of PJF, severity of proximal junctional kyphosis angulation, higher SVA, and female sex. Factors that were expected to influence revision but had no statistical effect included soft tissue versus bony mode of failure, age, levels fused, and upper thoracic versus thoracolumbar proximal junction.

Change in classification grade by the SRS-Schwab adult spinal deformity classification predicts impact on health-related quality of life measures: prospective analysis of operative and nonoperative treatment. Smith JS; Klineberg E; Schwab F; Shaffrey CI; Moal B; Ames CP; Hostin R; Fu KM; Burton D; Akbarnia B; Gupta M; Hart R; Bess S; Lafage V. *Spine* (Phila Pa 1976) 2013 Sep 1;38(19):1663-71.

STUDY DESIGN

Multicenter, prospective, consecutive series.

OBJECTIVE

To evaluate responsiveness of the Scoliosis Research Society (SRS)-Schwab adult spinal deformity (ASD) classification to changes in health-related quality of life (HRQOL) after treatment for ASD.

SUMMARY OF BACKGROUND DATA

Ideally, a classification system should describe and be responsive to changes in a disease state. We hypothesized that the SRS-Schwab classification is responsive to changes in HRQOL measures after treatment for ASD.

METHODS

A multicenter, prospective, consecutive series from the International Spine Study Group. Inclusion criteria: ASD, age more than 18, operative or nonoperative treatment, baseline and 1-year radiographs, and HRQOL measures (Oswestry Disability Index [ODI], SRS-22, Short Form [SF]-36). The SRS-Schwab classification includes a curve descriptor and 3 sagittal spinopelvic modifiers (sagittal vertical axis [SVA], pelvic tilt, pelvic incidence/lumbar lordosis [PI-LL] mismatch). Changes in modifiers at 1 year were assessed for impact on HRQOL from pretreatment values based on minimal clinically important differences.

RESULTS

Three hundred forty-one patients met criteria (mean age = 54; 85% females; 177 operative and 164 nonoperative). Change in pelvic tilt modifier at 1-year follow-up was associated with changes in ODI and SRS-22 (total and appearance scores) ($P \leq 0.034$). Change in SVA modifier at 1 year was associated

with changes in ODI, SF-36 physical component score, and SRS-22 (total, activity, and appearance scores) ($P \leq 0.037$). Change in PI-LL modifier at 1 year was associated with changes in SF-36 physical component score and SRS-22 (total, activity, and appearance scores) ($P \leq 0.03$). Patients with improvement of pelvic tilt, SVA, or PI-LL modifiers were significantly more likely to achieve minimal clinically important difference for ODI, SF-36 physical component score (SVA and PI-LL only), SRS activity, and SRS pain (PI-LL only).

CONCLUSIONS

The SRS-Schwab classification provides a validated system to evaluate ASD, and the classification components correlate with HRQOL measures. This study demonstrates that the classification modifiers are responsive to changes in disease state and reflect significant changes in patient-reported outcomes.

The SRS-Schwab adult spinal deformity classification: assessment and clinical correlations based on a prospective operative and nonoperative cohort. Terran J; Schwab F; Shaffrey CI; Smith JS; Devos P; Ames CP; Fu KM; Burton D; Hostin R; Klineberg E; Gupta M; Deviren V; Mundis G; Hart R; Bess S; Lafage V. *Neurosurgery* 2013 Oct;73(4):559-68.

BACKGROUND

The SRS-Schwab classification of adult spinal deformity (ASD) is a validated system that provides a common language for the complex pathology of ASD. Classification reliability has been reported; however, correlation with treatment has not been assessed.

OBJECTIVE

To assess the clinical relevance of the SRS-Schwab classification based on correlations with health-related quality of life (HRQOL) measures and the decision to pursue operative vs nonoperative treatment.

METHODS

Prospective analysis of consecutive ASD patients (18 years of age and older) collected through a multicenter group. The SRS-Schwab classification includes a curve type descriptor and 3 sagittal spinopelvic modifiers (sagittal vertical axis, pelvic tilt, pelvic incidence/lumbar lordosis mismatch). Differences in demographics, HRQOL (Oswestry Disability Index, SRS-22, Short Form-36), and classification between operative and nonoperative patients were evaluated.

RESULTS

A total of 527 patients (mean age, 52.9 years; range, 18.4-85.1 years) met inclusion criteria. Significant differences in HRQOL were identified based on SRS-Schwab curve type, with thoracolumbar and primary sagittal deformities associated with greater disability and poorer health status than thoracic or double curve deformities. Operative patients had significantly poorer grades for each of the sagittal spinopelvic modifiers, and progressively higher grades were associated with significantly

poorer HRQOL ($P < .05$). Patients with worse sagittal spinopelvic modifier grades were significantly more likely to require major osteotomies, iliac fixation, and decompression ($P \leq .009$).

CONCLUSIONS

The SRS-Schwab classification provides a validated language to describe and categorize ASD. This study demonstrates that the SRS-Schwab classification reflects severity of disease state based on multiple measures of HRQOL and significantly correlates with the important decision of whether to pursue operative or nonoperative treatment.

Radiographical spinopelvic parameters and disability in the setting of adult spinal deformity: a prospective multicenter analysis. Schwab FJ; Blondel B; Bess S; Hostin R; Shaffrey CI; Smith JS; Boachie-Adjei O; Burton DC; Akbarnia BA; Mundis GM; Ames CP; Kebaish K; Hart RA; Farcy JP; Lafage V. *Spine* (Phila Pa 1976) 2013 Jun 1;38(13):E803-12.

STUDY DESIGN

Prospective multicenter study evaluating operative (OP) versus nonoperative (NONOP) treatment for adult spinal deformity (ASD).

Objective: Evaluate correlations between spinopelvic parameters and health-related quality of life (HRQOL) scores in patients with ASD.

Summary of Background Data: Sagittal spinal deformity is commonly defined by an increased sagittal vertical axis (SVA); however, SVA alone may underestimate the severity of the deformity. Spinopelvic parameters provide a more complete assessment of the sagittal plane but only limited data are available that correlate spinopelvic parameters with disability.

METHODS

Baseline demographic, radiographical, and HRQOL data were obtained for all patients enrolled in a multicenter consecutive database. Inclusion criteria were: age more than 18 years and radiographical diagnosis of ASD. Radiographical evaluation was conducted on the frontal and lateral planes and HRQOL questionnaires (Oswestry Disability Index [ODI], Scoliosis Research Society-22r and Short Form [SF]-12) were completed. Radiographical parameters demonstrating highest correlation with HRQOL values were evaluated to determine thresholds predictive of ODI more than 40.

RESULTS

Four hundred ninety-two consecutive patients with ASD (mean age, 51.9 yr) were enrolled. Patients from the OP group (n = 178) were older (55 vs. 50.1 yr, $P < 0.05$), had greater SVA (5.5 vs. 1.7 cm, $P < 0.05$), greater pelvic tilt (PT; 22° vs. 11°, $P < 0.05$), and greater pelvic incidence/lumbar lordosis PI/LL mismatch (PI-LL; 12.2 vs. 4.3; $P < 0.05$) than

NONOP group (n = 314). OP group demonstrated greater disability on all HRQOL measures compared with NONOP group (ODI = 41.4 vs. 23.9, $P < 0.05$; Scoliosis Research Society score total = 2.9 vs. 3.5, $P < 0.05$). Pearson analysis demonstrated that among all parameters, PT, SVA, and PI-LL correlated most strongly with disability for both OP and NONOP groups ($P < 0.001$). Linear regression models demonstrated threshold radiographical spinopelvic parameters for ODI more than 40 to be: PT 22° or more ($r = 0.38$), SVA 47 mm or more ($r = 0.47$), PI - LL 11° or more ($r = 0.45$).

CONCLUSIONS

ASD is a disabling condition. Prospective analysis of consecutively enrolled patients with ASD demonstrated that PT and PI-LL combined with SVA can predict patient disability and provide a guide for patient assessment for appropriate therapeutic decision making. Threshold values for severe disability (ODI > 40) included: PT 22° or more, SVA 47 mm or more, and PI - LL 11° or more.

Reduction of airway complications with fluid management protocol in patients undergoing cervical decompression and fusion across the cervicothoracic junction. Hart RA; Dupaix JP; Rusa R; Kane MS; Volpi JD. *Spine (Phila Pa 1976)* 2013 Aug 15;38(18):E1135-40.

STUDY DESIGN

Retrospective comparative cohort analysis.

OBJECTIVE

To evaluate the effect of an intraoperative and intensive care unit protocol on incidence of airway complications for patients undergoing combined anterior-posterior cervical decompression and fusion crossing the cervicothoracic junction (CTAPF).

SUMMARY OF BACKGROUND DATA

Airway compromise remains an important potential complication for patients undergoing CTAPF. Volume of intravenous fluid replacement perioperatively has been correlated with risk of airway complications in this patient population.

METHODS

A retrospective cohort study was performed comparing airway complications (postoperative airway edema requiring reintubation and/or prolonged need for intubation) in patients undergoing CTAPF prior to and after introduction of a standardized protocol. The protocol required limitation of crystalloid fluid resuscitation intraoperatively, with maintenance of blood pressure using vasopressors. Comparisons between the 2 cohorts included operative time, intraoperative blood loss, volume of IV fluid replacement, and incidence of airway complications and dysphagia.

RESULTS

Among patients operated prior to establishment of the protocol, 45% (9/20) experienced airway edema requiring extended intubation or reintubation. This rate was reduced to zero among 8 patients operated after the adoption of the protocol (P

$= 0.029$). Intraoperative IV fluid volumes were reduced from 6190 mL to 4802 mL after institution of the protocol ($P = 0.016$). EBL and total surgical time did not differ between the 2 cohorts (1024 mL vs. 869 mL, $P = 0.443$; and 6.76 hr vs. 7.18 hr, $P = 0.460$). Incidence of dysphagia was not significantly different between the 2 cohorts.

CONCLUSIONS

Establishment of a fluid and airway management protocol for patients undergoing CTAPF reduced the incidence of prolonged intubation or reintubation. Given the potentially life-threatening impact of loss of airway patency, intraoperative restriction of IV fluid while maintaining adequate blood pressure may be helpful in increasing the safety of surgical intervention in this complex patient population.

Lumbar Stiffness Disability Index: pilot testing of consistency, reliability, and validity.

Hart RA; Gundle KR, Pro SL; Marshall LM. *Spine J* 2013 Feb;13(2):157-61.

STUDY DESIGN

Cross-sectional pilot study

BACKGROUND CONTEXT

The primary goal of surgical arthrodesis is to eliminate the motion of spinal segments in an effort to alleviate pain, improve deformity, and reduce disability. However, decreased spinal mobility may impair performance of activities of daily living (ADLs) due to the resulting stiffness or the lack of mobility of the fused segment. Current clinical outcome instruments do not seek information regarding the impact of spinal stiffness on functional ability. Therefore, a patient-reported outcome questionnaire measuring the impact of lumbar stiffness on functional abilities was devised and assessed for internal consistency, retest repeatability, and external validity.

OBJECTIVE

To develop and validate an outcome instrument to measure the collateral effect of stiffness after lumbar fusion on functional ability.

Patient Sample: Consecutive cohort of lumbar spine fusion patients from a single surgeon's practice.

Outcome Measures: Lumbar Stiffness Disability Index (LSDI) and Cobb angle measurements from digital radiographs.

METHODS

We developed and evaluated a 10-item questionnaire, referred to as the LSDI, which seeks information on the impact of spinal stiffness on ADLs after lumbar spinal arthrodesis. The questionnaire yields a score from 0 to 100, with higher scores indicating greater difficulty resulting from lumbar spinal stiffness in performing 10 different ADLs. The study sample comprised 32 lumbar arthrodesis patients at a minimum of 1

year postoperatively. All patients completed the questionnaire twice via telephone interviews conducted 4 weeks apart. Internal consistency was assessed using the Cronbach alpha, and retest reliability was measured using an intraclass correlation coefficient (ICC). External validity of the questionnaire was evaluated by correlating the scores with lumbar range of motion (LROM) as measured from the angular change between the inferior end plate of T12 and the superior end plate of S1 on standardized digital flexion and extension lateral radiographs.

RESULTS

The study sample included 22 women (69%) and 10 men (31%) with an average age of 63 years. The questionnaire demonstrated high internal consistency (Cronbach alpha=0.89). Retest reliability was also high (ICC=0.87). External validity was demonstrated by a statistically significant inverse relationship between LROM and LSDI scores ($r=-0.71$; $p<.001$).

CONCLUSIONS

This pilot study demonstrates that the LSDI questionnaire is a reliable and valid instrument for assessing functional limitations due to lumbar stiffness among spinal arthrodesis patients. The questionnaire is proposed for use in prospective evaluation of lumbar stiffness impacts after arthrodesis.

Lumbar stiffness as a collateral outcome of spinal arthrodesis: a preliminary clinical study. Hart RA; Pro SL; Gundle KR; Marshall LM. *Spine J* 2013 Feb;13(2):150-6.

STUDY DESIGN

Cross-sectional study.

BACKGROUND CONTEXT

Although spinal arthrodesis can improve function by correcting deformity and reducing pain, it also by intention reduces spinal mobility. Increased spinal stiffness may have the potential to impair function and ability to perform activities of daily living (ADLs), independent of pain levels.

OBJECTIVE

To evaluate the ability to discriminate spinal stiffness from pain in ADLs after lumbar spine arthrodesis using two outcome instruments.

Study Design: Cross-sectional study.

Patient Sample: Consecutive cohort of lumbar spine fusion patients from a single surgeon's practice.

Outcome Measures: Oswestry Disability Index (ODI), Lumbar Stiffness Disability Index (LSDI), radiographs.

METHODS

We developed the LSDI questionnaire to assess the impact of spinal stiffness on ability to perform different ADLs. The LSDI and ODI were administered to 93 patients who underwent lumbar arthrodesis extending from one to five or more motion segments at a minimum follow-up of 1 year. Comparisons of mean LSDI and ODI scores between patients were made using generalized linear regression. A Pearson correlation coefficient (r) was computed to determine the relationship between the LSDI and ODI scores.

RESULTS

The sample included 61 women and 32 men, with mean age at surgery of 55.0 years (standard deviation [SD], 13.1) and mean time since surgery

of 3.4 years (SD, 1.8). The mean LSDI score was 29.6 (SD, 19.2), and the mean ODI score was 39.7 (SD, 19.1). Comparing one-level and five-level arthrodesis, the LSDI scores were significantly different ($p=.05$), whereas the ODI scores were not significantly different ($p=.36$). Comparisons between other levels of arthrodesis did not show significant differences for either the LSDI or the ODI. Within the entire study group, LSDI and ODI scores were positively correlated ($r=0.69$, $p<.001$).

CONCLUSIONS

Difficulty in performing certain ADLs increases for patients with multilevel lumbar fusions as opposed to one-level arthrodesis. The LSDI distinguishes functional difficulties with ADLs accruing because of spinal stiffness, which appear to be independent of the functional limitations resulting from low back pain as measured by ODI.

Post-traumatic stress symptoms after elective lumbar arthrodesis are associated with reduced clinical benefit. Hart R; Perry E; Hiratzka S; Kane M; Deisseroth K. *Spine* (Phila Pa 1976) 2013 Aug 1;38(17):1508-15.

STUDY DESIGN

Prospective cohort study.

OBJECTIVE

To assess the impact of postoperative post-traumatic stress disorder (PTSD) symptoms on clinical outcomes after lumbar arthrodesis. Summary of Background Data: Postoperative PTSD symptoms occur among many patients who underwent elective lumbar fusion. Although adverse impact of preoperative depression and psychiatric distress has been described, no reports have assessed the impact of postoperative PTSD symptoms on clinical outcomes after lumbar arthrodesis.

METHODS

Seventy-three patients undergoing elective lumbar spinal arthrodesis completed the PTSD Checklist-Civilian Version (PCL-C) at 3, 6, 9, and 12 months postoperatively. Short-Form 36 and the Oswestry Disability Index (ODI) were completed preoperatively and at 1 year postoperatively. Impact of postoperative PTSD symptoms, preoperative psychiatric diagnoses, and mental composite scores on clinical outcome scores and likelihood of reaching minimal clinically important difference for ODI and physical composite score (PCS) was evaluated.

RESULTS

PTSD symptoms were reported in 22% of the cohort, with significantly reduced surgical benefit as measured by final ($P < 0.0001$ and $P = 0.003$) and total change ($P = 0.013$ and $P = 0.032$) in ODI and PCS scores, respectively. Likelihood of reaching minimal clinically important difference for both ODI and PCS was also reduced for patients reporting PTSD symptoms ($P = 0.009$ and

$P = 0.001$, respectively). A preoperative psychiatric diagnosis correlated only with final ODI score ($P = 0.008$). Preoperative mental composite scores were significantly correlated with final ODI and PCS scores, as well as final change from preoperative and likelihood of reaching minimal clinically important difference for PCS, but not for ODI scores.

CONCLUSIONS

Postoperative psychological distress was strongly correlated with reduced clinical benefit among patients who underwent elective lumbar arthrodesis, and seemed to be a stronger predictor of reduced clinical benefit than either major psychiatric diagnosis or preoperative mental composite scores. Efforts to reduce postoperative psychological distress may offer an opportunity to enhance patient reported clinical outcomes from elective spine surgery.

Posterior global malalignment after osteotomy for sagittal plane deformity: it happens

and here is why. Blondel B; Schwab F; Bess S; Ames C; Mummaneni PV; Hart R; Smith JS;

Shaffrey CI; Burton D; Boachie-Adjei O; Lafage V. *Spine* (Phila Pa 1976) 2013 Apr 1;38(7):E394-401.

STUDY DESIGN

Multicenter, retrospective analysis of 183 consecutive patients undergoing lumbar osteotomy.

OBJECTIVE

To evaluate cause and impact of posterior postoperative alignment.

SUMMARY OF BACKGROUND DATA

Sagittal malalignment in the setting of adult spinal deformity (ASD) has shown significant correlation with pain and disability. Surgical treatment often entails correction of deformity by pedicle subtraction osteotomies (PSO). Key radiographical spinopelvic objectives to reach improvement in clinical outcomes have been previously reported. Although anterior alignment is a cause of poor outcomes, the impact and cause of posterior spinal alignment by PSO has not been reported.

METHODS

The patient inclusion criteria were age, more than 18 years, with a diagnosis of sagittal plane deformity (C7 plumbline offset >5 cm, a pelvic tilt >20°, or a lumbar lordosis to pelvic incidence mismatch of $\geq 10^\circ$) requiring a surgical procedure involving a lumbar posterior osteotomy and a long fusion. Patients were divided into 3 groups based on postoperative sagittal vertical axis (SVA): neutral alignment ($0 < \text{SVA} < 50$ mm), anterior alignment ($\text{SVA} > 50$ mm), and posterior alignment ($\text{SVA} < 0$ mm). All patients underwent pre- and postoperative full-length sagittal spine radiography. Differences between groups were evaluated using ANOVA and χ^2 analysis.

RESULTS

Seventy-six patients were postoperatively classified

in the anterior group: 59 in the neutral group and 48 in the posterior group. These groups were comparable preoperatively in terms of surgical status (revision vs. primary surgery) and regional alignment (lumbar lordosis and thoracic kyphosis). The patients with posterior alignment were younger and had a significantly lower pelvic incidence (53° vs. 62°), preoperative pelvic tilt (30 vs. 36°), SVA (94 vs. 185 mm) and cervical lordosis (16° vs. 25°) than patients in the anterior alignment group. No significant differences were found in terms surgical procedure. Patients in the posterior alignment group demonstrated a significantly greater change in SVA and pelvic tilt correction ($P < 0.05$) but with a lower gain in thoracic kyphosis (5 vs. 12°) and reduction of cervical lordosis (4° vs. 22°).

CONCLUSIONS

A significantly lower pelvic incidence and lack of restoration of thoracic kyphosis may lead to sagittal overcorrection with a posterior alignment. Although the clinical significance of posterior malalignment is still unclear, this study showed a compensatory loss of cervical lordosis in these patients. Particular attention must be paid to preoperative planning before sagittal realignment procedures. Further study will be necessary to evaluate long-term clinical outcomes of these patients.

The Spine Patient Outcomes Research Trial (SPORT): a continuing return on investment: commentary on an article by Jeffrey A. Rihn, MD, et al.: “The influence of obesity on the outcome of treatment of lumbar disc herniation. Analysis of the Spine Patient Outcomes Research Trial (SPORT)”. Hart RA. *J Bone Joint Surg Am* 2013 Jan 2;95(1):E5.

Jeffrey Rihn, MD, and his coauthors are to be congratulated on their excellent publication titled “The Influence of Obesity on the Outcome of Treatment of Lumbar Disc Herniation. Analysis of the Spine Patient Outcomes Research Trial (SPORT).” This study represents a retrospective analysis of prospectively collected data from the Spine Patient Outcomes Research Trial (SPORT), focusing on patients with radiculopathy due to lumbar disc herniation and specifically on the influence of obesity on complication rates, reoperation rates and patient-reported outcomes.

Although the original SPORT study was a randomized clinical trial, for this study, the authors have utilized an as-treated analysis, eliminating the design benefit of randomization. In addition, this is a retrospective analysis of data that were not initially collected with the intent to evaluate the effect of obesity on outcomes. Finally, several potential confounding variables, including sex, education and income levels, compensation claims, and medical comorbidities, differed at baseline between obese patients and nonobese patients.

Recognizing these limitations, the current study nonetheless represents the highest-level medical evidence yet presented, analyzing the effect of obesity in patients managed operatively and nonoperatively for lumbar disc herniation. Importantly, although obese patients did not share the same clinical benefit that nonobese patients did from either operative or nonoperative interventions, both groups showed significant improvements in clinical outcomes with operative treatment compared with nonoperative treatment for this condition. Other important conclusions

were that complication and reoperation rates were similar between the two groups, despite the finding that operative times and length of hospitalization were slightly longer for obese patients.

Perhaps the most important aspect of this publication is its demonstration of the remarkable value returned on the financial investment and work effort in the SPORT study. A brief PubMed search reveals that the total number of peer-reviewed publications derived from the SPORT database is approaching forty. Although the primary clinical reports of patient outcomes with lumbar disc herniation, lumbar spinal stenosis, and degenerative spondylolisthesis in themselves represent a landmark achievement, continuing subanalyses of the SPORT database have provided high-quality evidence, furthering our understanding of specific variables of importance in managing these patients. Indeed, the accomplishments of the SPORT investigators serve as a unique demonstration of the importance and impact of high-quality orthopaedic research. The current study represents the latest installment in this ongoing enterprise, and as such is a welcome addition to the orthopaedic literature.

Abdominal body composition measured by quantitative computed tomography and risk of non-spine fractures: the Osteoporotic Fractures in Men (MrOS) study. Sheu Y; Marshall LM; Holton KF; Caserotti P; Boudreau RM; Strotmeyer ES; Cawthon PM; Cauley JA. *Osteoporos Int* 2013;24:2231-41.

INTRODUCTION

The association of abdominal adiposity and muscle composition with incident fracture is unclear, especially in older men. Therefore, we examined the relationship of subcutaneous adipose tissue (SAT), visceral adipose tissue (VAT), abdominal intermuscular adipose tissue (IMAT) and muscle volume with incident non-spine fractures among 749 men aged 65 and older.

METHODS

A case-cohort study design was used with a total of 252 fracture cases and 497 non-cases. We measured volumes (cm³) of adipose and muscle tissues obtained from quantitative computed tomography scan at the L4-L5 intervertebral space. Three groups of muscle and IMAT were evaluated: total abdominal, psoas and paraspinal. Cox proportional hazards regression with a robust variance estimator was used to estimate the hazard ratio (HR) of non-spine fractures per standard deviation (SD) increase in the abdominal body composition measures.

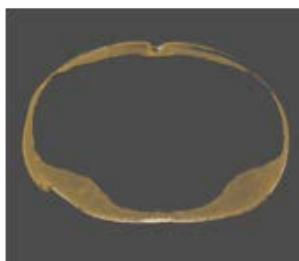
RESULTS

The mean age among men in the random subcohort was 74.2±6.1 years and the average follow-up time was 5.2±1.1 years. After adjusting for age, race, clinic site, percent body fat and femoral neck bone mineral density (BMD), no significant relationship was found between incident fractures and SAT or VAT. One SD increase in muscle volume at the psoas, but not paraspinal, was associated with 28% lower fracture risk (95% CI=0.55-0.95). When IMAT models were further adjusted for corresponding muscle volumes, only abdominal IMAT was significantly associated with fracture risk (HR=1.30, 95% CI=1.04-1.63).

CONCLUSIONS

Our findings suggest that lower total psoas muscle volume and higher IMAT of the total abdominal muscle contribute to higher fracture risk in older men independent of BMD. Among various adipose tissues and muscle groups, lower psoas muscle volume and higher fatty infiltration of abdominal muscle contribute to higher fracture risk independent of BMD.

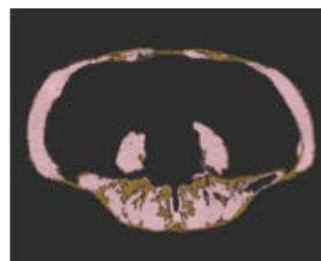
Figure 1. Illustration of abdominal body composition measures that result from image processing procedures established for the MrOS abdominal scans at OHSU.



A. Subcutaneous AT (SAT) volume (orange). The skin (white border) is defined, but not included in the estimation of the SAT volume



B. Visceral AT volume (orange), after internal organs have been removed during image processing.



C. Skeletal muscle volume (pink) and intermuscular AT (IMAT) volume (orange) defined. The average HU of the skeletal muscle, with and without IMAT included, can be calculated. Psoas and paraspinal muscle groups are further segmented for analysis.

Abbreviations: AT, adipose tissue; HU, Hounsfield Unit.

Instrumenting the balance error scoring system for use with patients reporting persistent balance problems after mild traumatic brain injury. King L; Horak F; Mancini M; Pierce D; Priest K; Chesnutt J; Sullivan P; Chapman J. *Archives of Physical Medicine and Rehabilitation* 2014 Feb;95(2):353-9.

OBJECTIVE

To determine whether alterations to the Balance Error Scoring System (BESS), such as modified conditions and/or instrumentation, would improve the ability to correctly classify traumatic brain injury (TBI) status in patients with mild TBI with persistent self-reported balance complaints.

DESIGN

Cross-sectional study.

SETTING

Outpatient clinic.

PARTICIPANTS

Subjects (n=13; age, 16.3±2y) with a recent history of concussion (mild TBI group) and demographically matched control subjects (n=13; age, 16.7±2y; control group).

MAIN OUTCOME MEASURES

Outcome measures included the BESS, modified BESS, instrumented BESS, and instrumented modified BESS. All subjects were tested on the

noninstrumented BESS and modified BESS and were scored by visual observation of instability in 6 and 3 stance conditions, respectively.

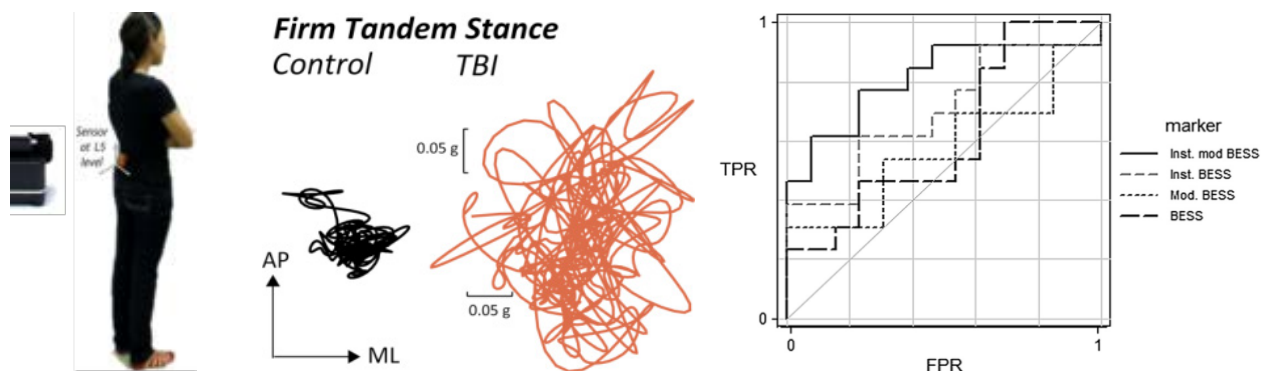
Instrumentation of these 2 tests used 1 inertial sensor with an accelerometer and gyroscope to quantify bidirectional body sway.

RESULTS

Scores from the BESS and the modified BESS tests were similar between groups. However, results from the instrumented measures using the inertial sensor were significantly different between groups. The instrumented modified BESS had superior diagnostic classification and the largest area under the curve when compared with the other balance measures.

CONCLUSIONS

A concussion may disrupt the sensory processing required for optimal postural control, which was measured by sway during quiet stance. These results suggest that the use of portable inertial sensors may be useful in the move toward more objective and sensitive measures of balance control postconcussion, but more work is needed to increase sensitivity.



Left: Inertial sensors were shown superior to BESS test and equal to Neurocom Balance Master testing (velocity, frequency, area of sway). The tracing in this picture is from one inertial sensor at the waist, yet you get complex information about sway that ordinarily you would need a force plate.

Right: ROC curves for the TPR and FPR for each balance test. Abbreviations: FPR, false positive rate; Inst., instrumented; Mod., modified; TPR, true positive rate.

The effectiveness of a web-based resource in improving post-concussion management in high schools. Glang A; Koester M; Chesnutt J; Gioia G; McAvoy K; Marshall S; Gau J. The home page of web-based resource *Brain 101: The Concussion Playbook*.

BACKGROUND

Because many sports concussions happen during school-sponsored sports events, most state concussion laws specifically hold schools accountable for training and effective post-concussion management practices. *Brain 101: The Concussion Playbook* is a web-based intervention that includes training in sports concussion for each member of the school community, presents guidelines on creating a Concussion Management Team, and includes strategies for supporting students in the classroom.

METHODS

The group randomized controlled trial examined the efficacy of *Brain 101* in managing sports concussion. Participating high schools (N=25) were randomly assigned to the *Brain 101* intervention or control. Fall athletes and their parents completed

online training, and *Brain 101* school administrators were directed to create concussion management policy and procedures.

RESULTS

Student athletes and parents at *Brain 101* schools significantly outperformed those at Control schools on sports concussion knowledge, knowledge application, and self-efficacy. Students who had concussions in *Brain 101* schools received more varied academic accommodations than students in Control schools.

CONCLUSIONS

Brain 101 can help schools create a comprehensive school-wide concussion management program. It requires minimal expenditures and offers engaging and effective education for teachers, coaches, parents, and students.



The biomechanical relevance of anterior rotator cuff cable tears in a cadaveric shoulder model. Mesiha MM; Derwin KA; Sibole SC; Erdemir A; McCarron JA. *J Bone Joint Surg Am.* 2013 Oct 16;95(20):1817-24.

BACKGROUND

Anterior tears of the supraspinatus tendon are more likely to be clinically relevant than posterior tears of the supraspinatus. We hypothesized that anterior tears of the supraspinatus tendon involving the rotator cuff cable insertion are associated with greater tear gapping, decreased tendon stiffness, and increased regional tendon strain under physiologic loading conditions compared with equivalently sized tears of the rotator cuff crescent.

METHODS

Twelve human cadaveric shoulders were randomized to undergo simulation of equivalently sized supraspinatus tears of either the anterior rotator cuff cable ($n = 6$) or the adjacent rotator cuff crescent ($n = 6$). For each specimen, the supraspinatus tendon was cyclically loaded from 10 N to 180 N, and a custom three-dimensional optical system was used to track markers on the surface of the tendon. Tear gap distance, stiffness, and regional strains of the supraspinatus tendon were calculated.

RESULTS

The tear gap distance of large cable tears (median gap distance, 5.2 mm) was significantly greater than that of large crescent tears (median gap distance, 1.3 mm) ($p = 0.002$), the stiffness of tendons with a small ($p = 0.002$) or large ($p = 0.002$) cable tear was significantly greater than that of tendons with equivalently sized crescent tears, and regional strains across the supraspinatus were significantly increased in magnitude and altered in distribution by tears involving the anterior insertion of the rotator cuff cable.

CONCLUSIONS

These findings support our hypothesis that the rotator cuff cable, which is in the most anterior 8 to 12 mm of the supraspinatus tendon immediately posterior to the bicipital groove, is the primary load-bearing structure within the supraspinatus for force transmission to the proximal part of the humerus. Conversely, in the presence of an intact rotator cuff cable, the rotator cuff crescent insertion is relatively stress-shielded and plays a significantly lesser role in supraspinatus force transmission.

CLINICAL RELEVANCE

Clinicians should consider early repair of rotator cuff cable tears, which may need surgical intervention to address their biomechanical pathology. In contrast, surgical treatment may be more safely delayed for rotator cuff crescent tears.

Post-operative complications following primary ACL reconstruction using allogenic and autogenic soft tissue grafts: increased relative morbidity risk is associated with increased graft diameter. Crawford DC; Hallvik SE; Petering RC; Quilici SM; Black LO; Lavigne SA; Lapidus J; Marshall LM. *The Knee* 2013 Dec;20(6):520-5.

BACKGROUND

The purpose of this study is to compare the risk of peri-operative complication events associated with allogenic and autogenic grafts during routine follow-up for six months after primary arthroscopic anterior cruciate ligament (ACL) reconstruction surgery.

METHODS

A retrospective cohort study identified patients that underwent ACL reconstruction via an arthroscopically assisted single tunnel technique. Fixation was primarily cortical suspension (endobutton) from the femora and bicortical fixation (Washer-loc) in the tibia. Patients were monitored for six months following surgery. Morbidity was defined as complications during this period requiring medical or surgical intervention. Risk of complications was compared according to tissue type and patient characteristics. The Cochran-Mantel-Haenszel method was applied to estimate risk ratios (RR) and confidence intervals (CI) as the measure of association between graft type and morbidity risk.

RESULTS

The cohort included 413 eligible patients. Sixty six percent received allograft tissue, while the remainder received autograft tissue. Morbidity risk was 7.0% among patients receiving allograft tissue and 2.8% among patients receiving autograft tissue. Allograft demonstrated elevated risk of complication versus autograft (RR=2.3 (95% CI: 0.9-7.2)), though the data are of borderline significance (p=0.11). Complications were associated with larger graft diameter in comparison to patients who experienced no complication (9.0+/-1.2 mm v. 8.4+/-1.0mm, p=0.005).

CONCLUSIONS

The relative morbidity risk was about two-fold greater among patients receiving allograft tissue. Regardless of tissue type, graft size was larger among patients who experienced a complication.

In vivo MRI of fresh stored osteochondral allograft transplantation with delayed gadolinium-enhanced MRI of cartilage: protocol considerations and recommendations.

Durkan MG; Szumowski J; Brown DS; Foss EW; Crawford DC. *Magn Reson Med* 2013

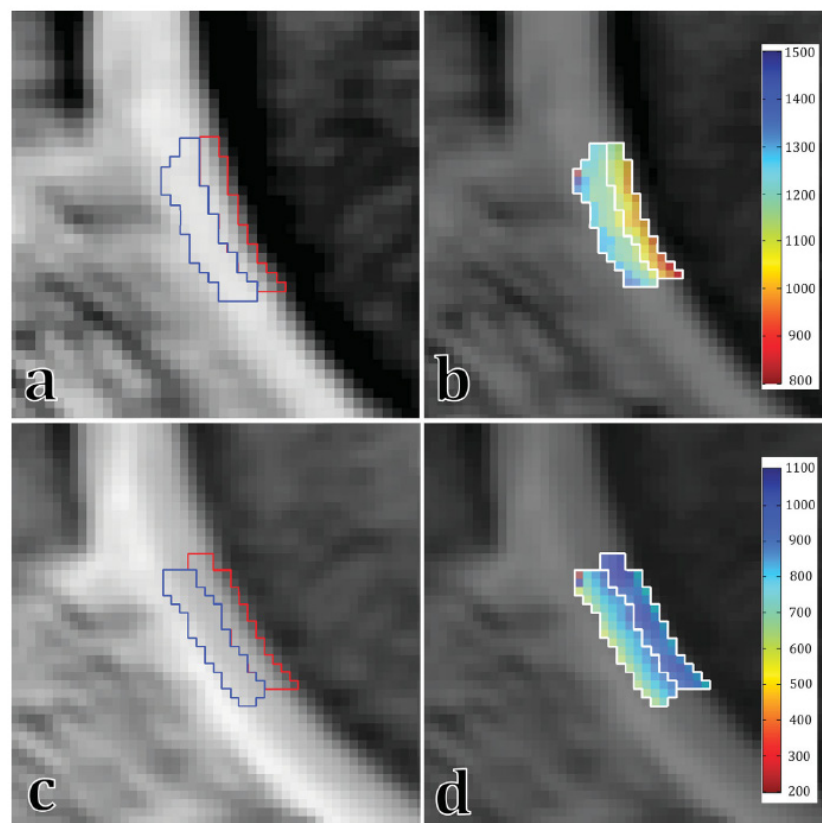
Jun;69(6):1745-53.

ABSTRACT

The protocol for delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) was adapted for the evaluation of transplanted osteochondral allograft cartilage. Eight patients with focal grade 4 cartilage defects of the femoral condyle were treated with single cylindrical osteochondral allografts. At 1 and 2 years, dGEMRIC image sequences were acquired and regions of interest (ROIs) were drawn in repair and native control cartilage. Mean T1 values of region of interest were used to calculate established dGEMRIC metrics. The correlation was measured between the $\Delta R1$ and R1 -Post metrics for repair and native cartilage. T1 times were measured in deep and

superficial zones of cartilage. A strong correlation was identified between full-thickness, deep, and superficial $\Delta R1$ and R1 -Post values for native cartilage and repair cartilage for all years (range: 0.893-1.0). The mean T1 times and $\Delta R1$ rate between deep and superficial regions of articular cartilage were statistically different for all regions of the distal femora analyzed at 1 year and 2 years after osteochondral allograft transplantation ($P < 0.05$). The dGEMRIC pre-Gadolinium scan is unnecessary when evaluating transplanted osteochondral allograft cartilage. The observation of stratified T1 and $\Delta R1$ values indicates a need to re-evaluate the methodology behind the placement of region of interest in dGEMRIC.

FIG. 1. Deep (red) and superficial (blue) ROIs were manually drawn over cartilage on the pre-Gadolinium (a) and post-Gadolinium (c) images using the T1 2200 ms image. T_1 times were color mapped and displayed on pre-Gadolinium (b) and post-Gadolinium (d) images. The color mapped T_1 values are displayed in milliseconds.



Prospective, multi-center, pilot study to evaluate symptom relief in patients with medial knee osteoarthritis (OA) treated with the KineSpring® knee implant for load reduction – The SOAR protocol. Farr J; Crawford D; Diduch D; Arendt E; Ma B; Li CS. *Journal of Long-Term Effects of Medical Implants* 2013;23(2–3):161–73.

ABSTRACT

The study described here is designed as a prospective, multicenter, open-label, single-arm pilot study. Eligible subjects with symptomatic osteoarthritis of the medial compartment of the knee will be enrolled in the study and will receive the KineSpring® Knee Implant System. The study population will consist of adult patients between 25 and 80 years of age that have been diagnosed with medial knee osteoarthritis and have failed to improve after at least 6 months of conservative medical treatment. A patient is considered to have a clinically important change in OA pain and function with a minimum improvement of 20% compared to baseline measures. We will collect data on the safety and effectiveness of the KineSpring in patients with primarily unicompartmental medial knee osteoarthritis through 24 months of postoperative follow-up. These data will provide insights on the overall clinical success and safety outcome of KineSpring System.

INTRODUCTION

Osteoarthritis (OA) is the most common joint disorder and one of the most frequent causes of pain and disability. In OA, articular cartilage and subchondral bone are gradually destroyed. As the bone surfaces become less well protected by cartilage, the patient experiences pain when weight bearing, including walking and standing. The main symptom of osteoarthritis is chronic pain, which causes loss of mobility and often stiffness. As OA progresses, the affected joints appear larger, are stiff and painful, and usually feel worse the more they are used and loaded throughout the day. With progression in OA, the cartilage loses its viscoelastic properties and its ability to absorb load; thus, repeated excess loading advances the rate of

damage to the knee, and a vicious cycle ensues. In an effort to reduce the pain from these activities, patients with OA are forced to exercise less, and this can dramatically impact their ability to perform daily activities and thus negatively affect their quality of life.

Osteoarthritis affects an estimated 15% of the world's population. Knee OA is the most predominant form, and approximately 90% of symptomatic patients present primarily with medial-compartment knee OA. The prevalence of OA will continue to rise with the increasing age and increasing lifespan of the population. This condition decreases functional independence and in some instances may impair the afflicted individual's ability to complete normal activities of daily living or to participate in age-appropriate recreational activities. Patients face progressive pain and disability for the remainder of their lives. In spite of the prevalence and the extensive study of the disease, no cure for OA has yet been identified.

There remains an absence of non-surgical modalities that clearly alter the natural history or prevent structural damage in OA of the knee. In short, OA is a process that is attempting to contain a mechanical problem in the joint. Thus, OA is defined as failed repair of damage that has been caused by excessive mechanical stresses or loading on joint tissues. Because the body's innate mechanisms for repairing the damaged tissues cannot be effective in the face of the underlying mechanical abnormality, they cannot solve the problem of OA; for example, remodeling of subchondral bone may reduce the excessive stress and contain the mechanical abnormality, but it may result in joint pain. OA has no common

pathophysiologic pathway, only a final common end stage. The inflammatory changes in OA are secondary and are caused by particulate and soluble breakdown products of cartilage and bone.

The aims of management of knee OA are (1) patient education about the disease and its management, (2) pain control, (3) improved function and decreased disability, and (4) altering the disease process and its consequences.

The management of OA should be individualized and consist of a combination of treatment options. In the absence of a cure, current conservative therapy primarily attempts to reduce pain and improve joint function by employing modalities targeted toward symptom relief that do not facilitate any improvement in joint structure. The recommended hierarchy of management consists of nonpharmacologic modalities initially, followed by drugs and then surgery. Several comprehensive guidelines have been developed that describe the management of knee OA, based on evidence from trials and expert consensus. Updated evidence-based, international consensus recommendations for the management of knee OA have been developed by the OARSI Treatment Guidelines Committee. These recommendations include the level of research evidence supporting them, the effect size for pain relief (95% CI), the extent of consensus (%), and the strength of recommendation (mean \pm SE) for each proposition.

CONCLUSIONS

This protocol describes the design of a multi-center prospective, single arm, pilot study that will collect data on the safety and effectiveness of the KineSpring in patients with primarily unicompartmental medial knee osteoarthritis through 24 months postoperative follow-up. These data will provide insights on the overall clinical success and safety outcome of KineSpring System.

Symptomatic bipartite patella: three subtypes, three representative cases. Werner S; Durkan M; Jones J; Quilici S; Crawford D. *J Knee Surg* 2013 Dec; 26 Suppl 1:S072-6.

ABSTRACT

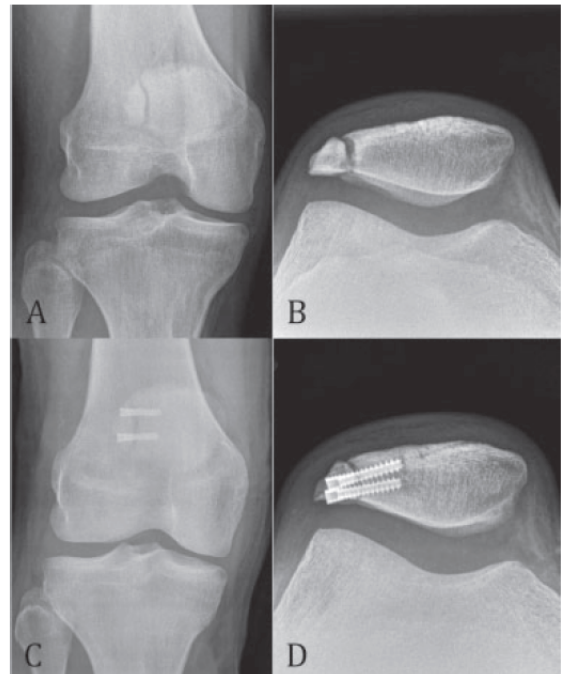
Bipartite patella can be classified into three unique subtypes; type I, II, and III. The following case series describes three representative cases of each subtype and a spectrum of location-specific treatment options for surgical care of the symptomatic bipartite patella.

INTRODUCTION

We present a case series applying operative treatment options for each representative type of bipartite patella. Although the bipartite patella is generally found to be an asymptomatic anatomic variant, occasionally any of the three subtypes may require surgical care. This small case series regards surgical treatment of each representative type of symptomatic bipartite patella.

CONCLUSIONS

Although uncommon, a bipartite patella can be symptomatic for a subset of individuals. After failure of nonsurgical management and exclusion of other etiologies of anterior knee pain, surgery should be considered. This article describes several options for surgical management of the bipartite patella and a representative case of each type, as classified by Saupe. Although open excision of the accessory fragment is most commonly performed, other procedures, including arthroscopic techniques or compression-type fixation may be effective. We recommend repair if the accessory fragment is thought to include significant articular cartilage or represent a stabilizing element to joint function. Although rarely required, surgical treatment of the recalcitrant symptomatic bipartite patella may require one of a spectrum of techniques.



Type II bipartite patella. Posteroanterior (A) and Merchant view (B) radiographs demonstrate a displaced lateral bipartite patella with sagittally oriented synchondrosis. Postoperative posteroanterior (C) and Merchant view (D) radiographs shows fixation with compression type variable pitch screws.

Conservative management of symptomatic knee osteoarthritis: a flawed strategy?

Crawford D; Miller L; Block J. *Orthopedic Reviews* 2013 Feb 22;5(1):5-10.

ABSTRACT

Conservative management of medial compartment knee osteoarthritis (OA) is a misleading term used to describe the application of medical, orthotic, and/or rehabilitative therapies exclusive of surgical interventions. The implication of this nomenclature is that these therapies offer satisfactory symptom relief, alter disease progression, and have limited side effects. Unfortunately, conservative therapeutic options possesses few, if any, characteristics of an ideal treatment, namely one that significantly alleviates pain, improves knee function, and reduces medial compartmental loading without adverse side effects. As uncompensated mechanical loading is a primary culprit in the development and progression of knee OA, we propose that the therapeutic perspective of conservative treatment should shift from pharmacological treatments, which have no influence on joint loading, minimal potential to alter joint function, substantial associated risks, and significant financial costs, towards minimally invasive load absorbing therapeutic interventions. A safe and effective minimally invasive medical device specifically engineered for symptomatic relief of medial knee OA by limiting joint contact forces has the potential to reduce the clinical and economic knee OA burden. This review characterizes the current standard of care recommendations for conservative management of medial compartment knee OA with respect to treatment efficacy, risk profile, and economic burden.

Reconstruction of a bony Bankart lesion: best fit based on radius of curvature.

DeHaan A; Munch J; Durkan M; Yoo J; Crawford D. *The American Journal of Sports Medicine* 2013;41(5):1140-45.

INTRODUCTION

The inferior coracoid process has traditionally been considered to be the gold standard for glenoid augmentation after anteroinferior bone loss. Other autograft sites, and more recently, osteochondral allograft sites, have been described as potential donor sources.

PURPOSE

Potential autograft and osteochondral allograft sites were compared to identify the graft source that would provide the best fit for glenoid augmentation.

METHODS

Mose circles, a geometric tool found on a standard goniometer, were used to make radius of curvature measurements of 10 anatomic locations in 17 cadaveric specimens. The bony surface of the glenoid, measured from superior to inferior (G-SI) and from anterior to posterior (G-AP), were used as the standard for comparison. Autograft sites were the inferior coracoid, lateral coracoid, and inner table of the iliac crest. Potential osteochondral allograft sites were the radial head, scaphoid fossa of the distal radius (S-DR), lunate fossa of the distal radius (L-DR), medial tibial plateau, and lateral distal tibia. An acceptable match for autograft sites was based on a paired analysis and defined as a radius of curvature within 5mm of the G-SI or the G-AP of the same cadaveric specimen. Allograft sites were evaluated using an unpaired analysis in which an ideal fit was defined as a radius of curvature of 25 to 30 mm, based on the interquartile range of the G-SI and G-AP.

RESULTS

The median (interquartile range) radii of curvature for the G-SI and G-AP were 30mm (range, 25-

30mm) and 25mm (range, 25-25mm), respectively. The inferior coracoid was within 5mm of the G-SI 59% of the time and G-AP 94% of the time; no measurements from the lateral coracoid or iliac crest were within range of the glenoid radius of curvature. Analysis of the allograft sites demonstrated an acceptable fit for 94% of the distal tibia, 68% of the medial tibial plateau, 12% of the S-DR, and 0% of the L-DR and the radial head specimens.

CONCLUSIONS

An autograft of the inferior coracoid or an osteochondral allograft of the lateral distal tibia provided the best match to re-establish the native radius of curvature of the glenoid. To best recreate the native glenohumeral anatomy, surgeons should consider the use of an autograft of the inferior coracoid or an osteochondral allograft of the lateral distal tibia for the reconstruction of osseous glenoid defects.

Salvage hip arthroplasty after failed fixation of proximal femur fractures. DeHaan A; Groat T; Priddy M; Ellis T; Duwelius P; Friess D; Mirza A. *Journal of Arthroplasty* 2013;28:855-9.

ABSTRACT

We reviewed 46 patients who underwent salvage hip arthroplasty (SHA) for revision of failed cannulated screws (CS), sliding hip screws (SHS), or intramedullary nails (IMN). The primary objective was to determine differences in operative difficulty. SHA after failed femoral neck fixation was associated with lower intra-operative demands than after failed peri-trochanteric fractures. Similarly, analysis by the index implant found that conversion arthroplasty after failed CSs was associated with lower intra-operative morbidity than failed SHSs or IMNs; differences between SHS and IMN were not as clear. Importantly, intra-operative data in cases of failed SHSs was similar regardless of the original fracture type, showing the device played a larger role than the fracture pattern. Complications and revision surgery rates were similar regardless of fracture type or fixation device. Our results suggest that operative demands and subsequent patient morbidity are more dependent on the index device than the fracture pattern during SHA.



Multiple cultures and extended incubation for hip and knee arthroplasty revision: impact on clinical care. DeHaan A; Huff T; Schabel K; Doung YC; Hayden J; Barnes P. *Journal of Arthroplasty* 2013;28,Supp1:59-65.

ABSTRACT

The impact on patient care of introducing a protocol of obtaining 5 or more intra-operative separate tissue biopsies that were cultured for 10 days was assessed for hip and knee arthroplasty revision. The charts of seventy-three patients undergoing 77 cases of revision arthroplasty were reviewed one year post-operatively. When compared to the prior standard of obtaining only one intra-operative culture, the protocol changed the microbiological diagnosis in 26/77 cases (34%, 95% Confidence Interval (CI): 23%-45%) and antibiotic treatment in 23/77 cases (30%, 95% CI: 20-41%). In addition, the protocol had a predictive value of joint sterility in culture negative cases of 95% (95% CI: 85-99%). This data demonstrated the new protocol significantly changed patient care, and suggests that 1 or 2 cultures are insufficient. Adopting a similar protocol should be considered by surgeons and institutions as a new minimum standard for management of prosthetic joint infections.

Modular versus nonmodular neck femoral implants in primary total hip arthroplasty: which is better? Duwelius PJ; Brukhart B; Carnahan C; Branam G; Ko LM; Wu Y; Froemke C; Wang L; Grunkemeier G. *Clin Orthop Relat Res* 2014;472:1240–45.

INTRODUCTION

Restoration of the hip center is considered important for a successful THA and requires achieving the right combination of offset, anteversion, and limb length. Modular femoral neck designs were introduced to make achieving this combination easier. No previous studies have compared these designs in primary THA, and there is increasing concern that modular designs may have a higher complication rate than their nonmodular counterparts.

METHODS

Two cohorts of patients undergoing primary THAs, 284 patients with a nonmodular neck and 594 patients with a modular neck, were treated by one surgeon through a posterior approach. These were two nearly sequential series with little overlap. Harris hip scores and SF-12 outcomes surveys were administered at followup with a mean of 2.4 years (maximum, 5.9 years).

RESULTS

In the modular neck cohort, a greater proportion of patients had equal (within 5 mm) radiographic limb lengths (89%, compared with 77% in nonmodular cohort $p = 0.036$), and a smaller offset difference (6.1 versus 7.5 mm, $p = 0.047$) was observed. Whether these statistical differences are clinically important is unclear. A smaller proportion of patients in the modular neck cohort achieved equal apparent or clinical limb length at 1 year (85% versus 95%, $p < 0.001$) and at 2 years (81% versus 94%, $p < 0.001$). In addition, these differences did not appear to result in better Harris hip or SF-12 scores, fewer complications, or reduced likelihood of revision surgery.

CONCLUSIONS

Use of modular neck stems did not improve hip scores nor reduce the likelihood of complications or reoperations. Because of their reported higher risks, there is no clear indication for modularity with a primary THA, unless the hip center cannot be achieved with a nonmodular stem, which is rare.

Patient satisfaction surveys: an evaluation of POSNA members' knowledge and experience. Halsey M; Albanese S; Thacker M. *J Pediatric Orthop* E-publication ahead of print 16 January 2014.

BACKGROUND

Patient satisfaction surveys (PSS) were originally designed to identify areas in need of improvement in patient interactions for individuals, practices and institutions. As a result of the Affordable Care Act, the Centers for Medicare and Medicaid Services incorporated PSS into a formula designed to determine the quality of medical care delivered to hospital in-patients; the resultant score and rank will determine subsequent hospital payments. This survey was developed to evaluate POSNA members' knowledge of and experience with PSS.

METHODS

The POSNA Practice Management Committee developed a 14-question survey that was sent to all active and candidate members. 229 members responded; and results were tabulated by answer and simple percentages were calculated for each question. Comments were reviewed and grouped by similarity to identify frequency.

RESULTS

82% of respondents were aware of PSS with 67% stating they were utilized in their setting. Utilization of PSS rarely alters clinical decision-making. However, PSS do affect decisions regarding the patient experience; and 45% of respondents believe that PSS have utility with respect to business decisions. 59% of respondents feel that scores can be predictably improved. Less than half the respondents stated they had a good or excellent understanding of PSS and only 48% believe that PSS are a valid measure of healthcare quality.

CONCLUSIONS

POSNA members' knowledge of and experience with PSS are not universal or uniform. While most agree that patient satisfaction does not drive

clinical decision-making it does appear to impact business and clinic-flow decisions with the idea that it can be predictably improved. Despite this, members' self-assessed knowledge is average and it is not clear to the members that patient satisfaction reflects medical quality. Based on these findings and as the impacts of PSS become more prominent, efforts to educate the members of POSNA about PSS should be enhanced. Furthermore, research to identify and develop best practices that enhance patient satisfaction and well-being while minimizing costs should be supported.

Popliteal artery injury associated with total knee arthroplasty: trends, costs and risk factors. Ko LM; Dehart M; Yoo J; Huff T. *Journal of Arthroplasty* E-publication ahead of print 15 January 2014.

ABSTRACT

Popliteal artery injury is a relatively rare but potentially devastating complication of total knee arthroplasty (TKA). We analyzed the Nationwide Inpatient Sample from 1998 to 2009 to determine the actual incidence, risk factors and consequences of this complication. There were 1,120,508 hospitalizations coded for TKA; of these, 633 (0.057%) were identified as having a popliteal artery injury. The rate of injury remained relatively constant though the number of both TKAs and injuries have risen annually by 0.65% and 0.5%, respectively. Significant risk factors included revision surgery, peripheral vascular disease, weight loss, renal failure, coagulopathy, and metastatic cancer. Consequences were increased hospital charges, length of stay, and mortality rates. Because the rate of popliteal artery injury is not diminishing with time and morbidity and mortality are high, patients should be assessed for known risk factors for popliteal artery injury.

Dynamic fixation of distal femur fractures using far cortical locking screws: a prospective observational study. Bottlang M; Fitzpatrick DC; Sheerin D; Kubiak E; Gellman R; Zandschulp CV; Doornink J; Earley K; Madey SMJ. *Orthop Trauma* E-publication ahead of print 16 November 2013.

OBJECTIVES

Document fixation and healing of distal femur fractures stabilized by plate osteosynthesis using Far Cortical Locking (FCL) screws.

STUDY DESIGN

Prospective, observational.

SETTING

Two level I and one level II trauma centers.

PATIENTS

Thirty-two consecutive patients with 33 distal femur fractures (AO/OTA types 33-A,C).

INTERVENTION

Fractures were stabilized by plate osteosynthesis with MotionLoc FCL screws without supplemental bone graft or bone morphogenic proteins. Patients were followed up for a minimum of one year with functional and radiographic assessments obtained at postoperative weeks 6, 12, and 24 and computed tomography scans at week 12. If union was not confirmed within one year, follow-up was continued until union or revision surgery.

MAIN OUTCOME MEASURES

The primary endpoint was fracture union in absence of complications and secondary interventions. Fracture healing was defined by resolution of pain at the fracture site and cortical bridging on biplanar radiographs. Complications were defined by fixation failure, loss of reduction, implant breakage, infection, non-union, and need for revision.

RESULTS

Thirty-one fractures were available for follow-up.

None of the 125 FCL screws used for diaphyseal fixation broke or lost fixation. One of 31 fractures displaced into varus ($\Delta\text{Varus}=5.8^\circ$). Thirty of 31 fractures healed within 15.6 ± 6.2 weeks. At an average follow-up of 17 ± 4 months there were two revisions, one to correct a mal-rotation at day 5, and one to treat a non-union at 6 months.

CONCLUSIONS

Absence of implant and fixation failure suggests that dynamic plating of distal femur fractures with FCL screws provides safe and effective fixation.

A prospective randomized comparison of two distinct allogenic tissue constructs for anterior cruciate ligament reconstruction. Rose M; Quilici S; Farooqi M; Crawford, D.

INTRODUCTION

Limited prospective data exists directly comparing allograft tissues for ACL reconstruction. We compared quadrupled hamstring tendon (HT) allograft vs. doubled tibialis anterior (TA) allograft.

METHODS

One hundred patients undergoing primary ACL reconstruction were studied in a prospective randomized fashion.

RESULTS

One patient in the TA group and no patients in the HT had a re-tear at two years. There was no difference in graft failure rate, graft stability, or PRQs between groups. The average variation in the T2W signal of the grafts was significantly different between groups (Figure 1).

CONCLUSIONS

Both HT and TA allograft provide a good option for ACL reconstruction. The clinical significance of increased graft variability in the HT group is not certain. It is possible that the quadrupled graft construct composed of smaller caliber hamstring tendons potentially lends itself to more rapid remodeling given a larger surface area and smaller radial diameter per strand.



Figure 1. Representative MRI from a study subject. MRIs were obtained 6 months (189 days \pm 62) after ACL reconstruction in the TA (n=23, 47%) and HT (n=22, 53%) groups to assess ligamentization of tendon allografts. Graft signal was measured on non-contrast T2/SPIR weighted MRI sequences. A standard ellipse demarcating the intra-articular portion of the graft was defined on the single sagittal cut containing the largest portion of the reconstructed ACL. The absolute signal and deviation were measured in the ellipse via the standard Impax markup tool. Values for the signal of the quadriceps and background were calculated via standard 3mm circles. The signal to noise quotient (SNQ) was calculated as follows as per standard in the literature: $SNQ = S - S_{q\&S}$. The average SNQ for the TA and HT allografts were 4.14 ± 3.65 and 2.94 ± 3.04 , respectively ($p = 0.23$). The average deviation in the signal of the grafts was 169.3 ± 141.89 and 67.1 ± 94.15 for the TA and HT grafts, respectively ($p = 0.03$).

Electronic collection of patient reported outcomes in orthopedics. Miles T; Lorzano A; Orfaly R; Mirarchi A.

INTRODUCTION

Patient reported outcomes (PROs) are likely to play a large role in future quality-based payment systems now in development, in self-monitoring for recertification, and in the healthcare reform process for establishing the value of orthopedics. With the current trend toward quality monitoring, it is increasingly important to find ways to efficiently and accurately collect and store these data in the routine clinical setting. We report our experience in implementing electronic collection of PROs, and its superiority over traditional paper collection.

METHODS

In a university-based upper extremity practice we established an online, secure database using research Electronic Data Capture (REDCap, Nashville, TN). We developed a single online questionnaire including The Visual Analog Pain Scale (VAS); The SF-12 Health Survey; and The Quick - Disabilities of the Arm, Shoulder, and Hand Survey (Quick-DASH). This was administered via an iPad, unless the patient asked for a paper version.

RESULTS

Over the initial 8 months (12/2011 – 08/2012) 1480 patients were seen and 1133 questionnaires were collected (capture rate 80%); 230 were completed using paper and 903 were acquired electronically. Of the 903 electronic surveys that were started by the patient, 771 (85%) were complete and useful for analysis purposes, and 132 were incomplete. Of the 230 paper surveys that were started, 79 (34%) were complete and 151 (66%) were incomplete.

CONCLUSIONS

We implemented a system to capture patient data using electronic means that quickly reached a high level of participation, producing high-quality data with minimal additional staff resources or

disruption of the primary goals of a clinic day. Further research is being done to quantify the superiority of electronic collection over traditional paper methods.

Presented at the North Pacific Orthopaedic Society, 2013

Cost savings created with perioperative efficiency in total joint arthroplasty.

Duwelius P; Ko LM; Tomaro J; Branam G; Coleman J; Froemke C.

INTRODUCTION/METHODS

The purpose of this study was to project the cost savings of an efficient total joint replacement program with a national database. Preoperative planning, an experienced OR team, and established total joint protocols were used to improve patient outcomes and decrease cost in this model.

RESULTS

Six months of cases (201 cases) were reviewed. Our operating room time averaged 72 minutes compared to 110 minutes in the national database with an estimated cost savings of \$760/case. Fifty-five percent of our patients were discharged after one day while 87% discharged within two days. Eighty-seven percent of the patients were discharged directly to their home. These indicators would be in the 90th percentile of a national database.

CONCLUSIONS

Creating an environment that allows for perioperative efficiency can allow overall cost savings to the hospital without sacrificing patient care and provide a means to meet the demand of the future total joint arthroplasty population.

Submitted to the American Association of Orthopaedic Surgeons 2014

The quantified effects of cryotherapy after distal radius fracture repair splinting.

Lorzano A; Mirarchi A.

INTRODUCTION

Cryotherapy studies have focused on effectiveness for injuries or arthritis and on various ways to adequately cool the skin and deep tissue, but the timing and duration of this effectiveness in acutely splinted limbs is not well known. The objective of this study is to quantify the amount of heat energy caused by splinting and the effectiveness of cryotherapy treatment on the surface of a volar wrist after splinting.

MATERIALS AND METHODS

A series of 10 trials were performed. A test mannequin arm and a control mannequin arm were simultaneously splinted using a standard protocol for post-surgical distal radius fracture repair. A temperature probe was placed at the approximate location of the volar distal radius underneath all the splinting materials. The splint consisted of three 4x4 gauze pads placed over the volar distal radius, 2 layers of webril, 10 sheets of 3x15 plaster, an additional layer of webril and an ACE bandage. Following this, an ice bag containing 200-225 grams of small-cubed ice was placed on top of the splint at the level of the temperature probe on the test arm. The control arm received no ice bag. Temperature measurements were taken at 2 minute intervals for a total of 150 minutes.

RESULTS

The average room temperature for the control group was 23.07°C, and the average maximum temperature reached was 31.55°C. The cryotherapy group had an average room temperature of 21.1°C and an average maximum temperature of 26.4°C. Post splinting, the control group increased in temperature and returned to room temperature after an average of 100 minutes, while the test group increased in temperature and then

decreased to room temperature after 40 minutes and continued to decrease to approximately 11.6°C after 140 minutes.

The control group experienced average heat energy of 104.99 calories before returning to room temperature while the test group experienced average heat energy of 16.59 calories before returning to room temperature, a statistically significant difference ($p < 0.0001$). Over the first 100 minutes after splint application, the control group experienced an increase of 105.57 calories while the experimental group cooled, losing an average -55.69 calories for a total difference of 161.26 calories, a statistically significant difference ($p < 0.0001$).

CONCLUSIONS

Application of cryotherapy is effective at decreasing the amount of heat energy experienced by a splinted wrist over the first 40 minutes as the splinting plaster hardened and continues for over 2.5 hours after application.

To be presented at the combined meeting of the American Orthopaedic Association/Canadian Orthopaedic Association

The epidemiology of primary and revision total hip arthroplasty in teaching and non-teaching hospitals in the United States. Kowalik T; DeHart M, Gehling P; Schabel K; Huff T; Mirza A.

PURPOSE

The purpose of this study is to examine the epidemiology of primary and revision total hip arthroplasty (THA) in teaching and non-teaching hospitals in the United States over a 5 year period. Methods: Data from the Nationwide Inpatient Sample (NIS) was searched from 2006-2010 to identify inpatient admissions related to primary and revision total hip arthroplasties at teaching and non-teaching hospitals. The data was stratified based on the teaching status of the hospital and outcome variables including number of procedures, total costs, age, gender, race, hospital region, payer type length of stay, disposition and in hospital mortality were analyzed.

RESULTS

A total of 1,336,396 primary and 223,520 revision hip arthroplasties were identified between 2006 and 2010. Of these, 46% (n=613,048) primaries and 54% (n=121,518) revisions were performed at teaching hospitals. For primary THA, teaching hospitals had fewer patients >65 y.o. (51% vs. 57%), fewer Medicare patients (49% vs. 55%), similar gender rates (56% vs. 57% female), and greater amounts of non-white patients (15% vs. 11%) and greater amounts of patients in the highest income quartile (34% vs. 25%) compared to non-teaching hospitals. These trends were similar for revision THA. The total costs, length of stay and Charleson score were similar between the hospital types. Inpatient mortality rate was lower at teaching hospitals (0.16% vs. 0.19%) for primary and (0.77% vs 0.87%) for revision THA compared to non-teaching hospitals. Teaching hospitals performed 17% of all their total hip arthroplasties as revisions vs. only 12% for non-teaching hospitals.

CONCLUSIONS

Comparisons of primary and revision THA at teaching and non-teaching hospitals show small but statistically significant differences in several key demographic and outcome variables

Patient specific versus conventional total knee arthroplasty: perioperative and cost differences. DeHaan A; Adams J; Dehart M; Huff T.

ABSTRACT

The role of patient-specific instrumentation in total knee arthroplasty (TKA) is yet to be clearly defined. Current evidence evaluating peri-operative and cost differences against conventional TKA is unclear and based on studies with small patient numbers. We reviewed 398 TKAs between July 2008 and April 2013; 331 of these had patient-specific instrumentation and 67 had conventional TKA. The patient-specific instrumentation group averaged 24.3 minutes less surgical time, a 20% decrease in operating room turnover time, and less post-operative blood loss. At our institution, the money saved through increased operating room efficiency was equal to or more than the costs of the custom cutting blocks and pre-operative advanced imaging. We conclude that routine use of patient-specific TKA can be performed with less peri-operative morbidity and at no increased cost when compared to conventional TKA.

Submitted to the Journal of Arthroplasty

Submitted to Western Orthopaedic Association 2014
Annual Meeting

Poster Presentation, American Association of Hip and Knee
Surgeons 2013 Annual Meeting

Perioperative outcomes of primary total knee arthroplasty stratified by body mass index. DeHaan A; Adams J; DeHart M; Huff T.

INTRODUCTION

With the growing obesity epidemic, there has been an increased interest in functional outcomes and complication rates in patients with a higher body mass index (BMI) during primary total knee arthroplasty (TKA). However, perioperative differences based on a patient's BMI has received little attention.

METHODS

A retrospective review of all primary TKAs performed by a single surgeon was examined between July 2008 and April 2013. Patient's BMI was stratified according to the world health organization definition (normal: 18.5-24.9; overweight: 25-29.9; obese class I: 30-34.9; obese class II: 35-39.9; obese class III: ≥ 40). Perioperative outcomes measured include tourniquet and total surgical time, blood loss, drain output, transfusion requirements, and hospital length of stay.

RESULTS

339 patients underwent 398 TKAs during the study period (normal: 47 cases; overweight: 117 cases; obese class I: 110 cases; obese class II: 76 cases; obese class III: 48 cases). The mean BMI was 32 kg/m² and age was 63 years, with 66 percent of cases performed in female patients. Between the five groups, there were no differences in tourniquet time ($p=0.578$), total surgical time ($p=0.384$), estimated blood loss ($p=0.537$), drain output ($p=0.393$), transfusion requirements ($p=0.594$), or hospital length of stay ($p=0.260$). Obese classes I-III had a lower post-operative hematocrit change than those in the normal BMI group ($p=0.001$). No intra-operative complications occurred in any group.

CONCLUSIONS

Primary TKA can be safely performed with similar

perioperative outcomes independent of the patient's BMI.

Submitted to Western Orthopaedic Association 2014 Annual Meeting

Case series - treatment of tibial osteomyelitis with spatial frame and RIA bone graft.

Friess D; Putnam-Pite D.

INTRODUCTION/METHODS

Tibial fractures complicated by osteomyelitis present a complicated clinical scenario due to the creation of a large bony defect following removal of infected bone and debridement of surrounding tissue. In this report, patients with a large bony defect following surgical treatment of tibial osteomyelitis were treated with the placement of an antibiotic cement spacer that was removed upon soft tissue healing followed by placement of an autologous bone graft obtained with a reamer-irrigator aspirator in the space left by the cement spacer. During the process bone transport was performed using Taylor spatial frame. The primary clinical endpoint was nonunion requiring treatment with an alternative technique.

RESULTS

A total of four patients (1 female) were treated with the technique with a mean age of 51.25. Two patients had satisfactory union and healing using an external fixator and two patients failed treatment due to failure of bony union with the Taylor spatial frame requiring placement of a tibial intramedullary nail.

CONCLUSIONS

Advantages of Taylor spatial frame mediated bone transport in tibial osteomyelitis include its minimally invasive nature, avoidance of placement of intramedullary devices and maintenance of limb length. However, it is a surgically and physiologically complex process and a low threshold for conversion to intramedullary nailing should be maintained if good bony union is not observed early in the clinical course.

Microvascular training. Ko JWK; Mirarchi A.

INTRODUCTION

The safe and effective acquisition of microvascular surgical skills is a challenge for any resident and its residency program. Variable clinical exposure, premiums on operating room efficiency, and a steep learning curve make these skills difficult to acquire through clinical experience alone. This perceived inadequacy was substantiated at our institution when more than half of our residents noted that they did not feel comfortable with microvascular surgery when assessed during their PGY-3 year. Some programs have integrated a structured microvascular training curriculum to help address this deficiency. The goal of our study was to determine the effectiveness of a hands-on training program on the development of microvascular surgical skills of our orthopaedic trainees.

METHODS

During each third year resident's rotation on the Hand & Upper Extremity Service, they completed a microvascular training curriculum consisting of 8 sessions lasting 2-3 hours each. The training cycle began with learning the basics of microvascular surgery on non-living model, and progressed to learning an end-to-end arterial anastomoses on a live rat femoral artery by the 3rd session. Following completion of the 3rd session, an initial evaluation was performed on each resident to document his or her baseline level of skill during performance of an end-to-end arterial anastomosis. A similar posttest evaluation was then performed at the completion of the training curriculum. Each session was taught and evaluated by a fellowship trained microvascular surgeon. 8 residents completed the training curriculum. The grading of each resident was performed using a standardized evaluation form that assessed tissue handling, time and efficiency of motion, handling of microvascular instruments,

performance of anastomosis, and anastomosis patency on 5-point scale. Additionally, the time to completion of the anastomosis was documented during the initial and final evaluations.

RESULTS

All residents improved on their standardized assessment scores from an average initial score of 13.5 ± 4.0 to an average final score of 19.4 ± 2.9 (out of a possible 25 points, $p < 0.05$). All residents demonstrated improvements in their time to completion of the anastomosis from an average of 38.6 ± 10.5 minutes to 23.6 ± 3.6 minutes ($p < 0.05$). The patency rates of the anastomosis also improved with 37.5% of residents being able to create a patent anastomosis at the initial evaluation and 87.5% able to create a patent anastomosis at the final evaluation.

DISCUSSION AND CONCLUSIONS

Based on the questionnaires and initial evaluations, the teaching of microvascular surgery has been inadequate at our institution. The results of our study demonstrate that the implementation of a microvascular training curriculum has been effective at improving the microvascular skills of our orthopaedic residents. As the landscape of orthopaedic trainee education moves towards the demonstration competency, a microvascular training curriculum may be a useful adjunct to help the acquisition of and comfort level with this difficult skill.

[Presented at the American Orthopaedic Association 2012](#)

Local injection around the ulnar nerve at the elbow: a cadaveric study. Larson D; McElvany M; Mirarchi A; Orfaly R.

INTRODUCTION/METHODS

Injection of the cubital tunnel at the level of the medial epicondyle does not lead to effective delivery of drug concentrations at all potential sites of compression of the ulnar nerve near the elbow. A local injection of radio-opaque contrast and methylene blue dye was delivered directed at the cubital tunnel of 6 fresh frozen cadaveric upper extremity specimens based on anatomic landmarks. Fluoroscopy was used to assess the distribution of the injectate. The specimens were dissected to determine the distance from the arcuate ligament to other potential sites of entrapment and the staining pattern of the ulnar nerve at these locations.

RESULTS

Injection of radio-opaque contrast resulted in a highly variable distribution of injectate. Fluoroscopic measurements indicated the injectate was unlikely to be delivered to all potential sites of entrapment. Anatomic dissection revealed poor staining of the ulnar nerve distal to the arcuate ligament. No nerves were stained distal to the junction of the ulnar and humeral heads of the flexor carpi ulnaris. No nerves were stained more than 3-cm proximal to the arcuate ligament, and no nerves were stained at the Arcade of Struthers nor the majority of the medial intermuscular septum.

CONCLUSIONS

Injections for cubital tunnel syndrome using anatomic landmarks show poor delivery of the injectate to all potential sites of nerve entrapment. The accuracy of the injection of the cubital tunnel is poor. Associated risks include intraarticular, intraneural, and intradermal delivery.

Presented at the American Society for Surgery of the Hand
2013

Extensor tendon injury and failure due to drill penetration sustained during volar plate fixation of distal radius fractures: a biomechanical analysis. Mahylis J; Burwell A; Marshall L; Bonneau L; Mirarchi A.

INTRODUCTION

Volar plate fixation has become the preferred surgical treatment for displaced distal radius fractures. Extensor tendon rupture is a known complication of volar plate fixation. However, little is known about the mode of extensor tendon failure, especially after drill penetration injury sustained during fixation. The goal of this study was to analyze extensor tendon failure and change in tendon displacement during cyclic loading following drill penetration injury in either a continuous or oscillating drill mode.

METHODS

Extensor Pollicis Longus (EPL) and Extensor Carpi Radialis Brevis (ECRB) tendons were harvested from 9 fresh frozen cadaveric arms. Tendons were sectioned equally into two, 6 cm lengths, proximal and distal, creating 18 EPL and 18 ECRB samples. Tendon samples were mounted in an MTS servohydraulic load frame and drill penetration injury was performed, in either continuous or oscillating mode, with a 2.8mm drill, under a physiological load of 1 kg. Injured tendons were subjected to 1200 cycles at frequency of 1 Hz while an increasing load of 1-15kg was applied to each sample. Tendons were analyzed for both complete failure at the drill injury sites and change in displacement (mm), throughout the testing cycle.

RESULTS

Six of the 18 EPL samples and 16 of 18 ECRB samples completed testing without failure. The mean change in displacement of all samples was 4.4 mm (SD+3.3mm; $P=0.26$). In the ECRB group, tendons injured in oscillating mode had a mean change in displacement of 2.8 mm (SD+1.5mm) compared to 5.9mm (SD+4.7mm) of mean change in displacement in tendons injured in continuous

mode ($P=0.19$). The EPL group had a mean change in displacement of 4.7mm (SD+2.7 mm) and 4.3mm (SD+1.8mm) for oscillating and continuous modes of injury respectively. A single EPL tendon, injured during continuous drill penetration, sustained failure due to propagation of tendon disruptions at the drill site.

CONCLUSIONS

Complete extensor tendon failure due to drill penetration injury was rare. Tendon injury following continuous drill penetration resulted in greater displacement after an increasing cyclic load, but this did not reach statistical significance. Increasing cyclic loading of extensor tendons after drill penetration injury causes extensor tendon elongation. While the power of this study did not demonstrate that drill injury results in rupture, it does present a tendon injury testing schema that can be used to elucidate this in future studies.

[Submitted to the American Society for Surgery of the Hand](#)

5-Year reoperation rates following primary procedures for degenerative disease of the spine. Mahylis J; Sauer B; Sahmoun A; Beal J.

INTRODUCTION

Repeat spinal surgery is often an unwanted procedure. Previous studies have yielded limited results on the rate of reoperation of the cervical and lumbar spine. The aim of this study was to determine the frequency of spinal reoperation in patients with degenerative disease of the spine.

METHODS

2258 electronic medical records from a single moderate sized hospital between 2001 and 2004 were reviewed. International Classification of Diseases Revision Nine Clinical Modification codes (ICD-9) were used to identify patients who underwent a second spinal surgery for degenerative disease within a 5-year period from their primary procedure. Patient demographics, primary diagnosis, index surgical procedure (fusion, decompression), and timing of reoperation were collected.

RESULTS

1880 patients' records were analyzed. One hundred seventy-nine patients, 9.5%, underwent reoperation within 5-years of their index surgery. Reoperation after fusion and decompression surgery was 10.6% and 9.4% ($p=0.533$) respectively. Reoperation of the lumbar spine occurred in 9.4% of patients and in 9.9% of patient with prior cervical spine surgery ($p=0.774$). Patients with a diagnosis of spinal stenosis had significantly fewer reoperations (5.9%, $p=0.035$) than patients with other diagnoses. 11.6% of fusions and 9.3% of decompressions of the lumbar spine required reoperation ($p=0.470$) while 10.1% of fusions and 9.8% of decompressions of the cervical spine required reoperation ($p=0.928$).

CONCLUSIONS

We found slightly lower reoperation rates for lumbar procedures and slightly higher reoperation

rates for cervical procedures than previously reported. No significant difference between reoperation rates for decompression or fusion procedures was found. There was no difference in reoperation rates between levels of the spine. A diagnosis of spinal stenosis had significantly lower rate of reoperation regardless of spinal level.

The association between advanced degenerative changes of the atlanto-odontoid joint and presence of odontoid fracture. Shinseki M; Zusman N; Hiratzka J; Marshall L; Yoo J.

BACKGROUND

Dens fractures in elderly patients are thought to be related to issues associated with an aging population, such as osteoporosis and difficulty balancing. We examined the association between degenerative changes of the atlanto-dens joint and the risk of dens fracture.

METHODS

We conducted a retrospective study of trauma patients aged ≥ 55 years who received a cervical spine computed tomography (CT) scan as part of their admission into a single level one trauma center. Of 1794 patients who met the inclusion criteria, scans were obtained for all 56 presenting with a dens fracture and for a random sample of 736 without dens fracture. Intraosseous cyst formation, synovitis, and joint space narrowing were recorded from patients' scans. The prevalence of degenerative changes was compared between persons with and without dens fracture with odds ratios (OR) and 95% confidence intervals (CI) estimated with multivariable logistic regression.

RESULTS

Intraosseous cysts in the dens were found in 16.4% of those without dens fracture and in 64.3% of patients with fracture ($p < 0.001$). Dens fractures extended through the existing cysts in 24 of 36 (66.7%) of those with cysts and dens fractures. Retro-dens synovitis was present in 4.2% of those without dens fracture and in 25.0% with fracture ($p < 0.001$). After adjustment for age and sex, both cysts (OR=7.7, 95% CI: 4.2-14.1) and synovitis (OR=4.6, 95% CI: 2.1-10.0) were significantly associated with dens fracture.

CONCLUSIONS

The presence of intraosseous dens cysts and of retro-dens synovitis was associated with dens fracture, by almost eight and five-fold, respectively. As a synovial joint, the degeneration of the atlanto-dens joint can lead to subchondral cyst formation and synovitis. These changes appear to weaken the dens and predispose affected individuals to fracture.

Accepted for publication in the Journal of Bone Joint Surgery

Prevalence of degenerative changes of the atlanto-axial joints. Betsch M; Blizzard SR; Shinseki M; Yoo JU.

PURPOSE

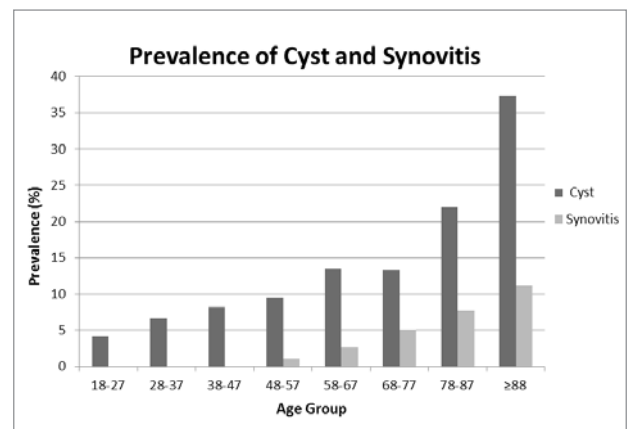
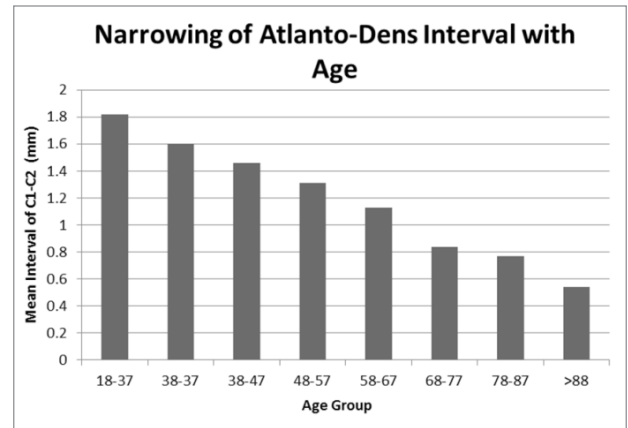
To described the prevalence of specific degenerative changes in the atlanto-dens and atlanto-axial facet joints as a function of age. Methods: Retrospective study of 1,543 adult trauma patients who received a CT scan. The anterior atlanto-dens joint interval was measured. The presence or absence of intraosseous cysts and synovitis was recorded. Degeneration of the atlanto-dens and atlanto-axial facet joints at age intervals was quantified.

RESULTS

The atlanto-dens interval narrowed linearly with age ($R^2 = 0.992$; $p < 0.001$). The prevalence of intraosseous cysts increased exponentially from 4.2% to 37.4%, and synovitis from 0% to 11.1%. Cyst formation generally began in the 2nd to 3rd decade of life and synovitis in the 5th and 6th decade of life. Facet joints also demonstrated age related changes.

CONCLUSIONS

This is the first study that documents specific changes of both atlanto-dens and atlanto-axial facet joints as a function of age in a large cohort of 1,543 patients. These changes increased exponentially with age and may contribute to pain and limitation in motion. In light of our findings cervical spine radiographs of elderly patients should be carefully assessed for these changes.



Major complications in cervical spine surgery are related to the magnitude of the surgery but not preoperative psychological factors. Myers RJ; Zusman NL; Larsen SD; Ching AC; Hart RA; Yoo JU.

INTRODUCTION

Surgical complications have been correlated to preoperative physical and psychological factors and the invasiveness of the surgery, yet not well studied in cervical patients.

METHODS

Retrospective analysis of cervical spine surgery patients. Psychiatric condition was defined via chart while preoperative condition by ASA classification. Surgical invasiveness was defined by procedural time, intra-operative fluids, estimated blood loss, and number of spinal levels. SF-12 Mental and Physical Component Summary scores (MCS, PCS) were prospectively collected. Major complications were chart extracted.

RESULTS

Major complication incidence was 5.4%. Psychiatric conditions were not associated with major complication (Figure 1). The mean preoperative PCS score was lower in the complication group (25.9±9.4 vs. 31.5±9.7, p=0.04). ASA class 3/4 patients experienced a 3.2-times greater incidence of complications than class 1/2 (9.0% vs. 2.8%, p=0.02) (Figure 2). Invasiveness of the procedure was correlated with increased complications: procedure time (≤3 hours = 1.9% vs. >3 hours = 9.0%, p=0.02), intraoperative fluids (≤1200mL=1.5% vs. >2100mL=8.3%, p=0.01), EBL (≤100mL = 2.5% vs. >100mL = 8.3%, p=0.04), and the number of levels fused (1-2 levels=2.2% vs. ≥3 levels=13.1%, p<0.01).

CONCLUSIONS

Complications are not influenced by psychological state but appear related to the physical capacity, general health and the magnitude of the surgery.

Psychiatric Comorbidities						
		No Complication		Major Complication		p-value
		N	%	N	%	
Depression	No	174	94.1	11	6	0.56
	Yes	84	96.6	3	3.5	
Anxiety	No	214	95.1	11	4.9	0.72
	Yes	44	93.6	3	6.4	
Fibromyalgia	No	220	94.83	12	5.17	1.00
	Yes	38	95	2	5	
Any Psych.	No	154	93.9	10	6.1	0.58
	Yes	104	96.3	4	3.7	

Figure 1

Operative Parameters						
		No Complication		Major Complication		p-value
		N	%	N	%	
ASA Class	1 & 2	175	97.22	5	2.78	0.03
	3 & 4	81	91.01	8	8.99	
Operative Time (Hrs.)	<3	152	98.06	3	1.94	0.02
	>3	101	90.99	10	9.01	
Intra-Op Fluids (mL)	<2100	135	98.54	2	1.46	0.01
	>2100	122	91.73	11	8.27	
EBL (mL)	<100	157	97.52	4	2.48	0.04
	>100	100	91.74	9	8.26	
Surgical Approach	Anterior	164	98.20	3	1.80	<0.01
	Posterior	67	94.37	4	5.63	
	A/P	27	79.41	7	20.59	
Number of Levels Fused	1-2 lvl	176	97.78	4	2.22	<0.01
	3+ lvl	53	86.69	8	13.11	
Hardware: Plate	No	75	93.75	5	6.25	0.56
	Yes	183	95.31	9	4.69	
Fusion Procedure?	No	29	93.55	2	6.45	0.67
	Yes	229	95.02	12	4.98	
Hardware Removal?	No	238	95.58	11	4.42	0.08
	Yes	17	85	3	15	

Figure 2

Presented at the Cervical Spine Research Society 2013

Geriatric pelvic fractures: trending the frequency and health care burden. Mirza A; Wearn J; Gehling P; DeHart M.

PURPOSE

This study examined the frequency and healthcare burden of sacral insufficiency fractures (SIF) across the United States over a 12-year period.

METHODS

The Nationwide Inpatient Sample (NIS) database was analyzed to trend frequency and burden of the disease, from 1998 to 2010. Variables of interest included patient demographics, primary and secondary diagnoses, primary and secondary procedures, hospital characteristics, discharge information, and total costs.

RESULTS

In 1998, there were 14,629 occurrences of SIFs in the NIS population; this number steadily increased to 35,345 by 2010. This is a 242% increase in SIF frequency over this 12-year span. Congruently, there was an exponential increase in the total financial burden of SIFs on the NIS health care institutions. In 1998, the total financial burden of SIFs within the NIS database was \$435 million; this number increased to \$3.18 billion in 2010.

CONCLUSIONS

The frequency of SIFs is increasing as our population ages, and that limited understanding of the disease characteristics have created a disproportionate burden on the health care system.

Effects of hypoxia-conditioned medium on mesenchymal stem cell chondrogenesis.

Betsch M; Wehrle R; Johnstone B.

INTRODUCTION/METHODS

Prior studies have shown that chondrocyte-derived soluble factors in cell-conditioned medium (CCM) improve mesenchymal stem cell (MSC) chondrogenesis, suppressing hypertrophy. Since the joint is a hypoxic environment, we evaluated the role of hypoxia conditioned medium (hCCM) on MSCs exposed to chondrogenic medium.

RESULTS

Proteoglycan production was significantly increased by hCCM ($p=0.018$) and CCM ($p=0.043$, Figure 1). Both hCCM ($p=0.012$) and CCM ($p=0.05$) also significantly decreased the mRNA expression ratio of COL10A1/COL2A1 (collagen X/collagen II) compared with controls, consistent with prior work showing chondrocytes make factors that decrease MSC neocartilage hypertrophy. However, hCCM also significantly decreased the COL1A1/COL2A1 (collagen I/collagen II) ratio compared with control ($p=0.028$) and the CCM group ($p=0.018$), creating a more hyaline cartilage phenotype.

DISCUSSION

The results suggest that articular chondrocytes in hypoxia produce a secretome differing from HACs in normoxia that positively influences the phenotype of the cartilage produced by differentiating MSCs.

Presented at the Orthopaedic Research Society 2014

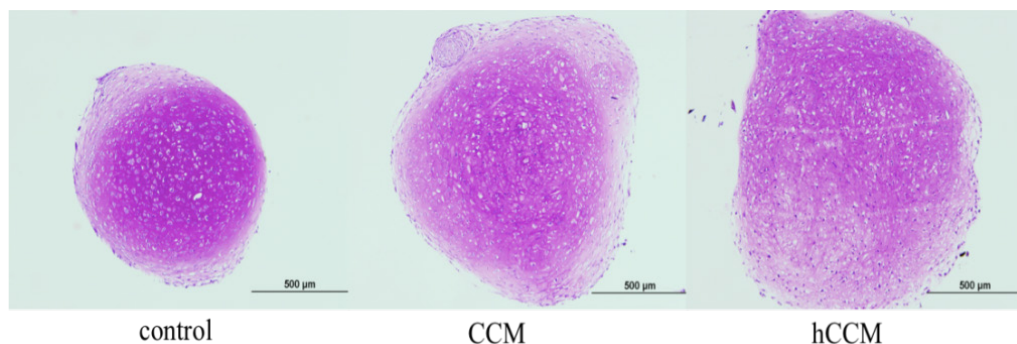


Figure 1. Representative histological sections stained with toluidine blue of pellets in the control group, pellets that received CCM from HACs in normoxia and hypoxia (hCCM).

Effects of hypoxia and cytokines on tissue-engineered cartilage. Markway B; Cho H; Johnstone B.

INTRODUCTION/METHODS

Mesenchymal stem cells (MSC) have anti-inflammatory properties but it is unknown how chondrogenically differentiated MSCs respond to inflammatory environments. Hypoxia is considered a positive factor for neocartilage formation. However, the role of oxygen-dependent signaling in arthritis is unclear and synergism between inflammatory and oxygen-dependent signaling may exist. Thus, we assessed whether MSC-based neocartilage is more resistant to TNF- α -mediated degradation than chondrocyte-based neocartilage and how oxygen tension influences this process.

RESULTS

Hypoxia significantly mitigated TNF- α -induced

matrix loss from both hAC- and hMSC-derived neocartilage. However, hMSC neocartilage retained a higher proportion of proteoglycans than hAC neocartilage except when oxygen was increased during TNF- α exposure. hACs and hMSCs exhibit distinct degradative enzyme expression profiles during TNF- α -exposure, indicating that degradation of matrix likely occurs through cell type-specific mechanisms.

CONCLUSIONS

MSC neocartilage may be more resistant to inflammatory-mediated degradation than hAC-derived neocartilage but more sensitive to the negative effects of repeated hypoxia/reoxygenation events.

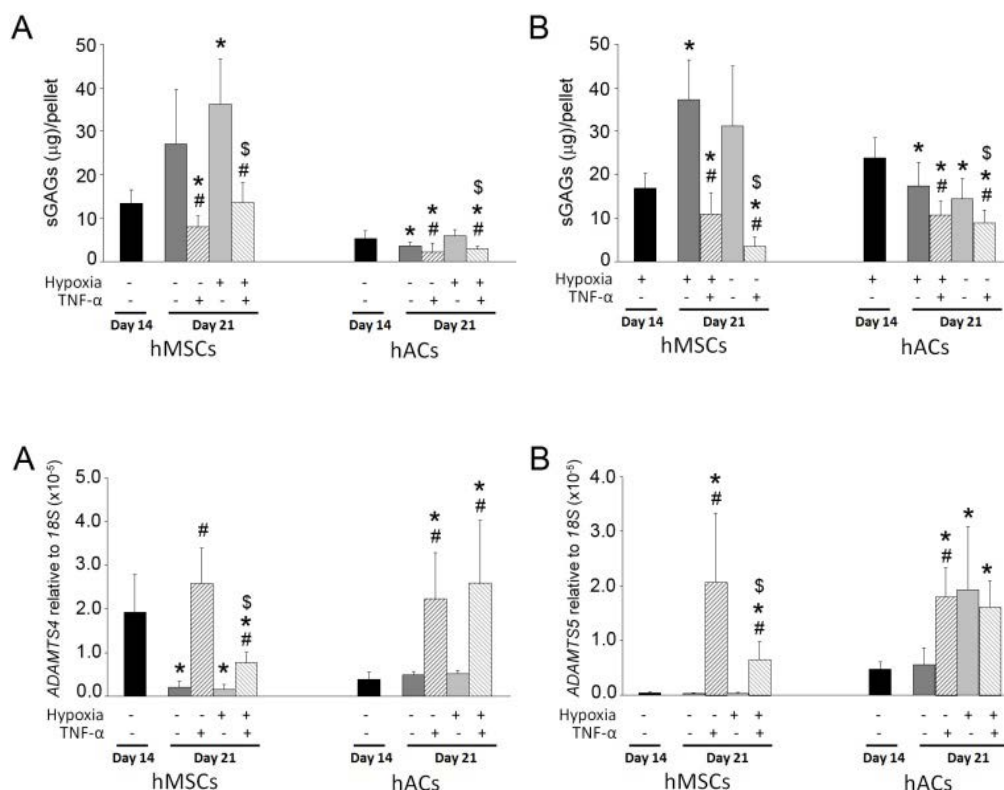


Figure 1: Effect of (A) hypoxic exposure and (B) reoxygenation on pellets' TNF- α -induced loss of sGAGs. p<0.05 vs day 14 (*), vs matched without TNF- α (#), vs TNF- α in other oxygen environment (\$).

Figure 2: Effect of hypoxic exposure on (A) ADAMTS4 expression and (B) ADAMTS5 expression. p<0.05 vs day 14 (*), vs matched without TNF- α (#), vs TNF- α in normoxia (\$).

Rare type of tarsal coalition as a cause of foot pain and recurrent ankle sprains. Malone J; Raney E.

INTRODUCTION

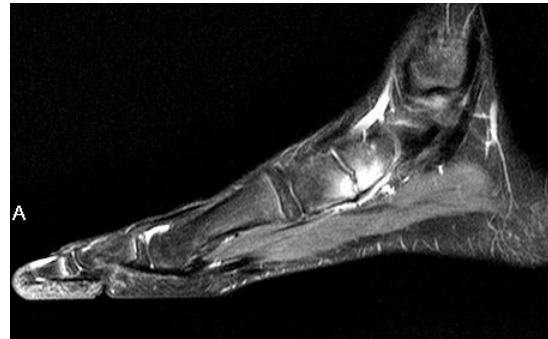
Isolated navicular-medial cuneiform tarsal coalition is a rare condition. Few case reports exist with limited treatment recommendations. The vast majority of previously reported cases were in patients of Japanese descent. Only one case in a patient of European descent has been reported which was unilateral. We present a case of an 11 year old of European descent with bilateral osseous isolated navicular-medial cuneiform tarsal coalition, who failed nearly a year of conservative therapy including decreased activity, temporary immobilization, and NSAIDs.

The patient was treated with osseous coalition excision and interposition of the soft tissue. The tarsal coalition involved the entire plantar surface and extended dorsally to encompass 25% of the joint.

The short term results were excellent in both feet at 7-months follow-up.

DISCUSSION

This is the first report of bilateral navicular – cuneiform coalition in a patient of European descent. The limited literature on the topic suggests conservative treatment should be the first line treatment for isolated coalitions. The authors recommend excision and tissue interposition as surgical treatment in young patients, which maintains the navicular-medial cuneiform joint motion with hopes of preventing adjacent joint arthritis. Good to excellent results have been reported with this treatment. Arthrodesis is recommended in elderly patients or patients who fail the excision surgery.



Submitted to the Western Orthopaedic Association
2014 Annual Meeting

Knee function assessment in patients with meniscus injury: reproducibility and response to treatment of performance based test. Naimark M; Kegel G; O'Donnell T; Lavigne S; Heveran C; Crawford D.

INTRODUCTION/METHODS

The reproducibility and response to arthroscopic partial meniscectomy of novel performance-based knee function tests in patients with torn menisci was tested. We developed a battery of 9 activities that require knee movements essential for everyday living. Reproducibility was assessed after randomizing 50 subjects to receive preoperative assessments and response to arthroscopic partial meniscectomy was evaluated in 35 of these patients. KOOS and IKDC questionnaires were assessed pre- and postoperatively.

RESULTS/CONCLUSIONS

All tests had excellent intra-rater intraclass correlation coefficients ($ICC > 0.8$). Performance on all tests improved significantly ($p < 0.05$) with surgery, with the greatest improvement in sit-to-stand and stair ascent and descent. Questionnaire outcomes generally showed a greater percentage response to surgery than performance-based tests. In conclusion, performance-based knee function tests demonstrated good reproducibility and responsiveness in patients undergoing partial meniscectomy.

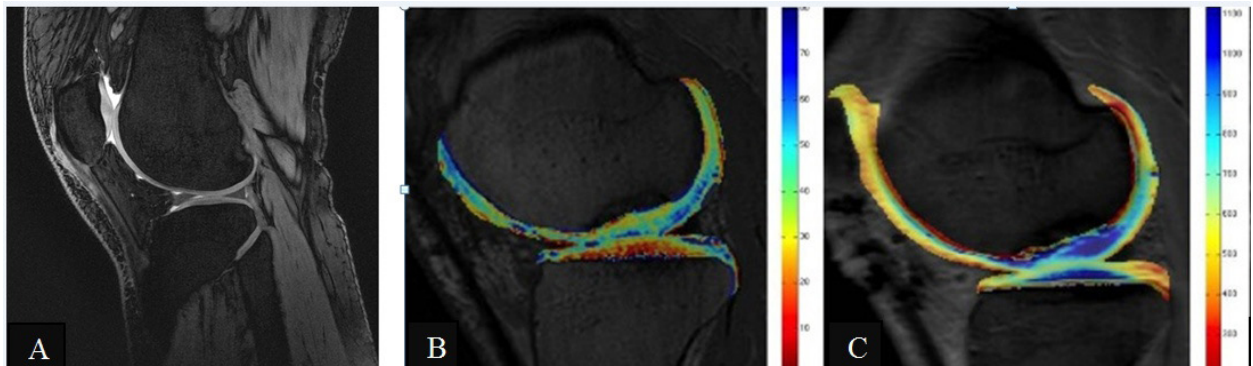


Pictorial representation of the performance-based knee function assessments. Performance-based tests – Top row: A, active/passive range of motion; B, sit-to-stand; C, stair ascent; D, stair descent. Bottom row: E, step-ups; F, step-downs; G, star lunges; H, 6-minute timed treadmill travel.

MRI of the knee in adults: AAOS Instructional Course Lectures 2014. Crawford D; Hirota M; Foss E.

This manuscript in our series regarding MRI about the joint focuses on adult peri-articular knee tissues. Descriptions of tumors, infection and pediatric conditions are not specifically covered. MRI of the knee is a crucial component of the evaluation of the symptomatic patient. Awareness of the normal and abnormal appearances assists clinical decision making. Chronic degenerative changes and focal traumatic injuries can sometimes be confused with one another, and differentiation is crucial. As technology continues to evolve, identification of early disease and prevention of disease progression will become an integral part of MRI interpretation.

To be published as part of the American Academy of Orthopaedic Surgeons Instructional Course Lectures, Volume 64.

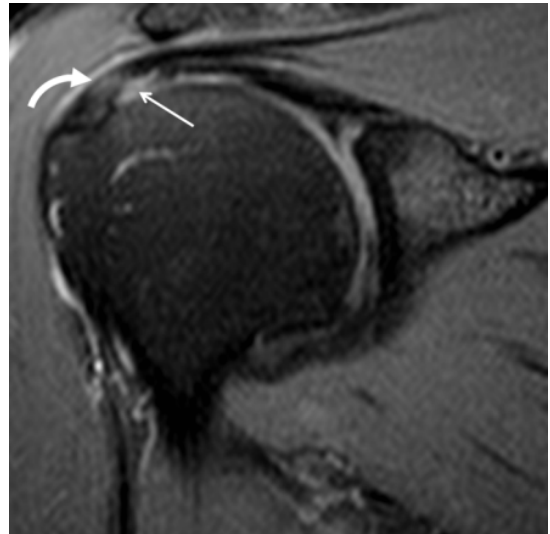


Examples of state-of-the-art imaging techniques for cartilage and cartilage repair. A) Sagittal 3D WATS GRE shows cartilage as grey; B) Sagittal T2 mapping identifies collagen organization of cartilage in color; C) Sagittal post-gadolinium dGEMRIC color map of cartilage biochemical activity representing cartilage health.

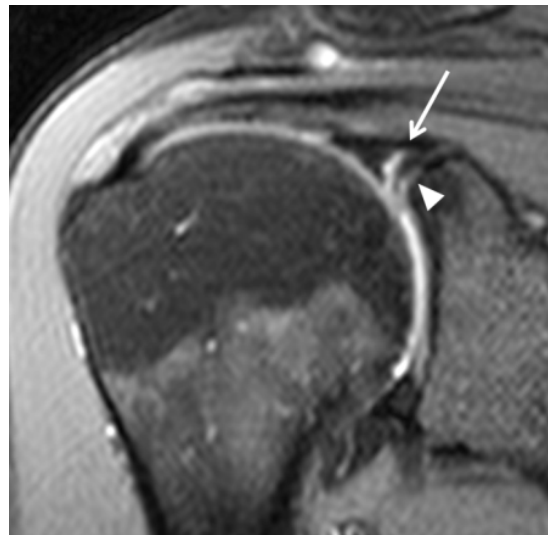
MRI of the Shoulder in Adults: AAOS Instructional Course Lecture 2014. Foss E; Weldon S; Crawford D.

ABSTRACT

This manuscript provides a concise overview of MRI capacity to assist in distinction of pathology and anatomic disruptions adjacent to the shoulder articulations. The summary is focused on common adult degenerative and post-traumatic conditions, with the intent of further familiarizing the generalist orthopedic surgeon and “sports medicine” oriented care provider to the perspective of shoulder specialist surgeons and musculoskeletal radiologists. MRI is a crucial tool in the evaluation of the symptomatic shoulder. Differentiation of traumatic and degenerative etiologies is important for patient management. As patients are granted increasing access to their medical records including radiology reports, sharing a more consistent understanding and nomenclature with radiology colleagues may help limit confusion and explain distinctions between correctable and normal anatomic changes, while improving mutual diagnostic accuracy.



PASTA Lesion: Partial Articular Surface Tear of Supraspinatus



Type II SLAP Tear: Superior Labral from Anterior to Posterior at Biceps Anchor

To be published as part of the American Academy of Orthopaedic Surgeons Instructional Course Lectures, Volume 64.

Preoperative epidural spinal injections increase risk of surgical wound complications but not overall complication risk or patient-perceived outcomes. Zusman NL; Munch JL; Ching AC; Hart RA; Yoo JU.

STUDY DESIGN

Single institution cohort study.

OBJECTIVE

To explore the relation of preoperative spinal injections to postoperative complications and patient-perceived outcomes.

SUMMARY OF BACKGROUND DATA

A lack of information exists on the relation between preoperative epidural spinal injections and outcomes after spine surgery. There is concern that injections might cause local changes, increasing the infection risk and surgical difficulty.

METHODS

The cohort was comprised of patients undergoing thoracic and/or lumbar arthrodesis with complete (pre- and 3 month post-operative) outcome scores (2007-2010). Patients' clinical courses were reviewed to determine the occurrence of major complications within a 30-day postoperative period. Surgical wound complications were reoperation for hematoma, seroma or infection. Patient-perceived outcomes were evaluated using Oswestry Disability Index (ODI) and Short Form 12 Health Status and Pain Assessment survey: mental and physical component summary (MCS and PCS) scores. Analyses were based on exposure to injections using chi-square exact tests, paired and unpaired T-tests.

RESULTS

Overall complication risks and patient-perceived outcomes did not differ with respect to exposure (13.7% injection vs 11.7% non-injection). Injected patients observed a 7.4-fold risk of developing surgical wound complications over non-injected patients (5.1% vs 0.6%, $p=0.02$).

Outcomes measures demonstrated no differences between groups. At three months postoperative, the MCS and ODI scores were similar (MCS: 49.6 ± 11.6 injection vs 47.4 ± 12.8 non-injection, ODI: 35.8 ± 18.0 vs 34.4 ± 19.1). MCS or ODI score improvement (3-month compared to entry) did not vary between groups. Injected patients maintained a 2-point lower PCS score at entry and three months postoperative as compared to non-injected peers (Entry: 27.6 ± 8.2 injection vs. 29.5 ± 9.3 non-injection ($p=0.09$); 3-month: (33.3 ± 8.6 vs 35.7 ± 9.0 , $p=0.03$)), the PCS score improvement between groups were similar (5.7 ± 9.9 vs 6.2 ± 9.7).

CONCLUSIONS

Patients exposed to preoperative epidural injections had a greater risk of developing surgical wound complications, however these complications had no effect on short-term improvements in outcome measures.

Clinical trials for cartilage repair and focal osteoarthritis of the knee

Dennis Crawford, MD, PhD, Samantha Quilici, PA-C

At OHSU Sports Medicine, one area of our clinical research has focused on novel approaches to the treatment of cartilage injury and ameliorating the symptomatic progression of degenerative joint disease. We are currently enrolling patients in three multi-center clinical trials designed to evaluate the efficacy of treatment options for patients with a spectrum of cartilage injury and focal osteoarthritis about the knee:

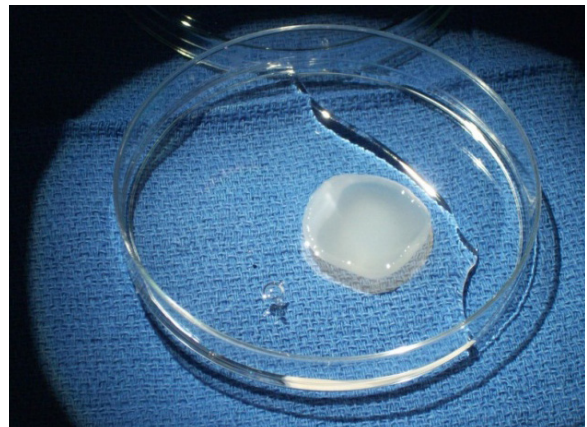
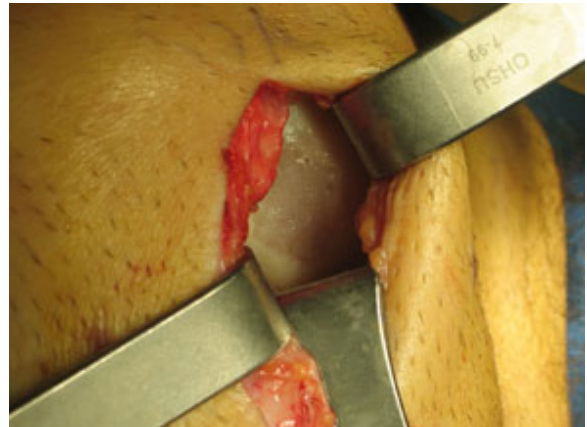
1. **Microfracture in comparison to a Tissue Engineered Cartilage Patch**

For symptomatic isolated (one or two) chondral defects, not previously treated with microfracture of the distal femora (no osteoarthritis):

Neocart (Histogenics, Waltham MA), is a bio-engineered tissue patch containing an autologous chondrocyte population matured in a biodegradable collagen matrix using bio-reactor technology. This is a unique approach for providing potentially improved replacement tissue to the damaged femoral condyle articular surface in comparison to microfracture. We are currently evaluating patients for inclusion in this phase III trial. Results from phase I and II trials have been reported in the AJSM and JBJS.

References

Crawford et al. Am J Sports Med. 2009 July; 37(7): 1334–1343.
Crawford et al. J Bone Joint Surg Am. 2012 June 6; 94(11): 979–989.



Bio-engineered tissue implant

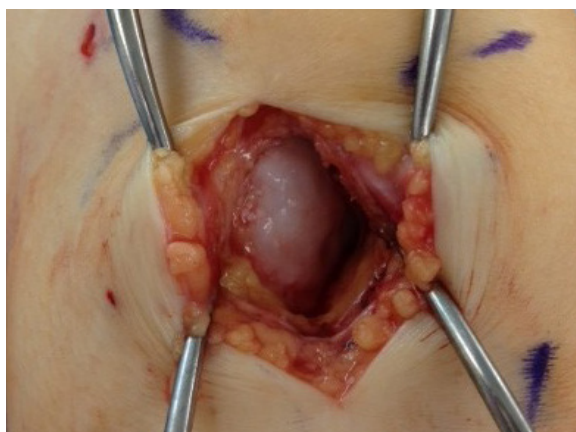
2. Juvenile Particulate Allogenic Cartilage Transplant

For symptomatic isolated (one or two) chondral defects of the patella, trochlea and or femora. This surgery may also be considered for patients previously treated with microfracture, in the absence of osteoarthritis.

DeNovo NT (Zimmer) is a juvenile allogeneic cartilaginous tissue graft currently available for commercial use. We are enrolling patients for a 5 year prospective post-market analysis to evaluate change in subjective clinical outcomes as well as MRI character of cartilage repair.



Juvenile cartilage allograft in manufacturer's packaging



Post implantation and application of fibrin glue

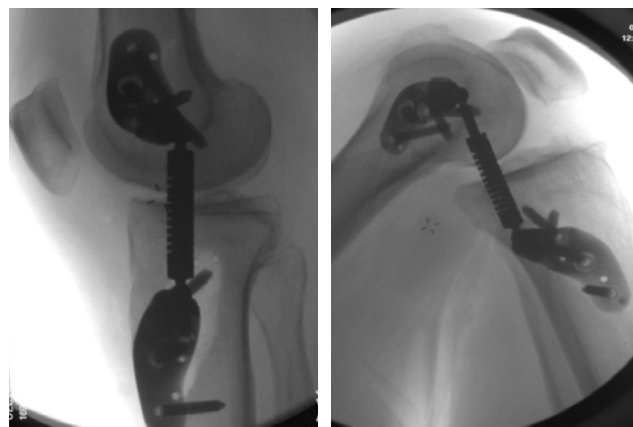
References

Saris et al. Am J Sports Med. 2009 November; 37 (Suppl 1): 10S–19S.

3. “Implantable Brace”

For symptomatic medial compartment OA and no significant varus mal-alignment:

Kinespring (Moximed) is an investigational device for symptomatic medial compartment OA. It reduces load (up to 13 kg) by acting as an extra-articular “shock absorber” and in contrast to HTO does not transfer the load to the lateral compartment. The device is placed outside of the joint capsule, during an out-patient procedure and allows immediate full weight-bearing. We are currently enrolling patients with symptomatic medial compartment OA, Kellgren-Lawrence grade 1-3 for this multi-center pilot study.



References

Prospective multi-center pilot study to evaluate symptom relief in patients with medial knee osteoarthritis (OA) treated with the KineSpring Knee Implant for load reduction-the SOAR protocol. Farr J, Crawford DC; Diduch DR; Arendt EA; Ma CB; Li CS. J Long Term Eff Med Implants 2013;23(2-3):161-73.

The KineSpring® Knee Implant System: an implantable joint-unloading prosthesis for treatment of medial knee osteoarthritis. Anton G Clifford, Stefan M Gabriel, Mary O'Connell, David Lowe, Larry E Miller, and Jon E Block. Med Devices (Auckl). 2013; 6: 69–76.

The value of surgical pathology in revision posterior instrumented spine surgery.

Ko JWK; Ching A; Barnes P.

INTRODUCTION

The diagnosis of implant related infections of the spine is challenging because of the poor sensitivity and specificity of bacterial culture. In addition, pathology evaluation is thought to be of limited utility because implant related particulate debris and osteobiologics may induce inflammation in the absence of infection. This study used enhanced culture techniques to better define infection and thus examined whether abnormal pathology findings were common in uninfected posterior spine implants.

METHODS

The enhanced diagnostics protocol was an IRB-approved quality improvement project. Inclusion criteria for analysis were consecutive revision spine cases exposing prior posterior spine instrumentation that had both of the following: (1) 5 intraoperative tissue/bone biopsies taken adjacent to hardware that were cultured for 10 days; and (2) a biopsy sent for pathology analysis. Each biopsy was taken with a separate sterile instrument. Cases were collected prospectively but retrospectively examined for culture results, treatment decisions, and pathology findings. Patients were followed post-operatively for evidence of infection. A true infection was defined as "treatment for infection", with treatment decisions made by a multi-disciplinary infection-spine team based on culture data and clinical findings. Treatment decisions were blinded to the pathology results. An abnormal result for the study analysis was defined as > 5 neutrophils per high-powered field (HPF).

RESULTS

44 cases met inclusion criteria with a minimum follow-up of 4 months. 39 cases were "uninfected":

neither treated for, nor had any signs of infection at follow-up. Of these uninfected cases, 32 were culture negative, of which 31 had normal pathology findings (< 5 cells per HPF). In the remaining 7 uninfected cases, bacteria cultured were considered contaminants. Six of these cases had normal pathology findings. Therefore, surgical pathology was normal in 37/39 (92%; 95% Confidence interval (CI): 79-98%) of uninfected cases. Five cases were treated for infection. All had positive cultures. Of these infected cases, 4/5 (80%; 95% CI: 28-99%) had abnormal surgical pathology.

DISCUSSION AND CONCLUSIONS

In this pilot study, pathology findings were normal in 92% of uninfected posterior spine instrumentation revisions. Pathology evaluation was abnormal (positive for inflammation) in 80% of infected cases. Thus, surgical pathology may aid in the diagnosis of posterior spine instrumentation infection.

Factors predictive of improved patient reported outcomes following distal femoral osteochondral allograft transplantation. Domont Z; Quilici S; DeHart M; Farooqi M; Crawford D.

INTRODUCTION

Fresh osteochondral allograft transplantation is a well-described surgical option for patients with large osteochondral defects of the distal femur. Optimal selection of patients and factors most associated with successful outcome is of clinical importance.

METHODS

We examined 97 patients receiving osteochondral allograft transplantation to the distal femur over five years. Fifty-three completed an average of 35.7 months follow-up. Donor and patient characteristics including pre-operative osteoarthritis and mechanical alignment were entered into a multivariate model to determine which factors most affected our patient-reported outcome scores, IKDC and KOOS.

RESULTS

Those factors that are independently associated with greater improvement include BMI less than 30, prior cartilage surgery, and Kellgren-Lawrence score 2-4. The most prominent predictors from our multivariate model were valgus alignment, smaller defect size, younger age, and no simultaneous procedure are associated with greater improvement.

CONCLUSION

Surgeons may use this data to help predict which patients may best benefit from osteochondral allograft transplantation.

To be presented at the American Orthopaedic Society for Sports Medicine 2014

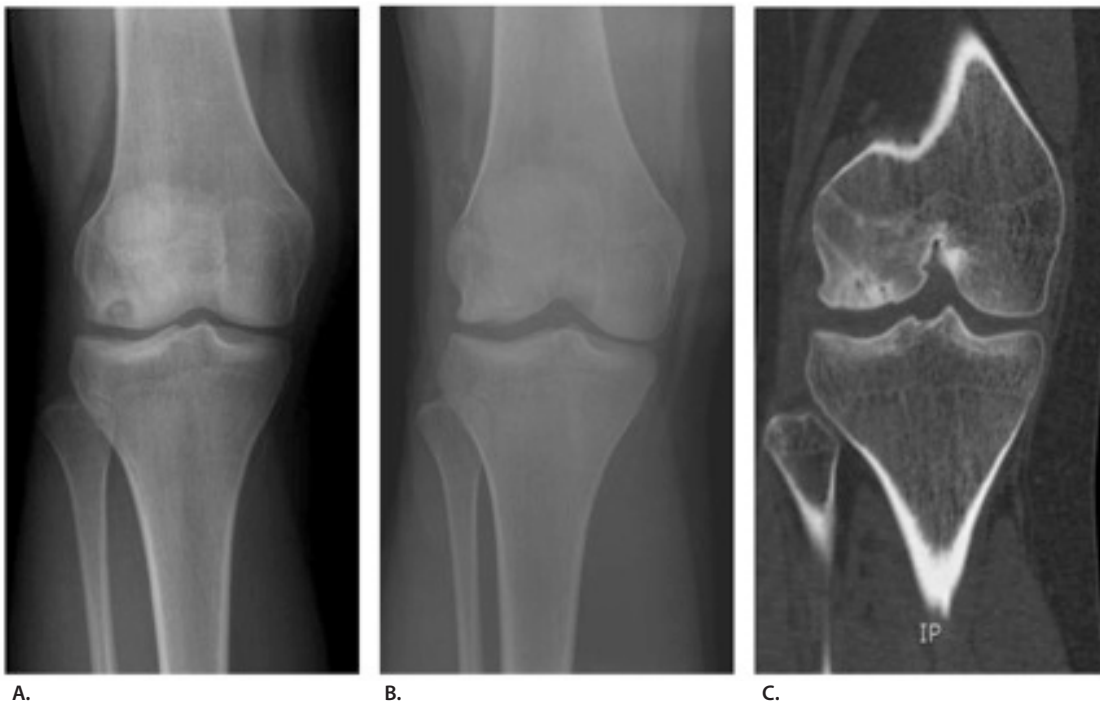


Figure 1. Images of an osteochondral dissecans lesion in the right lateral femoral condyle before and after treatment with fresh osteochondral allograft. (A, B) Pre-operative and post-operative AP X-rays, (C) 6-month post-operative coronal CT showing osseous integration of the allograft with restored joint space.

The association of quality of life indices and Waddell's Signs. McIver T; Yoo J; Ragel B; Hamilton D; Hiratzka J; Ching A; Zusman; Marshall L.

BACKGROUND/CONTEXT

The Waddell's Signs is a five-component physical examination with the function of detecting nonorganic manifestations of spine patients' illness.

PURPOSE

To determine the relationship between a patient's self-reported health related quality of life and disability indices to the presence of Waddell's signs.

STUDY DESIGN/SETTING

Prospective cohort of patients evaluated by a physician in a university mixed-practice spine center (2 physiatrists, 2 neurosurgery spine surgeons, 3 orthopaedic spine surgeons) between November 2012 and November 2013.

PATIENT SAMPLE

480 patients whose initial examination with a provider included the Waddell's Signs, and completed patient-reported outcomes scores (ODI and SF-12).

OUTCOME MEASURES

Oswestry Disability Index (ODI), Short Form 12 (SF-12): Mental Component Summary Score (MCS) and Physical Component Summary Score (PCS).

METHODS

Five categories of Waddell's Signs were assessed: tenderness, simulations, distraction, regional disturbance, and over-reaction. Clinicians were trained in the examination to ensure consistency. Non-anatomic tenderness was defined as positive if palpation of the thoracic and lumbar spine elicited more than three of the five areas to be painful. The groups were defined based on the number of positive Waddell's Signs as 0 through 5. The difference in the means of ODI, MCS and PCS groups

defined by the number of positive Waddell signs were compared using ANOVA.

RESULTS

Based on the number of Waddell's Signs (0 through 5 positive signs), the distribution of patients was 351 (73%), 59 (12%), 24 (5%), 13 (3%), 13 (3%), and 19 (4%); therefore the majority of patients did not have a single Waddell's sign. Average ODI scores were 39 ± 18 , 47 ± 15 , 53 ± 20 , 56 ± 13 , 59 ± 8 , and 61 ± 16 ($p < 0.0001$); average MCS scores were 40 ± 12 , 35 ± 9 , 33 ± 11 , 30 ± 11 , 28 ± 9 , and 22 ± 9 ($p < 0.0001$); and average PCS scores were 33 ± 10 , 29 ± 7 , 26 ± 8 , 26 ± 9 , 24 ± 3 , and 21 ± 4 ($p < 0.0001$), respectively for the 6 groups.

CONCLUSION

Presence of even a single positive Waddell's sign is associated with lower health related quality of life scores and higher self-perception of disability. However, the presence of three or more positive Waddell's Signs is associated with marked diminution in both physical and mental component of patient's well-being.

Gender influence on the diagnosis, affect, and prevalence of depression in cervical spine surgical patients Myers R; Zusman N; Larsen S; Ching A; Hart R; Yoo JU.

INTRODUCTION/METHODS

Understanding depression could improve patient selection, treatment, and results. We analyzed 272 consecutive patients from 2007-2011 with completed outcome measures including SF-12 data. Depression was defined as MCS ≤ 45 or as a preoperative chart diagnosis (self or clinical).

RESULTS

By chart, 32% were depressed, and females were 2.6 times more likely to report depression (42% vs. 16%, $p < 0.01$). Defined as MCS ≤ 45 , both genders were more likely than by chart to be depressed

(50% vs. 36%, $p = 0.03$). Males were less likely to be chart diagnosed when MCS is ≤ 45 (91% male vs. 71% female false negative proportion). Females had lower preoperative component scores (MCS 43.6 ± 12.7 vs. 46.9 ± 12.6 , $p = 0.04$; PCS 29.8 ± 9.2 vs. 33.4 ± 10.1 , $p < 0.01$).

CONCLUSIONS

Although women have a higher prevalence of depression, they may be more self-aware, and tend to report or be diagnosed as depressed more frequently. Less than half of the males were aware of their depression.

	MCS					PCS		
	N	Mean	SD	p-value		Mean	SD	p-value
Male	105	46.893	12.555			33.354	10.099	
Female	167	43.614	12.659	0.0379		29.796	9.2406	0.0031

Table 1: Component Scores by Gender

	Not Depressed	Depressed (Chart diagnosis)	
Males	88	17 (16%)	
Females	97	70 (42%)	p<0.001

	Not Depressed	Depressed (MCS ≤ 45)	
Males	67	38 (36%)	
Females	84	83 (50%)	p=0.0291

MALES

	MCS ≤ 45 (Depressed)	MCS > 45 (Not Depressed)	
Chart: Depressed	6	11	
Chart: Not Depressed	61	27	p=0.0075

FEMALES

	MCS ≤ 45 (Depressed)	MCS > 45 (Not Depressed)	
Chart: Depressed	24	46	
Chart: Not Depressed	60	37	p=0.0004

Table 2: Depression Diagnosis by Gender

Frequency and treatment trends for periprosthetic fractures about total knee arthroplasty in the United States. Roster B; Dehart M; Mirza A.

INTRODUCTION

Hospital admissions related to periprosthetic fractures about a total knee arthroplasty were identified and examined using the Nationwide Inpatient Sample database for the years 2006-2010.

PURPOSE

To identify the frequency, demographics, and treatment trends of periprosthetic fractures about a total knee arthroplasty over a five-year period in the United States.

METHODS

The Nationwide Inpatient Sample database (NIS) was used to identify inpatient admissions related to periprosthetic fractures about a total knee arthroplasty. Database records were reviewed for several outcome variables including patient age, gender, race, region, hospital type, inpatient mortality, medical comorbidities, total hospital charges, and number of days to primary procedure. ICD-9 procedure codes were used to identify the types of procedures performed during these admissions. Procedures were sub classified as closed treatment, open treatment with internal fixation, and revision arthroplasty procedures.

RESULTS

17,510 inpatient admissions were identified during the period comprising our study, including 19,956 fractures. An overwhelming majority of patients were admitted to institutions in urban settings (89%, n=15,640) with relatively equal distribution between teaching (51%, n=8967) and non-teaching institutions (49%, n=8543). The majority of patients were female (77%, n=13,533); overall inpatient mortality rate was very low (0.012%, n=207).

The most common comorbidities were hypertension, deficiency anemias, chronic pulmonary disease,

diabetes, fluid/electrolyte abnormalities, and obesity. The majority of these admissions occurred in large urban centers each year. The mean total charges for the years 2006-2010 were \$42,298, \$52,543, \$57,995, \$67,095, and \$68,715, respectively. Insurance payor was most commonly Medicare for each year. The mean length of stay was greater than 6 days for each year. The mean number of days from admission to procedure decreased from 1.85 days in 2006 to 1.35 days in 2010. Closed treatment of these fractures decreased from 5% of all procedures in 2006 to 2.5% of all procedures in 2010. Open treatment with internal fixation remained roughly constant at 65% of all procedures from 2006-2010. Revision arthroplasty procedures increased from 19.6% in 2006 to 30.3% in 2010.

CONCLUSIONS

To our knowledge, this is the largest study to date using sampled data from U.S. inpatient admissions to evaluate periprosthetic fractures about a total knee arthroplasty. While demographics and regional characteristics appear to be remaining fairly constant, hospital charges are increasing over time, time to procedure is decreasing, and treatment choices appear to be changing over this five-year period.

Yearly Admissions and Periprosthetic Fractures

Year	2006	2007	2008	2009	2010
Number of Admissions	2753	3770	4575	3027	3385
Number of Fractures	3147	4284	5200	3576	3749

Poster presentation at American Academy of Orthopaedic Surgeons 2014 Annual Meeting

Past and Present: Beals Annual Lectureship



The Beals memorial lectureship is an annual event established in honor of the late Rodney K. Beals, MD, Professor Emeritus in the OHSU Department of Orthopaedics & Rehabilitation, who taught orthopaedics for more than 50 years. Dr.

Beals was a lifelong "Oregonian" and spent his entire professional career practicing orthopaedic surgery in Portland, OR. Dr. Beals was a committed clinician, master surgeon, reverent educator and accomplished researcher. It was not only out of respect for his scientific accomplishments, but for his humble guidance and mentorship that the OHSU Department of Orthopaedics & Rehabilitation established the annual Beals Memorial Lecture Series.

Dr. Beals attended Willamette University for his undergraduate training graduating in 1952 and received his medical degree from the University of Oregon Medical School (precursor to OHSU) in 1956. He completed his internship at Minneapolis General Hospital followed by a General Surgical Residency in San Bernadino County Hospital in California. He ultimately completed his training in Orthopaedic Surgery at the University of Oregon Medical School in 1961. Dr. Beals immediately joined the faculty and rapidly rose through the ranks at OHSU and served as Head of the Division of Orthopedics from 1981 to 1994. Dr. Beals also served as the first chairman for the Department of Orthopaedic Surgery at OHSU in 1994. At the age of 77, he remained an active member of the orthopaedic faculty at OHSU until the time of his passing on August 7, 2008.

Dr. Beals was an accomplished researcher throughout his career. He was nationally recognized for his research on skeletal manifestations of growth

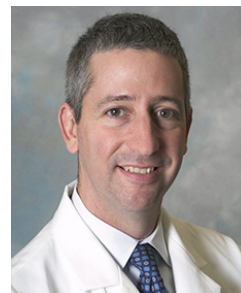
disturbances in children. He helped author more than 150 peer-reviewed publications. Dr. Beals was also a revered educator. During his tenure at OHSU he helped train more than 150 orthopaedic surgeons in residency. He also helped thousands of patients and mentored countless numbers of medical students. Through his remarkable career Dr. Beals represented and personified excellence in medicine and orthopaedic surgery.



Visiting Professor, May 2013

Vernon Tolo, MD

Chief Emeritus, Children's Orthopaedic Center
Keck School of Medicine, USC
Editor of *Journal of Bone & Joint Surgery*



Visiting Professor, May 2014

Seth Leopold, MD

University of Washington, Department of Orthopaedics
& Sports Medicine
Editor of *Clinical Orthopaedics & Related Research*

OHSU Orthopaedic Spine Professorship

Christopher Ignatius Shaffrey, MD, was born in Milwaukee Wisconsin. He graduated magna cum laude from The Citadel in 1982 with B.S. degree in Biology. He played varsity basketball and was the co-captain his senior year. In 1986, Dr. Shaffrey received his medical degree from the University of Virginia. He completed his general surgical internship at Naval Hospital San Diego in 1987 where he was named the surgical intern of the year. He completed both neurosurgical and orthopaedics residencies at the University of Virginia. A spine fellowship in pediatric and adult reconstructive spine surgery was completed in 1995.

Following his postgraduate training, Dr. Shaffrey completed a scholarship obligation to the United States Navy at Portsmouth Navy Medical Center. In 1997, he was appointed to the senior staff in the Departments of Neurological Surgery and Orthopaedic Surgery at Henry Ford Hospital where he was actively involved in treating members of Detroit's college and professional athletic teams. In 1999, Dr. Shaffrey was appointed Associate Professor of Neurological Surgery and Adjunct Associate Professor of Orthopaedic Surgery and Sports Medicine at the University of Washington in Seattle. In 2003, he returned to the University of Virginia as Professor of Neurological Surgery and Director of the Neurosurgery Spine Division. Dr. Shaffrey is board certified in the fields of neurological surgery and orthopaedic surgery.

Dr. Shaffrey has an active research interest in spinal surgery, particularly in numerous multicenter outcome research studies of pediatric and adult scoliosis, spinal trauma and tumors involving the spinal column. He has been a funded principal investigator in numerous grants and clinical trials. He serves on the Editorial Boards of Journal of Neurosurgery, Neurosurgery and Journal of Spinal Disorders. He is an active reviewer for Spine, The Spine Journal,



Christopher I. Shaffrey, MD

Department of Neurological Surgery
University of Virginia

Surgical Neurology and Journal of Trauma. Dr. Shaffrey has greater than 200 publications, greater than 500 national and international presentations and served as editor for several textbooks on spinal surgery.

During his career in medicine, Dr. Shaffrey has won numerous awards for clinical medicine. He has won the Counsel of State Neurosurgical Societies Young Neurosurgeons Award. He has been named to Best Doctors and Top Doctors numerous times. He has an active role in organized neurosurgery and spinal surgery. He has been the Chair for the AANS/CNS Joint Section on Disorders of the Spine and Peripheral Nerves, and previously both the Scientific Program Chair and Annual Meeting Chair for the AANS/CNS Joint Section on Disorders of the Spine and Peripheral Nerves. He is on the Scientific Program Committee for the Congress of Neurological Surgeons Annual Meeting. He serves as the IMAST Chair for the Scoliosis Research Society. He is a board member for the SRS, AANS and ABNS. He has been named to numerous honorary academic societies including the American Orthopaedic Association and the American Academy of Neurological Surgery.

OHSU Orthopaedic Spine Professorship

Dr. Serena Hu's research interests include prediction and prevention of metastatic fractures of the spine that could otherwise lead to paralysis, disc degeneration and its potential prevention or reversal. Her clinical interests include prevention of complications and treatment of adult scoliosis. She joined the UCSF faculty in 1991.

Dr. Hu completed her orthopedic surgery residency at the Hospital for Special Surgery and a fellowship in spine and scoliosis surgery at Rancho Los Amigos in Downey, CA. She has spent most of her career at the University of California, San Francisco, where she is now Chief of the Spine Service. Her clinical interests include scoliosis, degenerative disc disease, tumors of the spine and patient outcomes. She has served the AOA as a member at large of the Executive Committee, chaired the RLF program, served as Treasurer, and will be the Program Chair for the 2014 Annual meeting.

Dr. Hu received her undergraduate degree from Cornell University in Ithaca, NY. She completed her medical training at McGill University in Montreal, Canada before serving an internship in general surgery at Beth Israel Medical Center in New York. Dr. Hu was a resident in orthopaedic surgery at the Hospital for Special Surgery, Cornell University Medical School, NY.



Serena Shaw Hu, MD

Professor of Clinical Orthopaedics
University of California, San Francisco
Department of Orthopaedic Surgery

Shriners Hospital for Children – Portland Lectureship Series

BEATTIE LECTURESHIP

Mr. Byron Beattie was the owner and operator of a printing plant in Portland, OR. Mr. Beattie became acquainted with “French” Eldon Chuinard, MD, while Dr. Chuinard was the chief of staff at Shriners Hospital for Children–Portland. He was so impressed with the importance of Shriners educational mission that he created an endowment fund to support these local education activities. The first seminar was held in 1985.



Guest Lecturer 2013
Lori Karol, MD

Lori Karol, MD, is a staff orthopaedist and Medical Director of Performance Improvement and the Movement Science Lab at Texas Scottish Rite Hospital for Children. She earned her undergraduate and medical degrees from the University of Michigan. Dr. Karol completed her general surgery internship and orthopaedic surgery residency at Wayne State University School of Medicine. She also completed the Harrington Fellowship of Pediatric

Orthopaedics and Scoliosis at Texas Scottish Rite Hospital for Children in 1991. Dr. Karol is an Associate Professor in the Department of Orthopaedic Surgery at the University of Texas Southwestern Medical Center at Dallas and is an active staff member at Children’s Medical Center at Dallas. Dr. Karol is also a member of the American Academy for Cerebral Palsy and Developmental Medicine; the American Medical Association; a member and chair of the Communications Counsel of the Pediatric Orthopaedic Society of North America; a member of the American Academy of Orthopaedic Surgeons; the North American Society for Gait and Clinical Movement Analysis; the Scoliosis Research Society; and Société Internationale de Chirurgie Orthopédique et de Traumatologie.

DILLEHUNT LECTURES

The Dillehunt Memorial Lecture honors the contribution of a great surgeon and legendary teacher who inspired many orthopaedists. With his devotion to children, Richard Dillehunt, MD, was instrumental in the establishment of the Shriners Hospitals for Children—Portland, OR, and served as the first chief surgeon. His legacy continues through the Dillehunt Memorial Trust Fund, sponsoring visiting distinguished pediatric orthopaedic surgeons from throughout the world.



Guest Lecturer 2013
Muharrem Yazici, MD

Muharrem Yazici, MD, is a professor of orthopaedics at Hacettepe University in Ankara, Turkey. His clinical practice involves pediatric orthopaedics and spine conditions, and his research focuses on the treatment of pediatric spinal deformities. Dr. Yazici completed his orthopaedic residency at Hacettepe University in Ankara, Turkey, and completed a spine research fellowship in Kansas with Marc Asher, MD. His interests focus on musculoskeletal problems of

children, spine deformities, DDH, and Legg-Calve-Perthes Disease. Dr. Yazici has published more than 40 scientific papers in prestigious, peer-reviewed journals, and is currently president of the European Orthopaedic Society, on the board of directors of SRS and an executive committee member of the Growing Spine Study Group.

The Japanese Orthopaedic Association

OHSU Orthopaedics & Rehabilitation Hosts the 2013 AOA-JOA Traveling Fellows

Institutional Host Dennis C. Crawford, MD, PhD

Lecturer Toshihiro Akisue MD, PhD

Department of Orthopedic Surgery, Kobe University

Lecturer Toru Akiyama, MD, PhD

Department of Orthopedic Surgery, Jichi Medical University

Assistant Professor, Hirotaka Chikuda, MD

Department of Orthopedic Surgery, The University of Tokyo Hospital

Associate Professor Takehito Hananouchi, MD, PhD

Department of Medical Engineering, Osaka Sangyo University

Faculty Junichi Nakamura, MD, PhD

Graduate School of Medicine, Chiba University

Faculty Yoshihisa Sugimoto, MD, PhD

Department of Orthopedic Surgery, Okayama University



For two days in June, the OHSU Department of Orthopaedics & Rehabilitation served as the center of activity for the American Orthopaedic Association-Japanese Orthopaedic Association

Traveling Fellowship. Six of our international colleagues spent three days and two nights in Portland for a combination of didactic lectures, academic discussion, surgical observations and scientific inquiry. Our guests shared their expertise in spine surgery, adult joint reconstruction, hip arthroscopy, tumor surgery and orthopedic oncology during a formal symposium organized to highlight the art and science of orthopaedic surgery. As customary for our department as an honored United States host institution, and in keeping with being hospitable Oregonians, it was assured that the proper balance of work and play greeted our guests. Included in the visit was a hike up and around Multnomah Falls, a visit to Panorama Point in the Hood River Valley to view "the American Mt. Fuji" (sometimes called Mt. Hood) all before dinner, cigars and a drive home through the majestic Columbia River Gorge.

Resident and Teaching Awards

Leo S. Lucas Outstanding Orthopaedic Educator Award: Presented to the faculty member most instrumental in the development of future orthopaedic surgeons.

Morris Hughes Award: Presented to the resident who best demonstrates concern for patients and for education of the next generation of physicians.

Research Award: Presented to the resident recognized for a commitment to the development, execution and publication of original research during residency.

YEAR	LEO S. LUCAS	MORRIS HUGHES	RESEARCH AWARD
2007	Tom Ellis	Rob Tatsumi	Joseph Schenck
2008	Dennis Crawford	Stephan Pro	Kate Deisseroth
2009	Darin Friess	Stephan Pro	N/A
2010	Amer Mirza	Gary Kegel Gregory Byrd	Patrick Denard
2011	James Hayden	Jayme Hiratzka	Jayme Hiratzka Matthew Harrison
2012	Jesse A. McCarron	Luke Rust	Dawson Brown Matthew McElvany
2013	James Hayden	Laura Matsen Ko Jacqueline Munch	Adam Baker

OHSU Orthopaedic Program Alumni Directory

YEAR	FELLOWSHIP*
2013	
Adam Baker	Foot and Ankle, Campbell Clinic; Memphis, TN
Michael Kuhne	UCSF Trauma Fellowship; San Francisco, CA
Laura Matsen-Ko	Adult Recon Fellowship with Dr. Duwelius; Portland, OR
Jacqueline Munch	Sports Medicine, HSS; New York City, NY
Dan Wieking	Foot& Ankle Fellowship, Melbourne Orthopaedic; Australia

2012	
Dawson Brown	Sports Medicine, Southern California Orthopaedic Institute
Peter Fredericks	OrthoIndy Trauma Fellowship, Indianapolis, IN
Matthew McElvany	University of Washington Shoulder & Elbow Fellowship
Luke Rust	Foot & Ankle, Orthopaedic Associates of Michigan

2011	
Matthew Harrison	Foot & Ankle 1) Roger Mann MD - Oakland Bone and Joint Specialists; 2) Matthew Tomlinson MD - Middlemore Hospital, Auckland NZ
Jayne Hiratzka	Spine Surgery - University of Utah
Jackson Jones	Total Joint Arthroplasty - Brigham and Women's Hospital, Boston, MA

2010	
Adam Cabalo	Spine Surgery - Spine Care Medical Group, Daly City, CA
Patrick Denard	Shoulder Arthroscopy - San Antonio, TX and Lyon, France
Gregory Byrd	Harvard Hand and Microvascular Fellowship, Beth Israel Deaconess Medical Center, Boston, MA
Gary Kegel	St. Luke's Hand Fellowship, New York, NY
Matthew Bradley	No fellowship

2009	
Abner Ward	Hand Fellowship - Stony Brook Medical Center, Stony Brook, NY
Stephan Pro	Santa Monica Orthopaedic and Sports Medicine Group, Santa Monica, CA
Khalid Shirzad	Foot and Ankle Fellowship - Duke University Medical Center, Durham, NC

2008	
Kate Deisseroth	Malcom Grow Medical Clinic, 770th Surgical Specialties Flight, Andrews AFB
Andy Kranenburg	San Francisco Spine Institute, San Francisco, CA
Kenna Larson	Hand Fellowship - University of New Mexico, Albuquerque, NM

2007	
William Magee (Billy)	Arthroscopy/Sports Medicine - Park Nicollet Methodist Hospital, Minneapolis, MN
J. Rafe Sales	San Francisco Spine Institute
Joseph Schenck	
Robert Tatsumi	The Spine Institute - Santa Monica, CA

OHSU Orthopaedic Program Alumni Directory

YEAR	FELLOWSHIP*
2006	
Catherine Humphrey	Orthopaedic Trauma - Vanderbilt University Medical Center, Nashville, TN
Amer Mirza	Trauma - Harborview Medical Center, Seattle, WA
Mark Wagner	
2005	
Patrick Dawson	Upper Extremity and Sports Medicine - Congress Medical Associates, Pasadena, CA
Suresh Kasaraneni	
Christopher Untch	Surgical Services, Davis Monthan AFB, Arizona
Corey Vande Zandschulp	Trauma - OrthoIndy, Methodist Hospital, Indianapolis, IN
2004	
Benjamin Kam	USAF Academy, CO
Britton Polzin (Frome)	UT Southwestern Hand Surgery - Dallas, TX
2003	
Jennifer Miller	Sports Medicine - Congress Medical Associates, Pasadena, CA
John (Jeb) Reid	Taos Orthopaedic Institute, Taos, NM
Eric Shepherd	Orthopaedic Trauma - UC Davis Medical Center, Sacramento, CA Orthopaedic Trauma - Auckland City Hospital, NZ
2002	
Michael Binnette	Spine Fellowship - University of Washington, Seattle, WA
Kevin Kahn	Trauma - Universitatsspital, Zurich Switzerland Trauma - Vanderbilt Orthopaedic Institute, Nashville, TN
Tammy Simpson	Sports Medicine - UCSF, San Francisco, CA Orthopaedic Traumatology - Hennepin Medical Center, Minneapolis, MN
2001	
Mike Gustavel	San Diego Sports Medicine and Orthopaedic Center, San Diego, CA
James Hayden	Musculoskeletal Oncology - Massachusetts General Hospital, Boston, MA
Todd Ulmer	Sports Medicine - University of Washington, Seattle, WA
2000	
Mark Metzger	Joint, Spine & Tumor - Harvard Medical School, Boston, MA
Lorenzo Pacelli	Hand & Microvascular Surgery - Hand Center San Antonio, San Antonio, TX
Edward Perez	Trauma - R. Adams Cowley Shock Trauma Center, Baltimore, MD
1999	
Tony Colorito	Sports Medicine - Cincinnati Sports Medicine and Orthopedic Center, Cincinnati, OH
J. Michael Kioschos	Shoulder and Elbow Surgery - Florida Orthopaedic Institute, Tampa, FL
Jill Rider	

OHSU Orthopaedic Program Alumni Directory

YEAR	FELLOWSHIP*
1998	
Dory Curtis	
Darrin Eakins	Sports Medicine - Royal N Shore Hospital, Sydney, Australia
Ron Wobig	
1997	
Dennis Davin	
Kevin Lee	
Ron Teed	
1996	
Knute Buehler	Lower Extremity Reconstruction - Scripps Clinic and Research Foundation, San Diego, CA
Tom Croy	
Marc Davidson	The Hughston Clinic, Columbus, GA
1995	
Douglas Bagge	
Bob Foster	Hand and Microvascular Surgery - University of Minnesota, Minneapolis, MN
Greg Voit	Hand and Microvascular Surgery - University of New Mexico Health Sciences Center, Albuquerque, NM
1994	
R. Jeffrey Grondel	Sports Medicine and Shoulder - Mississippi Orthopaedic and Sports Medicine Clinic Trauma - Legacy Emanuel Medical Center, Portland, OR
Allen Hershey	Lower Extremity Reconstruction - Scripps Clinic and Research Foundation, San Diego, CA
Brian Padrta	Foot and Ankle - University of South Florida, Tampa, FL
Mark Rangitsch	
1993	
Blaine Markee	
K. Dean Olson	
Andrew Schmidt	Reconstruction, Shoulder Surgery, Trauma - Hennepin County Medical Center, Minneapolis, MN
1992	
Ed Pino	Sports Medicine - Cincinnati Sports Medicine, Cincinnati, OH
Stephen Tower	
Michael Van Allen	

OHSU Orthopaedic Program Alumni Directory

YEAR	FELLOWSHIP*
1991	
Ronald Bowman	
William Dickinson	
Richard Rubinstein	Methodist Sports Medicine Center, Indianapolis IN
1990	
Greg Bigler	Sports Medicine and Arthroscopy, Harvard Medical School, Massachusetts General Hospital, Boston, MA
Adrian Ryan	
T. Scott Woll	Foot and Ankle - University of Washington, Seattle, WA
1989	
James Hazel	
Asa Stockton	
Keith Ure	Joint Replacement - Joint Replacement Institute , Naples, FL
Robert Zirschky	
1988	
John DiPaola	
Jeffrey Flemming	University of Texas , Austin, TX
Morris Hughes	
Michael Wyman	
1987	
Dale Bramlet	University of Rochester Medical Center, Rochester, NY
Scott Jones	
Stefan Tarlow	Knee Surgery - Dr. Jan Gillquist/ Sport Medicine - Dr. James Andrews
1986	
Mark Buehler	Duke University, Durham, NC
Wendell Ferguson	Providence Medical Center, Portland, OR
Paul Switlyk	Shoulder Fellowship - University of Western Ontario, London, ON
1985	
Stan Neitling	
Daniel Ovadia	
1984	
Steven Bruce	
Kenneth Hermens	
Wendy Hughes	

OHSU Orthopaedic Program Alumni Directory

YEAR	FELLOWSHIP*
1983	
Michael Grundy	
Paul Mills	
John Schwartz	

1982	
Julie Isaacson	
James Livermore	
John Toohey	

1981	
Christopher Blake	
Samuel Tabet	Fellowship - Oregon Health & Science University, Portland, OR
Wayne Nadamoto	

1980	
Len C. Ceder	
Jon Hoppert	
Robert Jordan	

1979	
Brian Laycoe	
Donald Peterson	
James Robbins	Cincinnati Sports Medicine & Orthopaedic Center, Cincinnati, OH

*Fellowship information available from 1979 onward

YEAR
1978
Lyle Mason
Edgar Ragsdale
E. David Shaw

1977
David Noall
K. Byron Skubi
Ted Vigeland

1976
W. Curtis Kaesche
Walter Smith
Stephen Thomas

YEAR
1975
John Hayhurst
Kelsey Peterson, Jr.
Ned Schroeder

1974
Thomas Hutchinson
Robert Porter, Jr.
Fred Surbaugh

1973
James Baldwin
David Haaland
Craig MacCloskey

YEAR
1972
Michael Hmura
Grant Lawson
Michael Marble

1971
Charles Bird
Robert Chuinard
Jim Dineen
Ilmar Soot

OHSU Orthopaedic Program Alumni Directory

YEAR
1970
Art Hauge
Edwin Kayser
Gerald Lisac
Ira Yount

1969
Thomas Fagan
Michael Graham
George Ingham
Scott Struckman

1968
James Kunzman
James Nelson
Frederick Wade

1967
Michael Baskin
John Gilsdorf
John Thompson

1966
Charles Bonnett
McGregor Church
Don D'Amico
Fred Grewe
Howard Johnson

1965
Arthur Eckhardt
John Hazel
Richard Mercer

1964
Robert Corrigan
Richard Zimmerman

1963
Donn McIntosh
Michael Rask

1962
Phaen Gambee
Norman Logan
Keith Taylor

YEAR
1961
Rodney Beals
Thomas Edwards
George Keyes
Ralph Peterson

1960
Charles Fagan
Calvin Kiest, Jr.
Bud Yost

1959
Raymond Case

1958
Richard Gardner
William Guyer

1957
H. Freeman Fitch
Richard Gilbert

1956
William Hummel
Jack Watkins

1955
Edward Attix
Max Bocek

1954
Howard Popnoe
Dale Popp

1953
Donald Smith

1952
Melvin Makower

1951
Phillip Fagan
Bob Maris
James Weed

YEAR
1949
Howard Cherry
Boyd Holbrook
R.J. Hopkins

1948
Robert Anderson
George Cottrell
Carl Holm
Ralph Thompson

1947
Edward LeBold

1946
Donald Platner
Faulkner Short

1945
Joseph Gill

1942
Rodney Begg
Harold Davis

1940
L.S. Porter

1938
Arthur Compton

1935
E.G. Chuinard

1931
Harry Leavitt

1929
D.G. Leavitt

1928
C. Leslie Mitchell

1925
John LeCocq

1924
Leo S. Lucas

Special Thanks and Comments

We would like to give a special thanks to our Residency Program Coordinator, Robin Sasaoka, for being our go-to resource for all resident needs. She is responsible for coordinating all student and resident interviews, financial paperwork, timing of conferences and the education schedule – to name just a few.

The goal of this publication is to grow and mature over the next several years. We would love input from our alumni and local community on ways to improve the journal.

If you are an alumni and your information has changed with regard to your current practice type and/or practice location, please contact us so that your information can be updated for next year's journal.

Department of Orthopaedics & Rehabilitation

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1. Data on file DePuy Orthopaedics, Inc.
2. Vidalain JP (2011) 25-year ARTRO Results: A Special
Vintage from the Old World. In: Vidalain JP et al; The
CORAIL Hip System: A Practical Approach Based on 25
Years of Experience . Springer; pg 94-101

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